Status: TEST
Version: 1.0

IEEE 2030.5 CSIP Sub-Profiles Library

A Collection of Sub-Profiles of IEEE 2030.5 and the Common Smart Inverter Profile (CSIP)

SunSpec Specification

Abstract

The IEEE P2030.5.1 Working Group is updating CSIP, the Common Smart Inverter Profile of the IEEE 2030.5 standard. Originally, CSIP focused on California Rule 21 compliance. Now, IEEE has made CSIP more generic, removing specific categorizations like jurisdiction, standards, or device type. To address the resulting gap, the SunSpec CSIP Sub-Profiles Project defines requirements for common categories, known as Sub-Profiles of CSIP.

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Revision History

Version	Date	Comments
0.1	10-28-2025	Draft candidate.
1.0	01-15-2026	Promoted to TEST status.

About the SunSpec Alliance

The SunSpec Alliance is a California-based non-profit trade alliance that develops open information standards to support Distributed Energy Resource (DER) interoperability, cybersecurity, and grid resiliency. With over 180 member organizations from North America, Europe, Asia, Australia, and the Middle East, SunSpec serves manufacturers, software developers, utilities, and service providers across the DER industry.

SunSpec standards enable seamless integration of DER systems at residential, commercial, and utility scales, helping reduce cost, ensure compliance, and accelerate innovation. Membership is open to corporations, non-profits, and individuals.

Over 150 organizations are members of the SunSpec Alliance, including global leaders from Asia, Europe, and North America. Membership is open to corporations, non-profits, and individuals. For more information about the SunSpec Alliance, or to download SunSpec specifications at no charge, visit https://sunspec.org.

About the SunSpec Specification Process

SunSpec Alliance specifications are initiated by SunSpec members to establish an industry standard for mutual benefit. Any SunSpec member can propose a technical work item. Given sufficient interest and time to participate, and barring significant objections, a workgroup is formed, and its charter is approved by the board of directors. The workgroup meets regularly to advance the agenda of the team.

The output of the workgroup is generally in the form of a SunSpec Interoperability Specification. These documents are normative, meaning that there is a matter of conformance required to support interoperability. The revision and associated processes of managing these documents is tightly controlled. Other documents are informative, or make some recommendation about best practices, but are not a matter of conformance. Informative documents can be revised more freely to improve both the quality and quantity of information provided.

SunSpec Interoperability Specifications follow a lifecycle pattern of DRAFT, TEST, APPROVED, and SUPERSEDED statuses where these terms are defined as follows:

DRAFT: Some time after convening a SunSpec workgroup to develop a specification, a DRAFT is published. This means that the workgroup has decided the specification is complete and ready for public review and comment but may contain undiscovered errors. Multiple DRAFT revisions of the specification can be produced based upon the comments that are received.

TEST: When the workgroup decides the DRAFT specification is stable and free of normative errors, it is promoted to TEST status. TEST status means that the document is unlikely to contain significant defects and that it is ready to be implemented in demonstration projects, field tests, and early deployments. If defects of any type are discovered, they are remedied in a new TEST document and the process is repeated.

APPROVED: When the workgroup decides the specification has proven itself in field deployments and no additional comments have been received for some time, the document becomes an APPROVED SunSpec standard. Once APPROVED, the normative requirements in the document may not be changed.

SUPERCEDED: When a new specification that covers the same subject matter as an existing, APPROVED specification has reached the APPROVED stage, the original specification is labeled as SUPERCEDED. SUPERCEDED specifications remain in effect but are considered to be obsolete.

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1 Introduction

The SunSpec CSIP Sub-Profiles Project helps utilities, DER manufacturers, and operators specify requirements for common use cases, including those required by different jurisdictions. While CSIP sets the framework for device compliance and interoperability, this project adds detailed sub-profiles to address specific use case needs.

1.1 Word Usage

- ***SHALL*** – The word SHALL indicates mandatory requirements strictly to be followed in order to conform to the standard and from which no deviation is permitted (SHALL equals is required to).
- ***SHOULD*** – The word *SHOULD* indicates that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required (*SHOULD* equals is recommended that).
- ***MAY*** – The word MAY is used to indicate a course of action permissible within the limits of the standard (MAY equals is permitted to).
- ***CAN*** – The word CAN is used for statements of possibility and capability, whether material, physical, or causal (CAN equals is able to).

1.2 References

IEEE 1547-2018	*IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces* Unless otherwise indicated, any reference to IEEE 1547 refers to the 2018 revision.
IEEE 2030.5-2023	*IEEE Standard for Smart Energy Profile Application Protocol* Unless otherwise indicated, any reference to IEEE 2030.5 refers to the 2023 revision.
CSIP v2.1	*The Common Smart Inverter Profile v2.1* This document is the original CSIP profile published in March 2018
CSIP-2026	*The Common Smart Inverter Profile - 2026* The expected update to the *CSIP v2.1*

CSIP-AUS v1.2 *Common Smart Inverter Profile – Australia*
Version 1.2 published February 2025

1.3 Acronyms

Acronym	Name
CSIP	Common Smart Inverter Profile
DER	Distributed Energy Resource
DOE	Dynamic Operating Envelopes
EPS	Electric Power System
IEEE	Institute of Electrical and Electronics Engineers
GW	Gateway
LGP	Limited Generation Profile
PICS	Protocol Implementation Conformance Statement

Table 1 – Acronyms

2 Overview

This document assumes readers possess a foundational understanding of IEEE 2030.5 and CSIP.

The project defines sub-profiles of CSIP and operates under the following assumptions:

- Compliance with IEEE 2030.5-2023
- Compliance with CSIP-2026

Additional requirements necessary for particular jurisdictions and use cases are specified in this project. Each set of requirements is termed a “sub-profile” of CSIP. Devices may implement one or more sub-profiles as needed to specify end product functionality.

Generally, sub-profiles introduce requirements not addressed by IEEE 2030.5 or CSIP, including:

- **Device Information**: identification and version information
- **DER Controls**: mandatory DER controls
- **Nameplate Information**: required nameplate ratings and operational settings
- **Metering Information**: necessary meter readings to be reported
- **Status Information**: supplementary status data beyond CSIP specifications
- **Miscellaneous**: any additional requirements outside the scope of IEEE 2030.5 or CSIP

Note: CSIP identifies three types of actors: clients, servers, and aggregators. The term "CSIP actor" refers collectively to these entities.

2.1 Scope of Project

This project attempts to provide a rich set of sub-profiles for all stakeholders. By selecting one or more of the sub-profiles, stakeholders can define requirements based on jurisdiction (e.g. California Rule 21), based on standards (e.g. IEEE 1547), based on functionality (e.g. storage systems), based on device type (e.g. gateways), or any other type of categorization that is needed by industry.

2.2 Using the Sub-Profiles

This project establishes a detailed menu of sub-profiles for CSIP. Device manufacturers may choose to make their devices compliant with CSIP and one or more sub-profiles. During testing and certification, the device is evaluated for CSIP compliance along with any selected sub-profiles.

For example, a DER manufacturer wishing to sell in the PG&E territory in California may choose to implement the following sub-profiles:

- IEEE 1547 – satisfies DER interconnection in California and other jurisdictions

- Import-Export – adds dynamic operating envelopes or limited generation and load functions
- Energy Storage – adds active power dispatch and energy storage extensions
- PG&E Metering – adds metering requirements for the PG&E territory

2.3 Sub-Profiles Testing and Certification

CSIP Sub-Profile testing and certification can use the same existing infrastructure. When applying for certification, additional check boxes will be available for the submitter to indicate which sub-profile(s) the submitted product supports. An example of what the PICS (Protocol Implementation Conformance Statement) could look like is shown below:

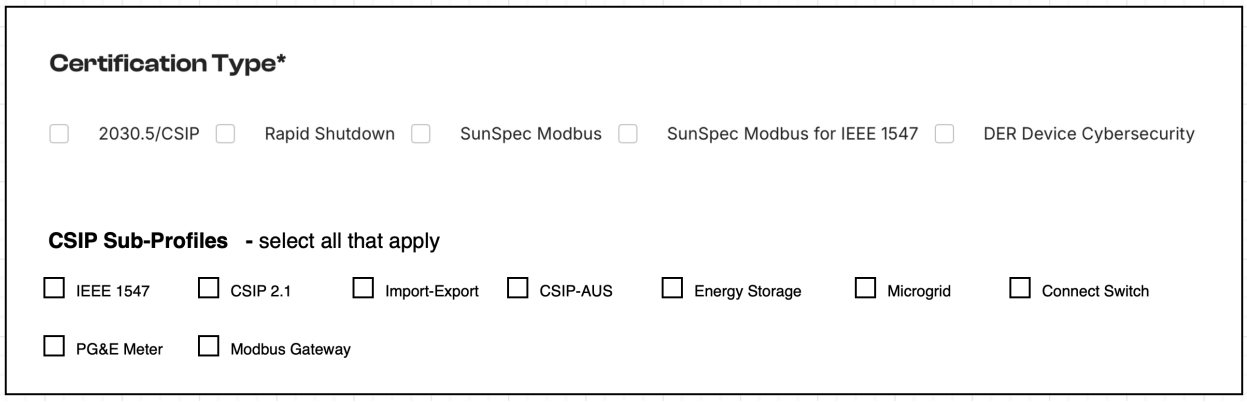

Figure 1 – Sub-Profile Example PICS

2.4 Sub-Profiles Available

The table below shows the sub-profiles of CSIP defined in this document.

