

# Conext™ Gateway

Modbus Interface Specification (503)

Conext™ MPPT 80/100 600 Solar Charge Controllers

990-6270A

Feb 13, 2020



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## Revision History

<b>Rev</b>	<b>Date</b>	<b>Description of Change</b>
A	Feb 13, 2020	v1.06 Firmware Release

## Document Applicability

This Modbus map applies to the following products:

<b>Product ID</b>	<b>Product Description</b>
865-1032	MPPT 80 600
865-1032-02	MPPT 80 600
865-1034	MPPT 100 600

**⚠ WARNING****UNINTENDED OPERATION**

The use of this product with Modbus communications requires expertise in the design, operation, and programming of the device. Only qualified personnel should program, install, alter, and commission this product. Unless specified, information on safety, specifications, installation and operation is as shown in the primary documentation received with the product. Qualified personnel must be familiar with that information before proceeding. When writing values to the device, you must ensure other persons are not working with the device.

**Failure to follow these instructions can result in death or serious injury, and/or equipment damage.**

**⚠ WARNING****LOSS OF CONTROL**

Do not assign the same address to two Modbus devices. The entire serial bus may behave unexpectedly if the master device cannot communicate with all the slave devices on the bus.

**Failure to follow these instructions can result in death or serious injury, and/or equipment damage.**

## Overview

This document describes the structure of the Modbus register address map, which is used to configure, control, and monitor the device. Use this document in conjunction with the device Owner's Guide. The information in this document is intended for use only by qualified personnel who have a detailed technical understanding of the Modbus protocol. The Modbus map is divided into rows of Modbus registers. Each row indicates the Modbus register address, its name, data type, access type, units, scale, offset, and applicable notes as required. External Modbus master devices, such as the Schneider Electric M340 PLC, can read and write the Modbus registers to configure, control, or monitor the device remotely.

## Writing Modbus Registers

Modbus does not provide an error response when data written to a Modbus register is out of range or invalid. To confirm that a Modbus register is correctly written, you should read it back and compare it with the expected value. For descriptions of settings and their valid values, refer to the product's Owner's Guide.

## Supported Modbus Data Types

Data Type	Description
uint16	unsigned 16-bit integer [0,65535]
sint16	signed 16-bit integer [-32768,32767]
uint32	unsigned 32-bit integer [0,4294967295]
sint32	signed 32-bit integer [-2147483648,2147483647]
str<nn>	packed 8-bit character string, where <nn> is the length of characters in the string. Two characters are packed into each Modbus register. Example: str20 = 20-character string (packed into 10 Modbus registers) str16 = 16-character string (packed into 8 Modbus registers)

## Modbus Device Addressing

The Modbus slave address registers are automatically assigned on a first come, first served basis. The first detected device is assigned to the start of the address range. Subsequently added devices are assigned the next available address in the range.

Once assigned, the modbus slave address is associated to the serial number of the device, ensuring the consistency of the modbus address for the lifetime of the installation.

If Modbus slave addresses need to be changed, the Conext Gateway can be reset to its factory defaults and devices added one by one to establish the desired modbus address mapping.

ModbusTCP port	503
Modbus Slave Address Range	[ 170 .. 189 ]

## Modbus Register Addressing

The Register Number is the 1-based register identifier. Some 3rd party Modbus tools require 1-based register addressing.

The Register Address is the zero-based register address representing the register address as it is transmitted on-the-wire inside the Modbus data frame.

## Modbus Error Response

The Modbus Server will respond with a 02 ILLEGAL DATA ADDRESS error if an attempt is made to read/write registers which don't exist or if a request is made to read only part of a 32-bit register. This error will also be thrown if a read/write address range contains a data point which does not exist, or if the read/write address range starts or ends halfway through a 32-bit word.

A blank row in the Modbus Register map indicates a boundary between sets of contiguous registers. Multi-register reads/writes across these boundaries will result in a 02 ILLEGAL DATA ADDRESS error

## Modbus Cybersecurity Considerations

### **WARNING**

#### **CYBERSECURITY RISK: POTENTIAL COMPROMISE OF SYSTEM AVAILABILITY, INTEGRITY, AND CONFIDENTIALITY**

Always secure the Local Area Network on which the Conext Gateway is connected. Modbus TCP must NEVER be routed over a public network. Use cybersecurity best practices to help prevent unauthorized access.

