Advanced Metering Infrastructure-Compatible Meters, Solid-State, Electronic

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1. Scope

This standard covers the requirements for single-phase and polyphase Advanced Metering Infrastructure (AMI)-compatible meters. RX, RXe, RXe-SD, RXRei-SD, and S4X meters will communicate with the Seattle City Light AMI network. AXe and AXe-SD meters will not communicate with the AMI network.

This standard applies to the following Seattle City Light (SCL) stock numbers:

Stock No.	Form	Current Class	Rated Voltage (V)	External Wires	Meter Type	SCL Designation
014586	1S	100	120	2	1PH-120V	AXe
014587	2S	200	240	3	1PH-240V	AXe
014588	2SE	320	240	3	1PH-240V	AXe
014589	3S	20	240	2 or 3	1PH-240V	AXe
014590	4S	20	240	3	1PH-240V	AXe
014591	25S-SD	200	120	3	1PH-120V	AXe-SD
014592	2S	200	240	3	1PH-240V	RXe
014593	2SE	320	240	3	1PH-240V	RXe
014594	4S	20	240	3	1PH-240V	RXe
014595	1S-SD	100	120	2	1PH-120V	RXe-SD
014596	2S-SD	200	240	3	1PH-240V	RXe-SD
014804	2SE-SD	320	240	3	1PH-240V	RXe-SD
014985	25S-SD	200	120	3	1PH-120V NTWK	RXRei-SD
014598	9S	20	120-277	4	3PH-240V OR LESS	RX
014599	16S	200	120-277	4	3PH-240V OR LESS	RX
014750	1S	200	120 480	2	1PH 240V OR GREATER	S4X
014751	2S	200	120 480	3	1PH GREATER THAN 240V	S4X
014752	3S	20	120 480	3	1PH GREATER THAN 240V	S4X
014753	4S	20	120 480	3	1PH GREATER THAN 240V	S4X
014754	9S	20	120 480	4	3PH GREATER THAN 240V	S4X
014755	9S KYZ	20	120 480	4	3PH GREATER THAN 240V	S4X
014756	25S	200	120 480	4	3PH GREATER THAN 240V	S4X
014757	16S	200	120 480	4	3PH GREATER THAN 240V	S4X
014758	45S	20	120 480	3	3PH GREATER THAN 240V	S4X

Single-phase, solid-state, kilowatthour meters (non-AMI compatible) are outside the scope of this standard. See SCL 4911.05.

Polyphase, solid-state, kilowatthour meters (non-AMI-compatible) are outside the scope of this standard. See SCL 4913.05.

2. Application

Single-phase and polyphase AMI-compatible meters are used to measure and record customer electric energy usage. AMI-compatible meters are used to monitor for abnormal conditions, including voltage or temperature irregularities and full or partial loss of grid power, at the meter base.

2.1 RX, RXe, RXe-SD, and RXRei-SD-Designated Meters

RX, RXe, RXe-SD, and RXRei-SD meters are typically used for smaller services for residential and small commercial accounts.

RX, RXe, and RXe-SD meters are used for services where the meter socket voltage is either 120V, 208V, or 240V and (in services with current transformers) where the CT Ratio is less than or equal to 40. These meters will measure and report delivered and received kWh and kVARh.

RXe meters are single-phase and either single-voltage or multiple-voltage.

RX meters may be either single or polyphase, and either single-voltage or multiple-voltage.

RXe-SD and RXRei-SD meters are equipped with a service disconnect.

2.2 AXe and AXe-SD-Designated Meters

AXe and AXe-SD meters are single-phase meters that can be used for smaller services for residential and small commercial accounts when the customer has selected a non-communicating meter.

These meters are used for services where the meter socket voltage is either 120V, 208V, or 240V and (in services with current transformers) where the CT Ratio is less than or equal to 40. AXe and AXe-SD meters will measure and report delivered and received kWh and kVARh to an optical port or LCD display.

AXe and AXe-SD meters will not communicate with the AMI network.

AXe-SD meters are equipped with a service disconnect.

