

Self-supply and Grid Sell Limiting Solution Guide

Exclusion for Documentation

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DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, ARC FLASH, AND FIRE

This document is in addition to, and incorporates by reference, the relevant product manuals for Conext XW Pro inverter/charger. Before reviewing this document, you must read the relevant product manuals. Unless specified, information on safety, specifications, installation and operation is as shown in the primary documentation received with the product. Ensure you are familiar with that information before proceeding.

Failure to follow these instructions will result in death or serious injury.

Scope

This Solution Guide provides planning, installation, and configuration information for Schneider Electric's Conext XW Pro inverter/charger to comply with self-supply requirements in certain regions or other requirements where power being sold to the grid is limited.

Audience

This Solution Guide is intended for qualified installers. To design and install a system that will operate correctly, qualified installers must have training and experience in solar power systems to safely and correctly follow these instructions and the applicable electrical and building codes. Qualified installers must have an awareness of the hazards involved in performing electrical installation work and how to reduce those hazards.

  **DANGER**

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Conext XW Pro Battery Inverters and Conext MPPT 80 600/60 150 Charge Controllers contain no user serviceable parts. Attempting to service the inverters yourself may result in a risk of electrical shock or fire and will void your warranty. Internal capacitors remain charged and hazardous after all power is disconnected.

To reduce the risk of electrical shock, authorized service personnel must disconnect both AC and DC power from Conext XW Pro Battery Inverters and Conext MPPT Charge Controllers, following the lock-out and tag-out instructions in the documentation for those products, before attempting any maintenance or cleaning or working on any circuits connected to the products. Putting the inverters in Standby mode will not reduce this risk. To reduce the chance of short-circuits, authorized service personnel must use insulated tools when installing or working with equipment.

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Introduction

The high penetration of Distributed Energy Resources has led regulators in many markets to mandate or incentivize Self-supply (also called Customer Self-supply, etc.). Depending on the local regulations, systems may have a requirement to limit the net export (or selling) of power from the PV system onto the grid ("Grid Sell Limiting"). In some cases, all power that is produced by the system must be consumed on site, except under special conditions as may be required by the grid codes.

The Conext XW Pro system can implement Grid Sell Limiting at the inverter AC1 (Grid) port, or by taking power measurements from a compatible meter at an external control point. From the metered control point, the Conext XW Pro system ensures power is effectively routed within the system so that power flow out to the grid is kept below a configured limit, depending on the compliance region being satisfied. The primary benefit of using an external power meter for Grid Sell Limiting is to Self-supply additional loads connected on the grid side of the inverter (AC1).

Definitions

Terminology	Definition
Generating Facility	Customer or utility-owned electrical power generation that is interconnected to the utility.
Grid Sell Limiting	Limiting the net export (or selling) of power from the PV & storage system onto the grid.
Grid Support	When the utility grid is connected, the Grid Support feature reduces the power demand from the grid by utilizing excess DC power to support the backup loads. No power is sold to the utility in this mode by itself. To enable and manage the export of power to the utility, Sell must be enabled.
Grid Support SOC	When using State of Charge control (with Conext Battery Monitor or a compatible external BMS), Grid Support SOC is the threshold to which batteries will be discharged when the inverter is supplying power to AC loads or selling power to the grid.
Grid Support Volts	When using voltage-based control, Grid Support Volts is the battery voltage to which batteries will be discharged when the inverter is supplying power to AC loads or selling power to the grid.
Inadvertent Export	Inadvertent Export is the un-permitted, unscheduled, and uncompensated export or real power generated from a Customer's Generating Facility and delivered to the Company.