**Failure to follow these instructions can result in unintended access to sensitive or secure customer data, permanent loss of data, and equipment damage.**

Modbus TCP is a legacy protocol in widespread use within the Solar industry. It is appreciated by system operators due to its simplicity and ease of use in control and monitoring applications. However, Modbus TCP is an insecure protocol which does not provide any data security, encryption, or authentication.

Anyone with access to the local area network on which the Conext Gateway is connected can monitor and control the power conversion devices attached to the Conext Gateway.

Modbus TCP should only be used on trusted, private, and highly secure local area networks for local control and monitoring applications only. Failure to properly secure the Local Area Network on which the Conext Gateway is connected can allow a remote attacker to compromise your power system installation.

## 1 Register Map for Conext™ MPPT 80/100 600 Solar Charge Controllers

Reg. No.	Reg. Addr.	Name	Type	R/W	Units	Scale	Offset	Notes
1	0x0000	Device Name	str16	r				
9	0x0008	reserved	uint16	r				
10	0x0009	reserved	uint16	r				
11	0x000A	FGA Number	str20	r				
21	0x0014	Unique ID Number	uint32	r				
31	0x001E	Firmware Version	uint32	r				
41	0x0028	Modbus Slave Address (Port 502)	uint16	rw		1.0	0.0	
42	0x0029	Device Number	uint16	r		1.0	0.0	
43	0x002A	System Instance	uint16	r		1.0	0.0	
44	0x002B	Hardware Serial Number	str20	r				
54	0x0035	Configuration Status	uint16	r		1.0	0.0	0=Refreshing 1=Done
55	0x0036	Configuration Refresh Counter	uint32	r		1.0	0.0	
65	0x0040	Device State	uint16	r		1.0	0.0	See section <a href="#">2.1</a>
66	0x0041	Charger Enabled Status	uint16	r		1.0	0.0	0=Disabled 1=Enabled
67	0x0042	Device Present	uint16	r		1.0	0.0	0=Inactive (all data invalid) 1=Active (data valid)
68	0x0043	Charge Mode Status	uint16	r		1.0	0.0	0=Stand alone 1=Primary 2=Secondary
69	0x0044	Active Faults	uint16	r		1.0	0.0	0=No Active Faults 1=Has Active Faults
70	0x0045	Active Warnings	uint16	r		1.0	0.0	0=No Active Warnings 1=Has Active Warnings
71	0x0046	Fault Bitmap 0	uint16	r		1.0	0.0	See section <a href="#">2.2</a>

Reg. No.	Reg. Addr.	Name	Type	R/W	Units	Scale	Offset	Notes
72	0x0047	Fault Bitmap 1	uint16	r		1.0	0.0	See section 2.3
73	0x0048	Warning Bitmap 0	uint16	r		1.0	0.0	See section 2.4
74	0x0049	Charger Status	uint16	r		1.0	0.0	See section 2.5
75	0x004A	Configuration Errors	uint32	r		1.0	0.0	
77	0x004C	PV Voltage	uint32	r	V	0.001	0.0	
79	0x004E	PV Current	uint32	r	A	0.001	0.0	
81	0x0050	PV Power	uint32	r	W	1.0	0.0	
87	0x0056	Battery Temperature	uint16	r	degC	0.01	-273.0	
88	0x0057	reserved	uint16	r				
89	0x0058	DC Output Voltage	sint32	r	V	0.001	0.0	
91	0x005A	DC Output Current	sint32	r	A	0.001	0.0	
93	0x005C	DC Output Power	uint32	r	W	1.0	0.0	
95	0x005E	DC Power Output Percentage	uint16	r	%	1.0	0.0	
96	0x005F	Auxiliary Output Status	uint16	r		1.0	0.0	See section 2.6
101	0x0064	Auxiliary Output On Reason	uint16	r		1.0	0.0	See section 2.7
102	0x0065	Auxiliary Output Off Reason	uint16	r		1.0	0.0	See section 2.8
113	0x0070	Energy From PV This Hour	uint32	r	kWh	0.001	0.0	
115	0x0072	PV Input Active This Hour	uint32	r	s	1.0	0.0	
117	0x0074	Energy From PV Today	uint32	r	kWh	0.001	0.0	
119	0x0076	PV Input Active Today	uint32	r	s	1.0	0.0	
121	0x0078	Energy From PV This Week	uint32	r	kWh	0.001	0.0	
123	0x007A	PV Input Active This Week	uint32	r	s	1.0	0.0	
125	0x007C	Energy From PV This Month	uint32	r	kWh	0.001	0.0	
127	0x007E	PV Input Active This Month	uint32	r	s	1.0	0.0	
129	0x0080	Energy From PV This Year	uint32	r	kWh	0.001	0.0	

