General technical requirements for private measurement

This document describes the technical requirements for private measurement devices (i.e. power measurements) connected to the Elia grid.

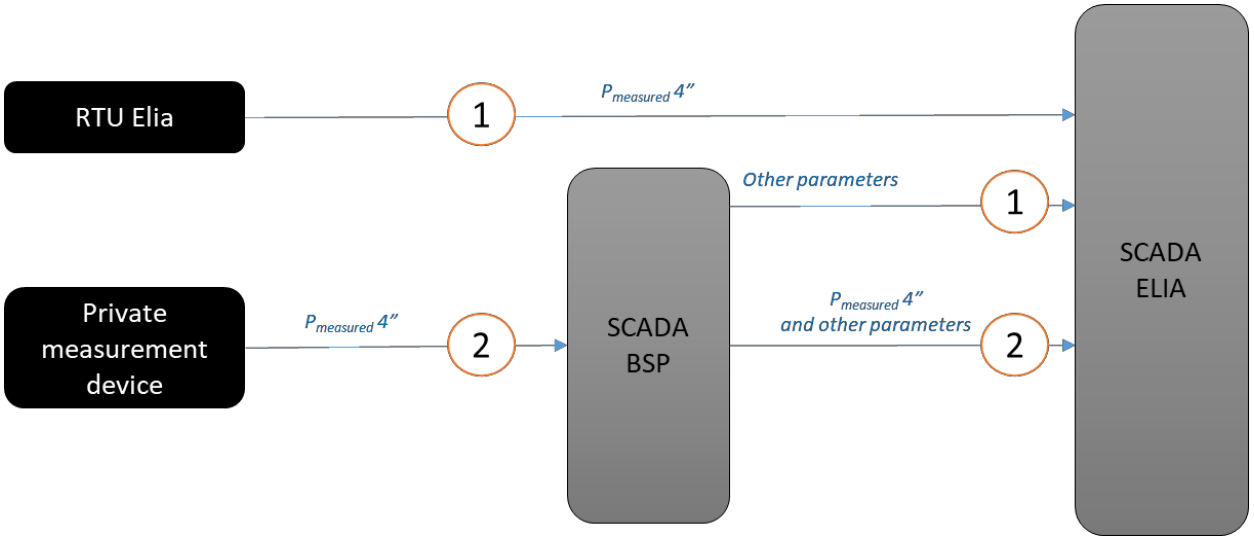
1 Configuration for Delivery Point DPSU (CIPU assets)

In case an RTU owned by Elia is installed on the level of the delivery point, this RTU communicates the instantaneous power measurements directly to the SCADA of Elia. For delivery points, where no RTU owned by Elia is installed, a private measurement device needs to be put in place to provide Elia the instantaneous power measurement every 4" via the SCADA of the BSP to the SCADA of Elia. To ensure a secure communication and a well-functioning of the architecture, minimal technical and regulatory requirements are defined in this document for the private measurement devices. The parameters to be communicated from the BSP to Elia and the communication requirements are described in the T&C BSP aFRR.

The following solutions are possible:

1. Option 1: The use of a RTU owned by Elia that collects the instantaneous power measurement and communicates them in real-time directly to the SCADA of Elia. The RTU of Elia is located at the delivery point.
2. Option 2: The use of a private measurement device that collects the instantaneous power measurement values every 4" and communicates them in real-time directly to the SCADA of the BSP. The SCADA of the BSPs forwards the values to the SCADA of Elia via a communication protocol determined by Elia. The private measurement devices are located at delivery point level.

Schematic view



These solutions apply exclusively to Delivery Points within the electrical facilities of a grid user.

