QE-CURRENT-485 | QE-CURRENT-485-H

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QE-CURRENT-485

QE-CURRENT-485-H

CONTENTS

SAFETY WARNINGS AND CAUTIONS

The following warnings and cautions must be observed to ensure personal safety and prevent damage.

Death or **serious injury** may result from failure to heed this warning.

Material damage or **serious personal injury** may result from failure to heed this warning.

The manufacturer **declines all responsibility** for electrical safety in the event of improper use of the equipment.

It is essential to read the entire contents of this manual before carrying out any work.

Installation and commissioning must be carried out by qualified personnel only.

Before commissioning, make sure that:

- the maximum values for all connections are not exceeded; refer to the product data sheet;
- the connection cables are not damaged or live during wiring;
- the direction of current flow and phase rotation are correct.

During installation, ensure that a switch or circuit-breaker is near the product and easily accessible.

The unit must be uninstalled if safe operation can no longer be guaranteed (e.g. visible damage). Disconnect all connections in this case. The unit should be returned to the manufacturer or to an authorised service centre for repair.

WARNING: High-intensity magnetic fields may alter the values measured by the transformer. Avoid installation near: permanent magnets, electromagnets, or iron masses. If irregularities are detected, reposition or move the unit to a more suitable location.

Failure to observe the warnings may result in damage to the equipment or failure to operate as intended.

Please note that the information on the nameplate must be observed.

It is necessary to comply with national regulations when installing and picking materials for power lines.

Repairs and modifications must be carried out only by the manufacturer. It is forbidden to open the case and make any changes to the device. Tampering with the device will invalidate the warranty.

The product described in this document may only be used for the specified application. The maximum performance data and environmental conditions specified in the product data sheet must be observed. Proper transport and storage, as well as professional assembly, installation, handling and maintenance are required for the correct and safe operation of the device.

Use under ambient conditions other than those specified, application of signals or voltages other than those specified, may cause significant deviations from the specified measurement tolerances, which may be irreversible.

Although the contents of this document have been checked for accuracy, it may contain errors or inconsistencies and we cannot guarantee its completeness or accuracy.

This document is subject to periodic revision and updating. QEED reserves the right to make changes to the product and/or its technical documentation at any time in the interests of continuous quality improvement. Always consult the latest version of the documentation available on the website:

www.qeed.it

If you find any errors or missing information in this document, please notify us by e-mail to:

technical@qeed.it

Disposal of waste electrical and electronic equipment (applicable in the European Union and other countries with separate collection). The symbol on the product or its packaging indicates that the product should not be treated as household waste. Instead, it will be handed over to an authorised collection point for the recycling of electrical and electronic waste. Ensuring that the product is disposed of properly will prevent potential negative effects on the environment and human health, which could otherwise be caused by inappropriate waste management of the product. Recycling materials helps to conserve natural resources. For further information, please contact your local authority, waste disposal service or the retailer from whom you purchased the product.

PRODUCT OVERVIEW

The QE-CURRENT-485 is a current transducer (and analyzer in the -H version) capable of interfacing with various isolated current transducers, with both current and voltage outputs, also suitable for reading 2- or 3-wire PT100 or NTC temperature probes, as well as non-characterized probes by entering the STEINHART-HART curve in the Q-WIZARD configuration software.

Different types of input signal measurement are available depending on the product version.

An analogue output and a digital output (configurable dry contact) are also provided.

Power/error/communication/output status LEDs are on the front of the case.

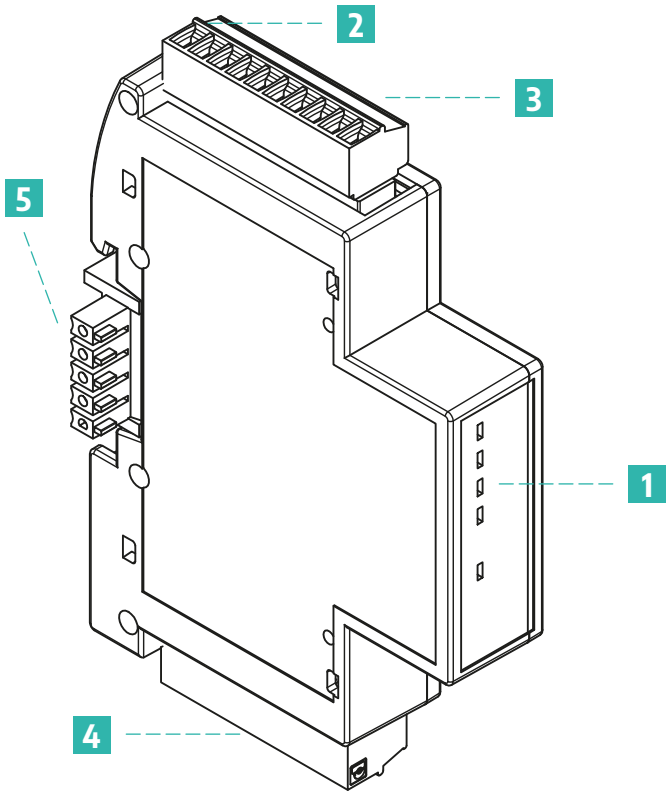
RS485 serial interface for communication with Modbus RTU protocol, either from the **Q-WIZARD configuration tool**, or with third party Modbus masters by acting on register map registers.