Terminology	Definition
Nameplate Rating	For the purpose of calculating Inadvertent Export, Nameplate Rating is defined as the lesser of <ul style="list-style-type: none"> ■ (1) the Total Inverter Capacity (kW) or ■ (2) the sum of the Total Module Capacity and the Total Energy Storage System Capacity (kW) (i.e. the aggregate of the DC-power components), as those amounts are stated in Exhibit A (Description of Generating Facility) of the Customer’s Standard Interconnection Agreement for Self-Supply Systems, and as depicted on the single-line diagram and three-line diagram.
Net Export	Net Export is the cumulative amount of Inadvertent Export energy produced by the Customer’s Generating Facility and delivered to the Company.
Self Supply	Supply of energy generated from on-site solar array to on-site loads. When the installed PV capacity exceeds the daytime loads, battery storage is used to store excess solar energy to power evening loads.
Sell	If Grid Support is Enabled, the Sell feature determines whether the XW Pro exports power on AC1 (grid). <ul style="list-style-type: none"> ■ Grid Support Enabled, Sell Disabled: Conext XW Pro supports loads only on AC Out (protected loads). ■ Grid Support Enabled, Sell Enabled: Conext XW Pro supports loads on AC Out (protected loads) as well as AC1 (grid).
System Capacity	Combined sums of capacities per inverter.

Prerequisites

You must upgrade to the latest Conext XW Pro and Conext Gateway firmware available for the following models at: <http://solar.schneider-electric.com>.

- Conext XW Pro Product Number: 865-6848-21
Firmware: 1.04.00 BN 353 or later
- Conext Gateway Product Number: 865-0329
Firmware: V1.06 or later

Required Equipment

- Conext XW Pro inverter/charger
- Conext Gateway
- Compatible external power meter (for Grid Sell Limiting at the main panel or point of interconnection)

Compatible Equipment

Power Meters

- Vendor: Continental Control Systems LLC
Product Name: WattNode Wide-Range Modbus Meter
Product Part No(s): WND-WR-MB

Current Transformers

<i>NOTICE</i>

EQUIPMENT DAMAGE

Refer to the technical documentation of the selected power meter for compatible current transformers. Ensure current rating is suitable for the application.
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Failure to follow these instructions can result in equipment damage.

Installation

There are several possible configurations for self-supply. A compatible power meter is used for Grid Sell Limiting when loads on the grid side of the inverter (AC1 port) will be Self-supplied by Solar Energy. For CT installation, the orientation is shown on the applicable diagrams in the following sections.

