IoTMeter - MODUBS TCP

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Modbus TCP

Introduction

More info about modbus find here: http://simplymodbus.ca

TCP/IP

TCP is Transmission Control Protocol and IP is Internet Protocol. These protocols are used together and are the transport protocol for the internet. When modbus information is sent using these protocols, the data is passed to TCP where additional information is attached and given to IP. IP then places the data in a packet (or datagram) and transmits it.

TCP must establish a connection before transferring data, since it is a connection-based protocol. The Master (or Client in Modbus TCP) establishes a connection with the Slave (or Server). The Server waits for an incoming connection from the Client. Once a connection is established, the Server then responds to the queries from the Client until the client closes the connection.

Modbus RTU over TCP

Simply put, this is a Modbus RTU message transmitted with a TCP/IP wrapper and sent over a network instead of serial lines. The Server does not have a SlaveID since it uses an IP Address instead.

Modbus TCP

A Modbus Messaging Implementation Guide provided by Schneider Automation outlines a modified protocol specifically for use over TCP/IP. The official Modbus specification can be found at www.modbus.org/specs.php . The main differences between Modbus RTU and Modbus TCP are outlined here.

ADU & PDU

Aside from the main differences between serial and network connections stated above, there are a few differences in the message content.

Starting with the Modbus RTU message and removing the SlaveID from the beginning and the CRC from the end results in the PDU, Protocol Data Unit.

Here is an example of a Modbus RTU request for the content of analog output holding registers # 40108 to 40110 from the slave device with address 17.

```
11 03 006B 0003 7687
```

11: The SlaveID Address (17 = 11 hex)

03: The Function Code (read Analog Output Holding Registers)

006B: The Data Address of the first register requested. (40108-40001 = 107 = 6B hex)

0003: The total number of registers requested. (read 3 registers 40108 to 40110)

7687: The CRC (cyclic redundancy check) for error checking.

Removing the SlaveID and CRC gives the PDU:

```
03 006B 0003
```

MBAP Header

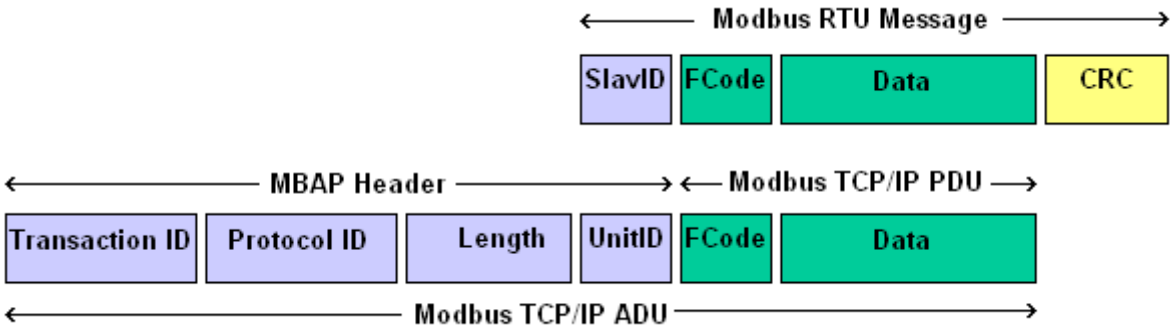
A new 7-byte header called the MBAP header (Modbus Application Header) is added to the start of the message. This header has the following data:

Transaction Identifier: 2 bytes set by the Client to uniquely identify each request. These bytes are echoed by the Server since its responses may not be received in the same order as the requests.

Protocol Identifier: 2 bytes set by the Client, always = 00 00

Length: 2 bytes identifying the number of bytes in the message to follow.

Unit Identifier: 1 byte set by the Client and echoed by the Server for identification of a remote slave connected on a serial line or on other buses.



Summary

The equivalent request to this Modbus RTU example

```
11 03 006B 0003 7687
```

in Modbus TCP is:

```
0001 0000 0006 11 03 006B 0003
```

0001: Transaction Identifier

0000: Protocol Identifier

0006: Message Length (6 bytes to follow)

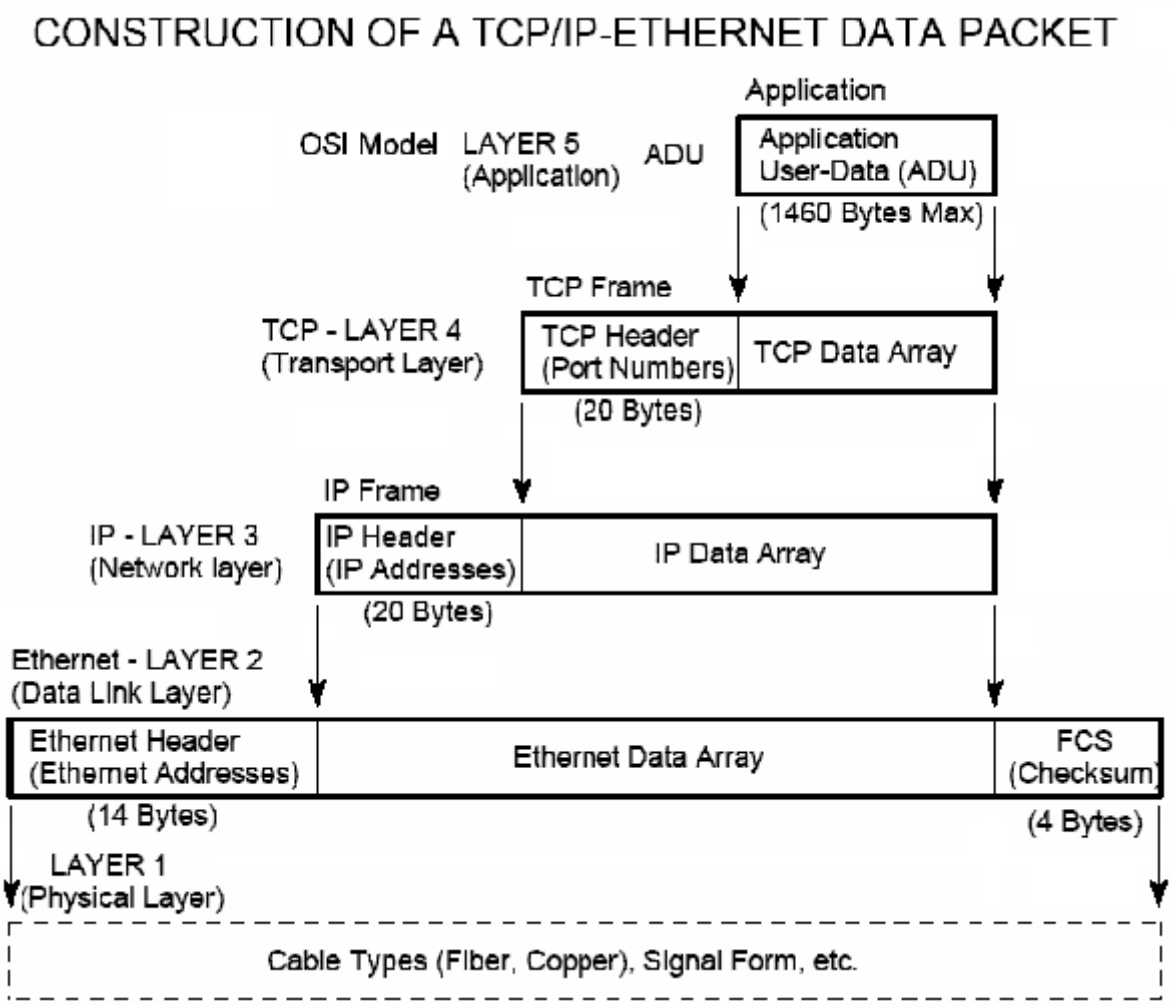
11: The Unit Identifier (17 = 11 hex)