Reg. No.	Reg. Addr.	Name	Type	R/W	Units	Scale	Offset	Notes
131	0x0082	PV Input Active This Year	uint32	r	s	1.0	0.0	
133	0x0084	Energy From PV Lifetime	uint32	r	kWh	0.001	0.0	
135	0x0086	PV Input Active Lifetime	uint32	r	s	1.0	0.0	
137	0x0088	Energy To Battery This Hour	uint32	r	kWh	0.001	0.0	
139	0x008A	Battery Charge Active This Hour	uint32	r	s	1.0	0.0	
141	0x008C	Energy To Battery Today	uint32	r	kWh	0.001	0.0	
143	0x008E	Battery Charge Active Today	uint32	r	s	1.0	0.0	
145	0x0090	Energy To Battery This Week	uint32	r	kWh	0.001	0.0	
147	0x0092	Battery Charge Active This Week	uint32	r	s	1.0	0.0	
149	0x0094	Energy To Battery This Month	uint32	r	kWh	0.001	0.0	
151	0x0096	Battery Charge Active This Month	uint32	r	s	1.0	0.0	
153	0x0098	Energy To Battery This Year	uint32	r	kWh	0.001	0.0	
155	0x009A	Battery Charge Active This Year	uint32	r	s	1.0	0.0	
157	0x009C	Energy To Battery Lifetime	uint32	r	kWh	0.001	0.0	
159	0x009E	Battery Charge Active Lifetime	uint32	r	s	1.0	0.0	
161	0x00A0	Maximum Power Point Tracking	uint16	rw		1.0	0.0	0=Disabled 1=Enabled
162	0x00A1	reserved	uint16	r				
163	0x00A2	HVMPPT Reference Voltage	uint32	rw	V	0.001	0.0	
165	0x00A4	reserved	uint16	r				
166	0x00A5	Battery Type	uint16	rw		1.0	0.0	See section 2.9
167	0x00A6	Nominal Battery Voltage	uint32	rw	V	0.001	0.0	24000=24V 48000=48V
169	0x00A8	Battery Bank Capacity	uint16	rw	Ah	1.0	0.0	

