ferroamp

Modbus TCP

2018-12-07
Revision B

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1 Revision History

Revision	Changes
PB1	• Modbus v.3.0
PA3	• Modbus v.2.0, Post-review
PA2	• Modbus v.2.0, Initial specification
PA1	• Modbus v.1.0

2 Introduction

Ferroamp EnergyHub supports the Modbus TCP standard. Once enabled, the interface is accessible on TCP port 502 on the EnergyHub's local IP-address.

Note regarding version of this document: As of today, Ferroamp's Modbus TCP implementation is in beta release state and compatibility between different versions of this document is not guaranteed. For changes between different versions, see the release notes in the bottom of this document.

3 Data formats

The **float** data type can be accessed in two ways. The first two addresses use the single precision (32-bit) floating point number as specified by IEEE 754 with the lower 16-bits at the lower address and the higher 16-bits at the following address. The two consecutive addresses use two signed 16-bit integers x, b such that the value represented is $x * 10^b$. For example, consider the grid voltage L1 located at Modbus number 32032, address 2031. At address 2031 and 2032 the data will be {f15,f14, ...,f0} and {f31,f30,...,f16} respectively, where fn is the n:th bit in the floating point representation. At 2033 and 32034 the data will be {x15,x14,...,x0} and {b15,b14,...,b0} respectively.

The **uint16_t** is a 16-bit unsigned integer and the **int16_t** is a signed integer represented in the binary two's-complement form.

4 Data addressing

In the tables below, the Modbus Number is logic number used in the Modbus standard, where 3xxxx and 4xxxx refers to an input register and a holding register, respectively. The address (specified within the parentheses) is the actual value sent in the Modbus ADU, which is always equal the number xxxx minus one.

5 Security Disclaimer

Modbus is an open protocol available for anyone to connect to without any authorization. To keep the system secure, access is restricted to the Ethernet interface and if further restrictions are needed these needs to be implemented in a firewall or similar.

6 Modbus Variables

6.1 General data

Parameter name	Object type	Modbus number (address)	Data type	Range	Notes
Modbus Major version	Input register	31005 (1004)	uint16_t	[0,65535]	Modbus major version in use
Modbus Minor version	Input register	31009 (1008)	uint16_t	[0,65535]	Modbus minor version in use

6.2 Energyhub Inverter Data

Parameter name	Object type	Modbus number (adress)	Data type	Range	Unit	Notes
Inverter Status	Input register	32001 (2000)	uint16_t	[0,65535]	enum	0 => unavailable, 1 =>idle, 2 => running, 3 => fault
Grid Frequency	Input register	32017 (2016)	float	[0, inf)	Hz	
Grid Voltage L1	Input register	32033 (2032)	float	[0, inf)	Vrms	
Grid Voltage L2	Input register	32037 (2036)	float	[0, inf)	Vrms	
Grid Voltage L3	Input register	32041 (2040)	float	[0, inf)	Vrms	
Grid Neutral Voltage	Input register	32045 (2044)	float	[0, inf)	Vrms	***Not implemented yet.***
Energy to DC-Nanogrid	Input register	32065 (2064)	float	[0, inf)	kWh	Incoming Energy from AC Grid to DC-Nanogrid
Energy from DC-Nanogrid	Input register	32069 (2068)	float	[0, inf)	kWh	Outgoing Energy from DC-Nanogrid to AC Grid
Inverter Active Power	Input register	32101 (2100)	float	(-inf, inf)	kW	Power based on inverter active currents
Inverter Reactive Power	Input register	32105 (2104)	float	(-inf, inf)	kVAr	Power based on inverter reactive currents
Inverter Apparent Power	Input register	32109 (2108)	float	[0, inf)	kVA	Power based on inverter RMS currents
Inverter Active Current L1	Input register	32113 (2112)	float	(-inf, inf)	Arms	Current measured using internal current sensors
Inverter Active Current L2	Input register	32117 (2116)	float	(-inf, inf)	Arms	Current measured using internal current sensors
Inverter Active Current L3	Input register	32121 (2120)	float	(-inf, inf)	Arms	Current measured using internal current sensors
Inverter Reactive Current L1	Input register	32125 (2124)	float	(-inf, inf)	Arms	Current measured using internal current sensors
Inverter Reactive Current L2	Input register	32129 (2128)	float	(-inf, inf)	Arms	Current measured using internal current sensors
Inverter Reactive Current L3	Input register	32133 (2132)	float	(-inf, inf)	Arms	Current measured using internal current sensors
Inverter RMS Current L1	Input register	32137 (2136)	float	[0, inf)	Arms	Current measured using internal current sensors

Inverter RMS Current L2	Input register	32141 (2140)	float	[0, inf)	Arms	Current measured using internal current sensors
Inverter RMS Current L3	Input register	32145 (2144)	float	[0, inf)	Arms	Current measured using internal current sensors

6.3 Energyhub facility Data

The EnergyHub measures the facility power/energy through a set of external current transformers (CTs).

