



SunSpec Modbus Development Webinar

June 17, 2025
Start @ 8:02AM PT

FEATURED SPEAKERS



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June 17 | 8AM PST | Google Meet Webinar

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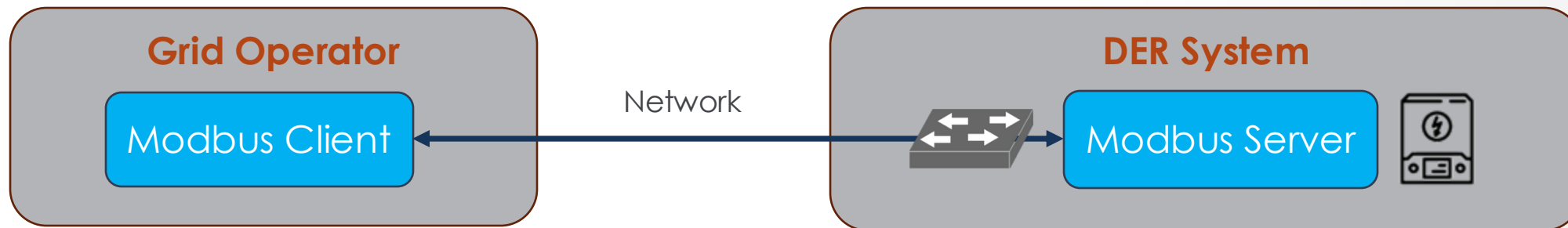
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Agenda

- Intro to Modbus Architecture
- Current State of SunSpec Modbus
- Work Group Tasks:
 - Modbus TLS
 - Requirements
 - Test Procedures
 - SunSpec Modbus Client Testing
 - Requirements
 - Test Procedures
 - SunSpec Modbus Test Results Reporting
 - SunSpec Modbus Implementation Guides:
 - for SAE J3068
 - for Poland
 - for Germany
 - for Denmark
 - SunSpec Modbus for MESA
 - Grid-forming model
 - Modular Energy Storage
- First 2025 Work Group Meeting

Modbus Architecture

- **Modbus Servers** are devices **equipped with register maps**. These maps **are used to adjust settings and report system performance and status**. A significant challenge in traditional Modbus implementations is the lack of standardization. Each Modbus map is typically proprietary, requiring integrators to obtain specific mapping information from the device manufacturer. This creates a fragmented and complex integration landscape.



Modbus Clients, are **responsible for applying settings and reading information from the system**. Traditionally, clients have had to develop custom drivers for each device they integrate with, further contributing to the complexity and cost of Modbus integration.

About SunSpec Modbus



- SunSpec standardizes how to implement Modbus for programmatic interoperability
- Over 50 standard SunSpec Modbus Information Models
- SunSpec Modbus was developed by by SunSpec Members on a 100% consensus basis
- SunSpec Modbus is freely available to the public
- As part of the North American National Interconnection Requirements, IEEE 1547, 80%+ of grid-tied inverters use SunSpec Modbus for compliance
- 90 Certified Devices/Product Lines
- 9 SunSpec Modbus for 1547 Certified Devices

SunSpec Modbus Specifications

- [SunSpec Device Information Model Specification](#)
- [SunSpec DER Information Model Specification](#)
- [SunSpec Information Model Reference](#)
- SunSpec Model Definition (Includes SMDX and JSON)
([Download from Github](#))
- [SunSpec Modbus IEEE 1547-2018 Specification, Profile and Implementation Guide](#)
- [SunSpec Modbus Conformance Test Procedures](#)
- [SunSpec Modbus Test Procedures Results Reporting \(TEST Status\)](#)

