

# **User Manual**

# P1- and TIC-Dongle

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### **1.Introduction**

Thank you for purchasing this P1/TIC Dongle. Xemex has a wide product range of devices. We have introduced a variety of meters and converters. For more information on other products visit our website at <u>Home - Xemex | Smart Energy Communicator</u> or contact our sales department on <u>sales@xemex.eu</u>.

### 1.1. P1 Dongle:

The Xemex P1 Dongle is a compact converter module that makes the Smart Meter P1 message contents available via Modbus TCP or via the P1 output port. The module supports P1 in the Netherlands defined by the DSMR4.2 or higher standard, and in Belgium the E-MUCS standard.

The Dongle connects to the P1 port of the Smart Meter via a cable with RJ12 connectors on both ends. The unit can be powered by the power present on the P1 port of the Smart Meter with exception of certain use cases. External power supply, via power adapter, can be added optionally should that be required.

#### 1.2. Tic Dongle:

The Xemex TIC Dongle is a compact converter module that makes the Linky Meter TIC message contents available via Modbus TCP.

The module supports TIC ports defined by Enedis-NOICPT\_54E norm V3, 2018. The Dongle connects to the TIC port of the Linky Meter via a double-pin connector.

The module acts as a Modbus TCP slave over Ethernet to connect to a Modbus master on the local network. The memory map for Modbus TCP is changeable by selecting an available template during configuration.

It has to be powered by an external USB-C power supply.

User interaction is facilitated by a multicolor backlit button, which utilize color coding to indicate the Dongle's status.



### 1.3. **Sco**pe

This manual is applicable to the P1- and TIC Dongle. The P1 dongle which interfaces to the P1 output port of a smart meter and make it available via a P1 output port or the Modbus TCP and the TIC Dongle that makes the Linky Meter TIC message contents available via Modbus TCP.

### 1.4. Target group

A qualified person in accordance with specific local standards and safety regulations must be responsible for the installation, operation and maintenance of the P1/TIC Dongle. It is assumed that the reader of this document is familiar with common electronics terminology, and has knowledge of analogue and digital electronic designs and similar products.

### 1.5. Intended usage

The P1 or TIC Dongle are only to be used for receiving a P1or TIC telegram and distributing the specified values. The main function of the software is to bridge P1 or TIC data from a residential smart meter to a network API (Modbus/TCP) to allow EV chargers to use this data for load balancing.



### 1.6. Used symbols

The following symbols are used in this document and/or are marked on the product:

	Alternating current
3~	Three-phase alternating current
	Equipment protected throughout by DOUBLE INSULATION or REINFORCED INSULATION
	Caution, possibility hazard of electric shock.
	Caution

### 1.7. Abbreviations and acronyms

<ul> <li>V DC: DC-voltage</li> <li>EV: Electrical Vehicule</li> <li>(D)SMR: (Dutch) Smart Meter Requirements</li> <li>E-MUCS: Extended Multi-Utility Companion Specification</li> <li>TCP: Transmission Control Protocol</li> <li>DNS: Domain Name Device</li> <li>mDNS: Multicast Domain Name Device</li> <li>DHCP: Dynamic Host Configuration Protocol</li> <li>TIC: Télé-Information Client</li> <li>LED: Light Emitting Diode</li> <li>HTTP: Hypertest Transfer Protocol</li> <li>API: Application Programming Interface</li> <li>JSON: JavaScript Object Notation</li> <li>USB: Universal Serial Bus</li> <li>UART: Universal Asynchronous Receiver-Transmitter</li> <li>UI: User Interface</li> </ul>	V AC:	AC-voltage
EV:Electrical Vehicule(D)SMR:(Dutch) Smart Meter RequirementsE-MUCS:Extended Multi-Utility Companion SpecificationTCP:Transmission Control ProtocolDNS:Domain Name DevicemDNS:Multicast Domain Name DeviceDHCP:Dynamic Host Configuration ProtocolTIC:Télé-Information ClientLED:Light Emitting DiodeHTTP:Hypertest Transfer ProtocolAPI:Application Programming InterfaceJSON:JavaScript Object NotationUSB:Universal Serial BusUART:Universal Asynchronous Receiver-TransmitterUI:User Interface	V DC:	DC-voltage
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UI: User Interface	UART:	Universal Asynchronous Receiver-Transmitter
	UI:	User Interface