Wiring Instructions

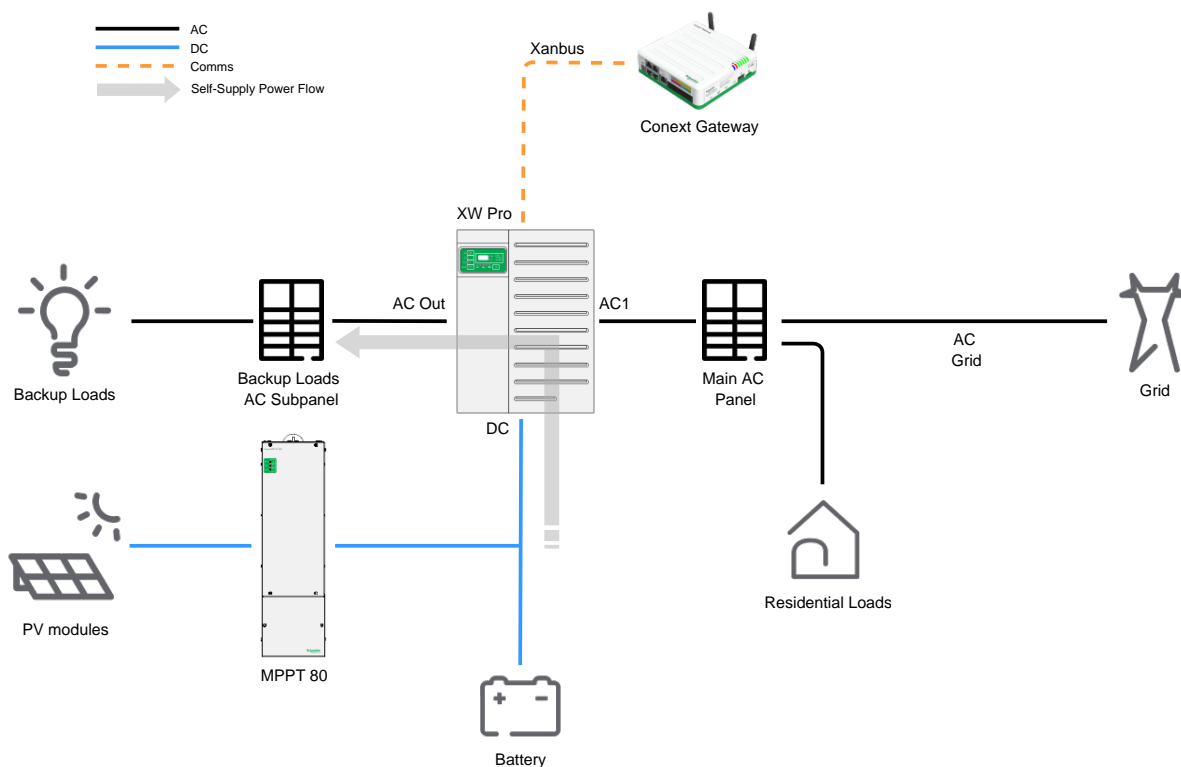
Power Meter Communications

The Conext Gateway supports two independent Modbus RTU 2-wire networks. If the power meter is used, it can be connected to either port. Refer to the Conext XW Pro Owner's Guide (document number 990-91227) and the selected power meter's technical manual for wiring details.

DC Coupled PV System – Self-Supply Backup Loads connected to AC Out

- Self-supply solar energy to the backup load panel only
- Backup load panel is connected to AC Out
- External power meter not required for Grid Sell Limiting
- Consider this configuration if the solar power capacity is lower than the daytime Self-supplied loads on AC Out

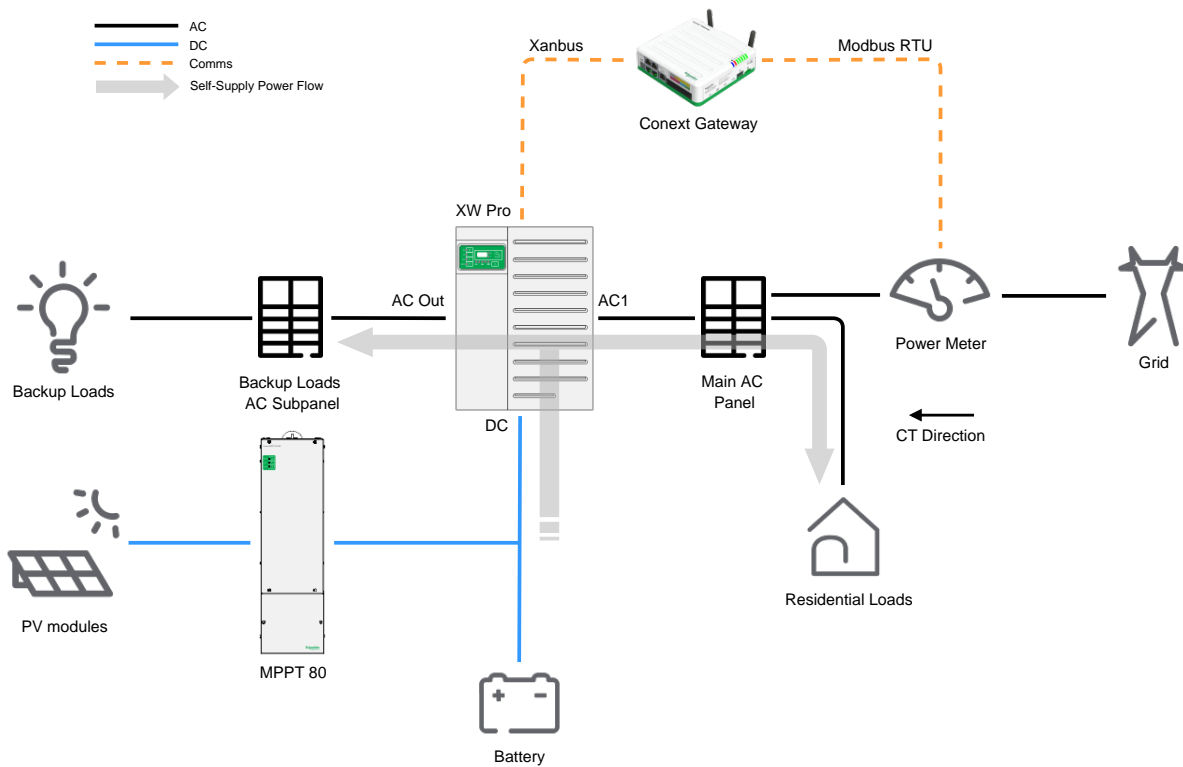
Figure 1DC Coupled PV System – Self-Supply Backup Loads connected to AC Out