Reg. No.	Reg. Addr.	Name	Type	R/W	Units	Scale	Offset	Notes
170	0x00A9	Battery Temperature Coefficient	uint16	rw	mV/degC	1.0	0.0	
171	0x00AA	Force Charger State	uint16	rw		1.0	0.0	1=Bulk 2=Float 3=No Float
172	0x00AB	Reset	uint16	rw		1.0	0.0	0=Reboot 2=Reset to Factory
173	0x00AC	Operating Mode	uint16	rw		1.0	0.0	2=Standby 3=Operating
174	0x00AD	Clear	uint16	rw		1.0	0.0	See section 2.10
175	0x00AE	Equalize Voltage Set Point	uint32	rw	V	0.001	0.0	
177	0x00B0	Bulk/Boost Voltage Set Point	uint32	rw	V	0.001	0.0	
179	0x00B2	Float Voltage Set Point	uint32	rw	V	0.001	0.0	
181	0x00B4	Recharge Voltage	uint32	rw	V	0.001	0.0	
183	0x00B6	Absorption Voltage Set Point	uint32	rw	V	0.001	0.0	
185	0x00B8	Absorption Time	uint16	rw	min	0.016667	0.0	
186	0x00B9	Charge Cycle	uint16	rw		1.0	0.0	1=3 Stage 2=2 Stage (No Float)
187	0x00BA	Maximum Charge Rate	uint16	rw	%	1.0	0.0	
188	0x00BB	Equalize Now	uint16	rw		1.0	0.0	0=Disabled 1=Enabled
189	0x00BC	reserved	uint16	r				
190	0x00BD	reserved	uint16	r				
191	0x00BE	Charge Mode	uint16	rw		1.0	0.0	See section 2.11
192	0x00BF	Default Battery Temperature	uint16	rw		1.0	0.0	0=Cold 1=Warm 2=Hot
193	0x00C0	Identify Enable	uint16	rw		1.0	0.0	0=Disabled 1=Enabled
194	0x00C1	reserved	uint16	r				

Reg. No.	Reg. Addr.	Name	Type	R/W	Units	Scale	Offset	Notes
195	0x00C2	Manual Aux	uint16	rw		1.0	0.0	0=Manual Off 1=Manual On 2=Automatic
196	0x00C3	reserved	uint16	r				
197	0x00C4	Auxiliary Output Trigger Source	uint32	rw		1.0	0.0	See section <a href="#">2.12</a>
199	0x00C6	Network Power Night time Disable	uint16	rw		1.0	0.0	0=Disabled 1=Enabled
200	0x00C7	Low Power at Night time Enable	uint16	rw		1.0	0.0	0=Disabled 1=Enabled
201	0x00C8	Low Battery Voltage Trigger Set	uint32	rw	V	0.001	0.0	
203	0x00CA	Low Battery Voltage Trigger Set Delay	uint16	rw	s	0.01	0.0	
204	0x00CB	reserved	uint16	r				
205	0x00CC	Low Battery Voltage Trigger Clear	uint32	rw	V	0.001	0.0	
207	0x00CE	Low Battery Voltage Trigger Clear Delay	uint16	rw	s	0.01	0.0	
208	0x00CF	reserved	uint16	r				
209	0x00D0	Low Array Voltage Trigger Set	uint32	rw	V	0.001	0.0	
211	0x00D2	Low Array Voltage Trigger Set Delay	uint16	rw	s	0.01	0.0	
212	0x00D3	reserved	uint16	r				
213	0x00D4	Low Array Voltage Trigger Clear	uint32	rw	V	0.001	0.0	
215	0x00D6	Low Array Voltage Trigger Clear Delay	uint16	rw	s	0.01	0.0	
216	0x00D7	reserved	uint16	r				
217	0x00D8	High Battery Voltage Trigger Set	uint32	rw	V	0.001	0.0	
219	0x00DA	High Battery Voltage Trigger Set Delay	uint16	rw	s	0.01	0.0	
220	0x00DB	reserved	uint16	r				
221	0x00DC	High Battery Voltage Trigger Clear	uint32	rw	V	0.001	0.0	
223	0x00DE	High Battery Voltage Trigger Clear Delay	uint16	rw	s	0.01	0.0	
224	0x00DF	reserved	uint16	r				

