MANUAL

TACWB Modbus Communication

Modbus RTU – RS485 and TCP/IP

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Contents

1. Purpose

This document describes the mapping from smart charging data to Modbus (RS485 and TCP/IP) and how to read and write to registers in Terra AC Wallbox.

The document covers functionalities available to the Terra AC Wallbox Platform from FW 1.3.x onwards. Note: some functionalities can only be configured from Terra Config app v1.6 and onwards.

2. Overview

This document applies to Terra AC Wallbox acting as (1) Modbus Primary device, connected to a meter or as (2) Modbus Secondary device, connected to local controller.

Variant	RTU		TCP/IP	
	Primary	Secondary	Primary	Secondary
CE	Available	Available with FW 1.3.5 onwards	Not supported	Not supported
MID	Available with FW 1.3.5 onwards	Available with FW 1.3.5 onwards	To be made available	Available with FW 1.3.5 onwards
UL	Available with FW 1.3.5 onwards	Available with FW 1.3.5 onwards	To be made available	Available with FW 1.3.5 onwards

Terra AC Wallbox as:

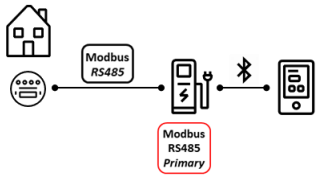
- Modbus Primary Device reads data from Modbus meter Secondary Device
- Modbus Secondary Device reads and writes from the Modbus local controller Primary Device

2.1. Modbus topologies supported

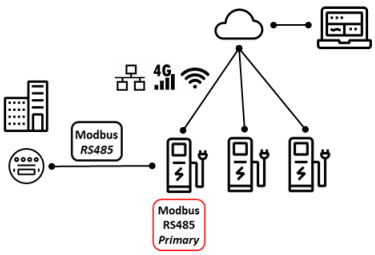
These topologies can be configured via the Terra Config app v1.6.1.

- **Modbus RTU - RS485**

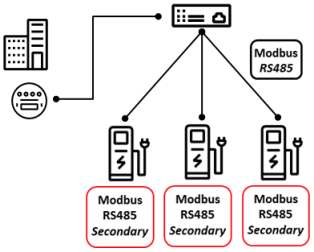
Dynamic w/ single charger



Dynamic w/ multiple chargers

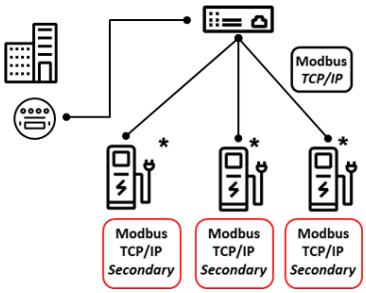


Dynamic w/ multiple chargers via local controller



- **Modbus TCP/IP**

Dynamic w/ multiple chargers via local controller



3. Terra AC Wallbox as Primary Device

- **ABB meters**

Supporting A, B and EV series for firmware 1.4.2.

Modbus Primary Device reads the following registers from the Modbus meter Secondary Device:

Start Reg	Name	Size*	Res.	Unit	Data Type	Attr.
5000	Active import	4	0.01	kWh	Unsigned	RO
5b00	Voltage L1-N	2	0.1	V	Unsigned	RO
5b02	Voltage L2-N	2	0.1	V	Unsigned	RO
5b04	Voltage L3-N	2	0.1	V	Unsigned	RO
5b0c	Current L1	2	0.01	A	Unsigned	RO
5b0e	Current L2	2	0.01	A	Unsigned	RO
5b10	Current L3	2	0.01	A	Unsigned	RO
5b14	Active power total	2	0.01	W	Signed	RO
5b16	Active power L1	2	0.01	W	Signed	RO
5b18	Active power L2	2	0.01	W	Signed	RO
5b1A	Active power L3	2	0.01	W	Signed	RO

* Number of Modbus registers for the meter Quantity. A Modbus register is 16 bits long.