DC Coupled PV System – Self Supply Entire Home (backup loads sub-panel and main panel)

- Self-supply solar energy to the backup loads sub-panel and the main panel
- Backup loads for backup power are connected to AC Out, and the main panel is connected to AC1 (Grid)
- External power meter required for Grid Sell Limiting
- Consider this configuration if the daily solar energy generation is greater than the daily consumption of the backed up loads on AC Out

Figure 2DC Coupled PV System – Self Supply Entire Home (backup loads sub-panel and main panel)



Configuration

Once the system is physically installed, it will need to be configured to operate correctly as well as to enable the Grid Sell Limiting features.

Conext Gateway Configuration Parameters for Grid Sell Limiting with External Meter

WARNING

ADVANCED CONFIGURATION HAZARD

- Advanced menu settings should be used by qualified personnel only.
- Three phase operation should be configured by qualified personnel only.
- Consult with the local utility before enabling Conext XW Pro sell mode or grid support functions.
- Do not change these settings unless you are under the supervision and direction of qualified personnel.
- Connect the Conext Gateway and the network router connected to the Conext Gateway to an assured power source during configuration.


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

The following configuration settings are relevant to enabling Grid Sell Limiting with an external meter. Settings are applied to the Conext Gateway, under the Setup menu of the Conext Gateway web application, as described in Conext XW Pro Owner's Guide (document number 990-91227).

Menu Location	Parameter	Units	Description
Setup > Smart Energy Manager > Grid Sell Limiting ¹	Enable	n/a	Enable or disable Grid Sell Limiting. Must be set to Enabled .
	Trip Power	W	If the power to the grid at the power meter point of measurement exceeds this threshold for longer than Trip Time , Conext XW Pro unit(s) will cease to energize. IMPORTANT: This value must be greater than or equal to Sell Setpoint .
	Trip Time	sec	Time delay in seconds such that if power to the grid exceeds Trip Power for longer than the defined duration, the Conext XW Pro unit(s) will cease to energize.
	Clear Time	sec	Time delay in seconds such that if power to the grid falls below Trip Power for longer than the defined duration after first tripping it, the Conext XW Pro unit(s) will reconnect as per applied grid code settings and resume normal operation.
	Sell Setpoint	W	The target to which Conext Gateway will limit the networked Conext XW Pro unit's sell power. Setting this parameter to a value slightly below the limit enforced by the applicable grid codes is recommended in order to minimize inadvertent power sell. See examples below. IMPORTANT: This value must be less than or equal to Trip Power .

¹ See "Example Configuration Sets" on page 14 for more information.



Conext XW Pro Inverter/Charger Configuration Parameters

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  WARNING

UNEXPECTED OPERATION HAZARD

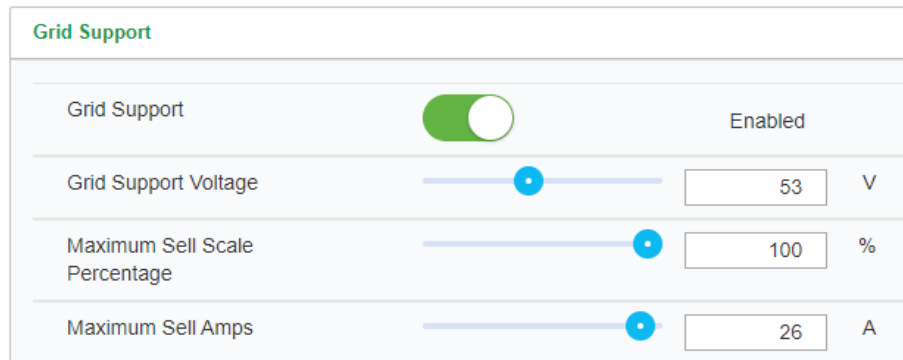
- Some battery technologies will experience accelerated degradation if not fully charged periodically.
- If the Grid Support settings and available solar energy capacity don't provide a full battery charge, consider adjusting the Grid Support settings or periodically forcing a full charge.
- Refer to the Owner's manual for information on forcing a full charge cycle.