03: The Function Code (read Analog Output Holding Registers)

006B: The Data Address of the first register requested. (40108-40001 = 107 =6B hex)

0003: The total number of registers requested. (read 3 registers 40108 to 40110)

TCP/IP Wrapper



IP address and PORT

To connect to TCP/IP IoTMeter server is needed to know the IP address of the IoTMeter. Two options are possible:

1. First connect to the Access Point of the IoTMeter device and next is possible to READ/WRITE data from/to IoTMeter. The IP address of this option is **192.168.4.1** and port is **8123**
2. After successful connection to local WiFi, find address of the IoTMeter throw mobile app. Found IP address can be used for modbus TCP address and port is **8123**

ID

Three possible options of ID:

1. ID in interval <1-99> is reserved for **EVSE**
2. ID in interval <100> is reserved for **WATTMETER**
3. ID in interval <101> is reserved for **IoTMeter**

FCE

The IotmEter supports two FCE:

1. Read holding registers (FC=03)
2. Preset multiple registers (FC=16)

REGISTERS

Refer to modbus registers

MODBUS TCP TOOLS EXAMPLE

Qmodbus, qModMaster

MODBUS R/W Registers

ESP registers

register numbers	Name	R/W	Data type	Unit	range	description
1000	Reset	W	uint16	True/False	0 ~ 1	Machine reset
1001	Update	R/W	uint16	True/False	0 ~ 1	1-Automatic update if available
1002	Version	R	uint16	-	0 ~ 65535	Actual SW version
1003	Charging	R/W	uint16	True/False	0 ~ 1	1-Enable charging, 2-Disable charging
1004	Break	R/W	uint16	A	0 ~ 65535	Max. break current for balancing algorithm
1005	Evse		uint16	A	0 ~ 65535	EVSE charging current
1006	Time		uint16	-	0 ~ 24	
1007	Number		uint16	-	0 ~ 99	Set number of EVSE
1008	Balancing		uint16	True/False	0 ~ 1	1-Enable Balancing
1009	HDO		uint16	True/False	0 ~ 1	1-Enable charging when HDO is active
1010	TST		uint16	True/False	0 ~ 1	1-Update IotmEter with actual testing SW version
1011	ID		uint16	-	0 ~ 65535	ID of IotmEter

Wattmeter registers

The bytes are coded in memory in Little Endian format. The lowest numbered byte in a word is considered the word's least significant byte and the highest numbered byte the most significant.

supported MODBUS TCP functions: CODE 0x03 - Read Holding Registers, CODE 0x10 Write Multiple Holding Registers

SLAVE ID: 100

*to get base unit as described in "unit" colum you have to divide read value with multiplier. example of register no. 1002 (I3): for read int16 value -1500 will be base unit value -1,5A

registers numbers	registers description
1000 ~ 1024	INSTANT VALUES 1 sec average periode updated every 1sec
2001 ~ 2021	logged values for previous 10s period updated every 10 sec
2201 ~ 2221	values for actual 10s period updated every 1 sec
2301 ~ 2321	logged values for previous 1 minute period updated every 1 minute
2501 ~ 2521	values for actual 1 minute period updated every 1 sec
2601 ~ 2621	logged values for previous 1 hour period updated every 1 hour always at 01:00, 02:00, 03:00,.. hours
2801 ~ 2821	values for actual 1 hour period updated every 1 sec, automatically cleared always at 01:00, 02:00, 03:00,.. hours
2901 ~ 2921	logged values for previous 1 day period updated every 1 day alway in midnight 00:00 hours
3101 ~ 3121	values for actual 1 day period updated every 1 sec, automatically cleared always in midnight 00:00 hours
3201 ~ 3221	values erasable by the user using the mobile app or via user 3party control system. values is cleared automatically at midnight
4000 ~ 4011	TOTAL LIFETIME ENERGY

INSTANT VALUES 1 sec average periode updated every 1sec

register numbers	name	Read / Write	data type	unit	*multi plier	range	description
1000	I1	R	int16	A	1000	-32768 ~ +32767	current RMS value of phase L1
1001	I2	R	int16	A	1000	-32768 ~ +32767	current RMS value of phase L2

1002	I3	R	int16	A	1000	-32768 ~ +32767	current RMS value of phase L3
1003	U1	R	int16	V	1	0 ~ 65535	voltage RMS value of phase L1
1004	U2	R	uint16	V	1	0 ~ 65535	voltage RMS value of phase L2
1005	U3	R	uint16	V	1	0 ~ 65535	voltage RMS value of phase L3
1006	P1	R	uint16	W	1	-32768 ~ +32767	active power of phase L1
1007	P2	R	int16	W	1	-32768 ~ +32767	active power of phase L2
1008	P3	R	int16	W	1	-32768 ~ +32767	active power of phase L3
1009	S1	R	int16	VA	1	-32768 ~ +32767	apparent power of phase L1
1010	S2	R	int16	VA	1	-32768 ~ +32767	apparent power of phase L2
1011	S3	R	int16	VA	1	-32768 ~ +32767	apparent power of phase L3
1015	PF1	R	uint16	-	100	0 ~ 100	power factor of phase L1
1016	PF2	R	uint16	-	100	0 ~ 100	power factor of phase L2
1017	PF3	R	uint16	-	100	0 ~ 100	power factor of phase L3
1018	PF_avg	R	uint16	-	100	0 ~ 100	power factor of phase average of phases L1, L2, L3
1019~1020	P_sum	R	int16	W	0.1	-32768 ~ +32767	active power summary of phases L1, L2, L3
1021~1022	S_sum	R	int16	VA	0.1	-32768 ~ +32767	apparent power summary of phases L1, L2, L3

logged values for previous 10s period updated every 10 sec

register numbers	name	Read / Write	data type	unit	*multiplier	range	description
2001	E1_P	R	uint16	Wh	10	0 ~ 65535	active energy positive (consumed) of phase L1