SunSpec Academy



SunSpec Authorized Test Software Providers



SunSpec Authorized Test Labs



SunSpec Resources



SunSpec Modbus for 1547 Certified Products



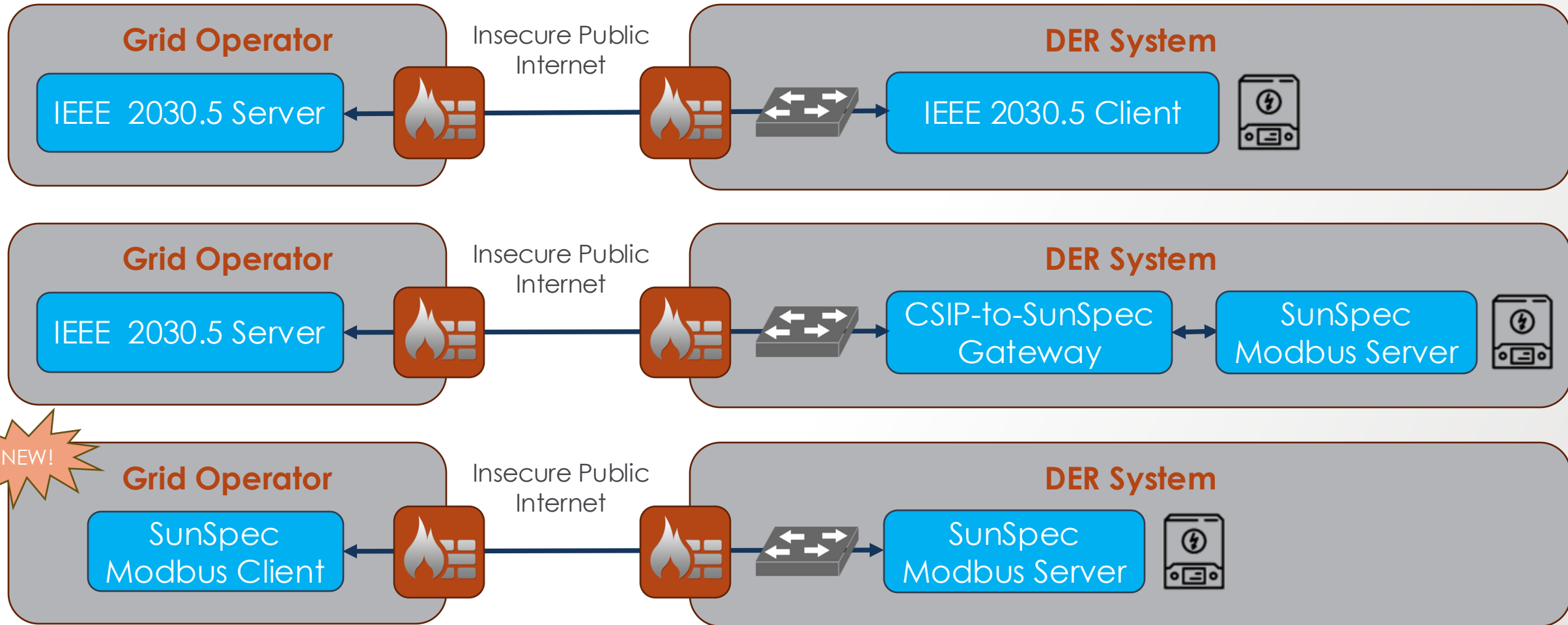
SunSpec Modbus Gaps to Fill

- Modbus TLS
 - Requirements
 - Test Procedures
- SunSpec Modbus Client Testing
 - Requirements
 - Test Procedures
- SunSpec Modbus Test Results Reporting
- SunSpec Modbus Implementation Guides:
 - for SAE J3068
 - for Poland
 - for Germany
 - for Denmark
 - SunSpec Modbus for MESA
- Grid-forming model
- Modular Energy Storage

Modbus/TCP Security

- Modbus/TCP Security Protocol Specification
- By convention, Modbus is only sometimes secured
- Industry leaders, regulators, & policy makers are pushing to support security
- Starting tomorrow the SunSpec Modbus Workgroup will begin developing:
 - Modbus/TCP Security Compliance specification
 - Modbus/TCP Security Test Procedures
 - Will be included in all SunSpec Modbus Certifications for devices with external TCP communication functionality