2.3 S4X-Designated Meters

S4X meters are multiple voltage meters (socket voltages between 120 V and 480 V). These are typically used for larger meter sets that include:

- Potential transformers
- Current transformers with a CT ratio greater than 40
- A socket voltage of 277 V or 480 V
- Single phase meters with non-standard socket voltages for that form

S4X meters are true four-quadrant meters and will measure and report delivered and received kWh, and all four quadrants of kVARh.

3. Industry Standards

AMI-compatible meters shall meet the applicable requirements of the following industry standards:

ANSI C12.1-2014; Electric Meters Code for Electricity Metering

ANSI C12.10-2011; Physical Aspects of Watthour Meters-Safety Standard

ANSI C12.18-2016; Protocol Specification for ANSI Type 2 Optical Port

ANSI C12.19-2012; Utility Industry End Device Data Tables

ANSI C12.20-2015; Electricity Meters - 0.2 and 0.5 Accuracy Classes

ANSI C12.22-2012; Protocol Specification for Interfacing to Data Communication Networks

FCC Title 47 Chapter 1, Subchapter A, Part 15; Radio Frequency Devices

IEC 61000-4-2:2008; Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test

IEC 61000-4-3:2010; Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test

IEC 61000-4-4:2012; Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test

IEC 61000-4-5:2014; Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test

IEC 61000-4-6:2013; Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields

IEC 61000-4-8:2009; Electromagnetic compatibility (EMC) - Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test

IEC 61000-4-9:2016; Electromagnetic compatibility (EMC) - Part 4-9: Testing and measurement techniques - Impulse magnetic field immunity test

IEC 61000-4-11:2017; Electromagnetic compatibility (EMC) - Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests

IEEE 519; IEEE Recommended Practice and Requirements for Harmonic Control in Electric Power Systems

IEEE C37.90.1-2012; IEEE Standard for Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus

ISO 9000:2005; Quality Management Systems

UL 2735; Electric Utility Meters

4. Requirements

4.1 General

The vendor shall specify all tools and training necessary to verify AMI-compatible meter accuracy, and to install and maintain the meter. This includes support equipment (hardware), documentation (manuals, instructions, etc.), and software.

Software shall include site licenses, upgrades, tracking, life expectancy, and compatibility (such as any standard read protocol). Each meter shall be provided with a nameplate meeting the requirements of SCL 4980.10.

Completed AMI-compatible meters shall be capable of withstanding internal failure without explosion or fire.

Meter label color shall be according to SCL 4980.10.

AMI-compatible meters shall meet the requirements listed in Table 4.1.

Table 4.1. Common Requirements for AMI-Compatible Meters

Attribute	Value
Phase	Single or poly
Mounting	Socket S (detachable)
Frequency	60 Hz
UL Compliance	UL 2735
Construction	▪ Solid-state operation ▪ Thermal sensor ▪ 5 or 6-character LCD display ▪ Single-mold polycarbonate cover ▪ Current transformer built into base ▪ Dustproof, insect-proof, and raintight for outdoor use ▪ Sealed effectively with a T-bar seal ▪ Gridstream communication module ▪ 5th terminal in the 9:00 position
Input voltage, operating range	80 to 115% of nominal voltage
Temperature, operating range, degrees, under cover	
°C	-40 to +85
°F	-40 to +185
Over-voltage withstand	▪ Temporary (0.5 seconds) 150% rated voltage ▪ Continuous (5 hours) 120% rated voltage
Frequency, operating range	+/- 5%
Humidity, operating range	5% to 95% non-condensing
Design life	20 years
Test links	Not required
Magnetic activation read switch	To initiate alternate display

4.2 Accuracy Class

The accuracy class of each meter shall be 0.2.

4.3 Meter Radio

RX, RXe, RXRei, and S4X meters shall be equipped with an AMI communication module (radio), programmed and tested by the meter manufacturer for use on the SCL AMI system.

Radios shall be compliant with Landis + Gyr Gridstream series radios.

