Introduction

This SunSpec Alliance Interoperability Specification describes the data models and MODBUS register mappings for meter devices used in Renewable Energy systems. This document defines the models for:

- Single Phase Meter
- Split Phase Meter
- Wye Connect Meter
- Delta Connect Meter

Meter Device Block

The following data elements are provided to describe meters.

- **C_SunSpec_DID –** A well-known value that uniquely identifies this block as a meter block. (4) for single phase meters and (5) for three phase meter types.
- **C_SunSpec_Length** – The length of the meter block in registers.
- **M_AC_xxxx**– Meter AC values.
- **M_Exported_xxxx**– Meter Exported Energy values
- **M_Imported_xxxx**– Meter Imported Energy values

Energy value

The energy value is represented by a 32 bit unsigned integer accumulator with a scale factor. Values for import and export are provided. Unsupported or invalid accumulators may return 0x00000000.

Power signs and Energy quadrants are per IEEE 1459-2000.

Meter Event Flag Values

The SunSpec Common Elements defines a C_Event value. The meter specific flags are defined here.

M_EVENT_Power_Failure	0x00000004	Loss of power or phase
M_EVENT_Under_Voltage	0x00000008	Voltage below threshold (Phase Loss)
M_EVENT_Low_PF	0x00000010	Power Factor below threshold (can indicate miss-associated voltage and current inputs in three phase systems)
M_EVENT_Over_Current	0x00000020	Current Input over threshold (out of measurement range)
M_EVENT_Over_Voltage	0x00000040	Voltage Input over threshold (out of measurement range)
M_EVENT_Missing_Sensor	0x00000080	Sensor not connected
M_EVENT_Reserved1	0x00000100	Reserved for future
M_EVENT_Reserved2	0x00000200	Reserved for future
M_EVENT_Reserved3	0x00000400	Reserved for future
M_EVENT_Reserved4	0x00000800	Reserved for future
M_EVENT_Reserved5	0x00001000	Reserved for future
M_EVENT_Reserved6	0x00002000	Reserved for future
M_EVENT_Reserved7	0x00004000	Reserved for future
M_EVENT_Reserved8	0x00008000	Reserved for future
M_EVENT_OEM1-15	0x7FFF000	Reserved for OEMs

MODBUS Register Mappings

Meter Model - MODBUS Mapping

This map supports single, split, wye, and delta meter connections in a single map as proper subsets. The connection type is distinguished by the C_SunSpec_DID. Registers that are not applicable to a meter class shall return the unsupported value. (e.g. Single Phase meters will support only summary and phase A values).

Start	End	#	R/W	Name	Type	Units	ScaleFactor	Contents	Description
Identification									
0001	0001	1	R	C_SunSpec_DID	uint16	N/A	0	201 202 203 or 204	Well-known value. Uniquely identifies this as a SunSpecModbus Map: Single Phase (AN or AB) Meter (201) Split Single Phase (ABN) Meter (202) Wye-Connect Three Phase (ABCN) Meter (203) Delta-Connect Three Phase (ABC) Meter(204)
0002	0002	1	R	C_SunSpec_Length	uint16	Registers	0	105	Length of meter model block
Current									
0003	0003	1	R	M_AC_Current	int16	Amps	M_AC_Current_SF	Measured	**AC Current** (sum of active phases)
0004	0004	1	R	M_AC_Current_A	int16	Amps	M_AC_Current_SF	Measured	Phase A AC Current
0005	0005	1	R	M_AC_Current_B	int16	Amps	M_AC_Current_SF	Measured	Phase B AC Current
0006	0006	1	R	M_AC_Current_C	int16	Amps	M_AC_Current_SF	Measured	Phase C AC Current
0007	0007	1	R	M_AC_Current_SF	int16	SF	0		AC Current Scale Factor
Voltage									
Line to Neutral Voltage									
0008	0008	1	R	M_AC_Voltage_LN	int16	Volts	M_AC_Voltage_SF	Measured	**Line to Neutral AC Voltage** (average of active phases)
0009	0009	1	R	M_AC_Voltage_AN	int16	Volts	M_AC_Voltage_SF	Measured	Phase A to Neutral AC Voltage
0010	0010	1	R	M_AC_Voltage_BN	int16	Volts	M_AC_Voltage_SF	Measured	Phase B to Neutral AC Voltage
0011	0011	1	R	M_AC_Voltage_CN	int16	Volts	M_AC_Voltage_SF	Measured	Phase C to Neutral AC Voltage
Line to Line Voltage									
0012	0012	1	R	M_AC_Voltage_LL	int16	Volts	M_AC_Voltage_SF	Measured	**Line to Line AC Voltage** (average of active phases)
0013	0013	1	R	M_AC_Voltage_AB	int16	Volts	M_AC_Voltage_SF	Measured	Phase A to Phase B AC Voltage