Sub-Profiles	Description
IEEE 1547	Compliance with IEEE 1547-2018 and California Rule 21
CSIP v2.1	Compliance with CSIP v2.1 for legacy purposes
Import-Export	Adds active power limits for Dynamic Operating Envelopes
CSIP-AUS	Adds CSIP-AUS power limits for Dynamic Operating Envelopes
Energy Storage	Adds active power dispatch and other energy storage resources
Microgrid	Adds permission to island and re-connect for Microgrids
Connect Switch	Adds galvanic connection control
PG&E Meter	Adds meter readings compliant to PG&E Customer-Owned Telemetry
Modbus Gateway	Defines gateway mappings between IEEE 2030.5 and SunSpec Modbus

Table 2 – List of Sub-Profiles

2.5 Sub-Profile Summaries

This section provides informative summary tables of the following resources:

- DER Control Modes (*DERControls*)
- Nameplate Ratings (*DERCapability*)
- Operational Settings (*DERSettings*)
- Status (*DERStatus*)
- Meter Reading

These tables are informative, not normative. Refer to each sub-profile section for normative statements.

DER Controls	Sub-Profiles								
	IEEE 1547	CSIP v2.1	Import-Export	CSIP-AUS	Energy Storage	Microgrid	Connect Switch	PG&E Meter	Modbus GW
Voltage Ride-Through									
opModLVRTMustTrip	✓	✓							✓
opModLVRTMayTrip		✓							✓
opModLVRTMomentaryCessation	✓	✓							✓
opModHVRTMustTrip	✓	✓							✓
opModHVRTMayTrip		✓							✓
opModHVRTMomentaryCessation	✓	✓							✓
Frequency Ride-Through									
opModLFRTMustTrip	✓	✓							✓
opModLFRTMayTrip		✓							✓
opModHFRTMustTrip	✓	✓							✓
opModHFRTMayTrip		✓							✓
Ramp Rates									
setGradW		✓							✓
setSoftGradW		✓							✓
Connection Controls									
opModEnergize	✓	✓							✓
Enter Service (setESxxx)	✓								✓
opModConnect							✓		
Active Power Controls									
opModVoltWatt	✓	✓							✓
opModFreqWatt		✓							✓
opModFreqDroop	✓								✓
opModFixedW		✓			✓				✓
opModTargetW		✓			✓				✓
opModMaxLimW	✓	✓	✓						✓
opModMaxLimPctWAbsorb			✓						
opModMaxLimWAbsorb			✓						
opModMaxLimWInject			✓						O
opModDeltaW									O

Reactive Power Controls									
opModVoltVar	✓	✓							✓
opModFixedPFInjectW	✓	✓							✓
opModFixedPFAbsorbW									✓
opModFixedVar	✓								✓
opModTargetVar	✓								✓
opModWattVar	✓								✓
opModMaxLimPctVarAbsorb									
opModMaxLimPctVarInject									
opModDeltaVar									O
CSIP-AUS Controls									
csipaus:opModExpLimW				✓					O
csipaus:opModImpLimW				✓					
csipaus:opModGenLimW				✓					O
csipaus:opModLoadLimW				✓					
Islanding Controls									
opModGridConnectPermit						✓			
opModIslandPermit						✓			
Apparent Power Controls									
opModMaxLimPctVAAbsorb									
opModMaxLimPctVAInject									
Voltage Controls									
opModFixedV									
opModTargetV									

Figure 2 – Sub-Profile DER Controls

DERCapability	IEEE 1547	CSIP v2.1	Import-Export	CSIP-AUS	Energy Storage	Microgrid	Connect Switch	PG&E Meter	Modbus GW
Nameplate									
rtgMaxChargeRateW	✓	✓	✓	✓	✓				✓
rtgMaxDischargeRateW		✓	✓	✓	✓				✓
rtgMaxVA	✓	✓							✓
rtgMaxVar	✓	✓							✓
rtgMaxVarNeg	✓	✓							✓
rtgMaxW	✓	✓	✓	✓	✓				✓
rtgOverExcitedPF	✓								✓
rtgUnderExcitedPF	✓								✓
rtgMaxWh	✓	✓			✓				✓
rtgOverExcitedW	✓								✓
rtgUnderExcitedW	✓								✓
rtgAbnormalCategory	✓								✓
rtgNormalCategory	✓								✓
rtgMaxChargeRateVA	✓								✓
rtgMaxDisChargeRateVA									✓
rtgMaxV	✓								✓

rtgMinV	✓								✓
rtgVNom	✓								✓
modesSupported	✓								✓
modesSupported2	✓								✓
rtgReactiveSusceptance	✓								✓
rtgMinPFOverExcited		✓							✓
rtgMinPFUnderExcited		✓							✓
rtgMaxA									✓
rtgMaxAh									O
csipaus:doeModesSupported				✓					

Figure 3 – Sub-Profile Nameplate Ratings

DERSettings	Sub-Profiles								
	IEEE 1547	CSIP v2.1	Import-Export	CSIP-AUS	Energy Storage	Microgrid	Connect Switch	PG&E Meter	Modbus GW
Settings									
setMaxChargeRateW	✓	✓	✓	✓	✓				✓
setMaxDischargeRateW		✓	✓	✓	✓				✓
setMaxVA	✓	✓							✓
setMaxVar	✓	✓							✓
setMaxVarNeg	✓	✓							✓
setMaxW	✓	✓	✓	✓	✓				✓
setMaxWh	✓	✓			✓				✓
setMaxChargeRateVA	✓								✓
setMaxDischargeRateVA									✓
setMaxV	✓								✓
setMinV	✓								✓
setVNom	✓								✓
modesEnabled	✓								✓
modesEnabled2	✓								✓
setESDelay	✓								✓
setESHighFreq	✓								✓
setESHighVolt	✓								✓
setESLowFreq	✓								✓
setESLowVolt	✓								✓
setESRampTms	✓								✓
setESRandomDelay	✓								✓
setGradW		✓							✓
setSoftGradW		✓							✓
setMinPFOverExcited		✓							✓
setMinPFUnderExcited		✓							✓
setVRef									✓
setVRefOfs									✓
setMaxA									✓
setMaxAh									O
csipaus:doeModesEnabled				✓					

Figure 4 – Sub-Profile Operational Settings

DERStatus	Sub-Profiles								
	IEEE 1547	CSIP v2.1	Import-Export	CSIP-AUS	Energy Storage	Microgrid	Connect Switch	PG&E Meter	Modbus GW
Status									
alarmStatus	✓	✓	✓	✓	✓	✓	✓	✓	✓
connectStatus	✓		✓	✓	✓	✓	✓		✓
inverterStatus	✓	✓	✓	✓	✓	✓			✓
localControlModeStatus									✓
manufacturerStatus									
operationalModeStatus	✓	✓	✓	✓	✓	✓	✓	✓	✓
stateOfChargeStatus	✓	✓			✓				✓
storageModeStatus	✓	✓			✓				✓
genConnectStatus (deprecated)		✓							
storConnectStatus (deprecated)									

Figure 5 – Sub-Profile DER Status

Meter Readings	Sub-Profiles								
	IEEE 1547	CSIP v2.1	Import-Export	CSIP-AUS	Energy Storage	Microgrid	Connect Switch	PG&E Meter	Modbus GW
Status									
Active Power Net	✓	✓	✓	✓	✓			✓	
Active Power Forward			✓	✓	✓				
Active Power Reverse			✓	✓	✓				
Reactive Power Net	✓	✓						✓	
Frequency	✓	✓	✓	✓	✓				
Voltage L1	✓	✓	✓	✓	✓			✓	
Voltage L2	✓	✓	✓	✓	✓			✓	
Voltage L2	✓	✓	✓	✓	✓			✓	
Active Power L1								✓	
Active Power L2								✓	
Active Power L3								✓	
Reactive Power L1								✓	
Reactive Power L2								✓	
Reactive Power L3								✓	
Current L1								✓	
Current L2								✓	
Current L3								✓	
Energy Net					✓				
Energy Forward					✓				
Energy Reverse					✓				

Figure 6 – Sub-Profile Meter Readings

3 General Technical Requirements

3.1 General

CSIP actors SHALL comply with IEEE 2030.5-2023 unless noted otherwise.

CSIP actors SHALL comply with CSIP-2026 unless noted otherwise.