#### **1.8.** Safety precautions

- 1. Always adhere to the following checklist:
- 2. Only qualified personnel or licensed electricians should install the Xemex P1/TIC DONGLE.
- 3. Follow all applicable local, national electrical and safety codes.
- 4. Install the P1/TIC DONGLE device in an electrical enclosure (panel or junction box) or in a limited access electrical room.
- 5. Verify that circuit voltages and currents are within the proper range for the meter model.
- 6. Equipment must be disconnected from the HAZARDOUS LIVE voltages before access.
- 7. Before applying power, the installer must check that all the wires are securely fixed by tugging on each wire.
- 8. Do not install the P1/TIC DONGLE where the temperatures can be below -25°C or above 75°C, excessive moisture, dust, salt spray, or other contamination. The device requires an environment no worse than pollution degree 2 (normally only non-conductive pollution; an occasionally temporary conductivity caused by condensation must be expected).
- 9. Do not drill mounting holes in the device. Click the module on a DIN Rail instead.
- 10. When the P1/TIC DONGLE is installed incorrectly, the safety protections may be impaired.

#### **1.9.** Certifications

Date	Accreditation Centre	IP Code	Kind



# 2. Technical description

This chapter describes the functionality of the P1/TIC dongle software (hereafter referred to as "the software").

The main function of the software is to bridge P1/TIC data from a residential smart meter to a network API (Modbus/TCP) to allow EV chargers to use this data for load balancing.

Figure 1-1 in the introduction shows the concept from a Hardware point of view. Figure 2-1 shows a high level software concept and the communication context.



Figure 2-1: Software context



### 2.1. Use cases









#### 2.1 P1 Forwarding modes

This section describes the P1 forwarding modes that can be supported by the dongle software/hardware. Actual supported modes in software

#### 2.1.1 P1 forwarding mode 1

Standard "passive splitter". Data is requested continuously by the Dongle (every second), data is forwarded to P1\_OUT data at the moment it is received. Data start of frame timing is asynchronous from request line on P1\_OUT port.

#### 2.1.2 P1 forwarding mode 2

"Active splitter". Data is buffered by the Dongle, and sent when request line on P1\_OUT port is asserted.

#### 2.1.3 P1 forwarding mode 3

"Passive splitter" where P1 out device is leading in data request. Data request is forwarded from P1\_OUT to P1\_IN (meter) assuming this is done at least every second (to guarantee data freshness on the Dongle). Data is forwarded (not buffered) from P1\_IN to P1\_OUT.

#### 2.2. LED states

This section describes the behaviour of the multi-colour LED. Table 2-2 shows the LED states of the dongle during normal operation.

State	Colour	Pattern	Description
Off	-	-	Module not powered
Powerup	Red	Continuous	Module booting
Normal Operation	Green	Continuous	Dongle is receiving
			P1/TIC data,
			Network is connected
			and
			configured. Serving
			Modbus TCP



	API on the Ethernet
	port.

Table 2-2 Normal LED states

#### 2.3. Button

This section describes the behaviour of the Dongle when the button is pressed.

Table 2-4 Button actions

Action	Description
Momentary press (< 4 seconds)	Soft reset, reconnect to network
Hold (>4)	Reset to factory defaults

#### 2.4. Network

This section describes the network parameters of the dongle software.

#### 2.4.1. MAC address

The MAC address for the Ethernet and Wi-Fi controllers are provided by the supplier of the MCU.

#### 2.4.2. Hostname

The hostname for the device is formatted as follows: "energy-dongle". This hostname is sent along with the DHCP request (DHCP option 12 field) for identification on the local network.

#### 2.4.3. mDNS

The dongle responds to mDNS requests for "energy-dongle.local" (hostname.local).



#### 2.4.4. DHCP

The dongle software will by default perform a DHCPv4 request on the Ethernet port. If the dongle is configured for DHCP (default) and an IP address is not received after 3 retries, a link local (APIPA) ipv4 address is assigned in the 169.256.0.0/16 range for easier provisioning.

There is no IPv6 support in the dongle software. Communication with the charger is only supported on the local subnet. Setting a static IP address can be done using the" /config" API endpoint.