List of compatible ABB meters with TACWB:

Variant	Smart meter (Modbus RTU-RS485)			
	Direct connected		Indirect connected	
CE_1PH*	B21 xx2-xxx EV1 xx2-xxx	A41 xx2-xxx	-	A42 xx2-xxx
CE_3PH	B23 xx2-xxx EV3 xx2-xxx	A43-xx2-xxx	B24 xx2-xxx	A44-xx2-xxx
MID_1PH*	B21 xx2-xxx EV1 xx2-xxx	A41 xx2-xxx	-	A42 xx2-xxx
MID_3PH	B23 xx2-xxx EV3 xx2-xxx	A43-xx2-xxx	B24 xx2-xxx	A44-xx2-xxx
UL	B21 xx2-xxx EV1 xx2-xxx	A41-xx2-xxx	-	A42 xx2-xxx

- **Siemens meters**

Supporting PAC3100 for firmware 1.4.2.

Modbus Primary Device reads the following registers from the Modbus meter Secondary Device:

Start Reg	Name	Size*	Res.	Unit	Data Type	Attr.
0AF3	Active import	4	1	Wh	Float	RO
0001	Voltage L1-N	2	1	V	Float	RO
0003	Voltage L2-N	2	1	V	Float	RO
0005	Voltage L3-N	2	1	V	Float	RO
000D	Current L1	2	1	A	Float	RO
000F	Current L2	2	1	A	Float	RO
0011	Current L3	2	1	A	Float	RO
0031	Active power total	2	1	W	Float	RO
0019	Active power L1	2	1	W	Float	RO
001B	Active power L2	2	1	W	Float	RO
001D	Active power L3	2	1	W	Float	RO

List of compatible Siemens meters with TACWB:

Variant	
	Indirect Connection
CE_1PH**	N/A
CE_3PH	PAC3100
MID_1PH**	N/A
MID_3PH	PAC3100
UL	N/A

- **Schneider Electric meters**

Supporting iEM3000 and PM5300 series for firmware 1.4.2.

Modbus Primary Device reads the following registers from the Modbus meter Secondary Device:

Start Reg	Name	Size	Res.	Unit	Data Type	Attr.
0C83	Active import	4	1	Wh	Int64	RO
0BD3	Voltage L1-N	2	1	V	Float	RO
0BD5	Voltage L2-N	2	1	V	Float	RO
0BD7	Voltage L3-N	2	1	V	Float	RO
0BB7	Current L1	2	1	A	Float	RO
0BB9	Current L2	2	1	A	Float	RO
0BBB	Current L3	2	1	A	Float	RO
0BF3	Active power total	2	1	kW	Float	RO
0BED	Active power L1	2	1	kW	Float	RO
0BEF	Active power L2	2	1	kW	Float	RO
0BF1	Active power L3	2	1	kW	Float	RO

List of compatible Siemens meters with TACWB:

Variant	
	Indirect Connection
CE_1PH**	N/A
CE_3PH	iEM3000 Series PM5300 series
MID_1PH**	N/A
MID_3PH	iEM3000 Series PM5300 series
UL	N/A

**If a single phase charger is connecting to a 3 phase meter, then the charger will only read values from L1. Please connect the charger to L1.

4. Terra AC Wallbox as Secondary Device

The charger is in secondary mode, connected to local controller. Recommended polling interval for Readable Data is 30s~90s.

Start Reg	Name	Size	Res.	Unit	Data Type	Attr.	Status
Readable Data							
4000	Serial Number	4			unsigned	RO	available
4004	Firmware version	2			unsigned	RO	available
4006	Max rated/settable current	2	0.001	A	unsigned	RO	available
4008	Error Code	2			unsigned	RO	available
400A	Socket lock state	2			unsigned	RO	available
400C	Charging state	2			unsigned	RO	available
400E	Current charging current limit	2	0.001	A	unsigned	RO	available
4010	Charging current phase 1	2	0.001	A	unsigned	RO	available
4012	Charging current phase 2	2	0.001	A	unsigned	RO	available
4014	Charging current phase 3	2	0.001	A	unsigned	RO	available
4016	Voltage phase 1	2	0.1	V	unsigned	RO	available
4018	Voltage phase 2	2	0.1	V	unsigned	RO	available
401A	Voltage phase 3	2	0.1	V	unsigned	RO	available
401C	Active power	2	1	W	unsigned	RO	available
401E	Energy delivered in charging session	2	1	Wh	unsigned	RO	available
Writeable Data							
4100	Set charging current limit	2	0.001	A	unsigned	WO	available
4102	Set charging phase	1			unsigned	WO	Not support
4103	Lock/Release cable	1			unsigned	WO	Not support

4104	Set charger availability	1	unsigned	WO	Not support
4105	Start/Stop Charging Session	1	unsigned	WO	available

4.1. 4000H – Serial Number

This register contains the serial number of the charging station.