0014	0014	1	R	M_AC_Voltage_BC	int16	Volts	M_AC_Voltage_SF	Measured	Phase B to Phase C AC Voltage
0015	0015	1		M_AC_Voltage_CA	int16	Volts	M_AC_Voltage_SF	Measured	Phase C to Phase A AC Voltage
0016	0016	1	R	M_AC_Voltage_SF	int16	SF	0		AC Voltage Scale Factor
Frequency									
0017	0017	1	R	M_AC_Freq	int16	Herts	M_AC_Freq_SF	Measured	**AC Frequency**
0018	0018	1	R	M_AC_Freq_SF	int16	SF	0		AC Frequency Scale Factor
Power									
Real Power									
0019	0019	1	R	M_AC_Power	int16	Watts	M_AC_Power_SF	Measured	**Total Real Power**(sum of active phases)
0020	0020	1	R	M_AC_Power_A	int16	Watts	M_AC_Power_SF	Measured	Phase A AC Real Power
0021	0021	1	R	M_AC_Power_B	int16	Watts	M_AC_Power_SF	Measured	Phase B AC Real Power
0022	0022	1	R	M_AC_Power_C	int16	Watts	M_AC_Power_SF	Measured	Phase C AC Real Power
0023	0023	1	R	M_AC_Power_SF	int16	SF	0		AC Real Power Scale Factor
Apparent Power									
0024	0024	1	R	M_AC_VA	int16	Volt-Amps	M_AC_VA_SF	Measured	**Total AC Apparent Power**(sum of active phases)
0025	0025	1	R	M_AC_VA_A	int16	Volt-Amps	M_AC_VA_SF	Measured	Phase A AC Apparent Power
0026	0026	1	R	M_AC_VA_B	int16	Volt-Amps	M_AC_VA_SF	Measured	Phase B AC Apparent Power
0027	0027	1	R	M_AC_VA_C	int16	Volt-Amps	M_AC_VA_SF	Measured	Phase C AC Apparent Power
0028	0028	1	R	M_AC_VA_SF	int16	SF	0		AC Apparent Power Scale Factor
Reactive Power									
0029	0029	1	R	M_AC_VAR	int16	VAR	M_AC_VAR_SF	Measured	**Total AC Reactive Power**(sum of active phases)
0030	0030	1	R	M_AC_VAR_A	int16	VAR	M_AC_VAR_SF	Measured	Phase A AC Reactive Power
0031	0031	1	R	M_AC_VAR_B	int16	VAR	M_AC_VAR_SF	Measured	Phase B AC Reactive Power
0032	0032	1	R	M_AC_VAR_C	int16	VAR	M_AC_VAR_SF	Measured	Phase C AC Reactive Power
0033	0033	1	R	M_AC_VAR_SF	int16	SF	0	Config	AC Reactive Power Scale Factor
Power Factor									
0034	0034	1	R	M_AC_PF	int16	%	M_AC_PF_SF	Measured	**Average Power Factor**(average of active phases)
0035	0035	1	R	M_AC_PF_A	int16	%	M_AC_PF_SF	Measured	Phase A Power Factor
0036	0036	1	R	M_AC_PF_B	int16	%	M_AC_PF_SF	Measured	Phase B Power Factor
0037	0037	1	R	M_AC_PF_C	int16	%	M_AC_PF_SF	Measured	Phase C Power Factor
0038	0038	1	R	M_AC_PF_SF	int16	SF	0	Config	AC Power Factor Scale Factor
Accumulated Energy									
Real Energy									
0039	0040	2	R	M_Exported	uint32	Watt-hours	M_Energy_W_SF	Measured	**Total Exported Real Energy**