Possibility of FW update with special software (on request).

Ready for DIN rail mounting with T-BUS terminal (optional) for fast connection with hot insertion/removal option.

Available versions

- **QE-CURRENT-485**: current converter for current transducers with current/voltage outputs, analogue output and RS485 Modbus RTU serial interface; RMS, AC and DC minimum, average and maximum measurements; frequency and crest factor measurement; temperature or resistance measurement
- **QE-CURRENT-485-H**: current converter and analyser for current transducers with current/voltage outputs, analogue output and RS485 Modbus RTU serial interface. Same measurements as the basic version with the addition of harmonic analysis up to the 63rd, THD, I peak and measurement of the module's internal temperature (to understand the cabinet temperature)



1 Status LEDs
2 Power supply terminals
3 Output terminals
4 Input terminals
5 T-BUS terminal for both power supply and Modbus RTU communication (optional)

Inputs

- **Programmable (non-isolated) current:**
  - ROGOWSKI coil
  - Current transformer with 1A/5A secondary
  - Current/voltage transformer with ±10Vpk or ± 1Vpk secondary
  - Current transducer with secondary 100mA AC/DC
  - Configurable* HALL sensor with its own power supply (±15V_{DC}) up to 10A AC/DC
- **Temperature**: PT100 (PT-385) 2-3 fili or NTC (10kΩ, 100kΩ or by entering STEINHART-HART coefficients)

Outputs

- **Voltage**: configurable* 0-10V, 2kΩ minimum load resistance
- **Current**: configurable* 0-20mA, 600Ω maximum load resistance
- **Alarm contact**: optoMOS (NA - 1 form-B) for alarm or pulse retransmission for totalisation, configurable via programming software or via RS485 using Modbus RTU registers

Communication interface

- **RS485 Modbus RTU**: connection to RS485 serial bus on module base via adapter (T-BUS optional) or terminals. Front dip-switch for manual setting of address and baud rate

* Via the **Q-WIZARD configuration software** or dedicated registers

Reports and alerts

The device notifies the user of the following faults via the LED interface:

- EEPROM problem on the configuration microprocessor (module out of order, configuration lost)
- Input signal above/below threshold
- RTD out of range
- Third RTD wire not connected

These anomalies can also be associated with digital output as alarms.

In addition, the digital output can also be associated with an alarm on the input measurement reported at the output; depending on the configuration software setting, the output contact can be set as NC or NO.

TECHNICAL SPECIFICATIONS

Electrical characteristics

Power supply	10÷30 V_{DC} Reverse polarity and overheating protected
Current consumption	250mA max
Temperature input	Precision ±1°C - PT100 (PT-385) 2-3 wire - NTC (10kΩ, 100kΩ customizable with STEINHART-HART coefficients)
Current input	- ROGOWSKI coil - Current transformer with 1A/5A secondary - Current/voltage transformer with ±10V_{pk} or ± 1V_{pk} secondary - Current transformer with 333mV secondary - Current transducer with secondary 100mA AC/DC - HALL sensor with its own power supply (±15V_{DC})
Outputs	- Voltage: configurable* 0-10V, 2kΩ minimum load resistance - Current: configurable* 0-20mA, 600Ω maximum load resistance - Digital (optoMOS NA, 1-form-B, 30V, <50mA)
Communication Interface	RS485 Modbus RTU
Visual Interface	Status LEDs
Sampling rate	6400 samples/s @50Hz
Analog output accuracy	0,1% F.S.
Temperature coefficient	< 100ppm/°C

Available measurements

	Model	
	QE-CURRENT-485	QE-CURRENT-485-H
I_{rms} min – med – MAX	✓	✓
I_{dc} min – med – MAX	✓	✓
I_{ac} min – med – MAX	✓	✓
Charge amount (Ah) I_{rms} – I_{dc} – I_{ac}	✓	✓
Frequency	✓	✓
Crest Factor	✓	✓
Temperature (PT100/NTC)	✓	✓
Resistance RTD/NTC	✓	✓
THD		✓
I_{picco}		✓
Harmonic analysis up to the 63rd harmony		✓
Internal microcontroller temperature		✓