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

The following configuration settings are relevant to enabling Self-supply and Grid Sell Limiting and need to be reviewed for all networked Conext XW Pro unit(s). They are accessible under each Conext XW Pro instance in the Devices menu of the Conext Gateway web application. The Grid Support settings for Self-supply applications will depend on the system design, the amount of power permitted to be sold to the grid, and the battery type. For more information on all configuration settings, refer to Conext XW Pro Owner's Guide (document number 990-91227).

Menu Location	Parameter	Units	Description
Configuration > Controls	Grid Support Sell Enable/Disable	n/a	Enable or disable the selling of power to the grid or loads connected at the AC1 port. For systems with loads connected to AC1 that should be self-supplied with solar energy, this parameter must be set to Enabled . Grid Support must also be Enabled for Sell to function.

Menu Location	Parameter	Units	Description
Configuration > Grid Support	Grid Support Voltage or Grid Support SOC (if enabled)	V	Sets the limit to which the batteries will be discharged when the inverter is supplying power to AC loads or selling power to the grid. Refer to the following section for information on configuring Self-Supply using Grid Support.
Configuration > Grid Support	Grid Support	n/a	Enable or disable grid support features. Must be set to Enabled .
Configuration > Grid Support	Maximum Sell Scale Percentage	%	Scale the sell current limit with respect to the Maximum Sell Amps setting.
Configuration > Grid Support	Maximum Sell Amps	A	Controls the maximum amount of sell power permitted to the AC1 (Grid) port. In systems where Self-Supply is limited to backup loads on AC Out and Grid Sell Limiting is required, this parameter can limit the sell current to AC1.



System Design Considerations

Solar power capacity is lower than the daytime Self-supplied loads

When all the solar energy produced during the day can be immediately consumed by Self-supplied loads, it is recommended to configure grid support to maintain the batteries at 100% State of Charge.

Solar power capacity is larger than the daytime Self-supplied loads

When daytime solar energy generation exceeds the daytime Self-supplied loads, the recommended settings depend on whether Grid Sell Limiting is required.

Grid Sell Limiting is not required

In this scenario, it may not be necessary to cycle the batteries daily, if exporting the excess power to the grid is permitted on a Net Metering or Feed in Tariff basis. For this use case, it is recommended to configure grid support to maintain the batteries at 100% State of Charge.

Grid Sell Limiting is required

In this scenario, full utilization of solar energy may require charging batteries during the day and supplying that energy to AC loads in the evening by discharging the batteries. For this use case, ensure a battery technology is chosen with lifespan that accounts for daily cycling. The Grid Support voltage or SOC set point will determine the depth of discharge for

powering AC loads. Select the Grid Support limit according to the battery capacity required to store excess daytime solar energy generation. Configure Maximum Sell Amps to ensure that solar energy generation exceeds the power supplied for grid support, allowing the batteries to charge during the day.

Note: Lowering the Grid Support SOC allows more capacity to store excess solar energy generation but also lowers the battery reserve capacity in the event of a grid Outage.

Battery Type

Li-ion batteries are typically used for applications that require daily cycling of the batteries. For Li-ion batteries, SOC control mode should be used. SOC can be provided by the Conext Battery Monitor. With State of Charge Control enabled and the Conext Battery Monitor connected, the Grid Support limit should be set with Grid Support SOC rather than Grid Support Voltage.

