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MP165 'ESME Voltage Accuracy'

Modification Report

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About this document

This document is a draft Modification Report. It currently sets out the background, issue, and progression timetable for this modification, along with any relevant discussions, views and conclusions. This document will be updated as this modification progresses.

Contents

1. Summary.....	3
2. Issue.....	3
3. Solution	5
4. Impacts.....	5
5. Costs	7
6. Implementation approach	7
7. Assessment of the proposal	8
8. Case for change.....	10
Appendix 1: Progression Timetable	11
Appendix 2: Glossary	11

Contact

If you have any questions on this modification, please contact:

Bradley Baker

020 7770 6597

bradley.baker@gemserv.com

1. Summary

This proposal has been raised by Alan Creighton from Northern Powergrid.

Electricity Network Parties have a statutory obligation to ensure that the voltage supplied to consumers' premises from Low Voltage electricity networks is always between defined limits. They currently do this by making planning assumptions when Low Voltage networks are designed.

During the development of the smart metering Technical Specifications, Electricity Network Parties requested that the average Root Mean Square (RMS) voltage readings from Electricity Smart Metering Equipment (ESME) would be recorded with a mandated level of accuracy. Such a requirement is not currently codified in the Smart Metering Equipment Technical Specifications (SMETS) or the Great Britain Companion Specification (GBCS).

The uncertainty associated with the lack of a mandated accuracy level means that Electricity Network Parties must make conservative planning assumptions when designing and analysing performance of Low Voltage networks. This prevents them from realising the full benefits from the smart meter rollout.

2. Issue

What are the current arrangements?

What is average RMS voltage and what is it used for?

The RMS voltage value of an Alternating Current (AC) circuit represents an equivalent voltage of a Direct Current (DC) circuit. Under the Electricity Safety, Quality and Continuity Regulations (ESQCR) each property supplied from a Low Voltage electricity network must receive a voltage within the range of 230V +10% (253V) and 230V -6% (216.2V).

Currently Electricity Network Parties use planning assumptions when designing Low Voltage electricity networks to ensure that the voltage supplied to consumers is always within these statutory limits. One of the anticipated benefits associated with smart metering is that Electricity Network Parties should be able to use smart meter average RMS voltage data to enable them to design Low Voltage networks more efficiently, monitor the performance of Low Voltage networks, identify any problems, and help develop more efficient solutions.

Management of network voltage will be an increasingly important activity as a means of supporting the transition to meet the [GB 2050 Net Zero](#) target. This will see an increase in the uptake of Low Carbon Technologies (LCTs), particularly Electric Vehicles, heat pumps and distributed generation connected to Low Voltage networks. The connection of such Devices is expected to cause an increase in the number of power flow and voltage issues on Low Voltage networks. Accurate voltage and consumption data from smart meters will help to mitigate these issues.

How accurate are the RMS voltage readings from ESME?

Currently there is no mandated level of accuracy for voltage measurements from ESME. The British Electrotechnical and Allied Manufacturers' Association (BEAMA) has confirmed an 'indicative voltage accuracy' that an Electricity Network Party could assume is $\pm 1\%$. However, this assumption is for all

ESME, and would not consider any differences between meters manufactured by different Manufacturers and different Device models made by the same Manufacturer.

Currently there is no requirement for a meter Manufacturer to share the results of any voltage measurement accuracy testing that it may carry out for each of their products.

How is the voltage accuracy of ESMEs tested?

There is currently no codified method for determining the accuracy of ESME voltage measurements. It is understood that the indicative voltage accuracy supplied by BEAMA is not based on an agreed testing methodology and each meter Manufacturer may have provided its view on their products using a differing methodology.

What is the issue?

There is an increase in the connection of LCTs to Low Voltage networks. This is only likely to grow as GB transitions to meet the 2050 Net Zero target.

The design and management of Low Voltage networks is becoming an increasingly important Electricity Network Party activity. Having increased visibility of network voltages, with a known level of accuracy from ESME, is a crucial element to Low Voltage network design and management. It is therefore important that an Electricity Network Party can access accurate voltage measurements, with a known degree of accuracy. This will enable them to better understand the level of network reinforcement required to help Great Britain meet its Net Zero targets.