2002	E2_P	R	uint16	Wh	10	0 ~ 65535	active energy positive (consumed) of phase L2
2003	E3_P	R	uint16	Wh	10	0 ~ 65535	active energy positive (consumed) of phase L3
2004	E1_N	R	uint16	Wh	10	0 ~ 65535	active energy negative (feeded to grid) of phase L1
2005	E2_N	R	uint16	Wh	10	0 ~ 65535	active energy negative (feeded to grid) of phase L2
2006	E3_N	R	uint16	Wh	10	0 ~ 65535	active energy negative (feeded to grid) of phase L3
2007	P1_peak_P	R	uint16	W	1	0 ~ 65535	active power positive (consumed) maximum averaged value for 1 sec periode of phase L1
2008	P2_peak_P	R	uint16	W	1	0 ~ 65535	active power positive (consumed) maximum averaged value for 1 sec periode of phase L2
2009	P3_peak_P	R	uint16	W	1	0 ~ 65535	active power positive (consumed) maximum averaged value for 1 sec periode of phase L3
2010	P1_peak_N	R	uint16	W	1	0 ~ 65535	active power negative (feeded to grid) maximum averaged value for 1 sec periode of phase L1
2011	P2_peak_N	R	uint16	W	1	0 ~ 65535	active power negative (feeded to grid) maximum averaged value for 1 sec periode of phase L2
2012	P3_peak_N	R	uint16	W	1	0 ~ 65535	active power negative (feeded to grid) maximum averaged value for 1 sec periode of phase L3
2013	U_peak	R	uint16	V	1	0 ~ 65535	voltage maximum averaged value for 1 sec periode of phase L1, L2 or L3
2020	E_P_sum	R	uint16	Wh	10	0 ~ 65535	active energy positive (consumed) summary of phases L1, L2, L3
2021	E_N_sum	R	uint16	Wh	10	0 ~ 65535	active energy negative (feeded to grid) summary of phases L1, L2, L3

values for actual 10s period updated every 1 sec

register numbers	name	Read / Write	data type	unit	*multi plier	range	description
2201	E1_P	R	uint16	Wh	10	0 ~ 65535	active energy positive (consumed) of phase L1
2202	E2_P	R	uint16	Wh	10	0 ~ 65535	active energy positive (consumed) of phase L2
2203	E3_P	R	uint16	Wh	10	0 ~ 65535	active energy positive (consumed) of phase L3
2204	E1_N	R	uint16	Wh	10	0 ~ 65535	active energy negative (feeded to grid) of phase L1
2205	E2_N	R	uint16	Wh	10	0 ~ 65535	active energy negative (feeded to grid) of phase L2

2206	E3_N	R	uint16	Wh	10	0 ~ 65535	active energy negative (feeded to grid) of phase L3
2207	P1_peak_P	R	uint16	W	1	0 ~ 65535	active power positive (consumed) maximum averaged value for 1 sec periode of phase L1
2208	P2_peak_P	R	uint16	W	1	0 ~ 65535	active power positive (consumed) maximum averaged value for 1 sec periode of phase L2
2209	P3_peak_P	R	uint16	W	1	0 ~ 65535	active power positive (consumed) maximum averaged value for 1 sec periode of phase L3
2210	P1_peak_N	R	uint16	W	1	0 ~ 65535	active power negative (feeded to grid) maximum averaged value for 1 sec periode of phase L1
2211	P2_peak_N	R	uint16	W	1	0 ~ 65535	active power negative (feeded to grid) maximum averaged value for 1 sec periode of phase L2
2212	P3_peak_N	R	uint16	W	1	0 ~ 65535	active power negative (feeded to grid) maximum averaged value for 1 sec periode of phase L3
2213	U_peak	R	uint16	V	1	0 ~ 65535	voltage maximum averaged value for 1 sec periode of phase L1, L2 or L3
2220	E_P_sum	R	uint16	Wh	10	0 ~ 65535	active energy positive (consumed) summary of phases L1, L2, L3
2221	E_N_sum	R	uint16	Wh	10	0 ~ 65535	active energy negative (feeded to grid) summary of phases L1, L2, L3

logged values for previous 1 minute period updated every 1 minute

register numbers	name	Read / Write	data type	unit	*multiplier	range	description
2301	E1_P	R	uint16	Wh	10	0 ~ 65535	active energy positive (consumed) of phase L1
2302	E2_P	R	uint16	Wh	10	0 ~ 65535	active energy positive (consumed) of phase L2
2303	E3_P	R	uint16	Wh	10	0 ~ 65535	active energy positive (consumed) of phase L3
2304	E1_N	R	uint16	Wh	10	0 ~ 65535	active energy negative (feeded to grid) of phase L1
2305	E2_N	R	uint16	Wh	10	0 ~ 65535	active energy negative (feeded to grid) of phase L2
2306	E3_N	R	uint16	Wh	10	0 ~ 65535	active energy negative (feeded to grid) of phase L3
2307	P1_peak_P	R	uint16	W	1	0 ~ 65535	active power positive (consumed) maximum averaged value for 1 sec periode of phase L1
2308	P2_peak_P	R	uint16	W	1	0 ~ 65535	active power positive (consumed) maximum averaged value for 1 sec periode of phase L2
2309	P3_peak_P	R	uint16	W	1	0 ~ 65535	active power positive (consumed) maximum averaged value for 1 sec periode of phase L3

2310	P1_peak_N	R	uint16	W	1	0 ~ 65535	active power negative (feeded to grid) maximum averaged value for 1 sec periode of phase L1
2311	P2_peak_N	R	uint16	W	1	0 ~ 65535	active power negative (feeded to grid) maximum averaged value for 1 sec periode of phase L2
2312	P3_peak_N	R	uint16	W	1	0 ~ 65535	active power negative (feeded to grid) maximum averaged value for 1 sec periode of phase L3
2313	U_peak	R	uint16	V	1	0 ~ 65535	voltage maximum averaged value for 1 sec periode of phase L1, L2 or L3
2320	E_P_sum	R	uint16	Wh	10	0 ~ 65535	active energy positive (consumed) summary of phases L1, L2, L3
2321	E_N_sum	R	uint16	Wh	10	0 ~ 65535	active energy negative (feeded to grid) summary of phases L1, L2, L3

values for actual 1 minute period updated every 1 sec

register numbers	name	Read / Write	data type	unit	*multi plier	range	description
2501	E1_P	R	uint16	Wh	10	0 ~ 65535	active energy positive (consumed) of phase L1
2502	E2_P	R	uint16	Wh	10	0 ~ 65535	active energy positive (consumed) of phase L2
2503	E3_P	R	uint16	Wh	10	0 ~ 65535	active energy positive (consumed) of phase L3
2504	E1_N	R	uint16	Wh	10	0 ~ 65535	active energy negative (feeded to grid) of phase L1
2505	E2_N	R	uint16	Wh	10	0 ~ 65535	active energy negative (feeded to grid) of phase L2
2506	E3_N	R	uint16	Wh	10	0 ~ 65535	active energy negative (feeded to grid) of phase L3
2507	P1_peak_P	R	uint16	W	1	0 ~ 65535	active power positive (consumed) maximum averaged value for 1 sec periode of phase L1
2508	P2_peak_P	R	uint16	W	1	0 ~ 65535	active power positive (consumed) maximum averaged value for 1 sec periode of phase L2
2509	P3_peak_P	R	uint16	W	1	0 ~ 65535	active power positive (consumed) maximum averaged value for 1 sec periode of phase L3
2510	P1_peak_N	R	uint16	W	1	0 ~ 65535	active power negative (feeded to grid) maximum averaged value for 1 sec periode of phase L1
2511	P2_peak_N	R	uint16	W	1	0 ~ 65535	active power negative (feeded to grid) maximum averaged value for 1 sec periode of phase L2
2512	P3_peak_N	R	uint16	W	1	0 ~ 65535	active power negative (feeded to grid) maximum averaged value for 1 sec periode of phase L3
2513	U_peak	R	uint16	V	1	0 ~ 65535	voltage maximum averaged value for 1 sec periode of phase L1, L2 or L3

