

Metering

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Metering Evaluation

Attribute	Cost (money)	Interoperability	long term relationship	Deployment Readiness	Build Quality
Inhemeter	3	5	3	3	5
Gomelong Meter (no PLC meter with built-in relay)					
Sagewood Meters					
Calin Meter	?	5	5	?	5
Spark Meter	3	1	3	1	5
China Brandless Meter	5	1	3	3	1
iSmart Meter	1	5	3	1	3
Hoptele Meter	3	5	5	5	3

Inhemeter

China/UG based OEM. Edwin Cho is our contact. 0 774 667667, +86 135 3210 1631. 1way Meter boxed FOB 46Usd

Cloud Vending System 100 USD per month up to 1000 meters

Free On Board (FOB)

Which means not including shipping and inland transport and any clearance fees

Sagewood

Sagewood is a UK based logistics supplier. +44 7831 135528 - Manoj

Got some feedback on this one . Here goes... Hi Hilary, all good am still in china snd heading back tomrrow to uk. China was on national holidays from 30 April to today May 5. Now working on it. I have discussed with the team - Due to small number of meters for the system, we suggest a cloud

version so you don't have to invest in hardware. Many endusers are doing this. Meters we can handle but MOQ is around 2000 metres. Or we can manufacture them to very with other orders. So you don't have to worry about MOQ. Allow me few days and I revert back.

Hoptele

China supplier / OEM. Single phase PLC meter. Wall mount with PLC support and inbuilt relay. DIN rail mount with PLC support but no inbuilt relay. 70 US per meter. No vending system.

Gomelong

China based supplier, has a local distributor in Uganda. Gomelong Meter (no PLC meter with built-in relay). May have none PLC option. Pricing for "digital meter" (probably with no relay) 127k UGX per unit.

Spark Meter

Kenya based. Proprietary system (Meters + AMI). 70 USD per meter. Comes with a DTU that requires line of sight to meters. 1 DTU per 2000 meters max. 600 USD per year per DTU.

Calinmeter

Have a DIN rail PLC with built-in relay. Waiting on quote. May also have AMI

iSmart

Found these ones online. They also have a [PLC with built-in relay](#).

The meter sample fee: 10pcs*600USD/pc; the DCU will need 7500USD/pc; the PC software for testing is 5000USD/pc; the optical head is 300USD/pc; the pilot system will need 30000USD; the technical assistance fee is 1500USD; DHL shipping cost is around 5500USD.

Wired vs Wireless meters

Wireless open standards

Comparison

Protocol	Frequency	Range	Data Rate	Topology	Power Usage
Zigbee	2.4 GHz, 915/868 MHz	Short	Up to 250 kbps	Mesh, Star	Very Low
LoRaWAN	868/915 MHz	Long	0.3-50 kbps	Star	Extremely Low
Wi-SUN	868/915 MHz	Medium to Long	50-300 kbps	Mesh	Low to Medium
Bluetooth LE	2.4 GHz	Short	125 kbps-2 Mbps	Star, Mesh	Very Low
IEEE 802.11ah	Sub-GHz (~900 MHz)	Medium	Up to Mbps	Star, Tree	Low
IEEE 802.15.4	Various	Short-Medium	20-250 kbps	Mesh, Star	Very Low
Thread	2.4 GHz	Short	250 kbps	Mesh	Very Low

Recommended for Residential Microgrid Applications in Uganda:

- **LoRaWAN:** If covering a large geographical area (kilometers), due to its excellent range, penetration, and low power use.
- **Wi-SUN:** For robust, medium-to-large-scale smart metering networks, especially if a mesh topology is desirable.
- **Zigbee/Thread:** Ideal for dense residential areas where devices (meters) are closer together, benefiting from low power and reliable mesh networking.