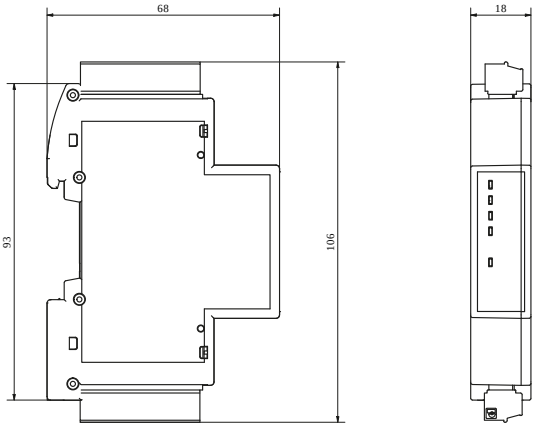
Measurement accuracy

1/5A Channel	Crest factor 4 (relative to 5A)		
	Range: 50mA < I < 250mA		Maximum reading error: 1%
	Range: 250mA < I < 5A		Maximum reading error: 0,5%
	Thermal drift		<100 ppm/°c
	Passband (-3dB)		>2 kHz
20/100mA Channel	Crest factor 4 (relative to 100mA)		
	Range: 1mA < I < 5mA		Maximum reading error: 1%
	Range: 5mA < I < 100mA		Maximum reading error: 0,5%
	Thermal drift		<100 ppm/°c
	Passband (-3dB)		>2 kHz
±1V_{pk} Channel	Range: 10mV < V < 50mV		Maximum reading error: 1%
	Range: 50mV < V< 1V		Maximum reading error: 0,5%
	Thermal drift		<100 ppm/°c
	Passband (-3dB)		>2kHz
±10V_{pk} Channel	Range: 100mV < V < 500mV		Maximum reading error: 1%
	Range: 500mV < V <10 V		Maximum reading error: 0,5%
	Thermal drift		<100 ppm/°c
	Passband (-3dB)		>800 Hz
PT100 Channel	Range		-200°C÷600°C
	Error		± 1.2°C on reading
	Thermal drift		<100 ppm/°C
NTC Channel	Range	200Ω÷20kΩ	20kΩ÷300kΩ
	Error	±1.2°C on reading	±1.6°C on reading
	Thermal drift	<100 ppm/°C	

Communication characteristics

Protocol	Modbus RTU
Baudrate	1200÷115200 bps (default 9600)
Addresses	1÷247 (default 1)
Data format	1 start bit, 8-bit data, NO/ODD/EVEN parity (default NO parity)
Response delay	1÷1000ms
Connection	Via removable terminal, T-BUS or microUSB

General data

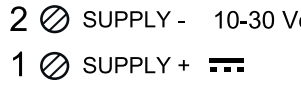
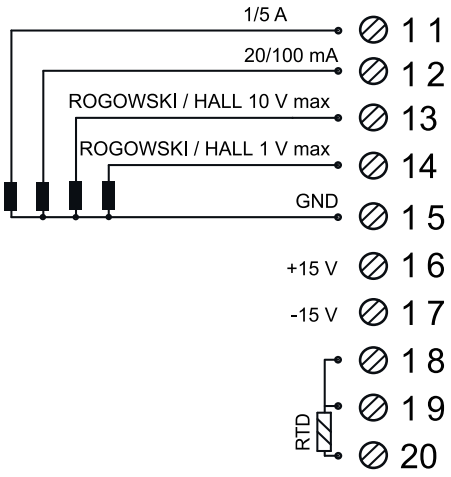
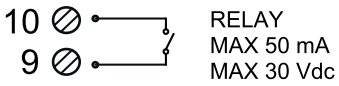
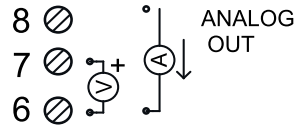
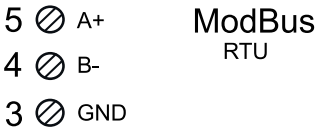
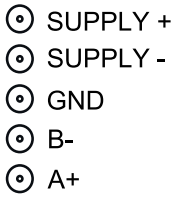
Working temperature	-15÷60° C
Storage temperature	-40÷85° C
Relative humidity	10÷90% not condensing
Elevation	Up to 2000m a.s.l.
Protection degree	IP20
Measurements	106x68x18 mm 
Weight	60 g
Terminal cable cross-section	0.05÷1.5 mm² (30÷14 AWG)
Energy values storage	Flash, min 100k writings
Approvals and certifications	EN61000-6-3; EN61000-4-2; EN61000-4-3; EN61000-4-4; EN61000-4-5; EN61000-4-6; EN61010-1
Installation	DIN rail mounting

Order codes

Converter	QE-CURRENT-485
Converter and analyzer	QE-CURRENT-485-H
T-BUS	QA-TBUS-22

CONNECTION AND INSTALLATION

For the connection of several instruments with reduced wiring, the unit is designed for DIN rail mounting, with or without T-BUS connector.
The functionality of the terminals is described below:

	Device power supply. **Please note:** Wiring must be protected against short circuits and/or accidental faults
	Sensors and transducer inputs Depending on the type of sensor or signal available, follow the connections as shown in the circuit diagram • 1/5A sensor: between terminals 11 and 15 (GND) • 20/100mA sensor: between terminals 12 and 15 (GND) • ±10V max. probes: between terminals 13 and 15 (GND) • ±1V max. probes: between terminals 14 and 15 (GND) • PT100 2-wire/NTC probes: 18, 19 **(by jumpering these two terminals together)** and 20 • 3-wire PT100 probes: between terminals 18, 19 and 20 (without jumper between terminals 18 and 19) **Hall sensor power supply** Dual power supply for a Hall sensor (external), either +15V or -15V (MAX 50mA), is available from terminals 16 (positive) and 17
	Digital output the output is a dry contact (OptoMOS NA, 1-form-B, 30V, <50mA). The contact can be used as an alarm contact (the associated parameter can be set via configuration software)
	Analogue output For analogue voltage output, connect terminals 6 (negative) and 7 (positive). For the active current analogue output, connect terminals 8 (I_{out}) and 6 (I_{in})
	RS485 serial interface: available on terminals 3 (GND), 4 (B-), 5 (A+) or via accessory T-BUS accessory (optional) to be placed at the bottom of the board
	T-BUS connection (requires optional T-BUS accessory): the T-BUS accessory can be fitted to the module base to provide both power supply and serial communication (see figure below). The number of modules supported by the bus depends on the power supply used (please check the power consumption of the modules)

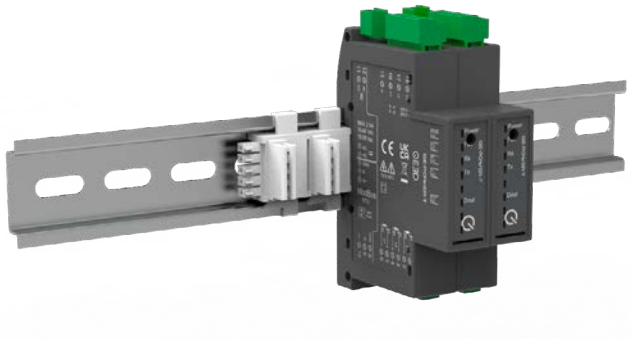


Figure 1: DIN-rail installation with T-BUS

RS485 bus termination

To avoid unbalances on the transmission bus, it is advisable to insert a termination resistor at the beginning of the RS-485 bus (typically on the USB-RS485 adapter) and at the end (typically on the last slave - which can also be activated by dip-switch). It is advisable to use 120Ω resistors with 1% tolerance, which corresponds to the typical impedance of RS485 cables.

The following images are for illustrative purposes only:

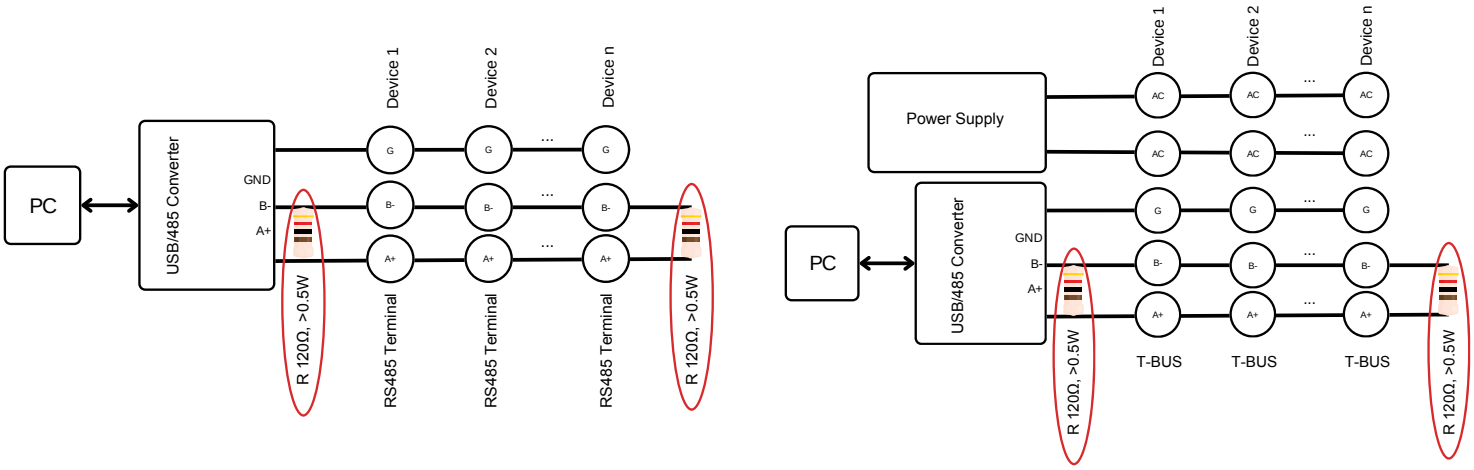


Figure 2: RS485 dynamic bus termination

STATUS LEDS

Function	Status	Meaning
Power (green)	ON	Powered device
Comm (yellow)	ON	Presence of one or more module anomalies/errors (configurable via **Q-WIZARD** or via dedicated registers - see page 14) The LED flashes when the bootloader is loaded
RX (red)	Flashing	The system is receiving data from the RS485
TX (red)	Flashing	The system is transmitting data on RS485
D_{out} (green)	ON	Active digital output

PRODUCT FEATURES

The following functions can be configured using the configuration software or the dedicated registers:

Modbus

Address, baud rate, parities and stop bits are adjustable.