Ofgem's upcoming review for electricity network price control RIIO (Revenue = Incentives + Innovation + Outputs) 2 will be used to set price controls for Electricity Network Parties. This performance-based framework seeks to put consumers at the heart of Electricity Network Parties' plans and to encourage longer-term thinking, greater innovation and more efficient delivery. Without a known level of accuracy for voltage measurements, Electricity Network Parties will need to make conservative assumptions which may lead to less efficient solutions being implemented.

What is the impact this is having?

Although the indicative voltage accuracy confirmation from BEAMA is helpful, there remains no mandated voltage accuracy requirement. It is anticipated that different ESME models have a varying level of voltage accuracy.

Network reinforcement is triggered when the voltage on the Low Voltage network approaches the statutory limits set out in the ESQCR, which are 230V +10% (253V) and -6% (216.2V). For example, if the network voltage is 252.5V reinforcement is not required, whereas if the network voltage is 253.5V reinforcement is required. This illustrates the need for accurate voltage measurements as a difference in network voltage of 1V could trigger the need for potentially expensive reinforcement, which may not necessarily be required. The nominal voltage at a customer's premise is 230V. BEAMA indicates that ESME have an accuracy of $\pm 1\%$ which corresponds to 2.3V.

Impact on consumers

Great Britain's electricity network is ultimately funded by consumers, and the cost savings that had been anticipated from the smart meter rollout may not be realised if Electricity Network Parties do not have access to accurate data to enable them to manage their networks as efficiently as possible.

3. Solution

Proposed Solution

The Proposed Solution is to mandate an agreed level of voltage accuracy across all ESME. The Proposed Solution will result in the agreed ESME voltage accuracy level being codified within the latest version of the Electricity Smart Metering Equipment Technical Specifications (ESMETS).

The Proposed level of ESME voltage accuracy is to be agreed. This value will be proposed following analysis of the feedback provided by ESME Manufacturers and discussions with other Network Parties. Further information can be found in Section 7 of this document.

4. Impacts

This section summarises the impacts that would arise from the implementation of this modification.

SEC Parties

SEC Party Categories impacted			
	Large Suppliers		Small Suppliers
✓	Electricity Network Operators		Gas Network Operators
✓	Other SEC Parties		DCC

Breakdown of Other SEC Party types impacted			
	Shared Resource Providers		Meter Installers
✓	Device Manufacturers		Flexibility Providers

Electricity Network Parties will be impacted by this change as they will now be aware of a minimum level of each Manufacturer's ESME voltage accuracy contained within SMETS. This will enable them to make more informed decisions when investigating potential network enhancements.

Device Manufacturers (in particular, ESME Manufacturers) will be impacted by this change as they will need to ensure that their ESME that are built to the Technical Specifications that this modification is implemented in, and meet the minimum voltage accuracy level.

DCC System

This modification will have no impact on DCC Systems.

SEC and subsidiary documents

The following parts of the SEC will be impacted:

- Schedule 9 'Smart Metering Equipment Technical Specifications'

The changes to the SEC required to deliver the proposed solution can be found in Annex A.

Technical specification versions

This modification will be implemented in the latest versions of the Technical Specifications issued at the relevant SEC Release. This modification is targeted to be implemented in the November 2024 SEC Release (7 November 2024). SECAS anticipate that the ESMETS will be uplifted to version 5.4 for this release.

Devices

Devices impacted			
✓	Electricity Smart Metering Equipment		Gas Smart Metering Equipment
	Communications Hubs		Gas Proxy Functions
	In-Home Displays		Prepayment Meter Interface Devices
	Standalone Auxiliary Proportional Controllers		Home Area Network Connected Auxiliary Load Control Switches
	Consumer Access Devices		Alternative Home Area Network Devices

This modification will impact ESME Devices, as they will have to adhere to a set level of voltage accuracy level. Although investigations have shown that ESME Manufacturers do test the voltage accuracy level, however there is currently no mandated level they must be built to. This will be of importance to any new ESME Manufacturer that wishes to enter the market, they will have to build ESME that can deliver the mandated ESME voltage accuracy.

Consumers

This modification will ensure DNOs are aware of the voltage accuracy of each ESME Manufacturer's Device. This will allow DNOs to make considered decisions for providing a consistent service to consumers. An example of this is the DNO deciding whether or not a Low Voltage network requires reinforcement to prevent potential outages.

