TECHNICAL MANUAL · EXPORT CONTROL

Zero-Export Design Manual

A specification guide for EPCs deploying export control alongside Sponge battery optimization hardware.

DOCUMENT TYPE	AUDIENCE
Specification Guide	EPCs & Procurement Teams

VERSION	ISSUED BY
V1.0	Sponge Microgrids Inc.

CONTENTS

01 · INTRODUCTION

This manual is for engineers and procurement teams specifying a Sponge zero-export deployment. It covers the four decisions you have to get right: where to measure, what to measure with, what meter to read it through, and how to get that data back to the EMC.

Each section walks the decision in the order you actually make it on a project. The intent is that a competent EPC could read this end-to-end and produce a complete bill of materials for an export control system without a call to Sponge engineering.

Sponge's Export Control product is a commissioning-level capability that unlocks zero-export operation on the Energy Management Controller (EMC). It requires both a Revenue Grade Meter and a Current Transformer. This manual focuses on the field decisions around those components.

> **HOW TO USE THIS MANUAL**
>
> Read sections 02 through 04 in order on your first deployment. Once a pattern is familiar, treat the decision tables and checklists in section 07 as the reference.

02 · POINT OF MEASUREMENT

Before sizing any hardware, decide where on the electrical system the measurement has to happen. The rule for export control is unambiguous: **the CT installs on a section of conductor beyond which power cannot flow back to the utility grid.**

In practice, that means somewhere on the service conductors between the utility meter and the main distribution panel — typically a long run of wire, sometimes a copper busbar, between the meter base and the point where the service splits out into branch circuits.

Related Applications

The same logic applies to other current-sensing use cases, with the point of measurement shifting accordingly:

- → **Export control** — measure everything heading from the building toward the utility meter.
- → **Busbar protection** — measure everything coming into a specific panel.
- → **Load monitoring** — measure at the conductor feeding the load of interest.

The CT sizing question is the same across all three; only the location changes.

03 · CURRENT TRANSFORMER SIZING

3.1 · Amperage Rating

Pull the single line diagram (SLD). Find the conductor or panel at your measurement point and read the service rating. North American service sizes are standardized in steps:

- → 200 A
- → 400 A
- → 600 A
- → 800 A
- → 1200 A and above

Match the CT amperage rating to the service rating. The SLD will either tag the conductor directly or label the panel it feeds with its capacity. Either is sufficient.

3.3 · Output Signal Type

Voltage Output (recommended)

A CT with an internal burden resistor outputs a voltage waveform. The lead voltage swings between zero and a maximum — most commonly **333 mV at full scale** — and the magnitude indicates current as a percentage of the CT rating. This is the standard most low-cost meters are built around.

Current Output (avoid)

A CT without a burden resistor pushes current through the leads. The receiving device must install its own burden resistor and perform its own conversion. Most meters are not built for this. Stick to 333 mV voltage-output CTs unless there is a specific reason not to.

3.2 · Form Factor: Split Core vs. Rogowski

Amperage rating tells you the electrical spec. **Physical conductor configuration** tells you what shape of CT you need.

Split Core CT

A split core CT is rigid. It has a fixed window opening — common sizes range from a 1.25-inch round window up to 3 × 5 inches and beyond. The window snaps closed around the conductor. Cheaper, simpler, and compatible with most low-cost meters out of the box.

Rogowski Coil

A Rogowski coil is a flexible CT. A long coil with a clasp on each end — wrap it around whatever conductor geometry is present and click it closed. It takes the shape it needs to take.

> **WHEN SPLIT CORE FAILS**
>
> On higher-amperage service you rarely see a single fat conductor per phase. Instead the design uses **ganged conductors** — three or four parallel wires per phase, routed and bent independently. To measure the phase you must encircle all of them simultaneously. Rigid CT windows cannot accommodate that geometry. This is the canonical Rogowski use case.

> **WHEN IN DOUBT, DEFAULT ROGOWSKI**
>
> The Rogowski coil is the most conservative specification you can make. It fits whatever conductor geometry shows up on install day. If procurement happens from a desk with no site visit, default Rogowski and budget for the downstream meter implications in section 04.

3.4 · Three-Phase Installation

A three-phase service requires three CTs — one per phase. Each phase is measured independently because the inverter output and the building loads are not necessarily balanced across phases. Wiring discipline matters: CT input 1 reads phase 1, CT input 2 reads phase 2, CT input 3 reads phase 3, and the voltage reference inputs must map to the *same* physical phases. Cross a phase reference and the meter reports nonsense. Verify phase mapping at commissioning. For export control, the control target is net-zero export **across all three phases combined** — the control loop does not care if one phase exports a little and another imports, as long as the sum at the meter is zero or negative.

04 · METER SELECTION

4.1 · Sponge's Default: WattNode

Sponge recommends the WattNode as the default revenue grade meter for export control deployments. It is inexpensive, reliable, and well-supported by the EMC.