2520	E_P_sum	R	uint16	Wh	10	0 ~ 65535	active energy positive (consumed) summary of phases L1, L2, L3
2521	E_N_sum	R	uint16	Wh	10	0 ~ 65535	active energy negative (feeded to grid) summary of phases L1, L2, L3

logged values for previous 1 hour period updated every 1 hour always at 01:00, 02:00, 03:00,.. hours

register numbers	name	Read / Write	data type	unit	*multi plier	range	description
2601	E1_P	R	uint16	Wh	1	0 ~ 65535	active energy positive (consumed) of phase L1
2602	E2_P	R	uint16	Wh	1	0 ~ 65535	active energy positive (consumed) of phase L2
2603	E3_P	R	uint16	Wh	1	0 ~ 65535	active energy positive (consumed) of phase L3
2604	E1_N	R	uint16	Wh	1	0 ~ 65535	active energy negative (feeded to grid) of phase L1
2605	E2_N	R	uint16	Wh	1	0 ~ 65535	active energy negative (feeded to grid) of phase L2
2606	E3_N	R	uint16	Wh	1	0 ~ 65535	active energy negative (feeded to grid) of phase L3
2607	P1_peak_P	R	uint16	W	1	0 ~ 65535	active power positive (consumed) maximum averaged value for 1 sec periode of phase L1
2608	P2_peak_P	R	uint16	W	1	0 ~ 65535	active power positive (consumed) maximum averaged value for 1 sec periode of phase L2
2609	P3_peak_P	R	uint16	W	1	0 ~ 65535	active power positive (consumed) maximum averaged value for 1 sec periode of phase L3
2610	P1_peak_N	R	uint16	W	1	0 ~ 65535	active power negative (feeded to grid) maximum averaged value for 1 sec periode of phase L1
2611	P2_peak_N	R	uint16	W	1	0 ~ 65535	active power negative (feeded to grid) maximum averaged value for 1 sec periode of phase L2
2612	P3_peak_N	R	uint16	W	1	0 ~ 65535	active power negative (feeded to grid) maximum averaged value for 1 sec periode of phase L3
2613	U_peak	R	uint16	V	1	0 ~ 65535	voltage maximum averaged value for 1 sec periode of phase L1, L2 or L3
2620	E_P_sum	R	uint16	Wh	1	0 ~ 65535	active energy positive (consumed) summary of phases L1, L2, L3
2621	E_N_sum	R	uint16	Wh	1	0 ~ 65535	active energy negative (feeded to grid) summary of phases L1, L2, L3

values for actual 1 hour period updated every 1 sec, automatically cleared always at 01:00, 02:00, 03:00,.. hours

register numbers	name	Read / Write	data type	unit	*multi plier	range	description

2801	E1_P	R	uint16	Wh	1	0 ~ 65535	active energy positive (consumed) of phase L1
2802	E2_P	R	uint16	Wh	1	0 ~ 65535	active energy positive (consumed) of phase L2
2803	E3_P	R	uint16	Wh	1	0 ~ 65535	active energy positive (consumed) of phase L3
2804	E1_N	R	uint16	Wh	1	0 ~ 65535	active energy negative (feeded to grid) of phase L1
2805	E2_N	R	uint16	Wh	1	0 ~ 65535	active energy negative (feeded to grid) of phase L2
2806	E3_N	R	uint16	Wh	1	0 ~ 65535	active energy negative (feeded to grid) of phase L3
2807	P1_peak_P	R	uint16	W	1	0 ~ 65535	active power positive (consumed) maximum averaged value for 1 sec periode of phase L1
2808	P2_peak_P	R	uint16	W	1	0 ~ 65535	active power positive (consumed) maximum averaged value for 1 sec periode of phase L2
2809	P3_peak_P	R	uint16	W	1	0 ~ 65535	active power positive (consumed) maximum averaged value for 1 sec periode of phase L3
2810	P1_peak_N	R	uint16	W	1	0 ~ 65535	active power negative (feeded to grid) maximum averaged value for 1 sec periode of phase L1
2811	P2_peak_N	R	uint16	W	1	0 ~ 65535	active power negative (feeded to grid) maximum averaged value for 1 sec periode of phase L2
2812	P3_peak_N	R	uint16	W	1	0 ~ 65535	active power negative (feeded to grid) maximum averaged value for 1 sec periode of phase L3
2813	U_peak	R	uint16	V	1	0 ~ 65535	voltage maximum averaged value for 1 sec periode of phase L1, L2 or L3
2820	E_P_sum	R	uint16	Wh	1	0 ~ 65535	active energy positive (consumed) summary of phases L1, L2, L3
2821	E_N_sum	R	uint16	Wh	1	0 ~ 65535	active energy negative (feeded to grid) summary of phases L1, L2, L3

logged values for previous 1 day period updated every 1 day alway in midnight 00:00 hours

register numbers	name	Read / Write	data type	unit	*multi plier	range	description
2901	E1_P	R	uint16	Wh	0.1	0 ~ 65535	active energy positive (consumed) of phase L1
2902	E2_P	R	uint16	Wh	0.1	0 ~ 65535	active energy positive (consumed) of phase L2
2903	E3_P	R	uint16	Wh	0.1	0 ~ 65535	active energy positive (consumed) of phase L3
2904	E1_N	R	uint16	Wh	0.1	0 ~ 65535	active energy negative (feeded to grid) of phase L1

2905	E2_N	R	uint16	Wh	0.1	0 ~ 65535	active energy negative (feeded to grid) of phase L2
2906	E3_N	R	uint16	Wh	0.1	0 ~ 65535	active energy negative (feeded to grid) of phase L3
2907	P1_peak_P	R	uint16	W	1	0 ~ 65535	active power positive (consumed) maximum averaged value for 1 sec periode of phase L1
2908	P2_peak_P	R	uint16	W	1	0 ~ 65535	active power positive (consumed) maximum averaged value for 1 sec periode of phase L2
2909	P3_peak_P	R	uint16	W	1	0 ~ 65535	active power positive (consumed) maximum averaged value for 1 sec periode of phase L3
2910	P1_peak_N	R	uint16	W	1	0 ~ 65535	active power negative (feeded to grid) maximum averaged value for 1 sec periode of phase L1
2911	P2_peak_N	R	uint16	W	1	0 ~ 65535	active power negative (feeded to grid) maximum averaged value for 1 sec periode of phase L2
2912	P3_peak_N	R	uint16	W	1	0 ~ 65535	active power negative (feeded to grid) maximum averaged value for 1 sec periode of phase L3
2913	U_peak	R	uint16	V	1	0 ~ 65535	voltage maximum averaged value for 1 sec periode of phase L1, L2 or L3
2920	E_P_sum	R	uint16	Wh	0.1	0 ~ 65535	active energy positive (consumed) summary of phases L1, L2, L3
2921	E_N_sum	R	uint16	Wh	0.1	0 ~ 65535	active energy negative (feeded to grid) summary of phases L1, L2, L3