Reg. No.	Reg. Addr.	Name	Type	R/W	Units	Scale	Offset	Notes
225	0x00E0	High Array Voltage Trigger Set	uint32	rw	V	0.001	0.0	
227	0x00E2	High Array Voltage Trigger Set Delay	uint16	rw	s	0.01	0.0	
228	0x00E3	reserved	uint16	r				
229	0x00E4	High Array Voltage Trigger Clear	uint32	rw	V	0.001	0.0	
231	0x00E6	High Array Voltage Trigger Clear Delay	uint16	rw	s	0.01	0.0	
232	0x00E7	reserved	uint16	r				
233	0x00E8	Low Battery Temperature Trigger Set	uint32	rw	degC	0.001	-273.0	
235	0x00EA	Low Battery Temperature Trigger Set Delay	uint16	rw	s	0.01	0.0	
236	0x00EB	reserved	uint16	r				
237	0x00EC	Low Battery Temperature Trigger Clear	uint32	rw	degC	0.001	-273.0	
239	0x00EE	Low Battery Temperature Trigger Clear Delay	uint16	rw	s	0.01	0.0	
240	0x00EF	reserved	uint16	r				
241	0x00F0	High Battery Temperature Trigger Set	uint32	rw	degC	0.001	-273.0	
243	0x00F2	High Battery Temperature Trigger Set Delay	uint16	rw	s	0.01	0.0	
244	0x00F3	reserved	uint16	r				
245	0x00F4	High Battery Temperature Trigger Clear	uint32	rw	degC	0.001	-273.0	
247	0x00F6	High Battery Temperature Trigger Clear Delay	uint16	rw	s	0.01	0.0	
248	0x00F7	reserved	uint16	r				
249	0x00F8	High Heatsink Temperature Trigger Set	uint32	rw	degC	0.001	-273.0	

Reg. No.	Reg. Addr.	Name	Type	R/W	Units	Scale	Offset	Notes
251	0x00FA	High Heatsink Temperature Trigger Set Delay	uint16	rw	s	0.01	0.0	
252	0x00FB	reserved	uint16	r				
253	0x00FC	High Heatsink Temperature Trigger Clear	uint32	rw	degC	0.001	-273.0	
255	0x00FE	High Heatsink Temperature Trigger Clear Delay	uint16	rw	s	0.01	0.0	
256	0x00FF	reserved	uint16	r				
257	0x0100	Refresh Configuration Data	uint16	rw		1.0	0.0	1=Refresh
258	0x0101	DC Input Association (PV)	uint16	rw		1.0	0.0	See section <a href="#">2.13</a>
259	0x0102	Battery Association	uint16	rw		1.0	0.0	See section <a href="#">2.14</a>

## 2 Data Point Enumerations

### 2.1 Device State

The following are the valid device state values:

0=Hibernate  
 1=Power Save  
 2=Safe Mode  
 3=Operating  
 4=Diagnostic Mode  
 5=Remote Power Off  
 255=Data Not Available

### 2.2 Fault Bitmap 0 Values

Each bit in the register corresponds to a specific fault as shown below:

bit0=F2:Capacitor Over-Temperature  
 bit1=F4:Battery Over-Temperature  
 bit2=F5:Ambient Over-Temperature  
 bit3=F9:DC Over-Voltage

bit4=F10:Output Under-Voltage Immediate  
bit5=F11:Output Under-Voltage  
bit6=F26:Auxiliary Power Supply  
bit7=F30:Battery Under-Temperature  
bit8=F54:Auxiliary Power Supply  
bit9=F55:Heatsink Over-Temperature  
bit10=F56:Ground Fault  
bit11=F69:Configuration Fault  
bit12=F70:DC Over-Voltage  
bit13=F71:DC Over-current  
bit14=F72:SPS Overload  
bit15=F73:Slow Output Over-Current

### 2.3 Fault Bitmap 1 Values

Each bit in the register corresponds to a specific fault as shown below:

bit0=F74:Input Over-Voltage  
bit1=F75:Fan Over-Voltage  
bit2=F76:Fan Over-Current  
bit3=F77:Input Over-Current  
bit4=F78:Output Over-Current  
bit5=F79:Fan Over-Current  
bit6=F80:Fan Under-Voltage  
bit7=F81:Fan Under-Current  
bit8=F82:Network Power Supply Failure  
bit9=F90:External BMS Disconnected

### 2.4 Warning Bitmap 0 Values

Each bit in the register corresponds to a specific warning as shown below:

bit0=W4:Battery Over Temperature Warning  
bit1=W5:Ambient Over Temperature  
bit2=W9:Battery Temperature Sensor not present  
bit3=W11:DC Input (PV) Over Voltage Warning  
bit4=W12:DC Under Voltage Warning  
bit5=W34:DC Output Over Voltage Warning  
bit6=W35:Heatsink Over Temperature Warning