Inputs/output

- Activation of the ampere-hour flash storage [Reg. 40007].
- Selection of the type of current input used [Reg. 40007] and related settings (transformer ratio [Reg. 40009], minimum sensed current [Reg. 40011], number of tenths of seconds (in DC) [Reg. 40013] or steps to zero (in AC) [Reg. 40014] for RMS current calculation (the higher the number, the slower and more accurate the calculation), update time for max, [Reg. 40015 - 40023] (if set to 0, the value is not averaged and absolute values are taken for max. and min. values)
- Signal type reported on output channel [Reg. 40007]
- Voltage/current output selection [Reg. 40007]
- Input and output signal range setting [Reg. 40025 - 40031]
- Harmonic analysis type: absolute/relative to first harmonic (-H version) [Reg. 40007]
- THD calculation (-H version) [Reg. 40007]
- Temperature probe type selection [Reg. 40007]

Status LEDs

By adjusting register [40008], it is possible to set a fault signal to be displayed via the Fail LED on the front of the device.

Digital input alarm

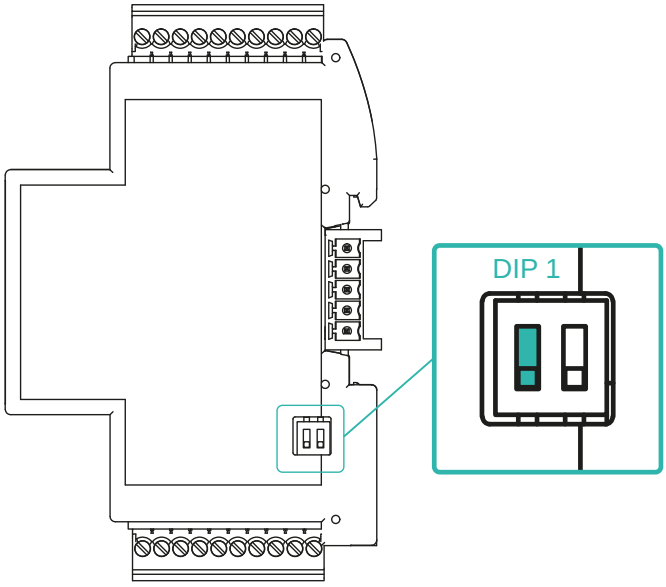
It is possible to define the threshold and hysteresis of the value that determines the activation of the alarm associated with the digital output by editing registers [40024, 40039 and 40041].

Finally, by accessing register [40007], it is possible to select whether an alarm is to be activated above/below the set threshold, with a lower/upper hysteresis, corresponding respectively to a NO or NC contact at start-up of the instrument.

DEVICE CONFIGURATION

Dip-switch Modbus RTU address and baud rate setting

The baud rate can be changed using the DIP switch on one of the two sides of the module. If DIP1 is set to zero, the module adopts the configuration from the EEPROM, otherwise it adopts the configuration set by the DIP switch according to the table:



DIP1	DIP2	Baudrate	Address
0	x	EEPROM	EEPROM
1	0	9600	1
1	1	38400	1

Figure 3: Baud rate configuration dip-switch

Addresses other than 1 (default) or baud rates other than those shown in the table can be configured using the **Q-WIZARD** configuration software or the Modbus RTU functions below by acting on the dedicated registers.

Functionality configuration

It is possible to connect to the product via an RS485 serial device, such as our Q-USB485, or via the microUSB port.

If the microUSB is used for configuration only, the main power supply from the terminals is not necessary, but it must be present to have all the functions active (real-time monitoring); if configuration is made from the terminals, the power supply must always be present.

The configuration of the module can be done with our **Q-WIZARD** configuration tool or with any third-party Modbus master, by acting on the registers of the card - see page 14.

Q-WIZARD

Using the **Q-WIZARD interface tool (downloadable from here)** all device parameters can be configured by following the simple, intuitive steps.

In addition to the configuration of various parameters, inputs and outputs, the **Q-WIZARD** also allows real-time monitoring of device variables.

Third-party Modbus Master

Alternatively, the product can communicate directly with a third-party Modbus RTU Master using the communication settings according to the DIP switch configuration (when using microUSB the DIP switch settings are irrelevant).

The communication protocol supported is Modbus RTU Slave:

- Modbus RTU connections: A+ and B- according to Modbus RTU standards
- Supported Modbus RTU functions: 03 hexadecimal (read multiple registers, max 100), 06 hexadecimal (write single), 10 hexadecimal (write multiple registers)
- Modbus RTU address numbering is by convention '1 BASED' (standard), but the physical register is base 0; the logical address, e.g. 40010, corresponds to the physical address #9, as required by Modbus RTU standards

PLEASE NOTE: All setting changes of calibration and configuration parameters must be followed by the flash save command 0xC1C0 = Flash settings save command in register 40328; changes of device communication parameters in addition must also be followed by the command 0xC1A0 = Reboot command in register 40328.