AXe and AXe-SD meters shall not communicate with the AMI network.

4.4 Meter Register

Software used to program the register shall be compatible with Windows 10 and available to SCL for use on Technical Metering computers. Software shall be onsite, licensed for use by SCL and acceptable to the users.

A pulsing infrared or LCD output on the register shall be provided for testing watthours.

Optical meter communications for reading, programming, and for configuring soft switches shall be performed through an ANSI Type 2 Optical Port as specified in ANSI C12.18.

The serial number shall be 9 digits or fewer. Details on size and style of the serial number are included in SCL 4980.10.

The following features and functions shall be provided on the register or nameplate:

- Power flow indication on the display to determine load and direction.
- A segment check as part of the normal display sequence.
- A programmable “K" value, if used. Display is optional.
- An electronics self-check to indicate errors.
- Space on the front of the meter, and visible through the cover, for multiplier and other programmable values (such as the "K" value).

5. Testing

5.1 Test Data

Test data that establishes compliance with the requirements of ANSI C12.1 and this standard shall be provided upon request.

5.2 Certified Test Data File

A certified test data file shall be provided as specified in SCL 4980.05.

5.3 Calibrations

Calibrations shall be stable whether fixed or adjustable by SCL personnel.

Adjustments (on adjustable meters) may be made by using either hardware or software. All adjustments shall be stable over the life of the meter.

5.4 Meter Acceptability

Meter acceptability shall be determined through sample evaluation by the SCL Technical Meter Shop. Test results obtained during acceptance or verification testing shall meet the requirements as specified in SCL 4980.05.

5.5 Testing Capability

Meters shall be capable of being tested using existing utility test equipment.

Field tests shall be performed in a test mode that does not affect the measured register data. Or, the register read must be able to be reset to a reading.

The test mode may be accessed through software or a switch (hardware), or both.

Provisions shall be made to assure that a meter cannot be inadvertently left in the test mode. This shall be done by a software program or by a message on the display (least desirable) when the meter is placed back in service.

6. Design Changes

The manufacturer shall inform SCL in writing of all design changes that could affect the understood or published capabilities of the product. The manufacturer shall obtain SCL approval six months prior to shipment of changed product.

7. Marking

Meters, cartons, and shipping pallets shall be labeled according to the requirements of SCL 4980.10.

8. Packaging

Meters shall be packaged to prevent damage during shipping, handling, and inside storage.

Meters shall be packaged up to four per carton.

Cartons shall be shipped stacked and shrink wrapped to wood pallets.

9. Issuance

Unit: EA

10. Approved Manufacturers

10.1 RX and RXe-Designated Meters

Stock No.	Form	LAN ID / AMI Label Colors	Barcode Serial No. Format	Landis+Gyr Catalog No.
014592	2S	White / White	NXAxxxxxxxxxF7E13	JM010XA5-0A78-600U
014593	2SE	Green / Split Green-White	NYAxxxxxxxxxF8E13	JM040XA5-0A78-600U
014594	4S	Red / Split Red-White	RJAxxxxxxxxxFQE13	JM0J0XA5-0A78-600U
014598	9S	Red / Split Red-White	KZAxxxxxxxxxFQE13	GM9A0XAC-0A78-600U
014599	16S	White / White	TEAxxxxxxxxxF7E13	GM2B0XAC-0A78-600U

where:

Catalog Digits 1 & 2: PRODUCT IDENTIFICATION
- JM = Focus RXe Reactive Energy, single-phase, with Time Of Use (TOU) register & 76K load profile w/ no battery (this feature requires a two-way AMI system capable of keeping time)
- GM = Focus RX Reactive Energy, polyphase, with Time Of Use (TOU) register & 76K load profile w/ no battery (this feature requires a two-way AMI system capable of keeping time)

