Valtoris.

Integration Guide: Polling SMA Inverters via Modbus RTU

Bypassing WebBox Dependency: RS485 Piggy-Back Wiring & S32/U32 Normalization

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Product Series:	Valtoris VT-DTU500 / Edge Gateways
Target Devices:	SMA Sunny Boy, Tripower (w/ RS485 Data Module)
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1. Executive Summary

Older SMA Sunny Boy and Tripower inverters are renowned for their hardware longevity. However, integrating them into modern SCADA or IoT dashboards typically requires expensive proprietary loggers (Data Manager M or legacy WebBox). By leveraging the optional SMA RS485 Piggy-Back module, engineers can poll data locally using standard Modbus RTU protocols. This Application Note clarifies the non-standard wiring layout and addresses the critical signed 32-bit integer (S32) rollover traps inherent in SMA's firmware.

2. Physical Layer: SMA RS485 Piggy-Back Pinout

Locate the RS485 communication terminal block (usually a green 4-pin or 6-pin connector) inside the inverter chassis. Establish a 3-wire differential bus with your RS485 Master Gateway:

SMA RS485 Terminal (Piggy-Back)	RS485 Master Gateway Terminal	Signal Description
Pin 2 (Data+)	**A+** (Data+)	Non-Inverted Differential Signal Line
Pin 7 (Data-)	**B-** (Data-)	Inverted Differential Signal Line
Pin 5 (GND)	**GND**	Signal Ground (Required for stable long-distance telemetry)

3. The Modbus Register Map & Addressing Quirk

Ensure your SMA DIP switches or Sunny Explorer settings have Modbus enabled. SMA serial ports typically default to **19200 Baud (or 9600), 8N1**. The default Slave ID is often 3 (or 126).

> **Critical Trap 1: The "-1 Address Offset"**
>
> SMA documentation references 1-based Modbus addressing. Modern polling engines (like Modbus Poll, Python pymodbus, or industrial gateways) utilize 0-based indexing. To successfully read a register listed in the SMA manual, **you must subtract 1 from the documented address**.

Manual Register	Actual Polled Address (-1)	Data Type	Description	Unit
30775	**30774** (0x7836)	S32 (Signed)	Active Power (Current Output / Night Consumption)	W
30531	**30530** (0x7742)	U32 (Unsigned)	Total Yield (Lifetime Energy)	kWh
30201	**30200** (0x75F8)	U32 (Unsigned)	Condition Status (35 = Fault, 307 = Ok)	N/A
30769	**30768** (0x7830)	S32 (Signed)	DC Current	mA

4. Deep Dive: S32 Rollover at Night (The 4.2 Billion Watt Error)

During the night, SMA inverters draw a small amount of active power from the grid to keep their control boards alive (e.g., -15 Watts). Because Active Power (30775) is a **Signed 32-bit Integer (S32)**, the inverter utilizes two's complement binary encoding.

```
Master Request (Tx): 03 03 78 36 00 02 2D C3
(Requesting 2 registers starting at 30774 / 0x7836 from Slave ID 3)

Meter Response (Rx): 03 03 04 FF FF FF F1 XX XX

The Trap:
If your script treats this 4-byte payload FF FF FF F1 as an Unsigned Integer (U32),
it converts to 4,294,967,281 Watts, destroying your database averages instantly.
When properly parsed as a Signed Integer (S32), it correctly converts to -15 Watts.
```

5. Integration Architecture: DIY Coding vs. Edge Protocols

A. Software Parsing (Python / IPC)

If coding a custom integration via a Linux IPC, your script must explicitly handle both U32 and S32 data types depending on the targeted register, along with the -1 offset.

```
import struct

# Nighttime payload: 0xFFFFFFF1
high_word = 0xFFFF
low_word = 0xFFF1

# Unpack as a Signed 32-bit int ('>i')
# (Use '>I' for U32 registers like Total Yield)
power = struct.unpack('>i', struct.pack('>HH', high_word, low_word))[0]

print(f"Active Power: {power} W") # Outputs: -15 W
```

Note: Managing these distinct casting rules across 40+ registers in Python introduces severe maintenance overhead.

B. Hardware Normalization (Edge Gateway)

Commercial integrators bypass the scripting layer entirely by utilizing industrial Modbus-to-MQTT Edge Gateways.

- **No Code Required:** The firmware natively manages the -1 offset. You simply map Register `30774` as **"INT32"** and Register `30530` as **"UINT32"** in the web UI.
- **JSON Forwarding:** The gateway automatically translates the Modbus registers into clean, ready-to-use JSON payloads (e.g., `{"ActivePower": -15}`) and pushes them to your broker over Ethernet or Cellular.

Scaling Commercial Retrofits

To eliminate Python maintenance and secure deterministic Modbus telemetry from legacy SMA networks, review the architecture specifications of the Valtoris Edge Gateway Series.