Parameter name	Object type	Modbus number (address)	Data type	Range	Unit	Notes
Energy Exported To Grid	Input register	33065 (3064)	float	[0, inf)	kWh	Outgoing Energy from facility to AC Grid
Energy Imported From Grid	Input register	33069 (3068)	float	[0, inf)	kWh	Incoming Energy from AC Grid to facility
Grid Active Power	Input register	33101 (3100)	float	(-inf, inf)	kW	Power based on grid active currents
Grid Reactive Power	Input register	33105 (3104)	float	(-inf, inf)	kVAr	Power based on grid reactive currents
Grid Apparent Power	Input register	33109 (3108)	float	[0, inf]	kVA	Power based on grid RMS currents
Grid Active Current L1	Input register	33113 (3112)	float	(-inf, inf)	Arms	Current measured using external current sensors
Grid Active Current L2	Input register	33117 (3116)	float	(-inf, inf)	Arms	Current measured using external current sensors
Grid Active Current L3	Input register	33121 (3120)	float	(-inf, inf)	Arms	Current measured using external current sensors
Grid Reactive Current L1	Input register	33125 (3124)	float	(-inf, inf)	Arms	Current measured using external current sensors
Grid Reactive Current L2	Input register	33129 (3128)	float	(-inf, inf)	Arms	Current measured using external current sensors
Grid Reactive Current L3	Input register	33133 (3132)	float	(-inf, inf)	Arms	Current measured using external current sensors
Grid RMS Current L1	Input register	33137 (3136)	float	[0, inf)	Arms	Current measured using external current sensors
Grid RMS Current L2	Input register	33141 (3140)	float	[0, inf)	Arms	Current measured using external current sensors
Grid RMS Current L3	Input register	33145 (3144)	float	[0, inf)	Arms	Current measured using external current sensors

6.4 Energyhub facility load

Load power/energy refers to the power from all AC grid-connected loads in the facility, with the exception of the EnergyHub.

Parameter name	Object type	Modbus number	Data type	Range	Unit	Notes

		(address)				
Load Production Energy	Input register	34065 (4064)	float	[0, inf)	kWh	Outgoing Energy from facility loads to AC Grid
Load Consumption Energy	Input register	34069 (4068)	float	[0, inf)	kWh	Incoming Energy from AC Grid to facility loads
Load Active Power	Input register	34101 (4100)	float	(-inf, inf)	kW	Power based on load active currents
Load Reactive Power	Input register	34105 (4104)	float	(-inf, inf)	kVAr	Power based on load reactive currents
Load Active Current L1	Input register	34113 (4112)	float	(-inf, inf)	Arms	
Load Active Current L2	Input register	34117 (4116)	float	(-inf, inf)	Arms	
Load Active Current L3	Input register	34121 (4120)	float	(-inf, inf)	Arms	
Load Reactive Current L1	Input register	34125 (4124)	float	(-inf, inf)	Arms	
Load Reactive Current L2	Input register	34129 (4128)	float	(-inf, inf)	Arms	
Load Reactive Current L3	Input register	34133 (4132)	float	(-inf, inf)	Arms	

6.5 PV Data

Parameter name	Object type	Modbus number (address)	Data type	Range	Unit	Notes
Number of idle SSOs	Input register	35001 (5000)	uint16_t	[0,65535]	number	Number of SSOs not producing any energy
Number of running SSOs	Input register	35003 (5002)	uint16_t	[0,65535]	number	Number of running SSOs
Number of faulty SSOs	Input register	35005 (5004)	uint16_t	[0,65535]	number	Number of SSOs not working properly
Energy produced	Input register	35065 (5064)	float	[0, inf]	kWh	Outgoing Energy from PV panels to DC-Nanogrid
Solar Output Power	Input register	35101 (5100)	float	[0, inf)	kW	Outgoing power from PV panels to the DC-Nanogrid

6.6 Battery control

Parameter name	Object type	Modbus number (address)	Data type	Range	Unit	Notes
Battery Mode	Holding register	46001 (6000)	uint16_t	[0,65535]	enum	0 => Default; 1 => Power-mode Power from batteries to DC-Nanogrid
Battery Power Reference	Holding register	46065 (6064)	float	(-inf, inf)	kW	-ve power implies charging

6.7 Battery Data

Parameter name	Object type	Modbus number (address)	Data type	Range	Unit	Notes
Number of idle batteries	Input register	36001 (6000)	uint16_t	[0,65535]	number	Number of batteries not configured for operation
Number of running batteries	Input register	36003 (6002)	uint16_t	[0,65535]	number	Number of running batteries
Number of faulty batteries	Input register	36005 (6004)	uint16_t	[0,65535]	number	Number of batteries not working properly
Rated Capacity	Input register	36009 (6008)	float	[0, inf)	kWh	Aggregated Rated Capacity of all connected batteries
State of Health	Input register	36013 (6012)	float	[0, 100]	%	Aggregated State of Health of all connected batteries
State of Charge	Input register	36017 (6016)	float	[0, 100]	%	Aggregated State of Charge of all connected batteries
Energy from Battery	Input register	36065 (6064)	float	[0, inf)	kWh	Outgoing Energy from Discharging Batteries to DC-Nanogrid
Energy to Battery	Input register	36069 (6068)	float	[0, inf)	kWh	Incoming Energy from DC-Nanogrid to Charging Batteries
Battery Output Power	Input register	36101 (6100)	float	(-inf, inf)	kW	Power from all batteries to the DC-Nanogrid -ve power implies charging