In this case, all device configurations are performed by accessing the Modbus RTU register map available in the last chapter of this document using the functions:

- Read holding registers (function 03 hexadecimal)
- Write single holding register (function 06 hexadecimal)
- Write multiple registers (function 10 hexadecimal)

Function 03 Hexadecimal (Read Holding Registers)

This function is used to read the contents of a contiguous block of holding registers (words). The request frame specifies the source register address and the number of registers to read. A maximum of 120 registers (words) can be read with a single request, unless otherwise specified. The register data in the response message is packaged as two bytes per register (word), with the binary contents right-justified within each byte. For each register, the first byte contains the most significant bits (MSB) and the second byte contains the least significant bits (LSB).

Request Frame			
Description	**Lenght**	**Value**	**Comments**
Physical address	1 byte	1 to F7 HEX (1 to 247)	
Function code	1 byte	03 HEX	
Starting address	2 bytes	0000 to FFFF HEX	Bytes order: MSB, LSB
Number of registers (N word)	2 bytes	1 to 10 HEX (1 to 16)	Bytes order: MSB, LSB
CRC	2 bytes		

Response frame (right action)			
Description	**Lenght**	**Value**	**Comments**
Physical address	1 byte	1 to F7 HEX (1 to 247)	
Function code	1 byte	03 HEX	
Required Number of bytes	1 byte	N word * 2	
Register value	N*2 bytes		Bytes order: MSB, LSB
CRC	2 bytes		

Response frame (wrong action)			
Description	**Lenght**	**Value**	**Comments**
Physical address	1 byte	1 to F7 HEX (1 to 247)	Possible exception: 01: illegal function 02: illegal data address 03: Illegal data value 04: Slave device failure
Function code	1 byte	83 HEX	
Exception code	1 byte	01, 02, 03, 04 (see note)	
CRC	2 bytes		

Function 06 Hexadecimal (Write Single Holding Register)

This function is used to write a single holding register. The request frame specifies the address of the register (word) to be written and its contents.
The correct response is an echo of the request, returned after the contents of the register have been written.

Request frame			
Description	**Lenght**	**Value**	**Comments**
Physical address	1 byte	1 to F7 HEX (1 to 247)	
Function code	1 byte	06 HEX	
Starting address	2 bytes	0000h to FFFF HEX	Bytes order: MSB, LSB
Register value	2 bytes	0000h to FFFF HEX	Bytes order: MSB, LSB
CRC	2 bytes		

Response frame (right action)			
Description	**Lenght**	**Value**	**Comments**
Physical address	1 byte	1 to F7 HEX (1 to 247)	
Function code	1 byte	06 HEX	
Starting address	2 bytes	0000h to FFFF HEX	Bytes order: MSB, LSB
Register value	2 bytes	0000h to FFFF HEX	Bytes order: MSB, LSB
CRC	2 bytes		

Response frame (wrong action)			
Description	Lenght	Value	Comments
Physical address	1 byte	1 to F7 HEX (1 to 247)	Possible exception: 01: illegal function 02: illegal data address 03: Illegal data value 04: Slave device failure
Function code	1 byte	86 HEX	
Exception code	1 byte	01, 02, 03, 04 (see note)	
CRC	2 bytes		

Function 10 Hexadecimal (Write Multiple Registers)

This function is used to write a block of contiguous registers (maximum of 2). The required values to be written are specified in the data field of the request. The data is packed as two bytes per register.

A correct response returns the function code, the starting address and the number of registers written.

Request frame			
Description	**Lenght**	**Value**	**Comments**
Physical address	1 byte	1 to F7 HEX (1 to 247)	
Function code	1 byte	10 HEX	
Starting address	2 bytes	0000 to FFFF HEX	Bytes order: MSB, LSB
Number of registers (N word)	2 bytes	0001 to 0078 HEX	Bytes order: MSB, LSB
Byte counting	1 byte	N word * 2	
Register value	N * 2 bytes	value	Bytes order: MSB, LSB
CRC	2 bytes		

Response frame (right action)			
Description	**Lenght**	**Value**	**Comments**
Physical address	1 byte	1 to F7 HEX (1 to 247)	
Function code	1 byte	10 HEX	
Starting address	2 bytes	0000 to FFFF HEX	Bytes order: MSB, LSB
Number of registers (N word)	2 bytes	0001 to 0078 HEX	Bytes order: MSB, LSB
CRC	2 bytes		

Response frame (wrong action)			
Description	**Lenght**	**Value**	**Comments**
Physical address	1 byte	1 to F7 HEX (1 to 247)	Possible exception: 01: illegal function 02: illegal data address 03: Illegal data value 04: Slave device failure
Function code	1 byte	90 HEX	
Exception code	1 byte	01, 02, 03, 04 (see note)	
CRC	2 bytes		

REGISTER MAP

Default values are in **bold**.