The WattNode is a bare board — it does not ship in an enclosure. The EPC is responsible for housing it appropriately. Practical requirements:

- → Mounted in a suitable enclosure (NEMA-rated where required).
- → Powered from a breaker on the main panel.
- → Receives three-phase voltage reference.
- → Phase mapping between CT inputs and voltage references must be consistent.

> METER — CT COMPATIBILITY
>
> **Split core CT, 333 mV output → WattNode (default).**
> Rogowski coil → AccuVim, or WattNode plus signal converter.

4.2 · WattNode Limitations

The WattNode accepts split core CTs only. It is **not** compatible with Rogowski coils for power, energy, or power factor measurement. If a Rogowski signal is wired into a WattNode, the meter will report current but will return incorrect values for power and power factor — the Rogowski waveform is phase-shifted and scaled differently than the WattNode's signal processing expects.

If Rogowski coils are specified, the EPC has two options:

OPTION A — UPGRADE THE METER

Use an **AccuVim** meter, which accepts Rogowski coil signals directly. Adds roughly ,000 over the WattNode cost, but eliminates an additional device from the install.

OPTION B — ADD A SIGNAL CONVERTER

Install a digital translation module between the Rogowski coil and a standard CT-input meter. The converter transforms the Rogowski output into a 333 mV waveform the meter can read. Cheaper than the meter upgrade in most cases, but adds another device that needs to be powered, wired, and commissioned.

05 · WIRING & PHYSICAL INSTALLATION

5.1 · CT to Meter

CTs ship with integrated leads — typically 6 to 12 feet. If the meter is mounted near the point of connection (the preferred layout), no additional wire is needed. The leads are used as supplied.

If the run from the CT to the meter exceeds the lead length, extension is done with standard copper wire. There is no special cable specification.

5.2 · Recommended Layout

The standard physical arrangement places both the CTs and the meter near the point of connection — the section of conductor between the utility meter and the main distribution panel. This minimizes lead length, keeps the analog signal path short, and simplifies installation.

The EMC itself does not need to be co-located with the meter. The meter-to-EMC link is digital and tolerates significant distance, as covered in section 06.

06 · METER TO EMC COMMUNICATION

6.1 · Protocol Options

The meter communicates back to the EMC over one of two protocols. The choice depends on the meter and the rest of the deployment.

Modbus RTU over RS-485

Two-wire serial communication. Standard Cat5 or Cat6 cable works well, and the link can span well over 100 metres. The WattNode supports Modbus RTU only.

Modbus TCP over Ethernet

Communicates over the building's local network. The meter and the EMC do not need a direct physical wire between them — they need to share a subnet, with each device having its own IP address. The AccuVim supports both Modbus RTU and Modbus TCP.

6.2 · Speed and Topology Tradeoffs

Ethernet is generally faster than RS-485. The more important architectural difference is what each protocol does to the EMC's available ports.

The EMC has **two RS-485 ports**. The meter is the most critical reference point in the export control loop — it should communicate with the EMC as quickly as possible, which means giving it a dedicated port or minimizing other traffic on its shared port.

When a Sponge deployment uses Modbus TCP for the meter, both RS-485 ports on the EMC remain available for inverter communication. This is a meaningful advantage on multi-inverter installations.

6.3 · When to Use Modbus TCP Converters

Most Sponge export control deployments are paired with Solis inverters. Solis does not currently offer Ethernet communication, so the inverters must be reached over RS-485. With two RS-485 ports available on the EMC and most deployments running three or fewer inverters, RS-485 directly to the EMC works.

On installations with more than three inverters, the deployment benefits from additional independent RS-485 channels. This is what a Modbus TCP converter provides — not just a protocol bridge, but parallelization across multiple isolated serial channels.

6.4 · Recommended TCP Converter

Sponge has had success deploying the **LinoVision four-channel Modbus TCP converter**. It requires preconfiguration before it ships to site, which Sponge performs prior to shipment when supplied through us.

A four-channel converter is overkill for projects that only need one or two extra channels. Smaller converters from other brands are currently in testing for deployments where the LinoVision is not the most cost-effective fit. Where these alternatives stabilize, they will be offered alongside the LinoVision through Sponge.

> **CHANNEL DISCIPLINE ON TCP CONVERTERS**
>
> The value of a TCP converter is parallelization across multiple independent RS-485 channels. Putting two inverters on a single channel gives the same response delay as putting them on one EMC port. To get the benefit, split inverters across separate channels — **one per channel where possible**.

