TITAN SERIES

Communication Integration Guide

Register map, framing, topics and payload formats for reading measurement data and operating a TITAN smart energy meter over Modbus RTU, Modbus TCP or MQTT.

RS485

Modbus RTU

Panel meters, PLCs and legacy SCADA on a serial bus

PORT 502

Modbus TCP

BMS, SCADA and PLC clients on the LAN

BROKER

MQTT

Cloud platforms, EMS and head-end systems

CONTENTS

01 Introduction

BIS-CERTIFIED SMART ENERGY METER PLATFORM

This document specifies the register map, framing, topics and payload formats an integrator needs to read measurement data and operate the meter from any of these interfaces. All three interfaces expose the same underlying measurement data.

1.1 Interface summary

INTERFACE	PHYSICAL LAYER	ROLE	TYPICAL CLIENT
Modbus RTU	RS485, half duplex	Slave (configurable master mode available)	PLC, panel SCADA, data logger
Modbus TCP	Ethernet 10/100 or Wi-Fi, TCP port 502	Server (slave), up to 4 concurrent clients	BMS, SCADA, OPC gateway
MQTT	Ethernet or Wi-Fi	Client, publishes to broker	Cloud EMS, head-end system

All three interfaces may run at the same time: a PLC can poll the RS485 bus while a BMS polls Modbus TCP and the meter publishes to an MQTT broker, with every client reading the same measurement snapshot.

One data set

100 measurement registers, identical across all three interfaces

One decoder

IEEE-754 float in CD AB word order everywhere, including the MQTT binary frame

Separate DG billing

DG1 registers accumulate only while the DG supply is active

02 Data format and scaling

IEEE-754 FLOAT, CD AB WORD ORDER

All measurement registers are IEEE-754 32-bit floating point values occupying two consecutive 16-bit Modbus registers, transmitted in CD AB word order (word-swapped float, also called “Float CDAB” or “Mid-Little Endian”). Most SCADA and BMS drivers offer this as a standard decode option.

Worked example

Reading registers 40001–40002 returns two 16-bit words, e.g.:

```
Register 40001 = 0xB601   (CD word)
Register 40002 = 0x437D   (AB word)

Re-assembled as ABCD = 0x437DB601
which decodes to 253.71 — the R-phase voltage in volts.
```

No additional scaling is applied to floating-point registers; values are already in engineering units.

Client driver setting

Select “32-bit Float, word swapped (CDAB)”. If your driver only offers standard ABCD floats, swap the two registers in software.

One decoder, three interfaces

The same word order applies to the 100 registers embedded in the MQTT binary instant frame, so a single decode routine serves Modbus and MQTT alike.

03 Modbus register map

HOLDING REGISTERS · 1 TO 25

The map applies identically to Modbus RTU and Modbus TCP. Addresses are given in conventional 4xxxx notation; the on-wire address field is zero-based (40001 = address 0). Each parameter spans two registers.

#	REGISTER	PARAMETER	UNIT
1	40001 / 40002	V1 Voltage R phase	V
2	40003 / 40004	V2 Voltage Y phase	V
3	40005 / 40006	V3 Voltage B phase	V
4	40007 / 40008	I1 Current R phase	A
5	40009 / 40010	I2 Current Y phase	A
6	40011 / 40012	I3 Current B phase	A
7	40013 / 40014	IN Current Neutral	A
8	40015 / 40016	PF1 Power Factor R	—
9	40017 / 40018	PF2 Power Factor Y	—
10	40019 / 40020	PF3 Power Factor B	—
11	40021 / 40022	Frequency	Hz
12	40023 / 40024	RY Phase Angle PA1	deg
13	40025 / 40026	YB Phase Angle PA2	deg
14	40027 / 40028	BR Phase Angle PA3	deg
15	40029 / 40030	Voltage THD R (H1)	%
16	40031 / 40032	Voltage THD Y (H2)	%
17	40033 / 40034	Voltage THD B (H3)	%
18	40035 / 40036	KW1 Active Power R	kW
19	40037 / 40038	KW2 Active Power Y	kW
20	40039 / 40040	KW3 Active Power B	kW
21	40041 / 40042	Total Active Power (SUM KW)	kW
22	40043 / 40044	KVAr1 Reactive Power R	kvar
23	40045 / 40046	KVAr2 Reactive Power Y	kvar
24	40047 / 40048	KVAr3 Reactive Power B	kvar
25	40049 / 40050	Total Reactive Power (SUM KVAr)	kvar