Wired Open standards

Comparison

Protocol	Standard	OSI Layers	Medium	Topology	Range	Data Rate	Typical Application Areas	Remarks
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G3-PLC	ITU-T G.9903	Layers 1-2	Power Lines	Mesh, Star	Up to several km	2.4-35 kbps	Smart grids, AMI, smart meters	Robust, designed for noisy environments; supports IPv6, strong security
PRIME	ITU-T G.9904	Layers 1-2	Power Lines	Mesh, Star	Up to several km	21-128 kbps	Smart metering, distribution automation	Optimized for higher-speed PLC, widely used in European smart meter rollouts
IEEE 1901.2 PLC	IEEE 1901.2	Layers 1-2	Power Lines	Mesh, Star	Up to several km	2.4-500 kbps	Smart grids, smart cities	High interoperability, IPv6 support; ideal for utility and smart city deployments
M-Bus (Meter-Bus)	EN 13757	Layers 1-2	Twisted pair cable	Bus	Up to ~1 km	0.3-38.4 kbps	Meter reading (water, heat, gas)	Widely used in Europe; reliable, low-cost wired solution
KNX	ISO/IEC 14543-3	Layers 1-2	Twisted pair cable	Bus, Star, Tree	Up to ~1 km	9.6 kbps	Building automation, home control	Open standard for building automation, popular in Europe
BACnet MS/TP	ASHRAE 135	Layers 1-2	RS-485 twisted pair	Bus	Up to ~1.2 km	9.6-115.2 kbps	Building automation, HVAC controls	Common in building and industrial automation; robust, scalable

Ethernet	IEEE 802.3	Layers 1-2	CAT5/CAT 6 cable	Star, Tree	Up to ~100 m	10 Mbps–100 Gbps	Networking backbone, smart buildings	High-speed, standard networking; widely supported across industries
RS-485 (EIA-485)	EIA-485	Layers 1-2	Twisted pair cable	Bus	Up to ~1.2 km	Up to 10 Mbps	Metering, industrial control systems	Simple, robust, widely used for serial data transmission
CAN Bus	ISO 11898	Layers 1-2	Twisted pair cable	Bus	Up to ~1 km	Up to 1 Mbps	Automotive, industrial automation	High reliability, robust error detection, common in harsh environments

Recommended Wired Protocols for Residential Microgrid Metering (Uganda)

- **PLC-based (e.g., G3-PLC or IEEE 1901.2):**
 - Ideal due to existing infrastructure (power lines).
 - Good for scalable, reliable deployments.
- **RS-485:**
 - Robust, simple wiring suitable for smaller clusters.
 - Common for direct-wired connections (local clusters).
- **M-Bus:**
 - Suitable if integrating gas, water, or heat metering alongside electricity

Comparison between wired and wireless

Aspect	Wireless Option (Wi-SUN/LoRaWAN)	Wired Option (G3-PLC, RS-485)	Recommendation
Installation Cost	☐ Lower	☐ Higher (cabling, labor)	Wireless ☐
Maintenance Cost	☐ Moderate (battery replacements)	☐ Low (no batteries required)	Wired ☐
Reliability	☐ Medium (environment dependent)	☐ High (consistent, stable)	Wired ☐

Aspect	Wireless Option (Wi-SUN/LoRaWAN)	Wired Option (G3-PLC, RS-485)	Recommendation
Scalability	☑ High (easy additions)	☐ Moderate to low (harder additions)	Wireless ☑
Range/ Coverage	☑ Good (with repeaters)	☑ Excellent (using PLC)	Wired (PLC) ☑
Security	☑ Good (depends on setup)	☑ Very Good	Wired ☑
Installation Time	☑ Short	☐ Longer	Wireless ☑
Physical disruption	☑ Minimal	☐ High (trenching, wiring)	Wireless ☑

? Recommended Choice: Hybrid or G3-PLC

? Primary Recommendation: G3-PLC (Wired)

Given your scenario (dense apartment blocks with existing electrical infrastructure and meters located closely on the ground floor), **G3-PLC** offers significant advantages:

- **Low Ongoing Maintenance:** No batteries to manage.
- **High Reliability:** Stable signal leveraging existing wiring.
- **Cost-effective (long-term):** Minimal ongoing costs after initial installation.
- **Robust & secure:** Highly suited for apartment complexes.

? Alternate Recommendation: Hybrid (PLC Backbone + Wireless Endpoints)

If flexibility or future expansions matter, consider a hybrid setup:

- Use **G3-PLC** within each block to connect meters reliably to a local gateway.
- Connect block gateways to a central system via wireless (**Wi-SUN or LoRaWAN**). This reduces physical disruption between buildings while maintaining the reliability within each block.

This hybrid method provides the best of both worlds—flexibility and low maintenance.