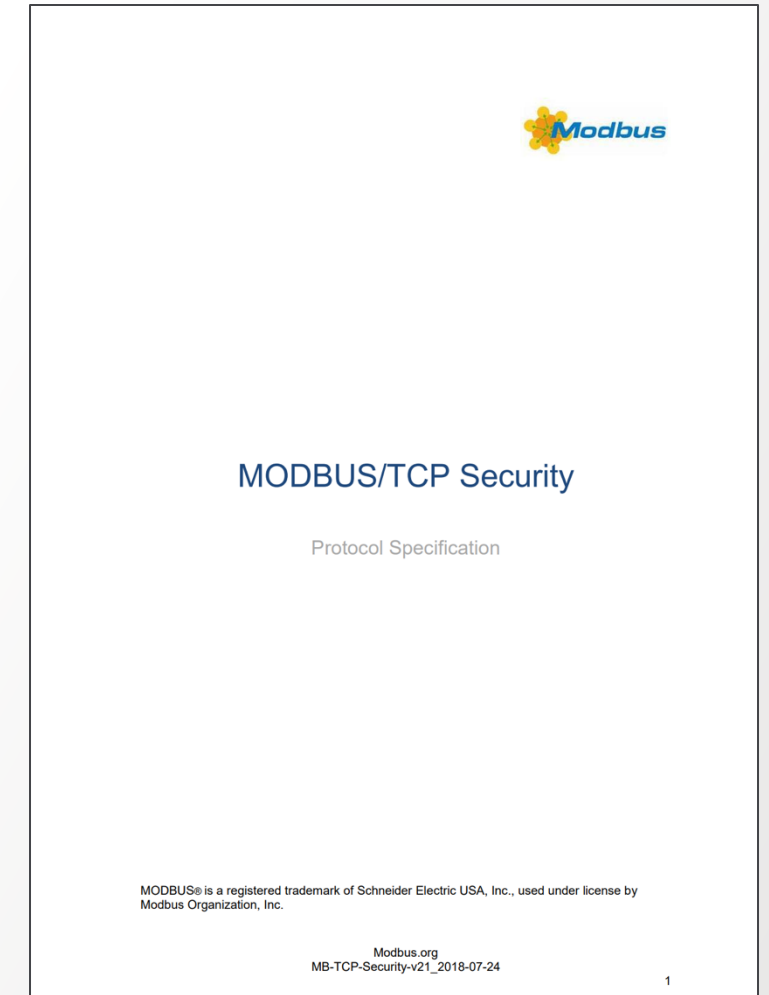
Modbus TLS Enables Remote DER Monitoring & Control



Main content area of the application, currently blank.

Encrypting SunSpec Modbus

- Resources for implementation
 - *pysunspec2* has been updated to include TLS options
 - Script to generate test TLS keys/certificates:
https://github.com/sunspec/pysunspec2/blob/master/sunspec2/tests/tls_data/create_tls_certs.sh
- Open questions for workgroup
 - Modifications/clarifications to MODBUS/TCP Security Protocol Specification
 - Mutual authentication
 - Crypto-agility & post-quantum suites?
 - Default: TLS_RSA_WITH_AES_128_CBC_SHA256, {0x00, 0x3C}
 - X.509v3 certificates with RoleOID
 - Role-Based Client Authorization with Roles-to-Rights Rules/Database
 - PKI Construction and Certificate Authority
 - Replicate requirements from CSIP?
 - DevOps pattern: SunSpec test certs; SecureG production CA
 - Certification requirements and testing methodology
 - New item for PICS



SunSpec Modbus Client Testing

- **SunSpec Dashboard:** A reference implementation of both SunSpec Modbus clients & servers
 - Includes a SunSpec Modbus client that can connect to and read any SunSpec Modbus device.
 - Includes a SunSpec Modbus server in the form of an IEEE 1547-compliant simulated device.
 - Custom simulated devices can be generated using JSON representations
- SunSpec Modbus Test Procedures for Modbus Servers are complete and APPROVED
- **GAP:** SunSpec Modbus Client Requirements and Test Procedures
- **CHALLENGE:** Complexity of generating different servers

Draft SunSpec Modbus Client Test Procedures



2.4	General Client Tests	8
2.4.1	CLI-1 – General Discovery for SunSpec Servers at Different IPv4 Addresses	9
2.4.2	CLI-2 – General Discovery for SunSpec Servers at Different Ports	9
2.4.3	CLI-3 – General Discovery for SunSpec Servers with Different Unit IDs	9
2.4.4	CLI-4 – General Discovery for SunSpec Servers with Different Starting Register Values	10
2.4.5	CLI-5 – General Discovery for SunSpec Servers with Different Baud Rates (Optional) ..	10
2.5	Read Tests	11
2.5.1	READ-1 – Single Point Reads.....	11
2.5.2	READ-2 – Multiple Point Reads	11
2.6	Write Tests	12
2.6.1	WR-1 – Write Single Point	12
2.6.2	WR-2 – Write Multiple Points	12
2.7	Information Tests	13
2.7.1	INFO-1 – SunSpec Type Interpretations.....	13
2.7.2	INFO-2 – Unimplemented Point Interpretations	14
2.8	Modbus Protocol Tests	14
2.8.1	PROT-1 – Partial Response.....	14
2.8.2	PROT-2 –TCP-Segmentation	14
2.9	Error Tests	15
2.9.1	ERR-1 – Noncompliant Server	15
2.9.2	ERR-2 – Exception Tests.....	15

Status: Draft
Version: 1.0

SunSpec Modbus Client Conformance Test Procedures SunSpec Specification



Abstract

This document specifies the conformance test procedures for compliance with the requirements specified in the *SunSpec Device Information Model Specification* and the associated specific SunSpec information model specifications.