03 Modbus register map

HOLDING REGISTERS · 26 TO 50

#	REGISTER	PARAMETER	UNIT
26	40051 / 40052	KVA1 Apparent Power R	kVA
27	40053 / 40054	KVA2 Apparent Power Y	kVA
28	40055 / 40056	KVA3 Apparent Power B	kVA
29	40057 / 40058	Total Apparent Power (SUM KVA)	kVA
30	40059 / 40060	Active Energy Import R	kWh
31	40061 / 40062	Active Energy Import Y	kWh
32	40063 / 40064	Active Energy Import B	kWh
33	40065 / 40066	Total Active Energy Import	kWh
34	40067 / 40068	Active Energy Export R	kWh
35	40069 / 40070	Active Energy Export Y	kWh
36	40071 / 40072	Active Energy Export B	kWh
37	40073 / 40074	Total Active Energy Export	kWh
38	40075 / 40076	Net Active Energy (Imp+Exp)	kWh
39	40077 / 40078	Reactive Energy Import R	kvarh
40	40079 / 40080	Reactive Energy Import Y	kvarh
41	40081 / 40082	Reactive Energy Import B	kvarh
42	40083 / 40084	Total Reactive Energy Import	kvarh
43	40085 / 40086	Reactive Energy Export R	kvarh
44	40087 / 40088	Reactive Energy Export Y	kvarh
45	40089 / 40090	Reactive Energy Export B	kvarh
46	40091 / 40092	Total Reactive Energy Export	kvarh
47	40093 / 40094	Net Reactive Energy	kvarh
48	40095 / 40096	Apparent Energy Import R	kVAh
49	40097 / 40098	Apparent Energy Import Y	kVAh
50	40099 / 40100	Apparent Energy Import B	kVAh

03 Modbus register map

HOLDING REGISTERS · 51 TO 75

#	REGISTER	PARAMETER	UNIT
51	40101 / 40102	Total Apparent Energy Import	kVAh
52	40103 / 40104	Apparent Energy Export R	kVAh
53	40105 / 40106	Apparent Energy Export Y	kVAh
54	40107 / 40108	Apparent Energy Export B	kVAh
55	40109 / 40110	Total Apparent Energy Export	kVAh
56	40111 / 40112	Net Apparent Energy	kVAh
57	40113 / 40114	DG1 Active Energy Import R	kWh
58	40115 / 40116	DG1 Active Energy Import Y	kWh
59	40117 / 40118	DG1 Active Energy Import B	kWh
60	40119 / 40120	DG1 Total Active Energy Import	kWh
61	40121 / 40122	DG1 Active Energy Export R	kWh
62	40123 / 40124	DG1 Active Energy Export Y	kWh
63	40125 / 40126	DG1 Active Energy Export B	kWh
64	40127 / 40128	DG1 Total Active Energy Export	kWh
65	40129 / 40130	DG1 Net Active Energy	kWh
66	40131 / 40132	DG1 Reactive Energy Import R	kvarh
67	40133 / 40134	DG1 Reactive Energy Import Y	kvarh
68	40135 / 40136	DG1 Reactive Energy Import B	kvarh
69	40137 / 40138	DG1 Total Reactive Energy Import	kvarh
70	40139 / 40140	DG1 Reactive Energy Export R	kvarh
71	40141 / 40142	DG1 Reactive Energy Export Y	kvarh
72	40143 / 40144	DG1 Reactive Energy Export B	kvarh
73	40145 / 40146	DG1 Total Reactive Energy Export	kvarh
74	40147 / 40148	DG1 Net Reactive Energy	kvarh
75	40149 / 40150	DG1 Apparent Energy Import R	kVAh