Address	Name	Size	Res.	Unit	Data Type	Attr.
4000H	Serial number	4			unsigned	RO

The serial number contains 8 bytes, from first byte to last will be indicated as A7~A0.

	A7	A6	A5	A4	A3	A2	A1	A0
Value	0x47…0x50 0x53…0x54	0x07…0x11…0x22	0x04	0x00	0x01~0x53 [1]	0x00~0x99 [1]	0x00~0x99 [1]	0x00~0x99 [1]
Meaning	Connector Type[2] 0x47-G-Type 2 Cable 0x50-P-Type 1 Cable 0x53-S-Type 2 Socket with Shutter 0x54-T-Type 2 Socket	Rated Power	Fixed byte	Fixed byte	Production Week	Production Year	Sequence number high	Sequence number low

Note 1: The number are not sequential, hexadecimal number like 0x0A, 0x1C is not included.

Example:

Value 0x54 0x22 0x04 0x00 0x49 0x20 0x00 0x25 indicates the product serial number is TACW22-4-4920-T0025, the prefix “TACW” is not part of this message

4.2. 4004H – Firmware version

This register contains the firmware version of the charging station.

Address	Name	Size	Res.	Unit	Data Type	Attr.
4004H	Firmware version	2			unsigned	RO

Example:

Value 0x01 0x02 0x13 0x00 indicates the firmware version is v1.2.13, the last byte are reserved.

4.3. 4006H – Max Rated/Settable current

This register contains the maximum current value that can be supported by the hardware of the charging station, and settable by TerraConfig.

Address	Name	Size	Res.	Unit	Data Type	Attr.
4006H	Max supported current	2	0.001	A	unsigned	RO

Example:

Value 10000(DEC): The maximum charging current of the charging station is 10000 mA = 10 A.

Note: Settable charging current could only be set at 1A interval, e.g. Value 16154(DEC) will be identified as 16A, 154mA will be ignored.

4.4. 4008H – Error code

This register contains the error code of the charging station.

Address	Name	Size	Res.	Unit	Data Type	Attr.
4008H	Error code	2			unsigned	RO

Supported values:

0x0000: No error

>0x0000: Specific error code. (refer to user manual)

4.5. 400AH – Socket lock state

This register contains the state of the charging cable, and socket lock.

Address	Name	Size	Res.	Unit	Data Type	Attr.
400AH	Socket Lock state	2			unsigned	RO

Supported values(lower bytes):

- 0x0000: No cable is plugged.
- 0x0001: Cable is connected to the charging station unlocked
- 0x0011: Cable is connected to the charging station locked
- 0x0101: Cable is connected to the charging station and the electric vehicle, unlocked in charging station
- 0x0111: Cable is connected to the charging station and the electric vehicle, locked in charging station.

4.6. 400CH – Charging state

This register contains the state of the charging station.

Address	Name	Size	Res.	Unit	Data Type	Attr.
400CH	Charging state	2			unsigned	RO

Charging State contains 4 bytes, A3 A2 A1 A0 in order.

A0- Availability

0x0000: Charging Station available/enable, change status by 4104H Enable/Disable charging station

0x0001: Charging Station unavailable/disable, change status by 4104H Enable/Disable charging station

A1-Charging

Bit7: 0- Charging rated current

Under set charging current limit

Bit 6~0

0x00: State A: Idle

0x01: State B1: EV Plug in, pending authorization

0x02: State B2: EV Plug in, EVSE ready for charging(PWM)

0x03: State C1: EV Ready for charge, S2 closed(no PWM)

0x04: State C2: Charging Contact closed, energy delivering.