### 2.5. Modbus TCP/IP

This section describes the details of the Modbus TCP/IP interface. for more details about Modbus TCP/IP and an explanation of the terms used in this section. The dongle exposes a Modbus TCP service on TCP port 502. The service is available on the IP address received in the DHCP request at dongle boot time. Multiple TCP sessions in parallel are not supported. The "Unit identifier" field in the in the MBAP header of the Modbus/TCP packet is ignored (all unit identifiers are accepted because the IP address already uniquely identifies the device).

The Modbus TCP/IP interface supports the following function codes:

- 0x03: Read holding registers
- 0x04: Read input registers

The device does not differentiate between holding and input registers. Both functions return the same value for a given register.

The register map is updated atomically every time the data is received on the P1/TIC interface. If multiple holding registers are read in one request, the data received is guaranteed to be from same P1/TIC telegram. For DSMR4.2 meters, due to DSMR4.2 standard, the following limitations apply:

- Data is updated every 10 seconds (compared to every 1 second for DSMR5)
- · Voltage information is missing (reads back as 0 in Modbus)

For TIC meters, due to TIC standard, the following limitations apply:

• Active power per phase cannot be negative (Only combined active power shows produced power delivered from the home to the grid as a negative value). Active power per phase reads back as 0 in Modbus if net energy is produced and delivered to the grid on that phase



### 2.5.1. Register map: Phoenix Contact EMPro

Table 2-5 Phoenix Contact EMPro emulated registers

Register (Hexadecimal)	Count	Unit	Format	Description
0x8006		2 Volt	FL32	Phase voltage U1
0x8008		2 Volt	FL32	Phase voltage U2
0x800a		2 Volt	FL32	Phase voltage U3
0x800e		2 Ampere	FL32	Current L1
0x8010		2 Ampere	FL32	Current L2
0x8012		2 Ampere	FL32	Current L3
0x8016		2 Watt	FL32	Active power combined
0x801e		2 Watt	FL32	Active power phase 1
ox8020		2 Watt	FL32	Active power phase 2
ox8022		2 Watt	FL32	Active power phase 3



# **3. Technical specifications**

### 3.1. Functional

Figure 2-1 shows a block diagram of the hardware design. Based on the configuration mentioned in Table 3-1 the required building blocks will be assembled, thus creating different modules.



#### 2.1.1. MCU

The MCU is responsible for the overall system control and provides an onboard Wi-Fi and PCB antenna.

#### 2.1.2. Ethernet physical

The following characteristics are applicable:

The P1/TIC Dongle supports 10/100BASE-T Ethernet via Ethernet PHY



### 2.2. Interfaces

Within this paragraph the P1/TIC Dongle building block circuits are discussed.

#### 2.2.1. P1-IN

The P1-IN has the following characteristics:

- P1-IN is compatible with DSMR 4.2
- P1-IN pinning is according to DSMR 4.2.

#### 2.2.2. P1-OUT

The P1 output port works as a P1 splitter device: in case the P1 port of the meter in connected with the P1 input of P1/TIC Dongle, this port provides a P1 output port to support other P1 devices. The P1 data lines are redirected to this output port. And power is supplied by the USB-C.

The P1-OUT has the following characteristics:

- P1-OUT is according to DSMR 4.2,
- P1-OUT pinning is according to DSMR 4.2.

#### 2.2.3. Télé Information Client (TIC)

The P1 has the following characteristics:

- TIC is according to Enedis-NOI-CPT\_54E,
- TIC power pin is not used.

#### 2.2.4. LED

The LED has the following characteristics:

• P1/TIC Dongle has one RGB LED

#### 2.2.5. Button

The Button has the following characteristics:

• P1/TIC Dongle has a single button available for software



#### 2.2.6. Power input

Within this paragraph the two options for power input are discussed. Table 2-1 describes in which case P1 Power is sufficient or an external USB-C power supply should be applied.

Table 2-1 Input power requirements

Usage	P1 in	P1 in + P1 out	TIC
P1 Power	X (DSMR5)		
USB-C Power	X(DSMR4.2)	Х	Х

#### 2.2.7. USB-C

• [FD\_POW\_USB-C\_01] The power input specifications are according to Table 2-2

Pin	Description	Min	Тур	Max	Unit	Remarks
VIN_5V	Voltage	4,5	5	5,5	[VDC]	
	Range					
Vripple	Ripple			100	[mV]	Maximum
	voltage					input ripple
IIN_5V	Input current			2.0	[A]	Including
						maximum
						current
						drawn on
						P1_OUT
PIN_5V	Input power			15	[W]	According to
						USB-C
						standard,
						ref [1.2]

Table 2-2 Power input USB-C - characteristics



#### 2.2.8. P1

• When no USB-C connection is present power is delivered from P1-IN.