2 Configuration for Delivery Point DPPG (non-CIPU assets)

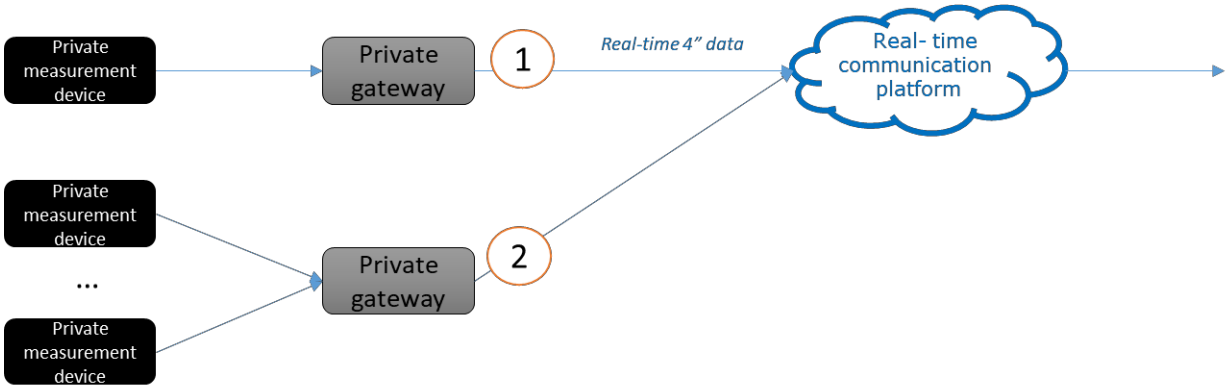
A private measurement device needs to be put in place to provide to Elia the instantaneous power measurement every 4" via a private gateway and via the real-time communication platform. To ensure a

secure communication and a well-functioning of the architecture, minimal technical and regulatory requirements are defined in this document.

The following solutions are possible:

1. Option 1: The use of a private gateway that collects the instantaneous power measurement values every 4" of a private measurement device and communicates them in real-time directly to the real- time communication platform via a communication protocol determined by Elia. The private measurement device is located at the delivery point. The delivery point can also be defined at the level of the access point. The gateways have to be installed locally within the premise of the grid user and must have direct connection with the communication platform.
2. Option 2: The use of a private gateway that collects the instantaneous power measurement values every 4" of two or more private measurement devices and communicates them in real-time directly to the real-time communication platform via a communication protocol determined by Elia. The private measurement devices are located at delivery point level. Connection of a private gateway on two or more access points is not allowed. The gateways have to be installed locally within the premise of the grid user and must have direct connection with the communication platform.

Schematic view



These solutions apply exclusively to Delivery Points within the electrical facilities of a grid user.

3 Technical requirements for the private measurement system connected to the federal transmission grid (GU of CDS and GU of Elia)

The private measurement system meets the following minimum requirements:

- The accuracy class of the measurement core of the current transformers (CT) should at least be in line with the requirements of the current transformers for the power measurements as specified in the table 1 below.
- The accuracy class of the measurement core of the voltage transformers (VT) should at least be in line with the requirements of the voltage transformers for the power measurements as specified in the table 1 below.
- The accuracy class of the private measurement device for the 4" power measurements at least should be in line with the requirements of the power measurements as specified in the table 1 below.
- The private measurement device must have a sampling rate which allows to give a new value exactly each 4". Refresh rate must be 1/2n times the 4" interval (with n = 1, 2, 3, 4, …).
- The data have to be timestamped each 4 seconds.

- The device that is responsible for the time stamping must be time synchronized with an NTP server or an equivalent system. The precision of the timestamp should be at least 20ms.
- Any cable connecting the current or voltage transformers to a measurement device must be as short as possible with a maximum of 50m. The section of the connection wires between the measurement device and the current transformer is ideally minimum 4 mm². The section of the connection wires between the measurement device and the voltage transformer is ideally minimum 10 mm².
- The connection wires to current and voltage transformers may not be located in the same cable.
- A system of 2 or 3 current / voltage transformers is allowed (method 2 or 3 power meters) but the 3 power meters method is preferred.
- The installation must be grounded correctly.
- Precision control of the private measurement device is mandatory every 5 years following technical specifications of ELIA. A copy of the report has to be transmitted to ELIA.
- Elia has the right to perform an ad-hoc on-site audit at any time.

Technical requirements applying to metering installations (power measurements)

A numerical power-meter with an S in the precision class needs a compliant CT with an S precision. All power meters (with Transfer of Energy) should be MID compliant for classes 2, 1 and 0.5%.