If there is a conflict between IEEE 2030.5-2023 and CSIP-2026 normative text, CSIP-2026 SHALL take precedence.

If there is a conflict between the normative text in the referenced standards and this document, the normative text in this document SHALL take precedence.

If there is a conflict between general and sub-profile normative text, the sub-profile text SHALL take precedence.

3.2 DeviceInformation

CSIP actors SHALL support and report the *DeviceInformation* resource.

CSIP actors SHALL support all the *DeviceInformation* fields in the table below.

CSIP actors MAY support other *DeviceInformation* fields.

Device Information	Notes
`mfID`	Private Enterprise Number
`mfModel`	Model Number
`mfSerNum`	Serial Number
`mfHwVer`	Hardware Version
`swVer`	Software Version

Table 3 – Device Information

3.3 DeviceCategory

CSIP actors SHOULD not set any bits in its *DeviceCategory* bitmap unless otherwise required by a sub-profile.

If a server sets a specific *DeviceCategory* bit in a *DERControl*, clients lacking that bit SHALL filter out and silently ignore the control, following IEEE 2030.5-2023 event processing rules.

3.4 LogEvent

When initially connecting to the server, non-aggregator CSIP clients SHALL send the *LE_GEN_HARDW*ARE_RTN (code 0x01) event if a *L*ogEvent resource link is provided.

When initially connecting to the server, CSIP aggregators SHALL send the *LE_GEN_HARDW*ARE_RTN (code 0x01) event if a *L*ogEvent resource link is provided. CSIP clients managed by aggregators SHALL not send this event.

The successful sending of this *LogEvent* signifies both a generally successful connection and a confirmed link to the *LogEvent* server. An unusually elevated frequency of posting this *LogEvent* may assist the server in identifying clients experiencing issues.

3.5 DER Controls

Each sub-profile SHALL define which DER controls are mandatory for that sub-profile. Both *DERControl* and *DefaultDERControl* SHALL be supported for each control unless noted otherwise.

3.6 DER Curves

CSIP actors SHALL support the following *DERCurve* parameters unless specified otherwise in the sub-profiles:

- *curveType* – specifies the associated curve-based DERControl Mode
- *openLoopTms* – open loop response time
- *xMultiplier* – power of ten exponent for the x-axis
- *yMultiplier* – power of ten exponent for the y-axis
- *description* – text string naming or describing the curve
- *curveType* – specifies the associated curve-based DERControl Mode

CSIP actors MAY support other optional *DERCurve* parameters.

3.7 DER Information

Each sub-profile SHALL define which of the DER Information resources (*DERCapability, DERSettings, DERStatus, and DERAvailability, CurrentDERControls*) are mandatory for that sub-profile.

3.8 Meter Readings

Each sub-profile SHALL define which meter readings are mandatory for that sub-profile.

4 Sub-Profiles Requirements

4.1 IEEE 1547 Sub-Profile

This sub-profile defines all requirements needed to comply with IEEE 1547-2018.

4.1.1 DER Controls and Default DER Controls

For the *DefaultDERControl* resource, the CSIP server SHALL include the *version* field with the identified object. The server SHALL increment the *version* field value whenever a change is made to the *DefaultDERControl*.

If the CSIP client or aggregator receives the *DefaultDERControl version* field, it SHALL use changes in this field to detect updates. If the field is not received, detection SHALL still be required through other methods, such as maintaining previous values or hashes.

CSIP actors SHALL support both the *DERControl* and *DefautDERControl* versions of the controls shown in the table below unless noted otherwise.

CSIP clients SHALL indicate support for all DERControls in the table below by setting the corresponding bits in the *modesSupported, modesSupported2, modesEnabled, and modesEnabled2* fields of the *DERCapability* and *DERSettings* resources.

Voltage Ride-Through	Notes
opModLVRTMustTrip	Low voltage ride-through Must Trip curve
opModLVRTMomentaryCessation	Low voltage ride-through Momentary Cessation curve
opModHVRTMustTrip	High voltage ride-through Must Trip curve
opModHVRTMomentaryCessation	High voltage ride-through Momentary Cessation curve
Frequency Ride-Through	
opModLFRTMustTrip	Low frequency ride-through Must Trip curve
opModHFRTMustTrip	High frequency ride-through Must Trip curve
Connection Controls	
opModEnergize	Used as Permit Service: Enter Service
Active Power Controls	
opModVoltWatt	Volt-Watt curve control
opModFreqDroop	Frequency droop algorithm for frequency-watt control
opModMaxLimW	Maximum active power generation as a percentage of capacity
Reactive Power Controls	
opModVoltVar	Volt-Var curve control
opModFixedPFInjectW	Fixed power-factor setting when injecting active power
opModFixedVar	Specifies the delivered or received reactive power setpoint

opModTargetVar	Target reactive power in vars
opModWattVar	Watt-Var curve control
Enter Service Settings	
DefaultDERControl:setESDelay	Enter Service delay
DefaultDERControl:setESRandomDelay	Enter Service random delay
DefaultDERControl:setESRampTms	Enter Service ramp time
DefaultDERControl:setESHighFreq	Enter Service high frequency parameter
DefaultDERControl:setESLowFreq	Enter Service low frequency parameter
DefaultDERControl:setESHighVolt	Enter Service high voltage parameter
DefaultDERControl:setESLowVolt	Enter Server low voltage parameter

Table 4 – IEEE 1547 DER Controls

4.1.1.1 Connection Control (opModEnergize)

The *opModEnergize* control is used to initiate or exit the IEEE 1547 Permit Service (Enter Service) function. Note that *opModEnergize* does not imply a physical galvanic connection.

4.1.1.2 Volt-Watt Curve (opModVoltWatt)

The *opModVoltWatt* curve control varies the active power as a function of measured voltage. The active powere is a percentage of the selected reference (*yRefType*).

CSIP actors SHALL support the following active power references:

- Maximum active power setting *(%setMaxW*)
- Available active power *(%statWAvail*)

4.1.1.3 Volt-Var Curve (opModVoltVar)

The *opModVoltVar* curve control provides reactive power compensation as a function of measured voltage. The reactive power is a percentage of the selected reference (*yRefType*).

CSIP actors SHALL support the following reactive power references:

- Maximum active power setting *(%setMaxW*)
- Maximum apparent power setting *(%setMaxVA*)
- Maximum reactive power setting *(%setMaxVar*)
- Available reactive power *(%statVarAvail*)

CSIP actors SHALL support the following *DERCurve* parameters:

- *vRef* – the nominal AC voltage (RMS) adjustment to the voltage curve points

- *autonomousVRefEnable* – enables/disables the autonomous adjustment of *vRef*
- *autonomousVRefTimeConstant* – the time constant used in the autonomous adjustment of *vRef*

4.1.1.4 Reactive Power Setpoint Control (opModFixedVar)

The *opmodFixedVar* control sets the reactive power setpoint. The reactive power is a percentage of the selected reference (*yRefType*).

CSIP actors SHALL support the following reactive power references:

- Maximum active power setting *(%setMaxW*)
- Maximum apparent power setting *(%setMaxVA*)
- Maximum reactive power setting *(%setMaxVar*)
- Available reactive power *(%statVarAvail*)

4.1.1.5 Watt-Var Curve (opModWattVar)

The *opModWattVar* curve control provides reactive power compensation as a function of delivered or received active power. The reactive power is a percentage of the selected reference (*yRefType*).

CSIP actors SHALL support the following reactive power references:

- Maximum active power setting *(%setMaxW*)
- Maximum apparent power setting *(%setMaxVA*)
- Maximum reactive power setting *(%setMaxVar*)
- Available reactive power *(%statVarAvail*)

4.1.1.6 Enter Service (setESxxx)

The Enter Service parameters are adjustable settings (*setESxxx*) found exclusively in the *DefaultDERControl* resource. There are seven *setESxxx* parameters available. When updating any Enter Service parameters, the server SHALL include all seven parameters in the same *DefaultDERControl* update.

If a CSIP client or aggregator gets an Enter Service update missing any of the seven parameters in the *DefaultDERControl*, they SHALL reject all Enter Service parameters and return the relevant rejection *Response*.

4.1.2 DER Nameplate and Operational Settings

CSIP actors SHALL support the *DERCapability* and *DERSettings* fields shown in the table below.

CSIP actors MAY support other optional *DERCapability* and *DERSettings* fields.

If the DER only supports nameplate ratings, the CSIP client SHALL copy the *DERCapability* field values to the corresponding *DERSettings* field values where possible.