0x05: Other

Example:

Under set charging current limit in State C2: 1000 0100 (0x84)

A2, A3 are reserved for future purpose

4.7. 400EH – Current charging current limit

This register contains the maximum charging current of the charging station.

Address	Name	Size	Res.	Unit	Data Type	Attr.
400EH	Current charging current limit	2	0.001	A	unsigned	RO

Example:

Value 10000(DEC): The maximum charging current of the charging station is 10000 mA = 10 A.

4.8. 4010H – Charging current (L1/2/3)

This register contains the measured current value on phase 1/2/3 in mA.

Address	Name	Size	Res.	Unit	Data Type	Attr.
4010H	Charging current L1	2	0.001	A	unsigned	RO
4012H	Charging current L2	2	0.001	A	unsigned	RO
4014H	Charging current L3	2	0.001	A	unsigned	RO

Example:

Value 6450(DEC): The charging current on phase 1 is 6450mA = 6.450A

4.9. 4016H – Voltage (L1/2/3)

This register contains the measured voltage value on each phase in volts.

Address	Name	Size	Res.	Unit	Data Type	Attr.
4016H	Voltage L1-N	2	0.1	V	unsigned	RO
4018H	Voltage L2-N	2	0.1	V	unsigned	RO
401AH	Voltage L3-N	2	0.1	V	unsigned	RO

Example: Value 2305(DEC): The measured voltage value on phase is 230.5 V.

4.10. 401CH – Active power

This register contains the active power in W.

Address	Name	Size	Res.	Unit	Data Type	Attr.
401CH	Active power	2	1	W	unsigned	RO

Example:

Value 22661(DEC): The active power of the charging station is 22661 W = 22.661 kW.

4.11.401EH – Energy delivered in charging session

This register contains the transferred energy of the current charging session.

Address	Name	Size	Res.	Unit	Data Type	Attr.
401EH	Energy delivered in charging session	2	1	Wh	unsigned	RO

Example:

Value 16000(DEC): The transferred energy of the current charging session is 16.000 kWh.

4.12. 4100H – Set Charging Current Limit

This register sets the maximum charging current. This register only can be set when a transaction is ongoing. The value will be affected immediately and stays valid until the transaction is stopped.

When the current limit is less then 6A, the charging session will pause, after the limit is over 6A, the session can be resume.

After reset, the value will be restored to previous limit.

This value can be read back from register 400E.

Address	Name	Size	Res.	Unit	Data Type	Attr.
4100H	Set charging current limit	2	1	0.001A	unsigned	WO

Example:

Value 16000(DEC): Set the charging current for the charger is 16.000A.(Number after decimal point will be ignored)

4.13. 4102H – Set Charging Phase

This register sets the number of phases that will be used for charging. The value stays valid until a reset or rewriting the register.

After reset, the value will be restored as default value as rated.

The set charging current limit will stay valid after reboot or power cycle.

Address	Name	Size	Res.	Unit	Data Type	Attr.
4102H	Set charging phase	1	1		unsigned	WO

Example:

0x0001: Set the charging to single phase

Note: When three phase EVSE set to charging at single phase, only the wire connected to the Phase A terminal will close contact to deliver energy.

0x0002: Set the charging to three phases

Note: Invalid for single phase EVSE.

4.14. 4103H – Lock/Release Cable

Register contains the lock and release cable command, only available for socket variants.

Address	Name	Size	Res.	Unit	Data Type	Attr.
4103H	Lock and Release cable	1	1		unsigned	WO

0x0000: Release Cable

Note: Use caution is advised, only deploy this function in Force Unlock scenario when no on-going charging session

0x0001: Lock Cable

Note: After cable is locked, until reset, reboot or rewriting the register to Release Cable, the cable will stay locked regardless the charging status.

4.15. 4104H – Set Charger Availability

Register contains the set charger availability, by setting charger disable, charger will not response to authorization for charging. Restore availability by setting charger enable or reset.

After reboot or power cycle, the availability will stay the same.