ONLY QE-CURRENT-H VERSION

Register Name	Description	Register Type	R/W	Default	Address Modbus
Machine ID	15 = QE-CURRENT-485 25 = QE-CURRENT-485-H	UShort [16b]	R		40001
HW/FW version	Hardware (MSB) and Firmware (LSB) Revision	UShort [16b]	R		40002
Address	Modbus address	UShort [16b]	R/W	1	40003
Delay	Machine answer delay (in characters)	UShort [16b]	R/W	1	40004
Baudrate	0 → 1200 1 → 2400 2 → 4800 **3 → 9600** 4 → 19200 5 → 38400 6 → 57600 7 → 115200	UShort [16b]	R/W	3	40005
Parity	**0 → None** 1 → Odd 2 → Even	UShort [16b]	R/W	0	40006
Flag Measurement	Bit 0: Ah Saving **0 → Ah disabled** 1 → Ah enabled Bit 1..2: Measurement Channel **0 → Input 1A/5A** 1 → Input 20 mA/100 mA 2 → Input 1 V 3 → Input 10 V Bit 3: RTD measurement 0 → 2 wire RTD **1 → 3 wire RTD** Bit 4: Output Type 0 → Voltage 0-10 V **1 → Current 0-20 mA** Bit 5..6: Output measurement retransmitted **0 → IRMS** 1 → IAC 2 → IDC 3 → Temperature Bit 7: FFT representation **0 → Absolute** 1 → Relative to the I 1 value Bit 8: THD calculation **0 → Only AC components** 1 → Including DC components Bit 9..10: Temperature sensor **0 → PT100** 1 → NTC 10 KΩ 2 → NTC 100 KΩ 3 → NTC Steinhart-Hart Bit 11..12: Measurement type **0 → Float** 1 → Float Swapped 2 → Hundredth (Float * 100) 3 → Hundredth swapped (Float * 100 SW) Bit 13: Integrator condition **0 → Integrator disabled** 1 → Integrator enabled (Rogowski input) Bit 14: Output switch initial condition 0 → Closed initial condition - Under threshold **1 → Open initial condition - Over threshold**	UShort [16b]	R/W	16408	40007
Led Settings	Set the yellow led (COMM LED) according to the corresponding bit set: Bit: 0 → Fail Eeprom 1 → Input Under-range 2 → Input Over-range 3 → Output Under-range 4 → Output Over-range 5 → RTD Out of the range **6 → RTD Third Wire error**	UShort [16b]	R/W	RTD Third Wire error	40008

Register Name	Description	Register Type	R/W	Default	Address Modbus
Transducer Ratio	If Input 1A/5A, 20mA/100 mA → Current transformer ratio M/N (Ex: TA ratio = 600:5 → transducer ratio = 120; TA ratio = 1000:1 → transducer ratio = 1000) If Input 1V, 10V → 1/Sensitivity [V/A] (Ex: Sensitivity = 100mV/1KA → transducer ratio = 10000; Sensitivity = 4V/400A → transducer ratio = 100)	Float [32b-LSW]	R/W	1	40009
Minimum Current Ripple	Minimum threshold under which the instrument reads 0 independent from the input value	Float [32b-LSW]	R/W	0	40011
Dc Filter	Number of tenth seconds for I RMS value in DC	UShort [16b]	R/W	10	40013
Ac Filter	Number of zero crossings for I RMS value in AC	UShort [16b]	R/W	50	40014
Seconds For Mean Rms	Register in seconds (0..30) for RMS average	UShort [16b]	R/W	0	40015
Seconds For Max Rms	Seconds 1..30 for MAX RMS value. If the register is 0, then the absolute MAX RMS is given	UShort [16b]	R/W	0	40016
Seconds For Min Rms	Seconds 1..30 for min RMS value. If the register is 0, then the absolute min RMS is given	UShort [16b]	R/W	0	40017
Seconds For Mean Dc	Register in seconds (0..30) for DC average	UShort [16b]	R/W	0	40018
Seconds For Max Dc	Seconds 1..30 for MAX DC value. If the register is 0, then the absolute MAX DC is given	UShort [16b]	R/W	0	40019
Seconds For Min Dc	Seconds 1..30 for min DC value. If the register is 0, then the absolute min DC is given	UShort [16b]	R/W	0	40020
Seconds For Mean Ac	Register in seconds (0..30) for AC average	UShort [16b]	R/W	0	40021
Seconds For Max Ac	Seconds 1..30 for MAX AC value. If the register is 0, then the absolute MAX AC is given	UShort [16b]	R/W	0	40022
Seconds For Min Ac	Seconds 1..30 for min AC value. If the register is 0, then the absolute min AC is given	UShort [16b]	R/W	0	40023
Alarm Register Start Address	Float value Starting address for alarm (40149 I RMS, 40151 I DC, 40153 I AC, ecc)	UShort [16b]	R/W	40149	40024
I Start	Current (in A)/temperature (in °C) (see Flag Measurement) which corresponds to Out start	Float [32b-LSW]	R/W	0	40025
Out Start	Output value (in mV o in uA) of the chosen output corresponding to I start	UShort [16b]	R/W	4000	40027
I Stop	Current (in A)/temperature (in °C) (see Flag Measurement) which corresponds to Out stop	Float [32b-LSW]	R/W	5	40029
Out Stop	Output value (in mV o in uA) of the chosen output corresponding to I stop	UShort [16b]	R/W	20000	40031
Steinhart Hart A	Coeff Steinhart-Hart A	Float [32b-LSW]	R/W	0	40033
Steinhart Hart B	Coeff Steinhart-Hart B	Float [32b-LSW]	R/W	0	40035
Steinhart Hart C	Coeff Steinhart-Hart C	Float [32b-LSW]	R/W	0	40037
Alarm Trip Value	Alarm Threshold	Float [32b-LSW]	R/W	0	40039
Alarm Hysteresis	Alarm Hysteresis	Float [32b-LSW]	R/W	1	40041
Status	bit 0: flash settings error; bit 1: flash calibration error; bit 2: Current Over Range; bit 3: Current Under Range; bit 4: don't care; bit 5: RTD Open or broken; bit 6: Current Zero crossing detecting; bit 7: Switch open; bit 8: RTD third wire error (Resistance > 20 Ω); bit 9: RTD out of the range (-200 °C .. + 600 °C) bit 10: Ah storing error; bit 11: Analog Output over range; bit 12: don't care; bit 13: Alarm detection; bit 14: Analog Output under range; bit 15: don't care;	UShort [16b]	R		40147
V I Out	Voltage or current output (in mV o mA)	Short [16b]	R		40148
I Rms	RMS Value [A]	Float [32b-LSW]	R		40149
I Dc	DC value [A]	Float [32b-LSW]	R		40151
I Ac	AC value [A]	Float [32b-LSW]	R		40153
Frequency	Frequency [Hz]	Float [32b-LSW]	R		40155
Crest Factor	Crest Factor	Float [32b-LSW]	R		40157
Thd	Total Harmonic Distortion	Float [32b-LSW]	R		40159
I 0 Rms	DC Harmonic	Float [32b-LSW]	R		40161
I 1 Rms	1st Harmonic	Float [32b-LSW]	R		40163
I 2 Rms	2nd Harmonic	Float [32b-LSW]	R		40165
I 3 Rms	3rd Harmonic	Float [32b-LSW]	R		40167
I 4 Rms	4th Harmonic	Float [32b-LSW]	R		40169
I 5 Rms	5th Harmonic	Float [32b-LSW]	R		40171