Other industry Codes

This modification will have no impact on other industry Codes. Please note however, that this modification may require changes to the Measuring Instruments Regulations (MIR), as this document sets out further Device specifications, for which this proposed attribute is relevant.

Greenhouse gas emissions

This modification will have no impact on greenhouse gas emissions.

5. Costs

DCC costs

This modification has no associated DCC costs.

SECAS costs

The estimated SECAS implementation cost to implement this as a stand-alone modification is one day of effort, amounting to approximately £600. This cost will be reassessed when combining this modification in a scheduled SEC Release. The activities needed to be undertaken for this are:

- Updating the SEC and releasing the new version to the industry.

SEC Party costs

SEC Party costs will be obtained through the Refinement Consultation.

6. Implementation approach

Recommended implementation approach

SECAS is recommending an implementation date of:

- **7 November 2024** (November 2024 SEC Release) if a decision to approve is received on or before 7 November 2023; or
- **6 November 2025** (November 2025 SEC Release) if a decision to approve is received after 7 November 2023 but on or before 6 November 2024.

As the change impacts the Technical Specifications, the modification should be implemented in a SEC Release that includes an uplift to the Technical Specifications. The earliest release this modification can be implemented in is the November 2024 SEC Release. New versions of the

Technical Specifications are usually targeted for November SEC Releases. SECAS has therefore recommended that if the modification is not implemented in the November 2024 SEC Release, it will be deferred to the November 2025 Release. Please note that the Technical Specification change scope has been agreed for the November 2023 SEC Release.

7. Assessment of the proposal

Observations on the issue

Business case for Devices currently installed

During the Development Stage, the Smart Energy Code Administrator and Secretariat (SECAS) presented the Draft Proposal to the Technical Architecture and Business Architecture Sub-Committee (TABASC) for initial comments.

The TABASC agreed that the issue is clear, but the business case will need further investigation. This is due to the impact the modification may have on Devices already installed as this could lead to physical replacement due to non-compliance. This is similar to [MP085A 'Synchronisation of smart meter voltage measurement periods'](#) which was split into two modifications to address the issue for newly manufactured Devices and under [MP085B 'Synchronisation of smart meter voltage measurement periods \(meters currently installed\)'](#), for those currently installed. MP085A will be implemented into the version of SMETS that will go live as part of the November 2022 SEC Release. Devices built to this specification will have to include the added functionality or be upgraded via firmware. Provided they can facilitate the additional functionality, existing Devices will be upgraded to the specification as and when the Supplier chooses to do so. In order to impose the functionality by a set date, previous versions of SMETS would have to be end-dated. This will be investigated under MP085B.

As the cost of firmware updates are borne by Suppliers, the business benefit of this modification must be clear. A TABASC member suggested that DNOs should have monitoring functionality at various points on their own network rather than requesting all Devices provide this information via the smart metering infrastructure. The Chair also questioned who would be funding this modification, suggesting that if it is solely a DNO issue, perhaps it should be at their cost.

Current Technical Specifications

A TABASC member raised concern that there is currently no requirement for Device Manufacturers to share the results of any voltage measurement testing. SECAS highlighted that there is some regulation, for example in the Measuring Instruments Directive (MID), but this does not satisfy the Proposer's requirements.

The SEC Sub-Committee Chairs advised that the modification may require a major version uplift of the Great Britain Companion Specification (GBCS) as potential hardware changes will be needed to facilitate the change. The Chairs advised that although the Proposed Solution will likely impact the SMETS and the GBCS, it is not expected to be a DCC Systems-impacting modification.

Areas for assessment

SECAS believes the following Sub-Committees will need to input to this modification:

Sub-Committee input needed during the Refinement Stage	
Sub-Committee	Input needed
OPSG	None – No impact on operational processes
SMKI PMA	None – No impacts on the Smart Meter Key Infrastructure (SMKI) document set
SSC	None – No impacts on the security infrastructure
TABASC	Assessment of the Proposed Solution.

SECAS has identified the following areas and questions that will need to be further considered during the Refinement Process before a suitable solution will be able to be taken forward:

The Proposed Solution may impact Devices currently installed, which may lead to physical replacement and high associated cost.

SECAS will discuss this with the Working Group; any potential solution will need to consider the impacts on existing Devices and any associated costs to update these compared to the expected benefits the solution would realise.