Address	Name	Size	Res.	Unit	Data Type	Attr.
4104H	Set charger availability	1	1		unsigned	WO

0x0000: Enable

0x0001: Disable

4.16. 4105H – Start/Stop Charging Session

Writing this register starts or stops a charge session depending on the value.

Address	Name	Size	Res.	Unit	Data Type	Attr.
4105H	Start/Stop charging session	1	1		unsigned	WO

0x0000: Start

0x0001: Stop

5. Modbus Protocol

5.1. Modbus Protocol

Modbus is a Primary-Secondary communication protocol that can support up to **247** Secondaries organized as a multidrop bus. The communication is half duplex. Services on Modbus are specified by function codes.

The function codes are used to read or write 16-bit registers. All charging data, such as active energy, voltage or firmware version, is represented by one or more such registers.

The Modbus protocol is specified in its entirety in Modbus Application Protocol Specification V1.1b. The document is available at http://www.modbus.org

5.1.1. Modbus Request Frame

A Modbus request frame generally has the following structure:

Secondary Address	Function Code	Data	Error Check

- Secondary address: Modbus Secondary address, 1 byte.
- Function code: Decides the service to be performed.
- Data: Dependent on the function code. The length varies.
- Error check: CRC-16, 2 bytes.

5.1.2. Message Types

The network messages can be query-response or broadcast type. The query response command sends a query from the Primary to an individual Secondary and is generally followed by a response.

The broadcast command sends a message to all Secondaries and is never followed by a response. Broadcast is supported by function code 6 and 16.

5.1.3. Exception Responses

If an error should occur while processing a request, then the TACWB gives an exception response that contains an exception code.

In the exception response the function code is set to the function code of the request plus 0x80.

An exception frame has the following structure:

Secondary Address	Function Code	Exception Code	Error Check

The exception codes that are used are listed in the following table:

Code	Exception	Definition
01	Illegal function	A function code that is not supported has been used.
02	Illegal data address	The requested register is outside the allowed range.
03	Illegal data value	The structure of a received message is incorrect.
04	Secondary device failure	Processing the request fail due to an internal error in the meter.

5.2. Supported Function Codes

The following function codes are supported:

- Function code 3 (Read holding registers)
- Function code 6 (Write single register)
- Function code 16 (Write multiple registers)

5.2.1. Function Code 3 (Read Holding Registers)

Function code 3 is used to read measurement values or other information from the electricity meter. It is possible to read up to **125** consecutive registers at a time. This means that multiple values can be read in one request.

Request frame:

Secondary Address	Function Code	Address	No. of Registers	Error Check

Response frame:

Secondary Address	Function Code	Byte Count	Register Values	Error Check

Example: Read total energy import, etc. …

Request:

Secondary address	**0x01**
Function code	0x03
Start address, high byte	0x50
Start address, low byte	0x00
No. of registers, high byte	0x00
No. of registers, low byte	0x18
Error check (CRC), high byte	0x54
Error check (CRC), low byte	0xC0

Response:

Secondary address	**0x01**
Function code	0x03
Byte count	0x30
Value of register 0x5000, high byte	0x00
Value of register 0x5000, low byte	0x15
…	0x18
Value of register 0x5017, high byte	0xFF
Value of register 0x5017, low byte	0xFF
Error check (CRC), high byte	0xXX
Error check (CRC), low byte	0xXX

5.2.2. Function Code 16 (Write Multiple Register)

Function code 16 is used to modify settings in the meter, such as date/time, to control output and to reset values, such as power fail counter. It is possible to write up to **123** consecutive registers in a single request. This means that several settings can be modified and/or several reset operations can be performed in a single request.