Catalog Digits 3 & 4: FORM, VOLTAGE, TEST AMPERES (TA), CURRENT CLASS, & WIRES
- 01 = 2S, 240 V, 30.0 A, 200 A, 3
- 04 = 2SE, 240 V, 50.0 A, 320 A, 3
- 0J = 4S, 240 V, 2.5 A, 20 A, 3
- 9A = 9S/8S, 120-277 V, 2.5 A, 20 A, 4
- 2B = 16/15/14S (No potential links), 120-277 V, 30.0 A, 200 A, 4

Catalog Digit 5: REGISTER OPTIONS
- 0 = no option board

Catalog Digit 6: HOUSING OPTIONS
- X = demand reset, test mode lever, scroll button (71812-10, 14, or 18), no perimeter openings

Catalog Digits 7 & 8: INSTALLED COMMUNICATIONS
- A5 = yes
- AC = yes

Catalog Digits 9, 10, 11 & 12: CUSTOMER OPTIONS
- 0A78 = Seattle City Light identifier

Catalog Digit 13: CLEAR COVER OPTIONS
- 6 = low profile poly (4.5 in) w/ optical port (72147-4)

Catalog Digit 14: INFORMATIONAL AIDS
- 0 = FCC label & warning label (English)

Catalog Digit 15: FOR FUTURE
- 0 = standard

Catalog Digit 16: CERTIFICATION AND SEALING
- U = UL 2735 Compliance Labeling

10.2 RXe-SD and RXRei-SD-Designated Meters

Stock No.	Form	LAN ID / AMI Label Colors	Barcode Serial No. Format	Landis+Gyr Catalog No.
014595	1S-SD	White / White	ZSAxxxxxxxxxF6F13	HMA00XA5-0A78-600U
014596	2S-SD	White / White	NXAxxxxxxxxxF7F13	HMA10XA5-0A78-600U
New Meters Under Test				
014804	2SE-SD	Green / Split Green-White	NYAxxxxxxxxxF8F13	HMA70XA5-0A78-600U
014985	25S-SD	White / White	W6AxxxxxxxxxF7F13	HTBH0XA4-0A78-600U

where:

Catalog Digits 1 & 2: PRODUCT IDENTIFICATION

HM = Focus RXe Reactive Energy, with disconnect, with Time of Use (TOU) register & 76K load profile w/ no battery (this feature requires a two-way AMI system capable of keeping time)

HT = Focus RXRei-SD Reactive Energy, with disconnect with Time of Use (TOU) register & 76K load profile w/ no battery (this feature requires a two-way AMI system capable of keeping time)

Catalog Digits 3 & 4: FORM, VOLTAGE, TEST AMPERES (TA), CURRENT CLASS, & WIRES

A0 = 1S, 120 V, 15.0 A, 100 A, 2

A1 = 2S, 240 V, 30.0 A, 200 A, 3

A7 = 2SE, 240 V, 50.0 A, 320 A, 3

BH = 25S, 120 V, 30.0 A, 200 A, 3

Catalog Digit 5: REGISTER OPTIONS

0 = no option board

Catalog Digit 6: HOUSING OPTIONS

X = demand reset, test mode lever, scroll button (71812-10, 14, or 18), no perimeter openings

Catalog Digits 7 & 8: INSTALLED COMMUNICATIONS

A4 = yes

A5 = yes

Catalog Digits 9, 10, 11 & 12: CUSTOMER OPTIONS

0A78 = Seattle City Light identifier

Catalog Digit 13: CLEAR COVER OPTIONS

6 = low profile poly (4.5 in) w/ optical port (72147-2)

Catalog Digit 14: INFORMATIONAL AIDS

0 = FCC label & warning label (English)

Catalog Digit 15: FOR FUTURE

0 = standard

Catalog Digit 16: CERTIFICATION AND SEALING

U = UL 2735 compliance labeling

10.3 AXe-Designated Meters

Stock No.	Form	LAN ID / AMI Label Colors	Barcode Serial No. Format	Landis+Gyr Catalog No.
014586	1S	Blue / Split Blue-White	ZSAxxxxxxxxxQCG13	JG000X00-0A78-600U
014587	2S	Blue / Split Blue-White	NXAxxxxxxxxxQDG13	JG010X00-0A78-600U
014588	2SE	Blue / Split Blue-White	NYAxxxxxxxxxQKG13	JG040X00-0A78-600U
014589	3S	Blue / Split Blue-White	TRAxxxxxxxxxRCG13	JG0H0X00-0A78-600U
014590	4S	Blue / Split Blue-White	RJAxxxxxxxxxRCG13	JG0J0X00-0A78-600U

where:

Catalog Digits 1 & 2: PRODUCT IDENTIFICATION
- JG = Focus AXe Active Energy, with Time Of Use (TOU) register & 76K load profile w/ no battery (this feature requires a two-way AMI system capable of keeping time)

Catalog Digits 3 & 4: FORM, VOLTAGE, TEST AMPERES (TA), CURRENT CLASS, & WIRES
- 00 = 1S, 120 V, 15.0 A, 100 A, 2
- 01 = 2S, 240 V, 30 .0 A, 200 A, 3
- 04 = 2SE, 240 V, 50.0 A, 320 A, 3
- 0H = 3S, 240 V, 2.5 A, 20 A, 2
- 0J = 4S, 240 V, 2.5 A, 20 A, 3

Catalog Digit 5: REGISTER OPTIONS
- 0 = no option board

Catalog Digit 6: HOUSING OPTIONS
- X = demand reset, test mode lever, scroll button (71812-10, 14, or 18), no perimeter openings

Catalog Digits 7 & 8: INSTALLED COMMUNICATIONS
- 00 = none

Catalog Digits 9, 10, 11 & 12: CUSTOMER OPTIONS
- 0A78 = Seattle City Light identifier

Catalog Digit 13: CLEAR COVER OPTIONS
- 6 = low profile poly (4.5 in) w/ optical port (72147-4)

Catalog Digit 14: INFORMATIONAL AIDS
- 0 = FCC label & warning label (English)

Catalog Digit 15: FOR FUTURE
- 0 = standard

Catalog Digit 16: CERTIFICATION AND SEALING
- U = UL 2735 compliance labeling

10.4 AXe-SD-Designated Meters

Stock No.	Form	LAN ID / AMI Label Colors	Barcode Serial No. Format	Landis+Gyr Catalog No.
014591	25S	Blue / Split Blue-White	W6AxxxxxxxxxQDG13	HGBH0X00-0A78-600U

where:

Catalog Digits 1 & 2: PRODUCT IDENTIFICATION

HG = Focus AXe Active Energy, with disconnect, with Time Of Use (TOU) register & 76K load profile w/ no battery (this feature requires a two-way AMI system capable of keeping time)

Catalog Digits 3 & 4: FORM, VOLTAGE, TEST AMPERES (TA), CURRENT CLASS, & WIRES

BH = 25S, 120 V, 30.0 A, 200 A, 3

Catalog Digit 5: REGISTER OPTIONS

0 = no option board

Catalog Digit 6: HOUSING OPTIONS

X = demand reset, test mode lever, scroll button (71812-10, 14, or 18), no perimeter openings

Catalog Digits 7 & 8: INSTALLED COMMUNICATIONS

00 = none

Catalog Digits 9, 10, 11 & 12: CUSTOMER OPTIONS

0A78 = Seattle City Light identifier

Catalog Digit 13: CLEAR COVER OPTIONS

6 = low profile poly (4.5 in) w/ optical port (72147-4)

Catalog Digit 14: INFORMATIONAL AIDS

0 = FCC label & warning label (English)