07 · DECISION REFERENCE

7.1 · CT Form Factor Decision Table

SCENARIO	CT CHOICE	NOTES
Single conductor per phase, geometry confirmed	**Split core CT, 333 mV output**	Cheapest path. Pairs with WattNode.
Ganged conductors per phase	**Rogowski coil**	Requires AccuVim or signal converter.
SLD only, no site visit possible	**Rogowski coil (default)**	Most conservative. Budget for the meter implication.
Busbar or unusual geometry	**Rogowski coil**	Flexible form is the only practical option.

7.2 · Meter Decision Table

CT TYPE	METER CHOICE	COMMUNICATION
Split core, 333 mV	**WattNode**	Modbus RTU / RS-485
Rogowski coil	**AccuVim**	Modbus RTU or Modbus TCP
Rogowski (budget-constrained)	**WattNode + signal converter**	Modbus RTU / RS-485

7.3 · Communication Topology Decision Table

INVERTER COUNT	RECOMMENDED TOPOLOGY	NOTES
1 to 3 inverters	Meter on one RS-485 port, inverters daisy-chained on the other	EMC's two native ports are sufficient.
4+ inverters	Modbus TCP converter to add RS-485 channels	Split inverters one-per-channel for parallelization.
Meter supports Modbus TCP (AccuVim)	Meter on Ethernet, both RS-485 ports free for inverters	Preferred when inverter count is high.

08 · SPECIFICATION CHECKLIST

Run this checklist before placing the order. Each item maps to a section of this manual.

8.1 · CT SIZING

01 **Point of measurement located** on the SLD — between the utility meter and the main distribution panel.

02 **Service amperage rating** read off the SLD.

03 **CT amperage rating matched** to the service rating.

04 **Physical conductor geometry assessed** — single conductor per phase, or ganged?

05 **Form factor chosen** — split core if geometry confirmed, Rogowski if uncertain.

06 **CT output type verified** — 333 mV voltage output, not current output.

07 **One CT per phase** on three-phase service.

8.2 · METER

01 **Meter selected** and compatible with the CT type.

02 **Enclosure specified** for the WattNode if used.

03 **Power source identified** — breaker on the main panel.

04 **Phase mapping plan documented** — CT inputs aligned with voltage references.

8.3 · COMMUNICATION

01 **Communication protocol chosen** — Modbus RTU or Modbus TCP.

02 **Cable run specified** — Cat5/Cat6 for RS-485, building network for TCP.

03 **Inverter count assessed** against EMC's two native RS-485 ports.

04 **Modbus TCP converter specified** if inverter count exceeds three.

05 **TCP converter channel allocation** plan documented — one inverter per channel where possible.

8.4 · COMMISSIONING

01 **Phase mapping verified** at commissioning.

02 **Signal sanity-checked at the meter** — current, voltage, power, and power factor all reasonable.

03 **Export control setpoint configured** and validated against utility requirements.

QUESTIONS?

Contact Sponge engineering before placing orders on non-standard installations. We can confirm the bill of materials and flag compatibility issues before they become field problems.

paul.kealey@sponge.to

APPENDIX A · GLOSSARY

CT (Current Transformer)
A device that produces a scaled output proportional to the current flowing through a conductor. Used to give the meter visibility into power flow without breaking the conductor.

Split Core CT
A rigid CT with a fixed window that snaps closed around a conductor. Voltage output, typically 333 mV at full scale.

Rogowski Coil
A flexible CT. Wraps around any conductor geometry. Output is a phase-shifted waveform that requires a compatible meter or signal converter.

EMC (Energy Management Controller)
Sponge's core hardware platform. The brain of the deployment. Manages inverter control, meter data ingestion, and export control logic.

Export Control
A commissioning-level capability that enforces a maximum export limit (commonly zero) from a behind-the-meter generation asset to the utility grid. Requires both a Revenue Grade Meter and a Current Transformer.

SLD (Single Line Diagram)
A simplified electrical schematic showing the major components and conductors of a power system as single lines. The primary reference for CT sizing.

Modbus RTU
A serial communication protocol that runs over RS-485 two-wire physical layer. Supported by all Sponge-compatible meters.

Modbus TCP
A version of Modbus that runs over Ethernet and IP. Supported by the AccuVim. Frees up RS-485 ports on the EMC for inverter communication.

TCP Converter
A device that bridges Modbus RTU and Modbus TCP. Its real value in Sponge deployments is providing multiple independent RS-485 channels for parallel inverter communication.

WattNode
Sponge's default revenue grade meter. Bare board, requires an enclosure. Accepts split core CTs with 333 mV voltage output. Communicates over Modbus RTU / RS-485.

AccuVim
Revenue grade meter compatible with Rogowski coil inputs. Supports both Modbus RTU and Modbus TCP. Used when ganged conductors require Rogowski coils or when Modbus TCP is preferred for topology reasons.

Sponge Microgrids Inc. · 219 Dufferin St, Suite 116C · Toronto, ON M6K 3J1

END OF MANUAL

paul.kealey@sponge.to · sponge.to