03 Modbus register map

HOLDING REGISTERS · 76 TO 100 · DG, HARMONICS AND RESERVED

#	REGISTER	PARAMETER	UNIT
76	40151 / 40152	DG1 Apparent Energy Import Y	kVAh
77	40153 / 40154	DG1 Apparent Energy Import B	kVAh
78	40155 / 40156	DG1 Total Apparent Energy Import	kVAh
79	40157 / 40158	DG1 Apparent Energy Export R	kVAh
80	40159 / 40160	DG1 Apparent Energy Export Y	kVAh
81	40161 / 40162	DG1 Apparent Energy Export B	kVAh
82	40163 / 40164	DG1 Total Apparent Energy Export	kVAh
83	40165 / 40166	DG1 Net Apparent Energy	kVAh
84	40167 / 40168	Current THD R	%
85	40169 / 40170	Current THD Y	%
86	40171 / 40172	Current THD B	%
87	40173 / 40174	Inrush Current R	A
88	40175 / 40176	Inrush Current Y	A
89	40177 / 40178	Inrush Current B	A
90	40179 / 40180	Reserved	–
91	40181 / 40182	Reserved	–
92	40183 / 40184	Reserved	–
93	40185 / 40186	System Power Factor	–
94	40187 / 40188	Reserved	–
95	40189 / 40190	Reserved	–
96	40191 / 40192	Reserved	–
97	40193 / 40194	Reserved	–
98	40195 / 40196	Reserved	–
99	40197 / 40198	Reserved	–
100	40199 / 40200	Reserved	–

Notes. PF registers are signed (negative = leading). DG1 energy registers accumulate only while the DG supply source is active, enabling separate grid/DG billing in changeover installations. Reserved registers read 0.

3.1 Extended data block

MODBUS TCP ADDRESSES 200–246

In addition to the measurement map, Modbus TCP clients may read an extended block containing the meter clock, tamper/event counters and maximum demand registers. This block is served byte-for-byte from the meter's internal record; values are 16-bit big-endian unless noted.

ADDRESS	CONTENTS
200–202	RTC: DD MM YY HH MM SS (1 byte each, packed 2 per register)
203–204	Tamper Status bitfield (32-bit)
205–206	Cumulative Tamper Count (32-bit)
207–220	Event counters: current / voltage / power / transaction / non-rollover / control / other — each pair (count, max)
221–223	Load ON hours R / Y / B
224–225	Load ON minutes R / Y / B + MD Reset Count
226–239	Maximum Demand blocks: MD kW Import, MD kVA Import, MD kW Export, MD kVA Export — each value (W / VA) + date-time DD MM YY HH MM
240–246	Reserved

04 Modbus RTU (RS485)

SERIAL BUS INTEGRATION

4.1 INTERFACE SETTINGS

Bus	RS485, 2-wire half duplex (A/B + common)
Baud rate	9600 (configurable)
Frame	8 data bits, no parity, 1 stop bit (8N1)
Slave address	Configurable, factory default 1
Function codes	0x03 Read Holding Registers
Max registers per request	125
Termination	120 Ω at both bus ends; fail-safe bias at master

```
4.2  Read V1 (40001–40002) from slave 1:

Request : 01 03 00 00 00 02 C4 0B
Response: 01 03 04 B6 01 43 7D <CRC16>   ->  253.71 V
```

CRC16 is standard Modbus (polynomial 0xA001), transmitted low byte first.

05 Modbus TCP (port 502)

LAN INTEGRATION

5.1 Connection

- The meter runs a Modbus TCP server on port 502 whenever its network interface (Ethernet or Wi-Fi) is up, regardless of which reporting layer is active
- Up to 4 concurrent client connections are supported
- Unit identifier is ignored and echoed (any value accepted)
- Function codes 0x03 (Read Holding Registers) and 0x04 (Read Input Registers) are supported and return identical data; maximum 125 registers per request
- Register data refreshes internally at 1-second intervals

5.2 Exceptions

CODE	NAME	RETURNED WHEN
0x01	Illegal Function	Function code other than 0x03 / 0x04
0x02	Illegal Data Address	Address + quantity beyond register 246
0x03	Illegal Data Value	Quantity outside 1–125
0x04	Slave Device Failure	Measurement snapshot not yet available (first seconds after power-up)