Solution development

Request for information

Understanding ESME Manufacturers' current voltage accuracy levels

When developing the Proposed Solution, SECAS investigated the voltage accuracy of existing ESME Manufacturers' Devices. SECAS received responses from seven Manufacturers in total.

The Manufacturers confirmed a minimum voltage accuracy of +/-1%, with a maximum level of accuracy of +/-0.3%.

How is this proven?

The Manufacturers stated that the accuracy level is validated as part of the ESME design, with several Manufacturers carrying out tests from the production line during quality assessment. One Manufacturer commented that ESME built to the SMETS are not power quality Devices, and as such are not capable of measuring to an accuracy greater than 0.2%. They advised that to do this would require a major redesign and would increase the price of the product considerably.

8. Case for change

Business case

This modification will allow SEC Parties to understand the level of voltage accuracy each ESME provides. In the case of Electricity Network Parties, this will allow them to make better informed decisions when investigating network upgrades.

Views against the General SEC Objectives

Proposer's views

The Proposer believes that this modification better facilitates SEC Objective (e)¹ as the agreed minimum level of ESME voltage accuracy will enable DNOs to better design their energy networks, which allow for a more secure energy supply.

The Proposer also believes that this modification better facilitates SEC Objective (g)² as the agreed minimum level of ESME voltage accuracy will remove any previous assumptions regarding voltage accuracy.

Industry views

Industry views will be gathered during the Refinement Consultation.

Views against the consumer areas

Improved safety and reliability

This modification will have a positive impact as the ESME voltage minimum accuracy will now be known.

Lower bills than would otherwise be the case

This modification will have a neutral impact on the price of a consumer's bills.

Reduced environmental damage

This modification will have a neutral impact on environmental damage.

Improved quality of service

This modification will have a positive impact on service quality as DNOs will be able to take into account the agreed level of voltage accuracy that ESME provide when investigating potential network enhancements.

¹ Facilitate innovation in the design and operation of energy networks to contribute to the delivery of a secure and sustainable supply of energy.

² Facilitate the efficient and transparent administration and implementation of the SEC.

Benefits for society as a whole

This modification will have a neutral impact on benefits to society.

Appendix 1: Progression Timetable

The Proposed Solution is being discussed with the TABASC and Working Group. SECAS will consider the discussions and draft the legal text. Following this, SECAS will issue the Refinement Consultation.

Timetable	
Event/Action	Date
Draft Proposal raised	27 May 2021
Presented to CSC for initial comment	29 Jun 2021
Modification discussed with the TABASC	5 Aug 2021
Modification discussed with the Operations Group (OPSG)	6 Jul 2021
CSC converts Draft Proposal to Modification Proposal	15 Mar 2022
Proposed Solution developed with the Proposer	Late Mar 2022
Legal text drafted with the Proposer	Apr 2022
Update provided to CSC	17 May 2022
Modification discussed with Working Group	1 Jun 2022
Request for information	Oct 2022 – Feb 2023
<i>Modification discussed with the TABASC</i>	3 Aug 2023
<i>Legal text developed with the Proposer</i>	Aug 2023
<i>Modification discussed with Working Group</i>	6 Sep 2023
<i>Refinement Consultation</i>	11 Sep – 29 Sep 2023
<i>Modification Report approved by CSC</i>	17 Oct 2023
<i>Modification Report Consultation</i>	18 Oct – 8 Nov 2023
<i>Change Board Vote</i>	22 Nov 2023

Appendix 2: Glossary

This table lists all the acronyms used in this document and the full term they are an abbreviation for.

Glossary	
Acronym	Full term
AC	Alternate Current
BEAMA	British Electrotechnical and Allied Manufacturers' Association
CSC	Change Sub-Committee

Glossary	
Acronym	Full term
DC	Direct Current
ESME	Electricity Smart Meter Equipment
ESQCR	Electricity Safety, Quality and Continuity Regulations
GBCS	Great Britain Companion Specification
LCT	Low Carbon Technology
MID	Measuring Instruments Directive
OPSG	Operations Group
RIIO	Revenue = Incentives + Innovation + Outputs
RMS	Root Mean Square
SECAS	Smart Energy Code Administrator and Secretariat
SMETS	Smart Metering Equipment Technical Specifications
TABASC	Technical Architecture and Business Architecture Sub-Committee