Request frame:

Secondary Address	**Function Code**	**Start Address**	**No. of Registers**	**Byte Count**	**Register Values**	**Error Check**

Response frame:

Secondary Address	Function Code	Start Address	No. of Registers	Error Check

Example: set Date/Time to November 11, 2010,12:13:14

Request:

Secondary address	**0x01**
Function code	0x10
Start address, high byte	0x8A
Start address, low byte	0x00
No. of registers, high byte	0x00
No. of registers, low byte	0x03
Byte count	0x06
Value of register 0x8A00, high type	0x0A
Value of register 0x8A00, low type	0x0B
Value of register 0x8A01, high type	0x0B
Value of register 0x8A01, low type	0x0C
Value of register 0x8A02, high type	0x0D
Value of register 0x8A02, low type	0x0E
Error check (CRC), high byte	0x8C
Error check (CRC), low byte	0x82

Response:

Secondary address	**0x01**
Function code	0x10
Register address, high byte	0x8A
Register address, low byte	0x00
No. of registers, high byte	0x00
No. of registers, low byte	0x03
Error check (CRC), high byte	0xAA
Error check (CRC), low byte	0x10

5.2.3. Function Code 6 (Write Single Register)

Function code 6 can be used as an alternative to function code 16 if there is only one register to be written. It can, for example be used to reset the power fail counter.

Request frame:

Secondary Address	Function Code	Register Address	Register Value	Error Check

Response frame:

Using function code 6, the response frame is an echo of the request frame.

Example: reset power fail counter.

Request:

Secondary address	**0x01**
Function code	0x06
Register address, high byte	0x8F
Register address, low byte	0x00
No. of registers, high byte	0x00
No. of registers, low byte	0x01
Error check (CRC), high byte	0x62
Error check (CRC), low byte	0xDE

5.3. Reading and Writing to Registers

Readable Register

The readable range in the Modbus mapping are registers 1000–8EFF (hexadecimal). Reading any registers within this range will result in a normal Modbus response. It is possible to read any number of registers between 1 and 125, i.e., it is not necessary to read all registers of a quantity listed on one line in the s. Any attempt to read outside this range will result in an illegal data address exception (Modbus exception code 2).

Multi-Register Values

For quantities that are represented as more than 1 register, the most significant byte is found in the high byte of the first (lowest) register. The least significant byte is found in the low byte of the last (highest) register.

Unused Registers

Unused registers within the mapping range, for example missing quantities in the connected charging station, will result in a normal Modbus response but the value of the register will be set to “invalid”.

For quantities with data type “unsigned”, the value will be FFFF in all registers.

For quantities with data type “signed”, the value is the highest value possible to express. That means that a quantity that is represented by only one register will have the value 7FFF. A quantity that is represented by 2 registers will have the value 7FFFFFFF, and so on.

Writing to Registers

Writing to registers is only permitted to the registers listed as writable in the mapping tables. Attempting to write to a register that is listed as writable but that is not supported by the charging station will not result in an error indication.

Confirm Set Values

After setting a value in the charging station, it is recommended that you read the value to confirm the result, since it is not possible to confirm if a write was successful from the Modbus response.

Available register for Confirm Set Values, is the writable “0x4100 Set charging current”, which can be read and confirm by reading “0x400E Current charging current limit”

5.4. RTU - RS 485 Configuration

The setting of the RS485 communication interface can be configured via TerraConfig App with the default values below:

The settings can be configured via Terra Config app v1.6.1 onwards.

Item	Value	Options	Description	Primary mode	Secondary Mode
Address	1	Integer <247	Primary mode to read the smart meter address Secondary controller to read the charger	configurable	configurable
Baud Rate	9600	4800 9600 19200 38400 57600 115200	Data rate for serial data transmission (in bits per second (bps)).	configurable	configurable
Data bits	8	7 or 8	Number of data bits for each character.	not configurable	not configurable
Parity	None	None Odd Even	In serial transmission, parity is a method of detecting errors. An extra data bit is sent with each data character, arranged so that the number of 1 bit in each character, including the parity bit, is always odd or always even. If a byte is received with the wrong number of 1s, then it must have been corrupted. However, an even number of errors can pass the parity check. **None** (**N**) - no parity method is used. Note: The parity could be modified while the charger is in secondary mode The parity could not be modified while the charger is in primary mode	not configurable	configurable

Stop bits	1	1 or 2	Stop bits sent at the end of every character allow the receiving signal hardware to detect the end of a character and to re-synchronize with the character stream. Electronic devices usually use one stop bit. Two stop bits are required if slow electromechanical devices are used.	not configurable	configurable