Links

[Chatgpt detailed thread](#)

CalinMeter

We got the API docs here: [Calin_API_for_NFE.postman_collection.json](#)

User Manuals

- [User instructions for the CA168-S Single-phase electricity meter \(1\).pdf](#)
- [CA168 Din Rail Meter- Technical Specification \(1\).pdf](#)
- [Installation Guide - Calin LoraWAN Smart Meters.pdf](#)

? CalinMeter Status Codes – Postpaid Quick Reference & Action Guide

? Common Meter Status / Short Codes (Postpaid Use)

Code	Meaning	Action
01	Cumulative total active kWh consumption	Record/check usage trend
14	Load threshold	Compare with customer load, adjust if configured too low
31	Current total active power	Check load at moment of query
35	Current total power factor	If persistently low, investigate load/PF correction
40	Number of meter cover open events	Check tamper log; reseal if necessary
41-45	Last 1st-5th cover open times	Verify tamper history

Code	Meaning	Action
46	Number of overload trip events	Review load demand; advise upgrade if frequent
47-51	Last 1st-5th overload trip times	Identify when overloads occurred
52	Number of power down events	Check supply reliability
53-57	Last 1st-5th power down times	Cross-check with outage records
58	Number of phase down events	Investigate supply-side issues
87	Reason for relay disconnecting	Use table below for action

(Codes related to credit/tokens are ignored in postpaid setups.)

Perfect — let's build a **lookup table** that maps your AMI responses (1000-1025) directly to the **Code 87 disconnect sub-codes**, with **meaning** and **field action** tailored for **postpaid deployments**.

? AMI Operating Status Code Lookup (Postpaid Mode)

AMI Code	Code 87 Sub-Code	Meaning	Field Action
1000	00	Relay Closed (normal supply)	☐ No action, meter supplying load.
1001	1	No Credit	<i>(Ignore in postpaid)</i> — not applicable.
1003	3	Over Power (load exceeded threshold)	Check load vs. configured trip limit; advise reduction or adjust threshold.
1004	4	Relay Test	No action needed — relay was tested.
1005	5	Open Upper Cover (tamper)	Reseal cover + enter clear tamper token.
1006	6	Open Terminal Cover (tamper)	Reseal cover + enter clear tamper token.
1007	7	Remote Disconnect	Confirm backend/HES instruction; reconnect if not intentional.

AMI Code	Code 87 Sub-Code	Meaning	Field Action
1008	8	Not-active (meter not commissioned)	Commission meter (default code: 12345).
1009	9	Over Current	Inspect load for surges; advise customer or adjust protection.
1011	11	Over Voltage	Supply voltage too high; report to utility/feeder operator.
1012	12	Under Voltage	Supply voltage too low; report to utility/feeder operator.
1013	13	Current Reverse (possible tamper/wiring issue)	Inspect wiring; correct polarity; clear tamper if needed.
1014	14	Open Enclosure Cover (tamper)	Reseal + enter clear tamper token.
1015	15	Magnetic Field Interference (tamper)	Investigate possible magnet tampering; clear tamper.
1016	16	Current Imbalance	Check for abnormal phase imbalance; troubleshoot load.
1017	17	Neutral Line Interference	Inspect neutral wiring/tamper.
1018	18	Bypass (illegal connection)	Investigate and escalate if confirmed.
1021	21	Voltage Imbalance	Investigate feeder phase imbalance.
1022	22	Thermal Overload	Meter overheating; check ventilation/load; allow cooling.
1023	23	Low Power Factor	Check load PF; recommend correction (capacitors).
1024	24	Tariff Error	Backend tariff configuration issue; escalate to AMI admin.
1025	25	Remote Reconnect + Local Trip	Local condition (e.g., overload/tamper) persists; troubleshoot before reconnection.

□ Key Notes for Postpaid Teams

- **Ignore credit-related codes** (1001, and codes tied to tokens/residual amounts).
- **Focus on tamper (1005, 1006, 1014, 1015, 1018)**, load/power quality (1003, 1009, 1011-1013, 1016-1023), and backend issues (1007, 1024, 1025).
- **Always check AMI Code → Action** before deciding if a site visit is required.

Would you like me to now **regenerate the PDF reference card** with this full **1000-1025 lookup table** included, so your team doesn't need to flip between guides?

□ Quick Action Guide Summary

- **Tamper-related (5, 6, 14, 15, 18)** → Reseal + enter clear tamper token.
- **Load/power issues (3, 9, 11, 12, 16, 21, 22, 23)** → Inspect loads and supply conditions; report or advise customer.
- **Backend-related (7, 24, 25)** → Confirm with HES/AMI admin.
- **Commissioning (8)** → Activate with code 12345.

Examples

Example #1

You query the meter for meter operating status and you get back this

Meter operating status ×

Meter operating status

1008

Close

Answer

Meter operating status = 1008

Step 1: Interpret the Code

- In many AMI/CalinMeter integrations, codes like **1000** and **1008** map directly to **relay/disconnect statuses (Code 87 sub-codes)**.
- **1008 = Sub-code 8 under Code 87.**
- From the guide:
 - **8 → “Not-active” → Meter not commissioned.**

Step 2: What This Means in Postpaid Setup

- The meter is physically installed, but it hasn't been **commissioned**.
- In this state, the meter will **not supply power**, regardless of load or tariff configuration.