values for actual 1 day period updated every 1 sec, automatically cleared always in midnight 00:00 hours

register numbers	name	Read / Write	data type	unit	*multi plier	range	description
3101	E1_P	R	uint16	Wh	0.1	0 ~ 65535	active energy positive (consumed) of phase L1
3102	E2_P	R	uint16	Wh	0.1	0 ~ 65535	active energy positive (consumed) of phase L2
3103	E3_P	R	uint16	Wh	0.1	0 ~ 65535	active energy positive (consumed) of phase L3
3104	E1_N	R	uint16	Wh	0.1	0 ~ 65535	active energy negative (feeded to grid) of phase L1
3105	E2_N	R	uint16	Wh	0.1	0 ~ 65535	active energy negative (feeded to grid) of phase L2
3106	E3_N	R	uint16	Wh	0.1	0 ~ 65535	active energy negative (feeded to grid) of phase L3
3107	P1_peak_P	R	uint16	W	1	0 ~ 65535	active power positive (consumed) maximum averaged value for 1 sec periode of phase L1
3108	P2_peak_P	R	uint16	W	1	0 ~ 65535	active power positive (consumed) maximum averaged value for 1 sec periode of phase L2

3109	P3_peak_P	R	uint16	W	1	0 ~ 65535	active power positive (consumed) maximum averaged value for 1 sec periode of phase L3
3110	P1_peak_N	R	uint16	W	1	0 ~ 65535	active power negative (feeded to grid) maximum averaged value for 1 sec periode of phase L1
3111	P2_peak_N	R	uint16	W	1	0 ~ 65535	active power negative (feeded to grid) maximum averaged value for 1 sec periode of phase L2
3112	P3_peak_N	R	uint16	W	1	0 ~ 65535	active power negative (feeded to grid) maximum averaged value for 1 sec periode of phase L3
3113	U_peak	R	uint16	V	1	0 ~ 65535	voltage maximum averaged value for 1 sec periode of phase L1, L2 or L3
3120	E_P_sum	R	uint16	Wh	0.1	0 ~ 65535	active energy positive (consumed) summary of phases L1, L2, L3
3121	E_N_sum	R	uint16	Wh	0.1	0 ~ 65535	active energy negative (feeded to grid) summary of phases L1, L2, L3

values erasable by the user using the mobile app or vy user 3party control system. values is cleared automatically in midnight

register numbers	name	Read / Write	data type	unit	*multi plier	range	description
3201	E1_P	R/W	uint16	Wh	0.1	0 ~ 65535	active energy positive (consumed) of phase L1
3202	E2_P	R/W	uint16	Wh	0.1	0 ~ 65535	active energy positive (consumed) of phase L2
3203	E3_P	R/W	uint16	Wh	0.1	0 ~ 65535	active energy positive (consumed) of phase L3
3204	E1_N	R/W	uint16	Wh	0.1	0 ~ 65535	active energy negative (feeded to grid) of phase L1
3205	E2_N	R/W	uint16	Wh	0.1	0 ~ 65535	active energy negative (feeded to grid) of phase L2
3206	E3_N	R/W	uint16	Wh	0.1	0 ~ 65535	active energy negative (feeded to grid) of phase L3
3207	P1_peak_P	R/W	uint16	W	1	0 ~ 65535	active power positive (consumed) maximum averaged value for 1 sec periode of phase L1
3208	P2_peak_P	R/W	uint16	W	1	0 ~ 65535	active power positive (consumed) maximum averaged value for 1 sec periode of phase L2
3209	P3_peak_P	R/W	uint16	W	1	0 ~ 65535	active power positive (consumed) maximum averaged value for 1 sec periode of phase L3
3210	P1_peak_N	R/W	uint16	W	1	0 ~ 65535	active power negative (feeded to grid) maximum averaged value for 1 sec periode of phase L1
3211	P2_peak_N	R/W	uint16	W	1	0 ~ 65535	active power negative (feeded to grid) maximum averaged value for 1 sec periode of phase L2
3212	P3_peak_N	R/W	uint16	W	1	0 ~ 65535	active power negative (feeded to grid) maximum averaged value for 1 sec periode of phase L3

3213	U_peak	R/W	uint16	V	1	0 ~ 65535	voltage maximum averaged value for 1 sec periode of phase L1, L2 or L3
3220	E_P_sum	R/W	uint16	Wh	0.1	0 ~ 65535	active energy positive (consumed) summary of phases L1, L2, L3
3221	E_N_sum	R/W	uint16	Wh	0.1	0 ~ 65535	active energy negative (feeded to grid) summary of phases L1, L2, L3