5.3 IP addressing

The meter's IP configuration (DHCP or static IP / gateway / subnet) is set during commissioning through the meter's provisioning interface. For SCADA installations a static IP is strongly recommended so that the polled address never changes after a power interruption.

```
5.4  Read 22 registers from address 0 (V1 through Frequency):

Request : 00 01 00 00 00 06 01 03 00 00 00 16
Response: 00 01 00 00 00 2F 01 03 2C B6 01 43 7D ...  (44 data bytes)
```

06 MQTT interface

BROKER, TOPICS AND THE INSTANT FRAME

6.1 Broker configuration

Broker address, port and the topic prefix are set during commissioning. All topics below are relative to the configured prefix (example prefix used in this document: `techovn/site/meter1`).

6.2 Topic scheme

TOPIC (RELATIVE TO PREFIX)	CONTENT
`instant`	Binary instant frame, 511 bytes, published every second (see 6.3)
`events`	Spontaneous event notifications (JSON)
`cmd/<command>`	Command topics — see 6.5; meter subscribes
`cmd_ack/<command>`	Command responses — meter publishes

6.3 Binary instant frame (511 bytes)

BYTES	FIELD	FORMAT
0 – 3	Serial Number	uint32, big-endian
4 – 7	Meter IP Address	4 octets
8 – 9	Payload Length = 500	uint16, big-endian
10	Packet Identifier = 0x01	instant frame
11 – 13	Modbus prefix 01 03 F0	—
14 – 413	100 measurement registers	float CDAB, 4 bytes each, order as per register map
415 – 420	RTC: DD MM YY HH MM SS	1 byte each
421 – 424	Tamper status bitfield	uint32 BE
425 – 428	Cumulative tamper count	uint32 BE
429 – 456	14 event counters	uint16 BE each
457 – 465	Load ON time R/Y/B	hours uint16 + minutes uint8
466 – 467	MD reset count	uint16 BE
468 – 495	4 × MD blocks (kW/kVA, Imp/Exp)	uint16 value (W/VA) + 5-byte date-time
509 – 510	CRC16-Modbus over bytes 11–508	little-endian

The 100 measurement registers occupy the same order and format (float CDAB) as the Modbus register map in section 3, allowing one decoder to serve both interfaces.

6.4 Binary bill frame

312 BYTES · PUBLISHED ON CMD_ACK/BILL

Published on `cmd_ack/bill` in response to a bill read command. All multi-byte values in the bill payload are little-endian; energies and power factors are stored ×100 (divide by 100 to restore).

BYTES	FIELD
0 – 3	Serial Number (uint32 BE)
4 – 7	Meter IP address
8 – 9	Payload length = 300 (uint16 BE)
10	Packet identifier = 0x02 (bill)
11	Bill month (0 = current, 1–12 = history)
12 – 16	Billing date DD MM YY + time HH MM
18 – 21	Average PF import / export (uint16 LE, ×0.01)
22 – 57	kWh Import: total + TOD1–8 (uint32 LE, ×0.01)
58 – 93	kWh Export: total + TOD1–8
94 – 129	kVAh Import: total + TOD1–8
130 – 165	kVAh Export: total + TOD1–8
166 – 181	kvarh Q1–Q4 (uint32 LE, ×0.01)
182 – 208	MD kW/kVA Import & Export: value (W/VA, uint16 LE) + date-time DD MM YY HH MM each
210 – 215	Power-ON counter, MD reset count
216 – 223	DG kWh, DG kVAh (uint32 LE, ×0.01)
310 – 311	CRC16-Modbus over payload, little-endian

6.5 Command reference

PUBLISHED TO CMD/<NAME> UNDER THE TOPIC PREFIX

Destructive commands require the confirmation token exactly as shown.