DERCapability	DERSettings	Notes
modesSupported	modesEnabled	Bitmap indicating the DERControl Modes implemented by the device
modesSupported2	modesEnabled2	Bitmap indicating the DERControl Modes implemented by the device
rtgMaxChargeRateW	setMaxChargeRateW	Active power charge maximum rating/setting
rtgMaxVA	setMaxVA	Apparent power rating/setting
rtgMaxVar	setMaxVar	Reactive power injected maximum rating/setting
rtgMaxVarNeg	setMaxVarNeg	Reactive power absorbed maximum rating/setting
rtgMaxW	setMaxW	Active power rating at unity power factor
rtgOverExcitedW		Active power rating at specified over-excited power factor
rtgOverExcitedPF		Over-excited power factor
rtgUnderExcitedW		Active power rating at specified under-excited power factor
rtgUnderExcitedPF		Under-excited power factor
rtgMaxChargeRateVA	setMaxChargeRateVA	Apparent power charge maximum rating/setting
rtgMaxV	setMaxV	AC voltage maximum rating/setting
rtgMinV	setMinV	AC voltage minimum rating/setting
rtgVNom	setVNom	AC voltage nominal rating/setting
rtgReactiveSusceptance		Reactive susceptance that remains connected to the Area EPS in the cease to energize and trip state
rtgAbnormalCategory		Abnormal operating performance category
rtgNormalCategory		Normal operating performance category
	setESDelay	Enter Service delay
	setESHighFreq	Enter Service high frequency parameter
	setESHighVolt	Enter Service high voltage parameter
	setESLowFreq	Enter Service flow requency parameter
	setESLowVolt	Enter Service low voltage parameter
	setESRampTms	Enter Service ramp time
	setESRandomDelay	Enter Service random delay

Table 5 – IEEE 1547 Nameplate Ratings and Operational Settings

4.1.3 DER Status

CSIP actors SHALL support the *DERStatus* fields shown in the table below.

CSIP actors MAY support other optional *DERStatus* fields.

DER Status	Notes
alarmStatus	Bitmap indicating the status of DER alarms
inverterStatus	Status value indicating the state of the inverter
operationalModeStatus	Operating mode current in effect

connectStatus	Bitmap of connection status
stateOfChargeStatus	State of charge status

Table 6 – IEEE 1547 DER Status

4.1.3.1 Connection Status

Note that the *Connected* bit (bit 0) of *connectStatus* is not used by this sub-profile. Only the *Energized* bit (bit 1) is used, and it represents the IEEE 1547 Permit Service (Enter Service) status.

4.1.3.2 State of Charge Status

Note: It is unclear if the *stateOfChargeStatus* is required by IEEE 1547-2018. The standard only mentions it in the definitions section and table 29 (Monitoring Information). Otherwise, it is not used.

TODO: Potential removal from this sub-profile since it may not be a real requirement.

4.1.4 Meter Readings

CSIP actors SHALL support the meter readings and *ReadingType* parameters described in the table below. A blank cell in the table means the corresponding *ReadingType* parameter SHOULD be omitted.

CSIP actors MAY support other meter readings.

For all readings in the table below, CSIP actors:

- SHALL use an *accumulationBehavior* = 12 (instantaneous)
- SHALL use a *commodity* = 1 (electricity)

Meter Reading	flowDirection	Kind	Phase	UOM
Real Power	4 = Net	37 = Power		38 = W
Reactive Power	4 = Net	37 = Power		63 = var
Frequency	0 = N/A			29 = Voltage
Voltage L1,L2,L3	0 = N/A		{phase-code}	33 = Hz

Table 7 – IEEE 1547 Meter Readings

4.2 CSIP v2.1 Sub-Profile (Legacy)

This sub-profile defines all requirements needed to comply with the original CSIP v2.1 specification. Going forward, devices should use the IEEE 1547-2018 sub-profile instead. This sub-profile is provided for legacy purposes.

4.2.1 DER Controls and Default DER Controls

CSIP actors SHALL support both the *DERControl* and *DefautDERControl* versions of the controls shown in the table below unless noted otherwise.

CSIP clients SHALL indicate support for all DERControls in the table below by setting the corresponding bits in the *modesSupported, modesSupported2, modesEnabled, and modesEnabled2* fields of the *DERCapability* and *DERSettings* resources.

Voltage Ride-Through	Notes
opModLVRTMustTrip	Low voltage ride-through Must Trip curve
opModLVRTMayTrip	Low voltage ride-through May Trip curve
opModLVRTMomentaryCessation	Low voltage ride-through Momentary Cessation curve
opModHVRTMustTrip	High voltage ride-through Must Trip curve
opModHVRTMayTrip	High voltage ride-through May Trip curve
opModHVRTMomentaryCessation	High voltage ride-through Momentary Cessation curve
Frequency Ride-Through	
opModLFRTMustTrip	Low frequency ride-through Must Trip curve
opModLFRTMayTrip	Low frequency ride-through May Trip curve
opModHFRTMustTrip	High frequency ride-through Must Trip curve
opModHFRTMayTrip	High frequency ride-through May Trip curve
Connection Controls	
opModEnergize	Energize/de-energize control
Active Power Controls	
opModVoltWatt	Volt-Watt curve control
opModFreqWatt	Frequency-Watt curve control
opModMaxLimW	Maximum active power generation as a percentage of capacity
Reactive Power Controls	
opModVoltVar	Volt-Var curve control
opModFixedPFInjectW	Fixed power-factor setting when injecting active power
Ramp Rates	
setGradW	Rate of change (ramp rate) for active power changes
setSoftGradW	Soft-start rate of change (soft-start ramp rate) for active power

Table 8 – CSIP v2.1 DER Controls

4.2.1.1 Volt-Watt Curve (opModVoltWatt)

The *opModVoltWatt* curve control varies the active power as a function of measured voltage. The active power is a percentage of the selected reference (*yRefType*).

CSIP actors SHALL support the following active power references:

- Maximum active power setting *(%setMaxW*)
- Available active power *(%statWAvail*)

4.2.1.2 Volt-Var Curve (opModVoltVar)

The *opModVoltVar* curve control provides reactive power compensation as a function of measured voltage. The reactive power is a percentage of the selected reference (*yRefType*).

CSIP actors SHALL support the following reactive power references:

- Maximum active power setting *(%setMaxW*)
- Maximum apparent power setting *(%setMaxVA*)
- Maximum reactive power setting *(%setMaxVar*)
- Available reactive power *(%statVarAvail*)

CSIP actors SHALL support the following *DERCurve* parameters:

- *vRef* – the nominal AC voltage (RMS) adjustment to the voltage curve points
- *autonomousVRefEnable* – enables/disables the autonomous adjustment of *vRef*
- *autonomousVRefTimeConstant* – the time constant used in the autonomous adjustment of *vRef*

4.2.2 DER Info: Nameplate and Operational Settings

CSIP actors SHALL support the *DERCapability* and *DERSettings* fields shown in the table below.

CSIP actors MAY support other optional *DERCapability* and *DERSettings* fields.

If the DER only supports nameplate ratings, the CSIP client SHALL copy the *DERCapability* field values to the corresponding *DERSettings* field values where possible.

DERCapability	DERSettings	Notes
`modesSupported`	`modesEnabled`	Bitmap indicating the DERControl Modes implemented by the device
`modesSupported2`	`modesEnabled2`	Bitmap indicating the DERControl Modes implemented by the device

rtgMaxChargeRateW	setMaxChargeRateW	Maximum rate of energy transfer received by the storage DER
rtgMaxDischargeRateW	setMaxDischargeRateW	Maximum rate of energy transfer delivered by the storage DER
rtgMaxVA	setMaxVA	Apparent power rating/setting
rtgMaxVar	setMaxVar	Reactive power injected maximum rating/setting
rtgMaxVarNeg	setMaxVarNeg	Reactive power absorbed maximum rating/setting
rtgMaxW	setMaxW	Active power rating at unity power factor
rtgMinPFOverExcited	setMinPFOverExcited	Minimum power factor when injecting reactive power
rtgMinPFUnderExcited	setMinPFUnderExcited	Minimum power factor when absorbing reactive power
rtgMaxWh	setMaxV	Maximum energy storage capacity

Table 9 – CSIP v2.1 Nameplate Ratings and Operational Settings

4.2.3 DER Info: DER Status

CSIP actors SHALL support the *DERStatus* fields shown in the table below.

CSIP actors MAY support other optional *DERStatus* fields.

DER Status	Notes
alarmStatus	Bitmap indicating the status of DER alarms
inverterStatus	Enumeration of inverter status values
operationalModeStatus	Operating mode current in effect
genConnectStatus	Bitmap of connection status
stateOfChargeStatus	State of charge status

Table 10 – CSIP v2.1 DER Status

4.2.4 Meter Readings

CSIP actors SHALL support the meter readings and *ReadingType* parameters described in the table below. A blank cell in the table means the corresponding *ReadingType* parameter SHOULD be omitted.

CSIP actors MAY support other meter readings.