Catalog Digit 15: FOR FUTURE

0 = standard

Catalog Digit 16: CERTIFICATION AND SEALING

U = UL 2735 compliance labeling

10.5 S4X-Designated Meters

Stock No.	Form	LAN ID / AMI Label Colors	Barcode Serial No. Format	Landis+Gyr Catalog No.
014750	1S	White / White	0KAxxxxxxxxxGRE13	XC3P0KET0100-0A78U
014751	2S	White / White	NXAxxxxxxxxxGRE13	XC470KET0100-0A78U
014752	3S	Red / Split Red-White	Y0AxxxxxxxxxGQE13	XC9N0KET0100-0A78U
014753	4S	Red / Split Red-White	3HAxxxxxxxxxGQE13	XC3Q0KET0100-0A78U
014754	9S	Red / Split Red-White	KZAxxxxxxxxxGQE13	XC000KET0100-0A78U
014755	9S KYZ	Red / Split Red-White	KZAxxxxxxxxxGQE13	XC001KET0100-0A78
014756	25S	White / White	W6AxxxxxxxxxGRE13	XC9C0KET0100-0A78U
014757	16S	White / White	TEAxxxxxxxxxGRE13	XC0K0KET0100-0A78U
014758	45S	Red / Split Red-White	X9AxxxxxxxxxGQE13	XC010KET0100-0A78U

where:

Catalog Digits 1 & 2: PRODUCT IDENTIFICATION
- XC = E650 RXe with Time Of Use (TOU) register and 256K load profile w/ no battery (this selection requires a two-way AMI system capable of keeping and setting time OR where the meter will be utilized in a non-TOU application)

Catalog Digits 3 & 4: FORM, VOLTAGE, TEST AMPERES (TA), CURRENT CLASS, & WIRES
- 3P = 1S, 120-480 V, 15 A, 200 A, 2
- 07 = 2S, 240-480 V, 30 A, 200 A, 3
- 47 = 2S, 240-480 V, 30 A, 200 A, 3, no pot links
- 9N = 3S, 9 o'clock, 120-480 V, 2.5 A, 20 A, 2
- 3Q = 4S, 120-480 V, 2.5 A, 20 A, 3
- 00 = 9S/8S, 120-480 V, 2.5 A, 20 A, 4
- 9C = 25S, 9 o'clock, 120-480 V, 30 A, 200 A, 3
- 0K = 16/15/14S (No potential links) 120-480 V, 30 A, 200 A, 4
- 01 = 45S, 120-480 V, 2.5 A, 20 A, 3

Catalog Digit 5: PULSE OUTPUT OPTIONS
- 0 = no option board, no KYZ relays
- 1 = two relays - Input-1, PCBA Part # 72544-1 w/ P/N 72615-1 30" cable w/ English language label

Catalog Digit 6: COVER OPTIONS
- K = smoke translucent (not opaque), optical port, only, 72515-11

Catalog Digits 7 & 8: INSTALLED COMMUNICATIONS
- AY = yes
- ET = yes

Catalog Digit 9: THREE-PHASE POWER SUPPLY OPTION
- 0 = default, metrology powered from "A" phase (single phase)

Catalog Digit 10: LOAD PROFILE OPTION
- 1 = standard load profile, single structure, may be used with 256K or 1 Meg. All channels have intervals of equal duration, in minutes

Catalog Digit 11: ASSEMBLY OPTION
- 0 = meter does not require additional assembly options (maintains demand across outages)

Catalog Digit 12: NON-AMR/AMI COMMUNICATIONS OPTION
- 0 = no non-AMR/AMI communications installed

Catalog Digits 13, 14, 15 & 16: CUSTOMER OPTIONS
- 0A78 = Seattle City Light identifier

Catalog Digit 17: LISTING AND CERTIFICATIONS
- U = UL 2735 compliance labeling

11. References

SCL Material Standard 4911.05; Kilowatthour Meter, Single-Phase, Solid-State, Electronic"

SCL Material Standard 4913.05; "Kilowatthour Meter, Polyphase, Solid-State, Electronic"

SCL Material Standard 4980.05; "Test Data Requirements, Electricity Meters"

SCL Material Standard 4980.10; "Bar Code, Nameplate, Shipping Label Requirements, Electricity Meters"

12. Sources

Hanson, Brett; SCL Standards Engineering Supervisor and originator of 4933.11

Kimball, Aimee; SCL Meter Engineer and subject matter expert for 4933.11

Shaw, Ben; SCL Meter Shop Crew Chief and subject matter expert for 4933.11