TOPIC SUFFIX	PAYLOAD	DESCRIPTION
cmd/bill	"0" .. "12"	Read bill: 0 = current month, 1–12 = history. Response: 312-byte binary bill frame on cmd_ack/bill
cmd/loadsurvey	{"days":N,"lip":1} or "ALL"	Read load survey. days −1/ALL = all stored days. Response: one JSON per day on cmd_ack/loadsurvey
cmd/loadprofile	{"count":N} or "ALL"	Read daily energy records. Response: one JSON per day on cmd_ack/loadprofile
cmd/nameplate	any	Read nameplate. Response: JSON (serial, ratings, versions, MDIP, LSIP, load limit)
cmd/todconfig	any	Read TOD configuration. Response: JSON zones / tariffs / slots
cmd/todset	{"token":"CONFIRM","zones":4,"tariffs":2,"time_slots":[[0,0],[6,0],[12,0],[18,0]],"tariff_map":[0,1,0,1,0,0,0,0]}	Program TOD zones (1–8) and tariff mapping
cmd/rtcset	{"token":"CONFIRM","datetime":"YYYY-MM-DD HH:MM:SS"}	Set meter RTC (epoch also accepted)
cmd/events_read	{"category":"voltage","count":0}	Read event log. Categories: current, voltage, power, transaction, non_rollover, control, other. count 0 = all
cmd/relay	{"state":"on"} / {"state":"off","token":"CONFIRM"} / {}	Relay control. OFF requires token. Empty payload = read state
cmd/paramset	{"name":"bill_date","value":1}	Set parameter: bill_date (1–28), md_ip / ls_ip (15/30/60 min), load_limit (W), bill_reset (+token)
cmd/calib	"CONFIRM"	Enter calibration mode (factory use)
cmd/clearall	"CONFIRM"	Erase billing history, load survey, load profile and events

6.6 JSON response examples

LOAD SURVEY, DAILY ENERGY AND EVENTS

Load survey day `cmd_ack/loadsurvey`


```
{"day_idx":0,"date":"05/07/2026","lip":1,"interval_minutes":60,
 "records_per_day":24,"kWh_imp":[...],"kVAh_imp":[...],"kWh_exp":[...],
 "kVAh_exp":[...],"V_r":[...],"V_y":[...],"V_b":[...],"I_r":[...],"I_y":[...],"I_b":[...]}
```


Daily energy record `cmd_ack/loadprofile`


```
{"idx":0,"SNo":102,"date":"05/07/2026","kWh_imp":5.10,"kVAh_imp":10.16,
 "kWh_exp":16.11,"kVAh_exp":17.64,"kWh_NET":-11.01,"kVAh_NET":-7.48,
 "DG KWH":0.00,"DG KVAH":0.00}
```


Event record `cmd_ack/events_read`


```
{"idx":0,"category":"voltage","event_id":7,"datetime":"2026-07-05 15:30:00",
 "kWh_imp":4.27,"kWh_exp":16.11,"voltage":[253.1,0,0],"current":[2.9,0,0],
 "pf":[0.55,0,0],"tamper_count":3}
```


Voltage, current and other-category events include the electrical snapshot at the moment of the event; power, transaction, non-rollover and control events carry the identifier and timestamp only. A completion summary (`"action":"events_done"`) follows the last record. Event identifiers follow IS 15959 conventions.

07 HTTP, HTTPS and TCP/IP push

METER-INITIATED JSON UPLINKS

Besides MQTT, the meter can push its one-second data directly to a web or TCP server. The uplink layer is chosen during pairing (`layer` = mqtt, tcpip, http or https); the destination host and port are set in the same step. Modbus TCP and RS485 remain active whichever layer is selected, and every layer carries the same measurement snapshot.

7.1 HTTP / HTTPS PUSH

Request	POST http(s)://<host>:<port>/instant
Cadence	1 POST per second
Content type	application/json
Body	JSON instant frame (7.3)
Freshness	Values never more than ~1 s old

7.2 TCP/IP PUSH

Transport	Raw TCP socket to the configured host:port
Framing	One JSON object per second, newline-terminated
Body	Same JSON instant frame (7.3)
Outage handling	Up to 30 frames queued and flushed on reconnect