For all readings in the table below, CSIP actors:

- SHALL use an *accumulationBehavior* = 12 (instantaneous)
- SHALL use a *commodity* = 1 (electricity)

Meter Reading	flowDirection	Kind	Phase	UOM
Real Power	4 = Net	37 = Power		38 = W
Reactive Power	4 = Net	37 = Power		63 = var
Frequency	0 = N/A			29 = Voltage
Voltage L1,L2,L3	0 = N/A		{phase-code}	33 = Hz

Table 11 – CSIP v2.1 Meter Readings

4.3 Import-Export Sub-Profile

This sub-profile adds import, export, load, and generation limits. This functionality supports programs requiring “dynamic operating envelopes (DOE)” and “limited generation profiles (LGP)”.

4.3.1 DER Controls and Default DER Controls

CSIP actors SHALL support both the *DERControl* and *DefautDERControl* versions of the controls shown in the table below unless noted otherwise.

CSIP clients SHALL indicate support for all DERControls in the table below by setting the corresponding bits in the *modesSupported, modesSupporte2, modesEnabled,* and *modesEnabled2* fields of the *DERCapability* and *DERSettings* resources.

Active Power Limit Controls	Notes
opModMaxLimW	Maximum active power generation limit (percentage of capacity)
opModMaxLimWInject	Maximum active power generation limit (watts)
opModMaxLimPctWAbsorb	Maximum active power consumption limit (percentage of capacity)
opModMaxLimWAbsorb	Maximum active power consumption limit (watts)

Table 12 – Import-Export DER Controls

4.3.2 DER Info: Nameplate and Operational Settings

CSIP actors SHALL support the *DERCapability* and *DERSettings* fields shown in the table below.

CSIP actors MAY support other optional *DERCapability* and *DERSettings* fields.

If the DER only supports nameplate ratings, the CSIP client SHALL copy the *DERCapability* field values to the corresponding *DERSettings* field values where possible.

DERCapability	DERSettings	Notes
modesSupported	modesEnabled	Bitmap indicating the DERControl Modes implemented by the device
modesSupported2	modesEnabled2	Bitmap indicating the DERControl Modes implemented by the device
rtgMaxChargeRateW	setMaxChargeRateW	Maximum rate of energy transfer received by the storage DER
rtgMaxDischargeRateW	setMaxDischargeRateW	Maximum rate of energy transfer delivered by the storage DER
rtgMaxW	setMaxW	Active power rating at unity power factor

Table 13 – Import-Export Nameplate Ratings and Operational Settings

4.3.3 DER Info: DER Status

CSIP actors SHALL support the *DERStatus* fields shown in the table below.

CSIP actors MAY support other optional *DERStatus* fields.

DER Status	Notes
`alarmStatus`	Bitmap indicating the status of DER alarms
`inverterStatus`	Enumeration of inverter status values
`operationalModeStatus`	Operating mode current in effect
`connectStatus`	Bitmap of connection status

Table 14 – Import-Export DER Status

4.3.4 Meter Readings

This sub-profile uses the Generator/Producer reference frame where the Generator/Producer is the DER. Using this definition,

- **Forward** is the flow direction from the DER to the grid and uses the terms “delivered”, “produced”, or “injected”. Forward values are non-negative.
- **Reverse** is the flow direction from the grid to the DER and uses the terms “received” or “consumed”, or “absorbed”. Reverse values are non-negative.
- **Net** is defined as the absolute value of Forward flow minus the absolute value of Reverse flow. Net values can be positive, negative, or zero.

CSIP actors SHALL support the meter readings and *ReadingType* parameters described in the table below. A blank cell in the table means the corresponding *ReadingType* parameter SHOULD be omitted.

CSIP actors MAY support other meter readings.

For all readings in the table below, CSIP actors:

- SHALL use an *accumulationBehavior* = 12 (instantaneous)
- SHALL use a *commodity* = 1 (electricity)

Meter Reading	flowDirection	Kind	Phase	UOM
Real Power (Net)	4 = Net	37 = Power		38 = W
Real Power (DER →Grid)	1 = Forward	37 = Power		38 = W
Real Power (Grid →DER)	19 = Reverse	37 = Power		38 = W
Frequency	0 = N/A			29 = Voltage
Voltage L1,L2,L3	0 = N/A		{phase-code}	33 = Hz

Table 15 – Import-Export Meter Readings

4.4 CSIP-AUS Sub-Profile

This sub-profile incorporates the new resources created in the CSIP-AUS specification. The new resources are extensions to the IEEE 2030.5 schema using the CSIP-AUS namespace which can be found at this link: https://csipaus.org/ns. These new resources are prefixed with "*csipaus:*".

Compliance with this sub-profile DOES NOT imply full compliance with CSIP-AUS. For a device to be fully CSIP-AUS compliant, please refer to the official CSIP-AUS specifications, test procedures, and certification procedures.

4.4.1 DER Controls and Default DER Controls

CSIP-AUS added four new controls to support Dynamic Operating Envelopes. This set of extensions is intended for conforming equipment to manage site- and device-level operating envelopes.

CSIP actors SHALL support both the *DERControl* and *DefautDERControl* versions of the controls shown in the table below unless noted otherwise.

CSIP clients SHALL indicate support for all DERControls in the table below by setting the corresponding bits in the *csipaus:doeModesSupported* and *csipaus:doeModesEnabled* fields of the *DERCapability* and *DERSettings* resources.

Active Power Limit Controls	Notes
`csipaus:opModExpLimW`	Constraint on the exported active power at the connection point
`csipaus:opModImpLimW`	Constraint on the imported active power at the connection point
`csipaus:opModGenLimW`	Constraint on the maximum allowable discharge rate for a single physical device
`csipaus:opModLoadLimW`	Constraint on the maximum allowable charge rate for a single physical device

Table 16 – CSIP-AUS DER Controls

4.4.2 DER Info: Nameplate and Operational Settings

CSIP actors SHALL support the *DERCapability* and *DERSettings* fields shown in the table below.

CSIP actors MAY support other optional *DERCapability* and *DERSettings* fields.

If the DER only supports nameplate ratings, the CSIP client SHALL copy the *DERCapability* field values to the corresponding *DERSettings* field values where possible.

DERCapability	DERSettings	Notes

csipaus:doeModesSupported	csipaus:doeModesEnabled	Bitmap indicating the DERControl Modes implemented by the device.
rtgMaxChargeRateW	setMaxChargeRateW	Maximum rate of energy transfer received by the storage DER
rtgMaxDischargeRateW	setMaxDischargeRateW	Maximum rate of energy transfer delivered by the storage DER
rtgMaxW	setMaxW	Active power rating at unity power factor

Table 17 – CSIP-AUS Nameplate Ratings and Operational Settings

4.4.3 EndDevice Information

CSIP-AUS added new resources to identify the network location (connection point) of the *EndDevice* DER.

CSIP actors SHALL support the following new resources:

ConnectionPoint Package	Notes
csipaus:ConnectionPointLink	Link to the *ConnectionPoint* instance (in *EndDevice*)
csipaus:ConnectionPoint	Contains identification information related to the network location where the EndDevice is installed
csipaus:ConnectionPointId	The ConnectionPoint identifier

Table 18 – CSIP-AUS Connection Point Information

4.4.4 DER Info: DER Status

CSIP actors SHALL support the *DERStatus* fields shown in the table below.

CSIP actors MAY support other optional *DERStatus* fields.

DER Status	Notes
alarmStatus	Bitmap indicating the status of DER alarms
inverterStatus	Enumeration of inverter status values
operationalModeStatus	Operating mode current in effect
connectStatus	Bitmap of connection status

Table 19 – CSIP-AUS DER Status

4.4.5 Meter Readings

This sub-profile uses the Generator/Producer reference frame where the Generator/Producer is the DER. Using this definition,

- **Forward** is the flow direction from the DER to the grid and uses the terms “delivered”, “produced”, or “injected”. Forward values are non-negative.

- **Reverse** is the flow direction from the grid to the DER and uses the terms “received” or “consumed”, or “absorbed”. Reverse values are non-negative.
- **Net** is defined as the absolute value of Forward flow minus the absolute value of Reverse flow. Net values can be positive, negative, or zero.

CSIP actors SHALL support the meter readings and *ReadingType* parameters described in the table below. A blank cell in the table means the corresponding *ReadingType* parameter SHOULD be omitted.

CSIP actors MAY support other meter readings.

For all readings in the table below, CSIP actors:

- SHALL use an *accumulationBehavior* = 12 (instantaneous)
- SHALL use a *commodity* = 1 (electricity)

Meter Reading	flowDirection	Kind	Phase	UOM
Real Power (Net)	4 = Net	37 = Power		38 = W
Real Power (DER →Grid)	1 = Forward	37 = Power		38 = W
Real Power (Grid →DER)	19 = Reverse	37 = Power		38 = W
Frequency	0 = N/A			29 = Voltage
Voltage L1,L2,L3	0 = N/A		{phase-code}	33 = Hz

Table 20 – CSIP-AUS Meter Readings

4.5 Energy Storage Sub-Profile

This sub-profile adds active power dispatch functionality as well as information related to charging and discharging of energy storage systems.