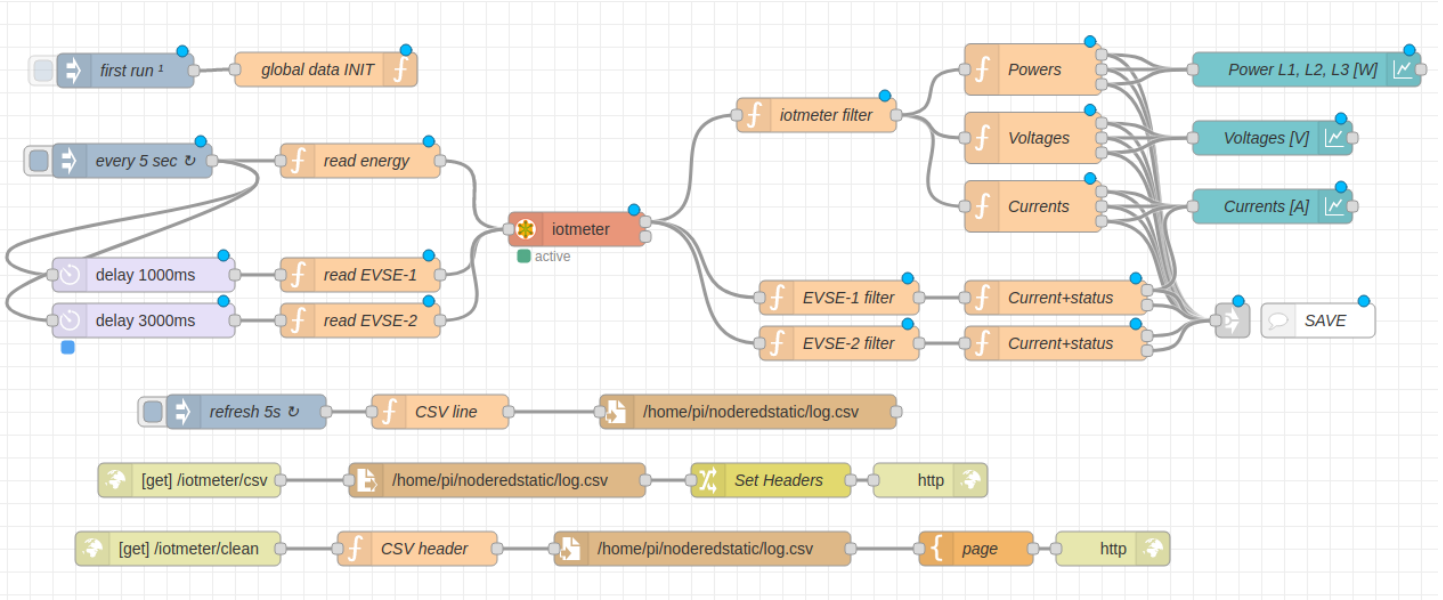
TOTAL LIFETIME ENERGY

register numbers	name	Read / Write	data type	unit	*multi plier	range	description
4000 ~ 4001	E1_P	R	uint32	Wh	0.1	0 ~ 4294967295	active energy positive (consumed) of phase L1
4002 ~ 4003	E2_P	R	uint32	Wh	0.1	0 ~ 4294967295	active energy positive (consumed) of phase L2
4004 ~ 4005	E3_P	R	uint32	Wh	0.1	0 ~ 4294967295	active energy positive (consumed) of phase L3
4006 ~ 4007	E1_N	R	uint32	Wh	0.1	0 ~ 4294967295	active energy negative (feeded to grid) of phase L1
4008 ~ 4009	E2_N	R	uint32	Wh	0.1	0 ~ 4294967295	active energy negative (feeded to grid) of phase L2
4010 ~ 4011	E3_N	R	uint32	Wh	0.1	0 ~ 4294967295	active energy negative (feeded to grid) of phase L3

Node-RED programming examples

Monitoring grid power and two EVSEs (2 EV charging)

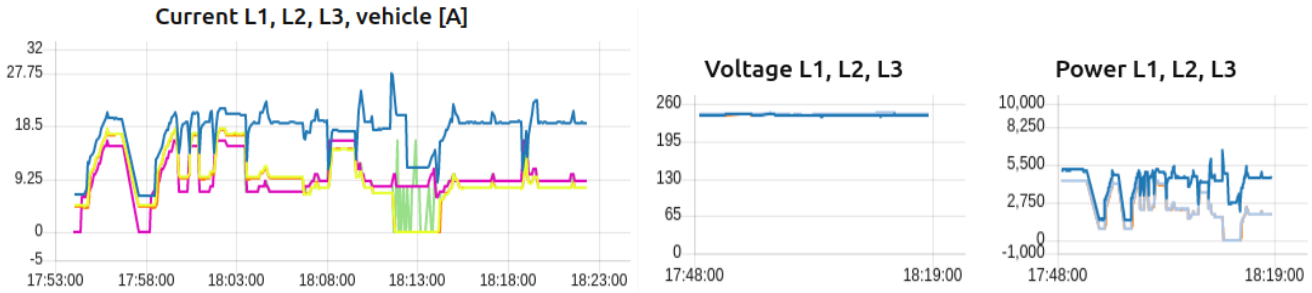
Read wattmeter data, read two EVSEs, plot online charts, save CSV data in file



Modules used:

- Modbus-Flex-Getter (read IoTmeter & EVSE data)
- HTTP in, HTTP response (download csv file)
- File in (csv)
- Dashboard (online charts)

How it works?
Node-RED periodically reads data from IoTmeter over Modbus TCP - first energy data from wattmeter (phase voltages, currents, powers). Then we request data from each EVSE (current, vehicle status). There is a bigger delay between those requests because each time we request such a data, then the IoTmeter is forwarding this request to each EVSE and we get the response. In noisy environments with weak wifi signal this can take up to a few seconds to get the response data back. Everything else - plotting charts and saving data should be self-explanatory and every customer will have his own idea how to process the data



Node-RED flow data:

[{"id":"64b161e0.e99e4","type":"function","z":"5b99f052.1c6f5","name":"read energy","func":"msg.payload = { \n   value: msg.payload, \n   'fc': 3, \n   'unitid': 100, \n   'address': 1000 , \n   'quantity': 9 };\nreturn msg;\n","outputs":1,"noerr":0,"initialize":"","finalize":"","x":450,"y":320,"wires":[["b721d50f.f4ba88"]]},{"id":"9ccc557c.c0eef8","type":"inject","z":"5b99f052.1c6f5","name":"every 5 sec","props":[{"p":"payload"}],"repeat":"5","crontab":"","once":false,"onceDelay":0.1,"topic":"","payload":"","payloadType":"date","x":250,"y":320,"wires":[["ae04a2ce.1b993","64b161e0.e99e4","150fca0b.0e0946"]]},{"id":"b721d50f.f4ba88","type":"modbus-flex-getter","z":"5b99f052.1c6f5","name":"iotmeter","showStatusActivities":true,"showErrors":true,"logIOActivities":false,"server":"1880e40e.2a250c","useIOFile":false,"ioFile":"","useIOForPayload":false,"emptyMsgOnFail":true,"keepMsgProperties":true,"x":640,"y":380,"wires":[["4aed48b1.f353f8","e55bbd32.dc8e3","3b2a63bf.f476ac"],[]]},{"id":"d2e834b9.91de48","type":"function","z":"5b99f052.1c6f5","name":"CSV line","func":"\nvar data = global.get('data');\n\n\nvar line = \"\";\nline += new Date().toISOString().replace(/T/, ' ').replace(/\\..+/, '') +\",\";\nline += data.elektromer.L1W +\",\"+data.elektromer.L2W+\",\"+data.elektromer.L3W+\",\";\nline += data.elektromer.L1A +\",\"+data.elektromer.L2A+\",\"+data.elektromer.L3A+\",\";\nline += data.elektromer.L1V +\",\"+data.elektromer.L2V+\",\"+data.elektromer.L3V+\",\";\nline += data.venus14.l1+\",\"+data.venus14.inv+\",\"+data.venus14.soc+\",\";\nline += data.elektromer.evse1A +\",\"+data.elektromer.evse1status+\",\";\nline += data.elektromer.evse2A +\",\"+data.elektromer.evse2status+\",\";\n\n\nmsg.payload = line;\nreturn msg;","outputs":1,"noerr":0,"initialize":"","finalize":"","x":520,"y":540,"wires":[["8ade6dac.7054f"]]},{"id":"838cc173.693aa","type":"function","z":"5b99f052.1c6f5","name":"Powers","func":"\nvar msg1 = {};\nvar msg2 = {};\nvar msg3 = {};\n\nnmsg1.payload = msg.payload[6];\nmsg1.topic = \"elektromer.L1W\";\n\nnmsg2.payload = msg.payload[7];\nmsg2.topic = \"elektromer.L2W\";\n\n\nnmsg3.payload = msg.payload[8];\nmsg3.topic = \"elektromer.L3W\";\n\n\nreturn [msg1, msg2, msg3];","outputs":3,"noerr":0,"initialize":"","finalize":"","x":1040,"y":240,"wires":[["12146228.fd047e","98db6010.9ff75"],["12146228.fd047e","98db6010.9ff75"],["12146228.fd047e","98db6010.9ff75"]]},{"id":"a97ff2c.c29af1","type":"function","z":"5b99f052.1c6f5","name":"Voltages","func":"\nvar msg1 = {};\nvar msg2 = {};\nvar msg3 = {};\n\nnmsg1.payload = msg.payload[3];\nmsg1.topic = \"elektromer.L1V\";\n\nnmsg2.payload = msg.payload[4];\nmsg2.topic = \"elektromer.L2V\";\n\n\nnmsg3.payload = msg.payload[5];\nmsg3.topic = \"elektromer.L3V\";\n\n\nreturn [msg1, msg2, msg3];","outputs":3,"noerr":0,"initialize":"","finalize":"","x":1040,"y":300,"wires":[["a183bdff.6ac69","98db6010.9ff75"],["a183bdff.6ac69","98db6010.9ff75"],["a183bdff.6ac69","98db6010.9ff75"]]},{"id":"494213f.b1a39ec","type":"function","z":"5b99f052.1c6f5","name":"Currents","func":"\nvar msg1 = {};\nvar msg2 = {};\nvar msg3 = {};\n\nnmsg1.payload = msg.payload[0]/100;\nmsg1.topic = \"elektromer.L1A\";\n\nnmsg2.payload = msg.payload[1]/100;\nmsg2.topic = \"elektromer.L2A\";\n\n\nnmsg3.payload = msg.payload[2]/100;\nmsg3.topic = \"elektromer.L3A\";\n\n\nreturn [msg1, msg2, msg3];","outputs":3,"noerr":0,"initialize":"","finalize":"","x":1040,"y":360,"wires":[["5851d618.d55428","98db6010.9ff75"],["5851d618.d55428","98db6010.9ff75"],["5851d618.d55428","98db6010.9ff75"]]},{"id":"a183bdff.6ac69","type":"ui_chart","z":"5b99f052.1c6f5","name":"Voltages [V]","group":"57f5ec66.b67754","order":2,"width":5,"height":4,"label":"Voltage L1, L2, L3","chartType":"line","legend":"false","xformat":"HH:mm:ss","interpolate":"linear","nodata":"","dot":false,"ymin":"0","ymax":"260","removeOlder":"30","removeOlderPoints":"","removeOlderUnit":"60","cutout":0,"useOneColor":false,"useUTC":false,"colors":["#1f77b4","#aec7e8","#ff7f0e","#2ca02c","#98df8a","#d91d1e","#ff9896","#9467bd","#c5b0d5"],"useOldStyle":false,"outputs":1,"x":1250,"y":300,"wires":[[]]},{"id":"5851d618.d55428","type":"ui_chart","z":"5b99f052.1c6f5","name":"Currents [A]","group":"57f5ec66.b67754","order":1,"width":10,"height":5,"label":"Current L1, L2, L3, vehicle [A]","chartType":"line","legend":"false","xformat":"HH:mm:ss","interpolate":"linear","nodata":"","dot":false,"ymin":"-5","ymax":"32","removeOlder":"30","removeOlderPoints":"","removeOlderUnit":"60","cutout":0,"useOneColor":false,"useUTC":false,"colors":["#1f77b4","#e7ff2e","#ff7f0e","#e00bbc","#98df8a","#da1b1b","#ff9896","#9467bd","#c5b0d5"],"useOldStyle":false,"outputs":1,"x":1270,"y":360,"wires":[[]]},{"id":"12146228.fd047e","type":"ui_chart","z":"5b99f052.1c6f5","name":"Power L1, L2, L3 [W]","group":"57f5ec66.b67754","order":3,"width":5,"height":4,"label":"Power L1, L2, L3","chartType":"line","legend":"false","xformat":"HH:mm:ss","interpolate":"linear","nodata":"","dot":false,"ymin":"-1000","ymax":"10000","removeOlder":"30","removeOlderPoints":"","removeOlderUnit":"60","cutout":0,"useOneColor":false,"useUTC":false,"colors":["#1f77b4","#aec7e8","#ff7f0e","#2ca02c","#98df8a","#d91d1e","#ff9896","#9467bd","#c5b0d5"],"useOldStyle":false,"outputs":1,"x":1280,"y":240,"wires":[[]]},{"id":"5ee15dee.49e4a4","type":"function","z":"5b99f052.1c6f5","name":"read EVSE-1","func":"msg.payload = { \n   value: msg.payload, \n   'fc': 3, \n   'unitid': 1, \n   'address': 1000 , \n   'quantity': 3 };\nreturn msg;\n","outputs":1,"noerr":0,"initialize":"","finalize":"","x":450,"y":420,"wires":[["b721d50f.f4ba88"]]},{"id":"4aed48b1.f353f8","type":"function","z":"5b99f052.1c6f5","name":"iotmeter filter","func":"\n\nif (msg.modbusRequest.hasOwnProperty('unitid')) {\n   if (msg.modbusRequest.unitid == 100) {\n   return msg;\n   }\n}\n\n","outputs":1,"noerr":0,"initialize":"","finalize":"","x":850,"y":280,"wires":[["494213f.b1a39ec","a97ff2c.c29af1","838cc173.693aa"]]},{"id":"e55bbd32.dc8e3","type":"function","z":"5b99f052.1c6f5","name":"EVSE-1 filter","func":"\n\nif (msg.modbusRequest.hasOwnProperty('unitid')) {\n   if (msg.modbusRequest.unitid == 1) {\n   return msg;\n   }\n}\n\n","outputs":1,"noerr":0,"initialize":"","finalize":"","x":870,"y":440,"wires":[["bacb4945.689e18"]]},{"id":"bacb4945.689e18","type":"function","z":"5b99f052.1c6f5","name":"Current+status","func":"var msg1 = {};\nvar msg2 = {};\n\nnmsg1.payload = msg.payload[0];\nmsg1.topic = \"elektromer.evse1A\";\n\nnmsg2.payload = msg.payload[2];\nmsg2.topic = \"elektromer.evse1status\";\n\nnreturn [msg1, msg2];","outputs":2,"noerr":0,"initialize":"","finalize":"","x":1060,"y":440,"wires":[["5851d618.d55428","98db6010.9ff75"],["98db6010.9ff75"]]},{"id":"ae04a2ce.1b993","type":"delay","z":"5b99f052.1c6f5","name":"","pauseType":"delay","timeout":"1000","timeoutUnits":"milliseconds","rate":"1","nbRateUnits":"1","rateUnits":"second","randomFirst":"1","randomLast":"5","randomUnits":"seconds","drop":false,"x":260,"y":420,"wires":[["5ee15dee.49e4a4"]]},{"id":"98db6010.9ff75","type":"link out","z":"5b99f052.1c6f5","name":"SAVE","links":["557bdfc3.eb625"],"x":1215,"y":460,"wires":[]},{"id":"da479f60.6d435","type":"comment","z":"5b99f052.1c6f5","name":"SAVE","info":"","x":1290,"y":460,"wires":[]},{"id":"a9f7b284.2b842","type":"http in","z":"5b99f052.1c6f5","name":"","url":"/iotmeter/csv","method":"get","upload":false,"swaggerDoc":"","x":300,"y":600,"wires":[["af99dec3.13df1"]]},{"id":"af99dec3.13df1","type":"file in","z":"5b99f052.1c6f5","name":"","filename":"/home/pi/noderedstatic/log.csv","format":"","x":570,"y":600,"wires":[["343b8265.779eee"]]},{"id":"343b8265.779eee","type":"change","z":"5b99f052.1c6f5","name":"Set Headers","rules":[{"t":"set","p":"headers","pt":"msg","to":"{}","tot":"json"},{"t":"set","p":"headers.content-type","pt":"msg","to":"text/csv","tot":"str"}],"action":"","property":"","from":"","to":"","reg":false,"x":810,"y":600,"wires":[["ef4e6ee9.e9b0b"]]},{"id":"ef4e6ee9.e9b0b","type":"http response","z":"5b99f052.1c6f5","name":"","x":950,"y":600,"wires":[]},{"id":"ca433f26.b1164","type":"inject","z":"5b99f052.1c6f5","name":"refresh 5s","props":[{"p":"payload"}],"repeat":"5","crontab":"","once":true,"onceDelay":"10","topic":"","payload":"$now()","payloadType":"jsonata","x":350,"y":540,"wires":[["d2e834b9.91de48"]]},{"id":"ccafe339.17104","type":"http in","z":"5b99f052.1c6f5","name":"","url":"/iotmeter/clean","method":"get","upload":false,"swaggerDoc":"","x":290,"y":660,"wires":[["ce499b73.0303f8"]]},{"id":"8ade6dac.7054f","type":"file","z":"5b99f052.1c6f5","name":"","filename":"/home/pi/noderedstatic/log.csv","appendNewline":true,"createDir":false,"overwriteFile":"false","encoding":"none","x":790,"y":540,"wires":[[]]},{"id":"cf8fe826.d2f278","type":"file","z":"5b99f052.1c6f5","name":"","filename":"/home/pi/noderedstatic/log.csv","appendNewline":true,"createDir":false,"overwriteFile":"true","encoding":"none","x":750,"y":660,"wires":[["c8b5bbd2.aa6808"]]},{"id":"ce499b73.0303f8","type":"function","z":"5b99f052.1c6f5","name":"CSV header","func":"//create CSV header\n\nvar header = \"\";\nheader   += \"time,\";\nheader   += \"L1 [W], L2 [W], L3 [W], \";\nheader += \"L1 [A], L2 [A], L3 [A], \";\nheader   += \"L1 [V], L2 [V], L3 [V], \";\nheader   += \"Victron grid [W], Victron output [W], Battery SOC [%], \";\nheader   += \"EVSE-1 [A], EVSE-1 status,\";\nheader   += \"EVSE-2 [A], EVSE-2 status,\";\n\nmsg.payload = header;\nreturn msg;","outputs":1,"noerr":0,"initialize":"","finalize":"","x":500,"y":660,"wires":[["cf8fe826.d2f278"]]},{"id":"d9346d6.328d59","type":"http response","z":"5b99f052.1c6f5","name":"","statusCode":"","headers":{},"x":1110,"y":660,"wires":[]},{"id":"c8b5bbd2.aa6808","type":"template","z":"5b99f052.1c6f5","name":"page","field":"payload","fieldType":"msg","format":"handlebars","syntax":"mustache","template":"<html>\n   <head></head>\n   <body>\n   <h1>OK file cleaned...</h1>\n   </body>\n</html>","x":990,"y":660,"wires":[["d9346d6.328d59"]]},{"id":"150fca0b.0e0946","type":"delay","z":"5b99f052.1c6f5","name":"","pauseType":"delay","timeout":"3000","timeoutUnits":"milliseconds","rate":"1","nbRateUnits":"1","rateUnits":"second","randomFirst":"1","randomLast":"5","randomUnits":"seconds","drop":false,"x":260,"y":460,"wires":[["4b67c2a3.862c6c"]]},{"id":"4b67c2a3.862c6c","type":"function","z":"5b99f052.1c6f5","name":"read EVSE-2","func":"msg.payload = { \n   value: msg.payload, \n   'fc': 3, \n   'unitid': 2, \n   'address': 1000 , \n   'quantity': 3 };\nreturn msg;\n","outputs":1,"noerr":0,"initialize":"","finalize":"","x":450,"y":460,"wires":[["b721d50f.f4ba88"]]},{"id":"3b2a63bf.f476ac","type":"function","z":"5b99f052.1c6f5","name":"EVSE-2 filter","func":"\n\nif (msg.modbusRequest.hasOwnProperty('unitid')) {\n   if (msg.modbusRequest.unitid == 2) {\n   return msg;\n   }\n}\n\n","outputs":1,"noerr":0,"initialize":"","finalize":"","x":870,"y":480,"wires":[["fc40b9.928e3f48"]]},{"id":"fc40b9.928e3f48","type":"function","z":"5b99f052.1c6f5","name":"Current+status","func":"var msg1 = {};\nvar msg2 = {};\n\nnmsg1.payload = msg.payload[0];\nmsg1.topic = \"elektromer.evse2A\";\n\nnmsg2.payload = msg.payload[2];\nmsg2.topic = \"elektromer.evse2status\";\n\nnreturn [msg1, msg2];","outputs":2,"noerr":0,"initialize":"","finalize":"","x":1060,"y":480,"wires":[["98db6010.9ff75","5851d618.d55428"],["98db6010.9ff75"]]},{"id":"803b8e5b.9af63","type":"function","z":"5b99f052.1c6f5","name":"global data INIT","func":"var data = global.get('data') || {};\n\n\ndata.elektromer = {};\n\n\nglobal.set('data',data);\n\n\nreturn null;\n","outputs":0,"noerr":0,"initialize":"","finalize":"","x":420,"y":240,"wires":[]},{"id":"83e4154a.c1c6a8","type":"inject","z":"5b99f052.1c6f5","name":"first run","props":[{"p":"payload","v":"","vt":"date"},{"p":"topic","v":"","vt":"string"}],"repeat":"","crontab":"","once":true,"onceDelay":"0.1","topic":"","payload":"","payloadType":"date","x":244,"y":241,"wires":[["803b8e5b.9af63"]]},{"id":"1880e40e.2a250c","type":"modbus-client","z":"","name":"iotmeter","clienttype":"tcp","bufferCommands":true,"stateLogEnabled":true,"queueLogEnabled":true,"tcpHost":"192.168.33.62","tcpPort":"8123","tcpType":"TPC-RTU-BUFFERED","serialPort":"/dev/ttyUSB","serialType":"RTU-BUFFERD","serialBaudrate":"9600","serialDatabits":"8","serialStopbits":"1","serialParity":"none","serialConnectionDelay":"100","unit_id":"100","commandDelay":"1","clientTimeout":"3000","reconnectOnTimeout":false,"reconnectTimeout":"5000","parallelUnitIdsAllowed":false},{"id":"57f5ec66.b67754","type":"ui_group","z":"","name":"Default","tab":"fb229376.49713","order":3,"disp":true,"width":10,"collapse":false},{"id":"fb229376.49713","type":"ui_tab","z":"","name":"Home","icon":"dashboard","disabled":false,"hidden":false}]

Enable & disable EVSE by button

This example demonstrates how to turn on and turn off EVSEs, which are connected to an IoTmeter via RS485. Server authorization can be made this way (pay to charge etc.)