Establishing Communication

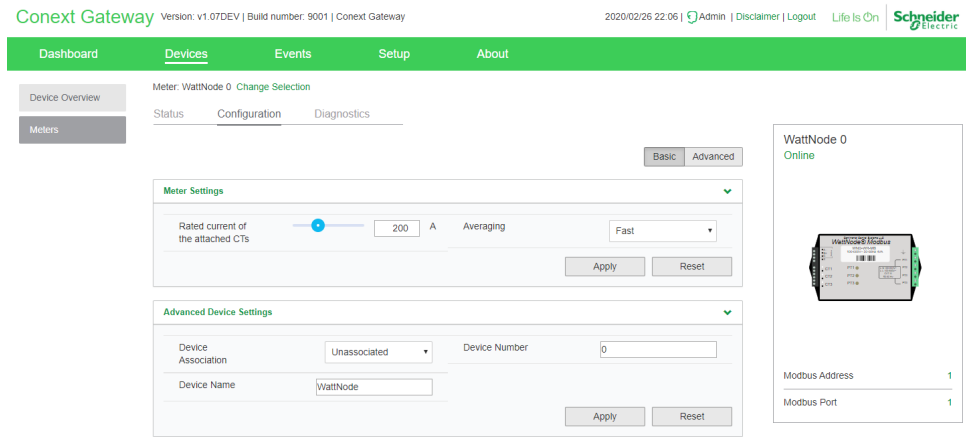
If a third-party meter is used, it must first be configured to match the communication protocol and settings at the Conext Gateway (2-wire Modbus RTU over RS-485). Ensure the address chosen is unique if other devices are on the same network. The Modbus configuration details of the Conext Gateway can be found and adjusted in the web application under **Setup > Configuration > Modbus settings**.

The Conext Gateway must then run a device discovery routine in order to see and connect to the power meter:

1. Navigate to **Setup > Device Detection > Detect devices** menu.
2. In the port where the power meter is connected to on the Conext Gateway connector header, enter any range of addresses, as long as the power meter lies within them. The range feature allows the user to detect multiple devices on the network in one action. The larger the range, the more time it takes to complete the search.

Third-Party Meter Configuration

Once the power meter is detected and online, it will appear in the web application as a configurable device. Ensure **Rated current of the attached CTs** is correct and **Device Association** reflects the location of the CT in the system. For the applications covered by this document, the **Device Association** is to be set to **Grid**. Some parameters as displayed in the figure below may not be present for some power meter makes/models.



Continental WattNode® Modbus - Additional Details

The following are verified and recommended configuration values for the Continental WattNode Modbus power meter.

Communication Settings

Baud Rate: 19200

Additional Modbus Parameters: 8 data bits, no parity, 1 stop bit

Meter Settings

Averaging: Fast

Setting the Modbus Address

Use the DIP switches 1-6 to select the Modbus address (1 to 63) in a base-2 numerical representation. The following table instructs how to toggle the switches for a few various address examples.

DIP Switch	1	2	3	4	5	6
Up (1) Value	1	2	4	8	16	32
Address	Examples					
1	1, Up	0, Down	0, Down	0, Down	0, Down	0, Down
1+2+4 = 7	1, Up	1, Up	1, Up	0, Down	0, Down	0, Down
4+16 = 20	0, Down	0, Down	1, Up	0, Down	1, Up	0, Down
1+2+16+32 = 51	1, Up	1, Up	0, Down	0, Down	1, Up	1, Up

Modbus Termination Resistor

If required, toggle the DIP switch to its ON position to apply an internal 120 ohm resistor to the network.

Wiring Harness Pinout

Gateway Modbus 1	Gateway Modbus 2	WattNode Terminal
16 - ISO2 RS485 GND	22 – ISO2 RS485 GND	C

Gateway Modbus 1	Gateway Modbus 2	WattNode Terminal
18 - ISO2 RS485 1A	24 – ISO2 RS485 2A	B+
20 - ISO2 RS485 1B	26 – ISO2 RS485 2B	A-

Example Configuration Sets

Hawaii Customer Self-supply (CSS) Program – Single Unit Split Phase, whole home

The following is an example of how a system can be configured to comply with the CSS program enacted by the Hawaiian Electric Industries under the Net Energy Metering program, when paired with a Continental WattNode® power meter and a 200A CT. **Trip Time** and **Trip Power** have been configured to comply with HECO Rule 14H and 22 inadvertent export rules so the system will activate a fault if they are violated.