4.5.1 DeviceCategory

This sub-profile uses *DeviceCategory* bit 25 (Other Storage System). CSIP clients SHALL set bit 25 in their *EndDevice:DeviceCategory* resource. When processing *DERControls* listed in the table below that have the corresponding *DeviceCategory* bit set, CSIP clients SHALL accept and process them as normal, following the IEEE 2030.5-2023 event processing rules.

CSIP servers MAY choose to send DER controls in this profile with or without this bit set. Setting this bit may improve communications efficiency by eliminating unnecessary traffic since only CSIP clients with the corresponding *DeviceCategory* bit set will send back *Responses*.

4.5.2 DER Controls and Default DER Controls

CSIP actors SHALL support both the *DERControl* and *DefautDERControl* versions of the controls shown in the table below unless noted otherwise.

CSIP clients SHALL indicate support for all DERControls in the table below by setting the corresponding bits in the *modesSupported, modesSupporte2, modesEnabled,* and *modesEnabled2* fields of the *DERCapability* and *DERSettings* resources.

Active Power Dispatch Controls	Notes
opModFixedW	Specifies received (charge) or delivered (discharge) of active power
opModTargetW	Specifies the target active power in watts

Table 21 – Energy Storage DER Controls

4.5.3 DER Info: Nameplate and Operational Settings

CSIP actors SHALL support the *DERCapability* and *DERSettings* fields shown in the table below.

CSIP actors MAY support other optional *DERCapability* and *DERSettings* fields.

If the DER only supports nameplate ratings, the CSIP client SHALL copy the *DERCapability* field values to the corresponding *DERSettings* field values where possible.

DERCapability	DERSettings	Notes
modesSupported	modesEnabled	Bitmap indicating the DERControl Modes implemented by the device
modesSupported2	modesEnabled2	Bitmap indicating the DERControl Modes implemented by the device
rtgMaxChargeRateW	setMaxChargeRateW	Maximum rate of energy transfer received by the storage DER

rtgMaxDischargeRateW	setMaxDischargeRateW	Maximum rate of energy transfer delivered by the storage DER
rtgMaxW	setMaxW	Active power rating at unity power factor
rtgMaxWh	setMaxWh	Maximum energy storage capacity of the DER

Table 22 – Energy Storage Nameplate Ratings and Operational Settings

4.5.4 DER Info: DER Status

CSIP actors SHALL support the *DERStatus* fields shown in the table below.

CSIP actors MAY support other optional *DERStatus* fields.

DER Status	Notes
alarmStatus	Bitmap indicating the status of DER alarms
inverterStatus	Enumeration of inverter status values
operationalModeStatus	Operating mode current in effect
connectStatus	Bitmap of connection status
stateOfChargeStatus	DER state of charge as a percentage of capacity
storageModeStatus	State (mode) of the storage system

Table 23 – Energy Storage DER Status

4.5.5 Meter Readings

This sub-profile uses the Generator/Producer reference frame where the Generator/Producer is the DER. Using this definition,

- **Forward** is the flow direction from the DER to the grid and uses the terms “delivered”, “produced”, or “injected”. Forward values are non-negative.
- **Reverse** is the flow direction from the grid to the DER and uses the terms “received” or “consumed”, or “absorbed”. Reverse values are non-negative.
- **Net** is defined as the absolute value of Forward flow minus the absolute value of Reverse flow. Net values can be positive, negative, or zero.

CSIP actors SHALL support the meter readings and *ReadingType* parameters described in the table below. A blank cell in the table means the corresponding *ReadingType* parameter SHOULD be omitted.

CSIP actors MAY support other meter readings.

For all readings in the table below, CSIP actors:

- SHALL use an *accumulationBehavior* = 12 (instantaneous)
- SHALL use a *commodity* = 1 (electricity)

Meter Reading	flowDirection	Kind	Phase	UOM

Real Power (Net)	4 = Net	37 = Power		38 = W
Real Power (DER →Grid)	1 = Forward	37 = Power		38 = W
Real Power (Grid →DER)	19 = Reverse	37 = Power		38 = W
Real Energy (Net)	4 = Net	12 = Energy		72 = Wh
Real Energy (DER →Grid)	1 = Forward	12 = Energy		72 = Wh
Real Energy (Grid →DER)	19 = Reverse	12 = Energy		72 = Wh
Frequency	0 = N/A			29 = Voltage
Voltage L1,L2,L3	0 = N/A		{phase-code}	33 = Hz

Table 24 – Energy Storage Meter Readings

4.6 Microgrid Sub-Profile

This sub-profile adds functions related to the connection of microgrids to the area electric grid.

4.6.1 DeviceCategory

This sub-profile uses *DeviceCategory* bit 26 (Microgrid Controller). CSIP clients SHALL set bit 26 in their *EndDevice:DeviceCategory* resource. When processing *DERControls* listed in the table below that have the corresponding *DeviceCategory* bit set, CSIP clients SHALL accept and process them as normal, following the IEEE 2030.5-2023 event processing rules.

CSIP servers MAY choose to send DER controls in this profile with or without this bit set. Setting this bit may improve communications efficiency by eliminating unnecessary traffic since only CSIP clients with the corresponding *DeviceCategory* bit set will send back *Responses*.

4.6.2 DER Controls and Default DER Controls

CSIP actors SHALL support both the *DERControl* and *DefautDERControl* versions of the controls shown in the table below unless noted otherwise.

CSIP clients SHALL indicate support for all DERControls in the table below by setting the corresponding bits in the *modesSupported, modesSupporte2, modesEnabled,* and *modesEnabled2* fields of the *DERCapability* and *DERSettings* resources.

Microgrid Controls	Notes
`opModGridConnectPermit`	Permits or disallows joining to the area electric grid
`opModIslandPermit`	Permits or disallows islanding from the area electric grid

Table 25 – Microgrid DER Controls

4.6.3 DER Info: Nameplate and Operational Settings

No requirements.

4.6.4 DER Info: DER Status

CSIP actors SHALL support the *DERStatus* fields shown in the table below.

CSIP actors MAY support other optional *DERStatus* fields.

DER Status	Notes
`alarmStatus`	Bitmap indicating the status of DER alarms
`inverterStatus`	Enumeration of inverter status values
`operationalModeStatus`	Operating mode current in effect

connectStatus	Bitmap of connection status

Table 26 – Microgrid DER Status

4.6.5 Meter Readings

No requirements.

4.7 Connect Switch Sub-Profile

This sub-profile provides a physical galvanic switch function.

4.7.1 DeviceCategory

This sub-profile uses *DeviceCategory* bit 13 (Load Control Switch). CSIP clients SHALL set bit 13 in their *EndDevice:DeviceCategory* resource. When processing *DERControls* listed in the table below that have the corresponding *DeviceCategory* bit set, CSIP clients SHALL accept and process them as normal, following the IEEE 2030.5-2023 event processing rules.

CSIP servers MAY choose to send DER controls in this profile with or without this bit set. Setting this bit may improve communications efficiency by eliminating unnecessary traffic since only CSIP clients with the corresponding *DeviceCategory* bit set will send back *Responses*.

4.7.2 DER Controls and Default DER Controls

CSIP actors SHALL support both the *DERControl* and *DefautDERControl* versions of the controls shown in the table below unless noted otherwise.

CSIP clients SHALL indicate support for all DERControls in the table below by setting the corresponding bits in the *modesSupported, modesSupporte2, modesEnabled,* and *modesEnabled2* fields of the *DERCapability* and *DERSettings* resources.

Connection Controls	Notes
opModConnect	Galvanic connection or disconnection

Table 27 – Connect Switch DER Controls

4.7.3 DER Info: Nameplate and Operational Settings

No requirements.

4.7.4 DER Info: DER Status

CSIP actors SHALL support the *DERStatus* fields shown in the table below.

CSIP actors MAY support other optional *DERStatus* fields.

DER Status	Notes
alarmStatus	Bitmap indicating the status of DER alarms
operationalModeStatus	Operating mode current in effect
connectStatus	Bitmap of connection status

Table 28 – Connect Switch DER Status

4.7.5 Meter Readings

No requirements.

4.8 PG&E Metering Sub-Profile

This sub-profile the metering requirements for the PG&E telemetry.

4.8.1 DER Controls and Default DER Controls

No requirements.

4.8.2 DER Info: Nameplate and Operational Settings

No requirements.

4.8.3 DER Info: DER Status

CSIP actors SHALL support the *DERStatus* fields shown in the table below.

CSIP actors MAY support other optional *DERStatus* fields.