## 2.5 Charger Status

The Charger Status register can take any of the following values as shown below:

768=Not Charging  
769=Bulk  
770=Absorption  
771=Overcharge  
772=Equalize  
773=Float  
774=No Float  
775=Constant VI  
776=Charger Disabled  
777=Qualifying AC  
778=Qualifying APS  
779=Engaging Charger  
780=Charge Fault  
781=Charger Suspend  
782=AC Good  
783=APS Good  
784=AC Fault  
785=Charge  
786=Absorption Exit Pending  
787=Ground Fault  
788=AC Good Pending

## 2.6 Auxiliary Output Status

The Auxiliary Output can be in one of the following states:

1=AutoOn  
2=Auto Off  
3=Manual On  
4=Manual Off

## 2.7 Auxiliary Output On Reason

The Auxiliary Output may be on for one of the following reasons:

0=Not on  
1=Manual on

2=Battery Voltage Low  
3=Battery Voltage High  
4=Array Voltage High  
5=Battery Temp Low  
6=Battery Temp High  
7=Heat Sink Temp High  
8=Fault

## 2.8 Auxiliary Output Off Reason

This status indicates the reason the auxiliary output is deactivated or 0 if it is activated. The following values are supported:

0=Not off  
1=Manual Off  
2=No Active Trigger  
3=Trigger Override  
4=Fault  
5=Bulk Exit  
6=Absorption Exit

## 2.9 Battery Type

The Charge Controller supports each of the following battery types. When custom battery type is selected the battery setpoints may be user defined.

0=Flooded  
1=Gel  
2=AGM  
3=Custom

## 2.10 Clear Command

The Clear Command can be used to clear the fault; warning; event; and communication logs. The following values are supported:

1=Fault Log  
2=Active Faults  
4=Warning Log

8=Active Warnings  
16=State Event Log  
32=Communication Statistics  
64=Statistics  
128=User Statistics  
255=All

### 2.11 Charge Controller Operating mode

The Charge Controller can be set to one of the following modes:

0=Stand-alone  
1=Primary  
2=Secondary  
3=Echo

### 2.12 Auxiliary Trigger Source

The Auxiliary Trigger Source Bitmap can take any one of the following values as shown below:

1=Low Battery Voltage  
2=High Battery Voltage  
4=Low Array Voltage  
8=High Array Voltage  
16=Low Battery Temperature  
32=High Battery Temperature  
64=High Heatsink Temperature  
128=Fault  
256=Ground Fault  
512=Input Over Voltage Fault  
1024=Input Over Voltage Error  
2048=Input Over Voltage Warning  
4096=Input Over Current Error  
8192=Output Over Voltage Error  
16384=Output Over Voltage Warning  
32768=Output Under Voltage Error  
65536=Output Under Voltage Warning  
131072=Output Over Current Error  
262144=Output Over Current Fault  
524288=Battery Over Temperature Error  
1048576=Battery Over Temperature Warning  
2097152=Battery Under Temperature Warning

4194304=Heatsink Over Temperature Error  
8388608=Heatsink Over Temperature Warning  
16777216=Ambient Over Temperature Error  
33554432=Ambient Over Temperature Warning  
67108864=Capacitor Over Temperature Error  
134217728=Fan Fault  
268435456=Fan Error  
536870912=Network Power Supply Fault

### **2.13 DC Input Association**

The following associations are supported:

21=Solar Array 1  
22=Solar Array 2  
23=Solar Array 3  
24=Solar Array 4  
25=Solar Array 5  
26=Solar Array 6  
27=Solar Array 7  
28=Solar Array 8  
29=Solar Array 9  
30=Solar Array 10  
31=Solar Array 11  
32=Solar Array 12  
33=Solar Array 13  
34=Solar Array 14  
35=Solar Array 15  
36=Solar Array 16

### **2.14 DC Output Association**

The following associations are supported:

3=House Battery Bank 1  
4=House Battery Bank 2  
5=House Battery Bank 3  
6=House Battery Bank 4  
7=House Battery Bank 5