7.3 JSON instant frame keys

```
Identity   Sr_No, RTC "DD/MM/YYYY,HH:MM:SS", sta_ip, nxp_ok (data-validity flag)
Electrical V_L1..3, I_L1..3, I_Ln, PF_L1..3, sys_pf, freq, Ph_angle_RY/YB/BR,
           THD_V1..3, THD_I1..3, InRush_L1..3
Power      P_L1..3, P_total (W) · KVAr_L1..3, KVAr_total (VAr) · KVA_L1..3, KVA_total (VA)
Energy     kWh1..3_imp, kWh_import, kWh1..3_exp, kWh_export, kWh_NET
           kvarh… and kvah… in the same pattern · DGkWh… / DGkvarh… / DGkvah…
Status     CUM_tpr_c, Tamper_status · I/V/P/T/NR/CTL/OTH_EVT_C + _EVT_MAX
           load_ON_H1..3, load_ON_m1..3 · MD_KW/KVA_imp/exp + _dt datetimes
```

Acceptance test. Expose POST /instant on your server and pair with layer http or https: one JSON POST per second with Content-Type application/json and Sr_No equal to the meter serial. For TCP/IP, run a server on the configured host:port and expect one JSON line per second; frames queued during a short outage (≤ 30) arrive on reconnect.

08 Provisioning REST API

PAIRING OVER THE METER HOTSPOT

8.1 HOTSPOT (AP MODE)

AP name	**Titan_<serial> (factory: Titan_123)**
Password	**Serial zero-padded to 8 digits (factory: 87654321)**
Base URL	**http://192.168.4.1:80**
AP window	**Never paired: stays up · paired: 2 min after power-up, extended to 5 min by pairing activity**

8.2 Endpoints

ENDPOINT	METHOD	PURPOSE
`/status`	GET	Full live status: mode, AP and station SSID, layer, IPs, RS485 role, CT ratio, firmware version, uplink counters
`/scan`	GET	WiFi site survey, up to 20 networks — also extends the AP window
`/deviceinfo`	GET	Serial, meter type TM01 and CT / demand parameters
`/setwifi`	POST	Store the configuration payload (8.3)
`/switchsta`	POST	{"protocol":"wifi"|"ethernet"} — commit and switch to operating mode ~1.5 s later
`/send`	POST	Program a parameter during pairing, e.g. {"message":"ct_ratio","ct_ratio":30.0}
`/events`	GET	Snapshot of the meter's transaction-event log
`/rs485`	GET	RS485 master poll status (or {"role":"slave"})
`/ota`	POST	{"url":"http(s)://.../firmware.bin"} — firmware update over the LAN
`/reboot`	POST	Restart the meter
`/resetap`	POST	Factory reset (erases provisioning) and reboot

8.3 POST /setwifi — configuration payload

```
{ "ssid":"SiteWiFi", "password":"wifi-password", "layer":"mqtt",
  "mqtt":  { "broker":"broker.example.com", "port":1883,
             "topic_prefix":"techovn/binola/ac/666666", "username":"", "password":"" },
  "tcpip": { "host":"192.168.137.1", "port":8080 },
  "ethernet": { "dhcp":false, "ip":"192.168.137.150", "gateway":"192.168.137.1",
                "subnet":"255.255.255.0", "dns1":"8.8.8.8", "dns2":"8.8.4.4" },
  "rs485": { "role":"slave", "addr":1 } }
```

Every key is optional — an absent key leaves the stored value unchanged. The meter serial is assigned from the **last path segment of topic_prefix**. `tcpip.host/port` is the destination for the TCP, HTTP and HTTPS layers. Ethernet on a direct meter-to-PC cable is forced to a static IP (192.168.137.150).

09 Commissioning checklist

BRING-UP IN ORDER

1. Power the meter; it starts in provisioning (AP) mode for 2 minutes, then switches to its configured network
2. Configure network (Ethernet static IP recommended for Modbus TCP installations) and reporting layer via the provisioning app
3. **Modbus RTU:** set slave address, verify with a single-register read of 40001 (expect nominal mains voltage)
4. **Modbus TCP:** ping the meter IP, then poll address 0 quantity 2, decode as float CDAB
5. **MQTT:** subscribe to <prefix>/instant on the broker and confirm one 511-byte frame per second
6. Verify CRC handling and word-order decoding against a known live value before bulk tag mapping

10 — SUPPORT

Sample decoder scripts (Python / Node) for the binary frames

For integration assistance or protocol conformance queries, contact your Tech OVN representative.

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