DER Status	Notes
`alarmStatus`	Bitmap indicating the status of DER alarms
`operationalModeStatus`	Operating mode current in effect

Table 29 – PG&E Meter DER Status

4.8.4 Meter Readings

This sub-profile uses the Generator/Producer reference frame where the Generator/Producer is the electric grid. This reference frame is typically used by residential electric meters. Using this definition,

- **Forward** is the flow direction from the grid to the DER and uses the terms “delivered”, “produced”, or “injected”. Forward values are non-negative.
- **Reverse** is the flow direction from the DER to the grid and uses the terms “received” or “consumed”, or “absorbed”. Reverse values are non-negative.
- **Net** is defined as the absolute value of Forward flow minus the absolute value of Reverse flow. Net values can be positive, negative, or zero.

CSIP actors SHALL support the meter readings and *ReadingType* parameters described in the table below. A blank cell in the table means the corresponding *ReadingType* parameter SHOULD be omitted.

CSIP actors MAY support other meter readings.

For all readings in the table below, CSIP actors:

- SHALL use an *accumulationBehavior* = 12 (instantaneous)
- SHALL use a *commodity* = 1 (electricity)
- SHALL use a *dataQualifier* = 0 (N/A)

- SHALL use a *flowDirection* = 0 (N/A)
- SHALL use a *kind* = 0 (N/A)

Meter Reading	phaseCode	uom	precision	Notes
Current A	128 = A	5 = A	1 A	Always positive
Current B	64 = B	5 = A	1 A	Always positive
Current C	32 = C	5 = A	1 A	Always positive
Voltage AN	129 = AN	29 = Voltage	0.1 V	Wye only. Omit for Delta.
Voltage BN	65 = BN	29 = Voltage	0.1 V	Wye only. Omit for Delta.
Voltage CN	33 = CN	29 = Voltage	0.1 V	Wye only. Omit for Delta.
Voltage AB	132 = AB	29 = Voltage	0.1 V	Delta only. Omit for Wye.
Voltage BC	66 = BC	29 = Voltage	0.1 V	Delta only. Omit for Wye.
Voltage CA	33 = CA	29 = Voltage	0.1 V	Delta only. Omit for Wye.
Active Power Total	224 = ABC	38 = W	1 W	Negative for export to grid
Active Power A	128 = A	38 = W	1 W	Negative for export to grid
Active Power B	64 = B	38 = W	1 W	Negative for export to grid
Active Power C	32 = C	38 = W	1 W	Negative for export to grid
Reactive Power Total	224 = ABC	63 = var	1 var	Negative for capacitive load
Reactive Power A	128 = A	63 = var	1 var	Negative for capacitive load
Reactive Power B	64 = B	63 = var	1 var	Negative for capacitive load
Reactive Power C	32 = C	63 = var	1 var	Negative for capacitive load

Table 30 – PG&E Meter – Meter Readings

4.9 Modbus Gateway Sub-Profile

This sub-profile defines an IEEE 2030.5 to SunSpec Modbus Gateway (GW).

Note: This sub-profile maps all IEEE 1547 information but also contains additional mappings that are not required by IEEE 1547.

4.9.1 DER Controls and Default DER Controls

The GW SHALL map all DER Controls according to the table below.

	SS Model	Notes and SunSpec Register Information
Voltage Ride-Through		
opModLVRTMustTrip	707	MustTrip: ActPt, V[...], Tms[...], V_SF, Tms_SF
opModLVRTMayTrip	707	MayTrip: ActPt, V[...], Tms[...], V_SF, Tms_SF
opModLVRTMomentaryCessation	707	MomentaryCessation: ActPt, V[...], Tms[...], V_SF, Tms_SF
opModHVRTMustTrip	708	MustTrip: ActPt, V[...], Tms[...], V_SF, Tms_SF
opModHVRTMayTrip	708	MayTrip: ActPt, V[...], Tms[...], V_SF, Tms_SF
opModHVRTMomentaryCessation	708	MomentaryCessation: ActPt, V[...], Tms[...], V_SF, Tms_SF
Frequency Ride-Through		
opModLFRTMustTrip	709	Must: ActPt, Hz[...], Tms[...], Hz_SF, Tms_SF
opModLFRTMayTrip	709	May: ActPt, Hz[...], Tms[...], Hz_SF, Tms_SF
opModHFRTMustTrip	710	Must: ActPt, Hz[...], Tms[...], Hz_SF, Tms_SF
opModHFRTMayTrip	710	May: ActPt, Hz[...], Tms[...], Hz_SF, Tms_SF
Ramp Rates		
setGradW	121	WGra
setSoftGradW	145	ConnRmpUpRte, ConnRmpDnRte
Connection Controls		
opModEnergize	703	ES
setEnterService	703	ESVHi, ESVLo, ESHzHi, ESHzLo, ESDlyTms, ESRndTms, ESRmpTms, V_SF, Hz_SF
opModConnect	701	ConnSt
Frequency Controls		
opModFreqWatt	134	
opModFreqDroop	711	DbOf, DbUf, KOf, KUf, RspTms, Db_SF, K_SF
Active Power Controls		
opModVoltWatt	706	ActPt, DeptRef, RspTms, V[...], W[...], V_SF, DeptRef_SF
opModFixedW	704	WSetEna, WSetMod, WSet, WSetPct_SF
opModTargetW	704	WSetEna, WSetMod, WSet, WSet_SF
opModMaxLimW	704	WMaxLimPctEna, WMaxLimPct, WMaxLimPct_SF
opModMaxLimPctWAbsorb		<No Mapping>
opModMaxLimWAbsorb		<No Mapping>
opModMaxLimWInject	704	No direct mapping, but can be inferred from opModMaxLimW
opModDeltaW	704	No direct mapping, but can be inferred from opModTargetW

Reactive Power Controls		
opModVoltVar	705	ActPt, DeptRef, VRef, VRefAuto, VRefAutoEna, VRefAutoTms, RspTms, V[...], Var[...], V_SF, DeptRef_SF
opModFixedPFInjectW	704	PFWInjEna, PF, Ext, PF_SF
opModFixedPFAbsorbW	704	PFWAbsEna, PF, Ext, PF_SF
opModFixedVar	704	VarSetEna, VarSetMod, VarSetPct, VarSetPct_SF
opModTargetVar	704	VarSetEna, VarSetMod, VarSet, VarSet_SF
opModWattVar	712	ActPt, DeptRef, W[...], Var[...], W_SF, DeptRef_SF
opModMaxLimPctVarAbsorb		<No Mapping>
opModMaxLimPctVarInject		<No Mapping>
opModDeltaVar	704	No direct mapping, but can inferred from opModTargetVar
Islanding Controls		
opModGridConnectPermit		<No Mapping>
opModIslandPermit		<No Mapping>
Apparent Power Controls		
opModMaxLimPctVAAbsorb		<No Mapping>
opModMaxLimPctVAInject		<No Mapping>
Voltage Controls		
opModFixedV		<No Mapping>
opModTargetV		<No Mapping>
CSIP-AUS Controls		
csipaus:opModExpLimW	704	No direct mapping, but may inferred from opModMaxLimW
csipaus:opModImpLimW		<No Mapping>
csipaus:opModGenLimW	704	No direct mapping, but may Inferred from opModMaxLimW
csipaus:opModLoadLimW		<No Mapping>

Table 31 – Modbus Gateway DER Control Mappings

4.9.2 DER Info: Nameplate and Operational Settings

The GW SHALL map all Nameplate Ratings and Operational Settings according to the tables below.

Nameplate	SS Model	Notes and SS Register Information
rtgMaxChargeRateW	702	WChaRteMaxRtg, W_SF
rtgMaxDischargeRateW	702	WDisChaRteMaxRtg, W_SF
rtgMaxVA	702	VAMaxRtg, VA_SF
rtgMaxVar	702	VarMaxInjRtg, Var_SF
rtgMaxVarNeg	702	VarMaxAbsRtg, Var_SF
rtgMaxW	702	WMaxRtg, W_SF
rtgMinPFOverExcited	702	PFOvrExtRtg, PF_SF
rtgMinPFUnderExcited	702	PFUndExtRtg, PF_SF

rtgMaxWh	713	WHRtg, WH_SF
rtgOverExcitedW	702	WOvrExtRtg, W_SF
rtgUnderExcitedW	702	WUndExtRtg, W_SF
rtgAbnormalCategory	702	AbnOpCatRtg
rtgNormalCategory	702	NorOpCatRtg
rtgMaxChargeRateVA	702	VAChaRteMaxRtg, VA_SF
rtgMaxDisChargeRateVA	702	VADisChaRteMaxRtg, VA_SF
rtgMaxV	702	VMaxRtg, V_SF
rtgMinV	702	VMinRtg, V_SF
rtgVNom	702	VNomRtg, V_SF
modesSupported	702	CtrlModes
modesSupported2	702	CtrlModes
rtgReactiveSusceptance	702	ReactSusceptRtg, S_SF
rtgMaxA	702	AMaxRtg, A_SF
rtgMaxAh	713	No direct mapping, but may be inferred from WHRtg
rtgOverExcitedPF	702	WOvrExtRtgPF, PF_SF
rtgUnderExcitedPF	702	WUndExtRtgPF, PF_SF