Power of measured process	VT	CT	Power meter (with Transfer of Energy)	Power meter (without Transfer of Energy)
	Accuracy class	Accuracy class	Accuracy class	Accuracy class/ requirements
≥ 10MVA	0.2	0.2S	0.2S or 0.25	0.2S or 0.25
≥ 5MVA à < 10MVA	0.2(1)	0.2S(1)	0.5S(1)	0.5S(1)
≥ 1 MVA à < 5MVA	0.2(1)	0.2(1)	0.5	0.5
≥ 100 kVA à < 1MVA	0.5	0.5	1	1
≥ 32kVA and < 100kVA	NA	0.5(4)	2	2%(2,3)
≥ 11kVA and < 32kVA	NA	0.5(4)	2	3.5%(2,3)
≥ 4kVA and < 11kVA	NA	0.5(4)	2	6%(2,3)
< 4 kVA	NA	0.5(4)	2	10%(2,3)

Table 1

(1) Elia can allow an accuracy of 0,5 or 0.5S for installation put into service before 01/12/2023

(2) Compliancy and certified as specified in the certification procedure in Annex 1.

(3) Only applicable for a minimum bid size of 100kW

(4) if required

4 Technical requirements for the private measurement system connected to local transmission grid (GU of CDS and GU of Elia)

The private measurement system meets the following minimum requirements:

- The accuracy class of the measurement core of the current transformers (CT) should at least be in line with the requirements of the current transformers for the power measurements as specified in the table 2 below.
- The accuracy class of the measurement core of the voltage transformers (VT) should at least be in line with the requirements of the voltage transformers for the power measurements as specified in the table 2 below.

- The accuracy class of the private measurement device for the 4” power measurements should be in line with the requirements of the power measurements as specified in the table 2below. The accuracy class of 0.2s and the accuracy class of 0.2 may be replaced by an accuracy class of 0.25.
- The private measurement device must have a sampling rate which allows to give a new value exactly each 4”. Refresh rate must be 1/2n times the 4” interval (with n = 1, 2, 3, 4, …).
- The data have to be timestamped each 4 seconds.
- The device that is responsible for the time stamping must be time synchronized with an NTP server or an equivalent system. The precision of the timestamp should be at least 20ms.
- Any cable connecting the current or voltage transformers to a measurement device must be as short as possible with a maximum of 50m. The section of the connection wires between the measurement device and the current transformer is ideally minimum 4 mm². The section of the connection wires between the measurement device and the voltage transformer is ideally minimum 10 mm².
- The connection wires to current and voltage transformers may not be located in the same cable.
- A system of 2 or 3 current / voltage transformers is allowed (method 2 or 3 power meters) but the 3 power meters method is preferred.
- The installation must be grounded correctly.
- Precision control of the private measurement device is mandatory every 5 years following technical specifications of ELIA. A copy of the report has to be transmitted to ELIA.
- Elia has the right to perform an ad-hoc on-site audit at any time.

Technical requirements applying to metering installations (power measurements)

Power of measured process	VT	CT	power meter
≥ 20 MVA	0.2	0.2S	0.2S
≥ 5 MVA à < 20 MVA	0.2	0.2	0.2
≥ 1 MVA à < 5 MVA	0.2	0.2	0.5
≥ 250 kVA à < 1 MVA	0.2	0.5	1

Table 2

5 Annex 1: IEC Light Specification

CONTENTS

1 Scope

This document applies only to embedded meters (for the definition, see section 3) of accuracy classes 3.5, 6 and 10 for the measurement of alternating current electrical active energy/power in 50 Hz (or 60 Hz) networks and it applies to their type tests only.
[Remark: We have used the same paragraph numbering as in IEC 62053-21 and IEC 62052-21. This makes it easier for individuals with knowledge of those standard to identify what is described in this document]

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document.
IEC 62052-11:2020, Electricity metering equipment – General requirements, tests and test conditions – Part 11: Metering equipment
IEC 62054-21:2017, Electricity metering (AC) – Tariff and load control – Part 21: Particular requirements for time switches

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62052-11:2020 apply.
ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia website: http://www.electropedia.org/
- ISO Online Browsing Platform website: http://www.iso.org/obp

In this document we define one additional term:
Embedded meter: meter in which currents and voltages act on solid state (electronic) elements to produce an output proportional to the energy/power to be measured. The meter has no own enclosing but is part of another appliance/product and its physically protection by the enclosure of the appliance/product.