#### 2.3. Interfaces

Within this paragraph the interfaces are described

#### 2.3.1. CN\_RJ45

• The connector type is shielded with LEDs and magnetics RJ45, according to IEEE 802.3 specification.

• Connector pinning orientation is according to Figure 2-2.

See paragraph 2.1.2 for functional description and characteristics of circuit.



Figure 2-2 CN\_RJ45 connector - orientation

#### 2.3.2. CN\_RJ12

- The connector type is RJ12, according to DSMR 4.2,
- · Connector pinning orientation is according to Figure 2-3.





Metering System RJ12 female socket

OSM RJ12 male connector

Figure 2-3 CN\_RJ12 connector - orientation

#### **CN\_TIC** 2.3.3.

- The connector is 3.5mm, pluggable terminal.
- · Connector pinning orientation is according to Table 2-4.

See paragraph 2.2.3 for functional description and characteristics of circuit.



# 4. stallation instructions

### 4.1. Guidelines for safety and installation



This installation guide must be consulted in all cases when manipulating parts which are marked with the Caution symbol.

The installation and the operation of this device and any maintenance must be carried out by a qualified person in accordance with specific local standards and safety regulations.



Caution: never open the secondary circuit of a Current Transformer while current is flowing through the primary circuit!

If the secondary circuit is opened when primary current is flowing, then the voltage will go to a very high value, possibly causing electrical arcing and/or electrical shock to service personnel. Therefore CT's with internal TVS must be used.

Failing to obey the "Guidelines for safety and installation", the guarantee no longer applies.

#### 4.2. Mounting

Mount the device in a DIN rail cabinet.

- 4.3. Electrical wiring
- 4.4. Wire stripping



### 5.Software

### 5.1. Configuring the P1/TIC Dongle Through the Web Interface

To ensure proper communication between the P1/TIC Dongle and your local network, you may need to configure the network settings through the built-in web interface. This section explains how to access the dongle's interface and adjust the Ethernet configuration as needed.

- 1. Connect the dongle
  - a. Plug the dongle into the network with an Ethernet cable.
  - b. Wait for it to boot. By default, it requests an IP address via DHCP.
  - c. If no DHCP server is found, the dongle assigns itself a link-local (APIPA) address in the 169.254.x.x range.

#### 2. Open the web interface

- a. On a device that is on the same local network, open any web browser.
- b. Browse to one of the following:
  - i. http://energy-dongle.local
  - ii. http://energy-dongle
  - iii. Or the current IP address (e.g. http://169.254.164.254)

#### 3. Review or adjust Ethernet settings

- a. Make sure "Enable Ethernet" is selected.
- b. For most installations, keep "DHCP" enabled so the dongle receives a valid network address automatically. If the dongle shows an address in the 169.254.x.x range, no DHCP server was detected—double-check the network connection.
- c. If you need a static IP address:
  - i. Select "Static IP."
  - ii. Enter the desired IP address, subnet mask, gateway, and DNS values.

#### 4. Save the settings

a. Click "Save Ethernet Settings" to store any changes.

#### 5. Optional mDNS access

 a. If mDNS is available on the network, the dongle is also reachable at http://energy-dongle.local.



## **P1/TIC Dongle Configuration**

Enable Ethernet				
Disable B	thernet			
IP Mode				
O DHCP				
O Static I	2			
DHCP IP S	ettings (Assigned)			
IP Address:				
169.254.1	4.254			
Netmask:				
16				
Gateway IF	Address:			
0.0.0.0				
DNS Serve	IP Address:			
0.0.0				
Save Ethernet Settings				