0041	0042	2	R	M_Exported_A	uint32	Watt-hours	M_Energy_W_SF	Measured	Phase A Exported Real Energy
0043	0044	2	R	M_Exported_B	uint32	Watt-hours	M_Energy_W_SF	Measured	Phase B Exported Real Energy
0045	0046	2	R	M_Exported_C	uint32	Watt-hours	M_Energy_W_SF	Measured	Phase C Exported Real Energy
0047	0048	2	R	M_Imported	uint32	Watt-hours	M_Energy_W_SF	Measured	**Total Imported Real Energy**
0049	0050	2	R	M_Imported_A	uint32	Watt-hours	M_Energy_W_SF	Measured	Phase A Imported Real Energy
0051	0052	2	R	M_Imported_B	uint32	Watt-hours	M_Energy_W_SF	Measured	Phase B Imported Real Energy
0053	0054	2	R	M_Imported_C	uint32	Watt-hours	M_Energy_W_SF	Measured	Phase C Imported Real Energy
0055	0055	1	R	M_Energy_W_SF	int16	SF	0	Config	Real Energy Scale Factor
Apparent Energy									
0056	0057	2	R	M_Exported_VA	uint32	VA-hours	M_Energy_VA_SF	Measured	**Total Exported Apparent Energy**
0058	0059	2	R	M_Exported_VA_A	uint32	VA-hours	M_Energy_VA_SF	Measured	Phase A Exported Apparent Energy
0060	0061	2	R	M_Exported_VA_B	uint32	VA-hours	M_Energy_VA_SF	Measured	Phase B Exported Apparent Energy
0062	0063	2	R	M_Exported_VA_C	uint32	VA-hours	M_Energy_VA_SF	Measured	Phase C Exported Apparent Energy
0064	0065	2	R	M_Imported_VA	uint32	VA-hours	M_Energy_VA_SF	Measured	**Total Imported Apparent Energy**
0066	0067	2	R	M_Imported_VA_A	uint32	VA-hours	M_Energy_VA_SF	Measured	Phase A Imported Apparent Energy
0068	0069	2	R	M_Imported_VA_B	uint32	VA-hours	M_Energy_VA_SF	Measured	Phase B Imported Apparent Energy
0070	0071	2	R	M_Imported_VA_C	uint32	VA-hours	M_Energy_VA_SF	Measured	Phase C Imported Apparent Energy
0072	0072	1	R	M_Energy_VA_SF	int16	SF	0	Config	Apparent Energy Scale Factor
Reactive Energy									
0073	0074	2	R	M_Import_VARh_Q1	uint32	VAR-hours	M_Energy_VAR_SF	Measured	**Quadrant 1: Total Imported Reactive Energy**
0075	0076	2	R	M_Import_VARh_Q1A	uint32	VAR-hours	M_Energy_VAR_SF	Measured	Phase A - Quadrant 1: Imported Reactive Energy
0077	0078	2	R	M_Import_VARh_Q1B	uint32	VAR-hours	M_Energy_VAR_SF	Measured	Phase B- Quadrant 1: Imported Reactive Energy
0079	0080	2	R	M_Import_VARh_Q1C	uint32	VAR-hours	M_Energy_VAR_SF	Measured	Phase C- Quadrant 1: Imported Reactive Energy
0081	0082	2	R	M_Import_VARh_Q2	uint32	VAR-hours	M_Energy_VAR_SF	Measured	**Quadrant 2: Total Imported Reactive Energy**
0083	0084	2	R	M_Import_VARh_Q2A	uint32	VAR-hours	M_Energy_VAR_SF	Measured	Phase A - Quadrant 2: Imported Reactive Energy
0085	0086	2	R	M_Import_VARh_Q2B	uint32	VAR-hours	M_Energy_VAR_SF	Measured	Phase B- Quadrant 2: Imported Reactive Energy
0087	0088	2	R	M_Import_VARh_Q2C	uint32	VAR-hours	M_Energy_VAR_SF	Measured	Phase C- Quadrant 2: Imported Reactive Energy
0089	0090	2	R	M_Export_VARh_Q3	uint32	VAR-hours	M_Energy_VAR_SF	Measured	**Quadrant 3: Total Exported Reactive Energy**
0091	0092	2	R	M_Export_VARh_Q3A	uint32	VAR-hours	M_Energy_VAR_SF	Measured	Phase A - Quadrant 3: Exported Reactive Energy
0093	0094	2	R	M_Export_VARh_Q3B	uint32	VAR-hours	M_Energy_VAR_SF	Measured	Phase B- Quadrant 3: Exported Reactive Energy
0095	0096	2	R	M_Export_VARh_Q3C	uint32	VAR-hours	M_Energy_VAR_SF	Measured	Phase C- Quadrant 3: Exported Reactive Energy
0097	0098	2	R	M_Export_VARh_Q4	uint32	VAR-hours	M_Energy_VAR_SF	Measured	**Quadrant 4: Total Exported Reactive Energy**
0099	0100	2	R	M_Export_VARh_Q4A	uint32	VAR-hours	M_Energy_VAR_SF	Measured	Phase A - Quadrant 4: Exported Reactive Energy
0101	0102	2	R	M_Export_VARh_Q4B	uint32	VAR-hours	M_Energy_VAR_SF	Measured	Phase B- Quadrant 4: Exported Reactive Energy
0103	0104	2	R	M_Export_VARh_Q4C	uint32	VAR-hours	M_Energy_VAR_SF	Measured	Phase C- Quadrant 4: Exported Reactive Energy

0105	0105	1	R	M_Energy_VAR_SF	int16	SF	0	Config	Reactive Energy Scale Factor
Events									
0106	0107	2	R	M_Events	uint32	Flags	0	M_EVENT_	See M_EVENT_ flags. 0 = no events.