Step 3: Field Action (from Quick Action Guide)

- **Action:** Commission the meter using the **commissioning token/code**.
 - Default commissioning code is **12345**.
 - Enter this via the CIU (Customer Interface Unit) or backend if supported.
- Once successfully commissioned:
 - Tamper detection is activated.
 - Relay will close and supply will start flowing.

□ Summary:

Your AMI response of **1008** means **“Meter not commissioned.”**

□□ To resolve: Enter **12345** (or your site-specific commissioning token) on the CIU/backend to activate the meter.

Example #2

Meter operating status ×

Meter operating status

1000

Close

Answer

Great — let's now map **1000** through the same guide.

Case: Meter operating status = 1000

Step 1: Interpret the Code

- In the AMI integration, **1000** corresponds to **Code 87 sub-code 00**.
- **00** → **“Relay Closed”**.

Step 2: What This Means in Postpaid Setup

- The meter is **active and commissioned**.
- The **relay is closed**, meaning the meter is supplying electricity normally.
- No tamper or abnormal condition is blocking supply.

Step 3: Field Action (from Quick Action Guide)

- **Action:** No intervention needed.
- Record this status if troubleshooting, since it confirms the meter is healthy and delivering power.

☐ **Summary for your case:**

Your AMI response of **1000** means **“Relay Closed - supply ON.”**

☐☐ Everything is normal; no technician action required.

✂ So together:

- **1000 = Relay Closed (meter supplying power)**
- **1008 = Not-active (meter not commissioned; activate with commissioning code)**

A2EI Data

Thank you for showing interest in our data and our efforts here at the A2EI!

We are happy to provide you with our latest data releases from our Solar Killed the Generator Star Project in Nigeria, our clean cooking pilots, and our research into productive-use appliances in East Africa. Please find a detailed summary of each dataset and latest release below.

Please drop us a line via datadatadata@a2ei.org if you have any comments or questions, or in case you would like to unsubscribe from receiving updates.

Most recent data releases SKGS

06.04.2022 The A2EI set out to provide the sector with an open-source hardware solar business system. Two years later, we have not only made the solar generator available, but sold over 1,000 systems. Every solar generator is sending real time data on consumption and system state, which allows the A2EI to share millions of data points with the sector as open-source data.

Please download our [SKGS Project Update and Data Release Report here](#).

Download the [associated data and readme here](#).

29.04.2020 To date, we have over 215 smart meters (and counting) connected to small scale generators and grids in Nigeria, located within multiple markets across several regions.

You can download the raw data, the meter list as well as the README [here](#).

Find some brief release notes [here](#).

Please find the Executive Summary [here](#).

02.06.2020 Please find our analysis of generator usage during COVID-19 [here](#).

Latest data releases Clean Cooking

15.11.2021 In a new comprehensive data release report, the A2EI analyses the entire data collected by our smart meters monitoring the usage of electric pressure cookers (EPCs) by 100 pilot users in rural Tanzania from March 2020 to May 2021.

Please [download the data release report here](#).

Download the data frames [here](#).

Download the Readme [here](#).

16.07.2021 The A2EI has been part of a feasibility study to pave the way for mass distribution of electric hotplates to rural households in Malawi. Please download the Study of Hotplate & Grid Use in Rural Malawi [here](#) and access the associated data [here](#).

Latest data releases Productive Use

14.07.2021 We are sharing our learnings of successful ventures in the agricultural productive use appliance sector by our first "Entrepreneur in Residence", Imara Tech, and are proposing a way forward that we believe could increase the likelihood for successful product development.

Download the [summary of learnings here](#).

21.09.2020 The Access to Energy Institute has developed a systematic methodology and published a report to jointly discuss the question what makes or breaks a successful solar-powered productive-use appliance - and to help find solutions for successful adoption and scaling.

Download the report [here](#).

Please find the associated data and materials [here](#).

Your feedback is very warmly welcomed. We believe that sharing our data is paramount to unlocking further entrepreneurship and engineering, which in turn will help us crack the many nuts of providing a reliable, clean and affordable universal energy supply. In our efforts to deliver meaningful data, we need your feedback in order to collect further data points and to make adjustments to our current measuring practices.

For now, we wish you a wonderful day...and cheerful data crunching!

All the best,
your A2EI Team