# **3. Trouble Shooting**

Issue/fault	Possible Cause	Solution
No LED light	- No power via P1 (only	- Connect USB-C power (required for
	available on DSMR5)	DSMR4.2)
	- Faulty USB adapter or	- Use a reliable 5V USB power adapter and
	RJ12 cable	check RJ12 cable for damage
LED blinking	- Incompatible smart	- Use DSMR 4.2 or higher only
red/green (1Hz)	meter (DSMR < 4.2)	
= No P1 data	<ul> <li>Incorrect or damaged</li> </ul>	- Ensure RJ12 is a straight-through cable
	RJ12 cable	with right pin out and check for damage
	<ul> <li>P1 port not activated</li> </ul>	- Request activation of P1 port from grid
		operator
LED blinking	- No network connectivity	- Check signal strength (Wi Fi analyser)
green/orange (1Hz)	<ul> <li>Faulty or incorrect</li> </ul>	<ul> <li>Test cable with a laptop or switch</li> </ul>
= No IP address	Ethernet cable	
	- No IP via DHCP	- Check that the router provides DHCP
		and optionally set static IP via web
		interface (/config)
LED blinking	- Both P1 data and	- Follow solutions from the two rows
red/orange (1Hz)	network connection are	above
= No data and no IP	missing	
I ED changes color	- Dongle is initializing	- Wait for startup to complete (LED should
continuously	Dongto is initiatizing	turn green)
oontinuouoty		
Dongle crashes or	<ul> <li>Unstable power supply</li> </ul>	- Use a stable USB power source (5V 1A+)
restarts often	<ul> <li>Overload on P1_OUT</li> </ul>	<ul> <li>Avoid powering external devices via</li> </ul>
		P1_OUT
EV charger not	- Dongle and charger not	- Ensure both devices are on the same
receiving data	on same subnet	local network
	<ul> <li>Incorrect network</li> </ul>	<ul> <li>Check IP settings via /config</li> </ul>
	configuration	
	<ul> <li>Wrong TCP port used</li> </ul>	- Verify that Modbus TCP port 502 is used
Voltage reads as zero	- DSMR 4.2 does not	- No issue. This is normal behavior for
	support voltage values	DSMR 4.2 meters



# **1.Operating instructions**

# 2.Cleaning

Clean the unit with a slightly damp cloth and mild detergent.

### 3. Lifting and carrying

Use care when lifting and carrying the product.

# 4. Maintenance and Service

There are no serviceable parts inside.

# **5. Decommissioning and Disposal**

The procedure for disconnecting and removing the device is described below.

Guidelines for safety and installation as specified in section LINK must be followed without fail.

#### 5.1. Decommissioning / Unwiring procedure

Please follow this sequence for uninstalling the device.

- 1. Disconnect the P1 cable by pressing down the on the latching tab and gently pulling the P1 cable out of the jack.
- 2. Disconnect the Ethernet cable by pressing down the on the latching tab and gently pulling the ethernet cable out of the jack.
- 3. If connected remove the power cable from the device.



### 5.2. Disposal

For the disposal of the device observe the local disposal and environmental protection regulations in effect without fail.

Based on the data specified in environmental certificate ISO 14001, the components used in the device are largely separable and can therefore be taken to the relevant disposal or recycling point.

Components	Disposal
Printed circuit boards	Electronic waste: disposal according to local
	regulations.
Metal parts	Sorted and taken to collective materials disposal
	point.
Plastic components	Sorted and taken to recycling (regranulation) plant.

### **11. Technical Support**

#### **Technical Support Contact Information**

For any technical issues or inquiries, our dedicated support team is available to assist you. Please use the following contact methods to reach out for assistance:

#### **Email Support:**

For general inquiries, troubleshooting, or technical assistance, please email our support team at: <a href="mailto:support@xemex.eu">support@xemex.eu</a> Please provide a detailed description of the issue, serial number, along with any relevant screenshots or error messages to expedite the resolution process.

#### **Phone Support:**

If you prefer to speak directly with a technician, you can reach us at:

#### +32 32 01 95 95

Our phone support is available Monday to Friday within regular business hours. If your request falls outside of business hours, please leave a ticket throughout our support portal.

#### **Support Portal:**

For access to FAQs, troubleshooting guides, and ticket submission, visit our dedicated support portal at: <u>https://xemex-support.freshdesk.com/nl/support/home</u>



#### **Social Media:**

For any non technical related information visit us via our official social media channels:

Website: <u>www.xemex.eu</u>

Linkedin: https://www.linkedin.com/company/xemex/posts/?feedView=all