Menu Location	Parameter	Value
Setup > Smart Energy Manager > Grid Sell Limiting	Enable	Enabled
	Trip Power	0 W
	Trip Time	30 sec
	Clear Time	60 sec
	Sell Setpoint	-20 W
XW Pro > Configuration > Controls	Grid Support Sell Enable/Disable	Enabled
XW Pro > Configuration > Grid Support	Grid Support	Enabled
XW Pro > Configuration > Grid Support	Maximum Sell Amps	26 A
Devices > Meters > Configuration	Rated current of the attached CTs	200 A
Devices > Meters > Configuration	Averaging	Fast
Devices > Meters > Configuration	Device Association	Grid

Hawaii Customer Self-supply (CSS) Program – Single Unit Split Phase, backup only

The following is another example of how a system can be configured to comply with the Hawaiian CSS program, where Self-supply is limited to the backup loads of the system. That is, residential loads on the main panel are to be powered by the grid only. In this instance, the Conext XW Pro sits at the point of connection where sell power flow is to be limited and can thus act as the power meter in the system, and so Grid Sell Limiting configurations in the Conext Gateway no longer apply. This is reflected in the **Maximum Sell Amps** parameter below where grid sell current is limited to 0 A. Consequently, the power control response is faster during sudden load and available PV power changes.

Menu Location	Parameter	Value
XW Pro > Configuration > Controls	Grid Support Sell Enable/Disable	Enabled
XW Pro > Configuration > Grid Support	Grid Support	Enabled
XW Pro > Configuration > Grid Support	Maximum Sell Amps	0 A

Commissioning Checklist

The following checklist summarizes the main steps for commissioning a Self-supply system and Grid Sell Limiting, if applicable.

Checklist

<input type="checkbox"/>	Standard configurations appropriate for the system layout has been applied.
<input type="checkbox"/>	<p>If the system layout calls for an external power measurement device:</p> <ul style="list-style-type: none"> ■ Current measurement device is oriented correctly and installed in the correct location. ■ Power measurement device is communicating with Conext Gateway. ■ Power measurement device is tracking power flow accurately.
<input type="checkbox"/>	Configurations applied to Conext Gateway as required.
<input type="checkbox"/>	Configurations applied to Conext XW Pro as required.
<input type="checkbox"/>	<p>If Grid Sell Limiting is required:</p> <ul style="list-style-type: none"> ■ In conditions of excess power generation, sell power does not exceed the limits defined in the applicable grid codes. ■ Inadvertent export does not exceed the limits defined in the applicable grid codes.

Troubleshooting

Symptoms	Troubleshooting Actions
Unable to detect the power meter on Modbus.	<p>Ensure or verify the following:</p> <ul style="list-style-type: none"> ■ Baud rate and other Modbus communication parameters of all devices on each network are identical. ■ Power meter is powered. ■ Wiring is correct. If using a Continental WattNode Modbus meter, refer to <i>"Wiring Harness Pinout"</i> on page 13 ■ Conext Gateway device detection is performed on the correct Modbus port. ■ Power meter address is unique on the Modbus network. ■ Power meter address is within the device detection search range. ■ A 120 Ω termination resistor is placed on the end of the bus opposite to the Conext Gateway. The Conext Gateway applies the other resistor internally. <p>If issue persists, contact Schneider Electric customer service.</p>

Symptoms	Troubleshooting Actions
<p>Power is exceeding the desired setpoint.</p>	<p>If loads are removed from the system or available PV power increases, it is normal for power to flow into the grid briefly while the system reacts. However, if the Trip Level is set appropriately, and the system repeatedly activates the fault, ensure or verify the following:</p> <ul style="list-style-type: none"> ■ Power meter is reading correctly from its CT. ■ Power meter is detected on the Conext Gateway. ■ All necessary configuration has been applied and are correct. <p>If issue persists, contact Schneider Electric customer service.</p>

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Contact Information

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