Table 32 – Modbus Gateway Nameplate Ratings Mappings

Settings	SS Model	Notes and SS Register Information
setMaxChargeRateW	702	WChaRteMax, W_SF
setMaxDischargeRateW	702	WDisChaRteMax, W_SF
setMaxVA	702	VAMax, VA_SF
setMaxVar	702	VarMaxInj, Var_SF
setMaxVarNeg	702	VarMaxAbs, Var_SF
setMaxW	702	Wmax, W_SF
setMinPFOverExcited	702	PFOvrExt, PF_SF
setMinPFUnderExcited	702	PFUndExt, PF_SF
setMaxWh	713	No direct mapping, but may be inferred from WHRtg
setMaxChargeRateVA		VAChaRteMax, VA_SF
setMaxDisChargeRateVA		VADisChaRteMax, VA_SF
setMaxV		VMax, V_SF
setMinV		VMin, V_SF
setVNom		VNom, V_SF
modesEnabled	702	No direct mapping, but may be inferred from CtrlModes
modesEnabled2	702	No direct mapping, but may be inferred from CtrlModes
setESDelay	703	ESDlyTms
setESHighFreq	703	ESHzHi, Hz_SF
setESHighVolt	703	ESVHi, V_SF
setESLowFreq	703	ESHzLo, Hz_SF
setESLowVolt	703	ESVLo, V_SF

setESRampTms	703	ESRmpTms
setESRandomDelay	703	ESRndTms
setGradW	121	WGra
setSoftGradW	145	ConnRmpUpRte, ConnRmpDnRte
setMaxA	702	AMax, A_SF
setMaxAh	713	No direct mapping, but may be inferred from WHRtg
setVRef	121	VRef, VRef_SF
setVRefOfs	121	VRefOfs, VRef_SF

Table 33 – Modbus Gateway Operational Settings Mappings

4.9.3 Information and Status

The GW SHALL map all Device Information and DER Status according to the tables below.

Device Information	SS Model	Notes and SS Register Information
mfID	1	Mn - PEN of manufacturer
mfModel	1	Md
mfSerNum	1	SN
mfHwVer	1	Vr
swVer		
swActTime		
mfDate		
mfInfo		
lfdi		
connectionPointID		
functionsImplemented		
gpsLocation		
primaryPower		
secondaryPower		

Table 34 – Modbus Gateway Device Information Mappings

DER Status	SS Model	Notes and SS Register Information
alarmStatus	701	Alrm
connectStatus	701	ConnSt
inverterStatus	701	InvSt
localControlModeStatus	715	LocRemCtl
manufacturerStatus		
operationalModeStatus	701	St
stateOfChargeStatus	713	SoC, Pct_SF

storageModeStatus	713	Sta
genConnectStatus (DEPRECATED)		
storConnectStatus (DEPRECATED)		

Table 35 – Modbus Gateway DER Status Mappings

4.9.4 Meter Readings

This sub-profile uses the Generator/Producer reference frame where the Generator/Producer is the DER behind the GW. Using this definition,

- **Forward** is the flow direction from the DER to the grid and uses the terms “delivered”, “produced”, or “injected”. Forward values are non-negative.
- **Reverse** is the flow direction from the grid to the DER and uses the terms “received” or “consumed”, or “absorbed”. Reverse values are non-negative.
- **Net** is defined as the absolute value of Forward flow minus the absolute value of Reverse flow. Net values can be positive, negative, or zero.

The GW SHALL map meter readings described in the table below. The GW SHALL use the *ReadingType* parameters listed in the table below. A blank cell in the table means the corresponding *ReadingType* parameter SHOULD be omitted.

The GW MAY support other meter readings.

For all readings in the table below, CSIP actors:

- SHALL use an *accumulationBehavior* = 12 (instantaneous)
- SHALL use a *commodity* = 1 (electricity)
- SHALL use a *dataQualifier* = 0 (N/A)

Meter Reading	UOM	Precision	Kind	Flow	SS Model	Notes and SS Register Information
System Readings						
Active Power	38 = W	1 W	37 = Power	4 = Net	701	W, W_SF
Apparent Power	61 = VA	1 VA	37 = Power	4 = Net	701	VA, VA_SF
Reactive Power	63 = var	1 var	37 = Power	4 = Net	701	Var, Var_SF
Power Factor	65 = PF	0.001			701	PF, PF_SF
Current	5 = A	0.1 A		4 = Net	701	A, A_SF
Voltage	29 = V	0.1 V			701	LLV, LNV, V_SF
Frequency	33 = Hz	0.01 Hz			701	Hz, Hz_SF
Total Active Energy Injected	72 = Wh	1 Wh	12 = Energy	1 = Forward	701	TotWhInj, TotWh_SF
Total Active Energy Absorbed	72 = Wh	1 Wh	12 = Energy	1 = Forward	701	TotWhAbs, TotWh_SF
Total Reactive Energy Injected	73 = varh	1 Wh	12 = Energy	19 = Reverse	701	TotVarhInj, TotVarh_SF
Total Reactive Energy Absorbed	73 = varh	1 Wh	12 = Energy	19 = Reverse	701	TotVarhAbs, TotVarh_SF
Line 1 Readings						
L1: Active Power	38 = W	1 W	37 = Power	4 = Net	701	WL1, W_SF

L1: Apparent Power	61 = VA	1 VA	37 = Power	4 = Net	701	VAL1, VA_SF
L1: Reactive Power	63 = var	1 var	37 = Power	4 = Net	701	VarL1, Var_SF
L1: Power Factor	65 = PF	0.001			701	PFL1, PF_SF
L1: Current	5 = A	0.1 A		4 = Net	701	AL1, A_SF
L1: Voltage	29 = V	0.1 V			701	VL1L2, VL1, V_SF
L1: Total Active Energy Injected	72 = Wh	1 Wh	12 = Energy	1 = Forward	701	TotWhInjL1, TotWh_SF
L1: Total Active Energy Absorbed	72 = Wh	1 Wh	12 = Energy	1 = Forward	701	TotWhAbsL1, TotWh_SF
L1: Total Reactive Energy Injected	73 = varh	1 Wh	12 = Energy	19 = Reverse	701	TotVarhInjL1, TotVarh_SF
L1: Total Reactive Energy Absorbed	73 = varh	1 Wh	12 = Energy	19 = Reverse	701	TotVarhAbsL1, TotVarh_SF
Line 2 Readings						
L2: Active Power	38 = W	1 W	37 = Power	4 = Net	701	WL2, W_SF
L2: Apparent Power	61 = VA	1 VA	37 = Power	4 = Net	701	VAL2, VA_SF
L2: Reactive Power	63 = var	1 var	37 = Power	4 = Net	701	VarL2, Var_SF
L2: Power Factor	65 = PF	0.001			701	PFL2, PF_SF
L2: Current	5 = A	0.1 A		4 = Net	701	AL2, A_SF
L2: Voltage	29 = V	0.1 V			701	VL2L3, VL2, V_SF
L2: Total Active Energy Injected	72 = Wh	1 Wh	12 = Energy	1 = Forward	701	TotWhInjL2, TotWh_SF
L2: Total Active Energy Absorbed	72 = Wh	1 Wh	12 = Energy	1 = Forward	701	TotWhAbsL2, TotWh_SF
L2: Total Reactive Energy Injected	73 = varh	1 Wh	12 = Energy	19 = Reverse	701	TotVarhInjL2, TotVarh_SF
L2: Total Reactive Energy Absorbed	73 = varh	1 Wh	12 = Energy	19 = Reverse	701	TotVarhAbsL2, TotVarh_SF
Line 3 Readings						
L3: Active Power	38 = W	1 W	37 = Power	4 = Net	701	WL3, W_SF
L3: Apparent Power	61 = VA	1 VA	37 = Power	4 = Net	701	VAL3, VA_SF
L3: Reactive Power	63 = var	1 var	37 = Power	4 = Net	701	VarL3, Var_SF
L3: Power Factor	65 = PF	0.001	37 = Power		701	PFL3, PF_SF
L3: Current	5 = A	0.1 A		4 = Net	701	AL3, A_SF
L3: Voltage	29 = V	0.1 V			701	VL3L1, VL3, V_SF
L3: Total Active Energy Injected	72 = Wh	1 Wh	12 = Energy	1 = Forward	701	TotWhInjL3, TotWh_SF
L3: Total Active Energy Absorbed	72 = Wh	1 Wh	12 = Energy	1 = Forward	701	TotWhAbsL3, TotWh_SF
L3: Total Reactive Energy Injected	73 = varh	1 Wh	12 = Energy	19 = Reverse	701	TotVarhInjL3, TotVarh_SF
L3: Total Reactive Energy Absorbed	73 = varh	1 Wh	12 = Energy	19 = Reverse	701	TotVarhAbsL3, TotVarh_SF

Table 36 – Modbus Gateway Meter Readings Mappings