Automated SunSpec Client Testing

- Automated testing will require the dynamic generation and execution of different SunSpec servers to validate the client implementations.
- Clients must parse all SunSpec models.

DERSEC LABTEST										Device	Certification Tests	Automation	Simulators	Tools	Help														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	101	102	103	111	112	113	120	121	122	123	124
125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	160	201	202	203					
204	211	212	213	214	220	302	303	304	305	306	307	308	401	402	403	404	501	502	601	701	702	703	704	705					
706	707	708	709	710	711	712	713	714	715	801	802	803	804	805	806	807	808	809	64001	64020	64101	64111							
▼ DER Capacity (DERCapacity)										Raw Value		Scaled Value		Units		Type		Register Hex Data											
Model ID (ID)										702						uint16		43133: 02 BE											
Model Length (L)										50						uint16		43134: 00 32											
Active Power Max Rating (WMaxRtg)										60499		(6049.900)		W		uint16		43135: EC 53											
Active Power (Over-Excited) Rating (WOvrExtRtg)										35649		(3564.900)		W		uint16		43136: 8B 41											
Specified Over-Excited PF (WOvrExtRtgPF)										53040		(5304.000)				uint16		43137: CF 30											
Active Power (Under-Excited) Rating (WUndExtRtg)										62011		(6201.100)		W		uint16		43138: F2 3B											
Specified Under-Excited PF (WUndExtRtgPF)										48438		(4843.800)				uint16		43139: BD 36											
Apparent Power Max Rating (VAMaxRtg)										4992		(499.200)		VA		uint16		43140: 13 80											
Reactive Power Injected Rating (VarMaxInjRtg)										40681		(4068.100)		Var		uint16		43141: 9E E9											
Reactive Power Absorbed Rating (VarMaxAbsRtg)										33170		(3317.000)		Var		uint16		43142: 81 92											
Charge Rate Max Rating (WChaRteMaxRtg)										15554		(1555.400)		W		uint16		43143: 3C C2											
Discharge Rate Max Rating (WDisChaRteMaxRtg)										63203		(6320.300)		W		uint16		43144: F6 E3											
Charge Rate Max VA Rating (VACHaRteMaxRtg)										18568		(1856.800)		VA		uint16		43145: 48 88											
Discharge Rate Max VA Rating (VADisChaRteMaxRtg)										50551		(5055.100)		VA		uint16		43146: C5 77											
AC Voltage Nominal Rating (VNomRtg)										50746		(5074.600)		V		uint16		43147: C6 3A											
AC Voltage Max Rating (VMaxRtg)										7376		(737.600)		V		uint16		43148: 1C D0											
AC Voltage Min Rating (VMinRtg)										17432		(1743.200)		V		uint16		43149: 44 18											
AC Current Max Rating (AMaxRtg)										46666		(4666.600)		A		uint16		43150: B6 4A											
PF Over-Excited Rating (Unused) (PFOvrExtRtg)										27144		(2714.400)				uint16		43151: 6A 08											
PF Under-Excited Rating (Unused) (PFUndExtRtg)										7094		(709.400)				uint16		43152: 1B B6											
Reactive Susceptance (ReactSusceptRtg)										19652		(1965.200)		S		uint16		43153: 4C C4											
Normal Operating Category (NorOpCatRtg)										0		CAT_A				enum16		43154: 00 00											
Abnormal Operating Category (AbnOpCatRtg)										0		CAT_1				enum16		43155: 00 00											
Supported Control Modes (CtrlModes)										8		0000 0000 0000 0000 0000 0000 0000 1000				bitfield32		43156: 00 00 00 08											
Intentional Island Categories (IntIslandCatRtg)										2		0000 0000 0000 0010				bitfield16		43158: 00 02											
Active Power Max Setting (WMax)										52219		(5221.900)		W		uint16		43159: CB FB											
Active Power (Over-Excited) Setting (WMaxOvrExt)										29533		(2953.300)		W		uint16		43160: 73 5D											
Specified Over-Excited PF (WOvrExtPF)										34259		(3425.900)				uint16		43161: 85 D3											
Active Power (Under-Excited) Setting (WMaxUndExt)										33969		(3396.900)		W		uint16		43162: 84 B1											
Specified Under-Excited PF (WUndExtPF)										36937		(3693.700)				uint16		43163: 90 49											
Apparent Power Max Setting (VAMax)										35892		(3589.200)		VA		uint16		43164: 8C 34											
Reactive Power Injected Setting (VarMaxInj)										47635		(4763.500)		Var		uint16		43165: BA 13											
Reactive Power Absorbed Setting (VarMaxAbs)										6291		(629.100)		Var		uint16		43166: 18 93											