4 Standard electrical values

4.1 Voltages

The values given in IEC 62052-11:2020 apply.

4.2 Currents

4.2.1 Nominal current

The values given in IEC 62052-11:2020 apply.

4.2.2 Starting current

The requirements and acceptance criteria of IEC 62052-11:2020 apply (see Table 4-1).

Embedded meters for	Starting current I_{st}			Power factor (cos ϕ)
	class 3.5	class 6	class 10	
Direct connection	0.005 I_n	0.01 I_n	0.01 I_n	1

Table 4-1: Starting current

4.2.3 Minimum current

The requirements and acceptance criteria of IEC 62052-11:2020 apply (see Table 4-2).

Embedded meters for	Minimum current I_{min} Class 3.5, class 6 and class 10
Direct connection	0.05 I_n

Table 4-2: Minimum current

4.2.4 Maximum current

The requirements and acceptance criteria of IEC 62052-11:2020 apply, that is:
The maximum current (I_{max}) for directly connected meters should be an integral multiple of the nominal current (for example four times the nominal current).

4.3 Frequencies

The values given in IEC 62052-11:2020 apply.

4.4 Power consumption

The requirements, test conditions and procedures, and acceptance criteria of IEC 62052- 11:2020 apply.
[Remark: This is about the self-power consumption of the meter. At the moment we apply IEC 62052- 11. Probably for embedded meters the requirements could be more stringent]

5 Construction requirements

Only the appliance/product construction requirements and standards are applicable. No further requirements are imposed.

6 Meter marking and documentation

Only the appliance/product requirements regarding marking and documentation are applicable.

Within the appliance/product documentation, the manufacturer shall indicate the accuracy class index of the embedded meter if it meets all applicable accuracy and performance requirements specified in this document.

7 Metrological performance requirements and tests

7.1 General test conditions

The test conditions of IEC 62052-11:2020 apply.

7.2 Methods of accuracy verification

The requirements, test conditions and procedures, and acceptance criteria of IEC 62052-11:2020 apply.

7.3 Measurement uncertainty

The requirements, test conditions and procedures, and acceptance criteria of IEC 62052-11:2020 apply.

7.4 Embedded Meter constant

The requirements, test conditions and procedures, and acceptance criteria of IEC 62052-11:2020 apply.

7.5 Initial start-up of the meter

The requirements, test conditions and procedures, and acceptance criteria of IEC 62052-11:2020 apply.

7.6 Test of no-load condition

The requirements, test conditions and procedures, and acceptance criteria of IEC 62052-11:2020 apply.

7.7 Starting current test

The requirements, test conditions and procedures, and acceptance criteria of IEC 62052-11:2020 apply.

7.8 Repeatability test

The requirements, test conditions and procedures, and acceptance criteria of IEC 62052-11:2020 apply.

7.9 Limits of error due to variation of the current

When the meter is operated under the reference conditions given in IEC 62052-11:2020, 7.1, the percentage errors shall not exceed the limits for the relevant accuracy class given in Table 7-1.

Value of current	Power factor (cos ϕ)	Acceptance percentage error limits for embedded meters of class		
		3.5	6	10
$I_{min} \le I < 0.1\ I_n$	1	±5.5	±9	±15
$0.1\ I_n \le I \le I_{max}$	1	±3.5	±6	±10
$0.1\ I_n \le I < 0.2\ I_n$	0.5 inductive 0.8 capacitive	±5.5 ±5.5	±9 ±9	±15 ±15
$0.2\ I_n \le I \le I_{max}$	0.5 inductive 0.8 capacitive	±3.5 ±3.5	±6 ±6	±10 ±10

Table 7-1: Acceptable percentage error limits (single-phase and poly-phase embedded meters with balanced loads or single-phase loads)

7.10 Limits of error due to influence quantities

Tests and test conditions given in IEC 62052-11:2020, 7.1 apply.