SunSpec Modbus Test Results Reporting



- [SunSpec Modbus Conformance Test Procedures](#) (APPROVED Status)
- [SunSpec Modbus Test Procedures Results Reporting](#) (TEST Status)
- SunSpec is tool agnostic for certification
 - SunSpec evaluates the transaction logs and packet traces to determine if:
 - Tests were performed appropriately as defined by the Test Procedures Specification
 - The device under test responds appropriately, as defined by the SunSpec Specifications & SunSpec Modbus Models
- Issues to finalize:
 - Log file format
 - Logs per test vs. multiple models for same test
 - Modbus message (Hex string) format
 - Requirement for human readable logs



SunSpec Modbus Implementation Guides



- SunSpec Modbus is referenced in multiple standards and national grid codes
 - Example: [SunSpec Modbus IEEE 1547-2018 Specification, Profile and Implementation Guide](#)
- Additional standards that reference SunSpec Modbus:
 - SAE J3068
 - Poland
 - Germany
 - Denmark
 - MESA
 - Others?

Grid-Forming Model

- Evo Power has proposed a new Grid-Forming Model for adoption by SunSpec

Address Offset	Modbus Address	Group Offset	Name	Value	Count	Type	Size	Scale Factor	Units	RW Access (RW)	Mandatory (M)	Static (S)	Label	Description
			DEREVOFFGRID			group							DER GRID-MODE Evo Power	DER Grid Operation Mode model.
0	41187		ID	64171		uint16				R	M	S	Model ID	DER GRID-MODE model ID.
1	41188		L	2		uint16				R	M	S	Model Length	DER GRID-MODE model length.
2	41189		GridMd			enum16				RW	M	S	Grid Operation Mode	Current Grid Operation Mode
			INITIAL	0									Communication Pending	Communication of the inverter not established
			GRID CONNECTED	1									Grid-Following Mode	The inverter is AC coupled
			OFF GRID	2									Grid-Forming Mode	The inverter creates its AC voltage
			RESERVED	3									NA	NA
3	41190		GridSt			enum16				R	M	S	Grid Operation Status	Current Grid Operation Status
			STOPPED	0									Units Stopped	All units stopped
			STARTING CONNECTED	1									Starting Ongrid	Starting in On-grid mode
			STARTING OFFGRID	2									Starting Offgrid	Starting in Off-grid mode
			STARTING LEADER	3									Starting Leader	Starting leader unit
			VOLT CHECK	4									Check Voltage	Checking voltage
			VOLT DONE	5									Voltage Done	Voltage established
			STARTING FOLLOWERS	6									Starting Followers	Starting following units
			OFFGRID ENABLED	7									Grid-Forming Enabled	Off-grid mode active
			OFFGRID FAULT	8									Grid-Forming Fault	Off-grid mode Fault
			ONGRID ENABLED	9									Grid-Following Enabled	On-grid mode Active
			ONGRID FAULT	10									Grid-Forming Fault	On-grid mode Fault

Modular Energy Storage

- Challenge: 800 series storage models have a hard time scaling with larger battery storage systems
- Solution: New 900 series models have been developed and proposed for APPROVAL
 - Leverages repeating blocks developed for 700 series models

SunSpec Modbus Work Group



- First 2025 Meeting: Tomorrow, June 18 @ 8AM PT
 - First meeting is open to the public: [Click here to add to calendar](#)
- Members: [Sign up in Member Portal](#)
 - Contact membership@sunspec.org if you need assistance getting signed in
- Non-Members:
 - You will receive 30-day trial license of SunSpec Dashboard
 - Use this link before July 18 to receive 10% discount on new membership: [Join the Alliance](#)

Q&A



Call to Action: JOIN NOW

[Discounted Membership](#)

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