Influence quantity	Specified range or value and recommended value of test current (balanced unless otherwise stated)	Power factor (cos φ)	Acceptable limits of variation in percentage error for meters of class		
			3.5	6	10
Radiated, radiofrequency, electromagnetic field immunity test – test with current	I_n	1	±5.5	±9	±15
Electrical fast transient/burst immunity test	I_n	1	±7	±12	±20
Immunity to conducted disturbances, induced by radio-frequency fields	I_n	1	±5.5	±9	±15
Test for immunity to conducted, differential mode disturbances and signaling in the frequency range 2 kHz to 150 kHz at AC power ports	I_n	1	±7	±12	±20
Damped oscillatory wave immunity test	I_n	1	±5.5	±9	±15
External static magnetic fields	I_n	1	±5.5	±9	±15
Power frequency magnetic field immunity test	I_n	1	±5.5	±9	±15
Harmonics in the current and voltage circuits – 5th harmonic test	$0.5\ I_{max}$	1	±1.75	±3	±5
Interharmonics in the current circuit – burst fired waveform test	$0.5\ I_n$	1	±7	±12	±20
Odd harmonics in the current circuit	$0.5\ I_n$	1	±7	±12	±20
DC and even harmonics – half-wave rectified waveform test	I_{max} / sqrt(2)	1	±7	±12	±20
		0.5			
Voltage variation	$I_{min} \le I \le I_{max}$ (I_n)	1	±1.75	±3	±5

Influence quantity	Specified range or value and recommended value of test current (balanced unless otherwise stated)	Power factor (cos φ)	Acceptable limits of variation in percentage error for meters of class		
			3.5	6	10
	I_n $0.1\ I_n \le I \le I_{max}$	0.5	±3.5	±6	±10
Ambient temperature variation	$I_{min} \le I \le I_{max}$ (I_n)	1	±0.2	±0.3	±0.5
	$0.2\ I_n \le I \le I_{max}$ (I_n)	0.5	±0.3	±0.5	±0.75
Frequency variation	$I_{min} \le I \le I_{max}$ (I_n)	1	±1.75	±3	±5
	$0.1\ I_n \le I \le I_{max}$ (I_n)	0.5	±1.75	±3	±5
Auxiliary voltage variation	I_{min}	1	±0.7	±1.2	±2
Operation of auxiliary devices	I_{min}	1	±0.7	±1.2	±2
Short-time overcurrents	I_n	1	±5.5	±9	±15
Self-heating	I_{max}	1	±1.75	±3	±5
		0.5	±2.6	±4.5	±7.5
Fast load current variations	I_n	1	±5.5	±9	±15
Earth fault	I_n	1	±1.75	±3	±5
Dry heat test	I_n	1	±1.75	±3	±5
Cold test	I_n	1	±1.75	±3	±5
Damp heat cyclic test	I_n	1	±1.75	±3	±5

Table 7-2: Acceptable limits of variation in percentage error due to influence quantities

7.11 Time-keeping accuracy

The time-keeping accuracy requirements of IEC 62054-11:2017 section 7.5.2 apply.

8 Climatic requirements

Only the appliance/product climatic requirements and standards are applicable. No further requirements are imposed.

Under the varying climatic conditions (and tests), the embedded meter shall still function with the accuracy as indicated in section 7.10.

9 The effects of external influences and disturbances

9.1 General

These general test conditions apply to all tests specified in 9.3 and 9.4, unless therein specified otherwise.

9.2 Acceptance criteria

The acceptance criteria, regarding energy/power registration, of IEC 62052-11:2020 apply. Table 13 in IEC 62052-11:2020 gives an overview of the requirements. For tests with acceptance criteria A, Table 7-2 of this document shall be used.

9.3 Electromagnetic compatibility

Only the appliance/product electromagnetic compatibility requirements and standards are applicable.

During the different electromagnetic compatibility conditions and tests, the embedded meter shall still function with the accuracy as indicated in section 7.10.

9.4 Tests of immunity to other influence quantities

The requirements, test conditions and procedures, and acceptance criteria of IEC 62052-11:2020 apply.

10 Type test

The requirements given in IEC 62052-11:2020 apply.