Register Name	Description	Register Type	R/W	Default	Address Modbus
I 6 Rms	6th Harmonic	Float [32b-LSW]	R		40173
I 7 Rms	7th Harmonic	Float [32b-LSW]	R		40175
I 8 Rms	8th Harmonic	Float [32b-LSW]	R		40177
I 9 Rms	9th Harmonic	Float [32b-LSW]	R		40179
I 10 Rms	10th Harmonic	Float [32b-LSW]	R		40181
I 11 Rms	11th Harmonic	Float [32b-LSW]	R		40183
I 12 Rms	12th Harmonic	Float [32b-LSW]	R		40185
I 13 Rms	13th Harmonic	Float [32b-LSW]	R		40187
I 14 Rms	14th Harmonic	Float [32b-LSW]	R		40189
I 15 Rms	15th Harmonic	Float [32b-LSW]	R		40191
I 16 Rms	16th Harmonic	Float [32b-LSW]	R		40193
I 17 Rms	17th Harmonic	Float [32b-LSW]	R		40195
I 18 Rms	18th Harmonic	Float [32b-LSW]	R		40197
I 19 Rms	19th Harmonic	Float [32b-LSW]	R		40199
I 20 Rms	20th Harmonic	Float [32b-LSW]	R		40201
I 21 Rms	21st Harmonic	Float [32b-LSW]	R		40203
I 22 Rms	22nd Harmonic	Float [32b-LSW]	R		40205
I 23 Rms	23rd Harmonic	Float [32b-LSW]	R		40207
I 24 Rms	24th Harmonic	Float [32b-LSW]	R		40209
I 25 Rms	25th Harmonic	Float [32b-LSW]	R		40211
I 26 Rms	26th Harmonic	Float [32b-LSW]	R		40213
I 27 Rms	27th Harmonic	Float [32b-LSW]	R		40215
I 28 Rms	28th Harmonic	Float [32b-LSW]	R		40217
I 29 Rms	29th Harmonic	Float [32b-LSW]	R		40219
I 30 Rms	30th Harmonic	Float [32b-LSW]	R		40221
I 31 Rms	31st Harmonic	Float [32b-LSW]	R		40223
I 32 Rms	32nd Harmonic	Float [32b-LSW]	R		40225
I 33 Rms	33rd Harmonic	Float [32b-LSW]	R		40227
I 34 Rms	34th Harmonic	Float [32b-LSW]	R		40229
I 35 Rms	35th Harmonic	Float [32b-LSW]	R		40231
I 36 Rms	36th Harmonic	Float [32b-LSW]	R		40233
I 37 Rms	37th Harmonic	Float [32b-LSW]	R		40235
I 38 Rms	38th Harmonic	Float [32b-LSW]	R		40237
I 39 Rms	39th Harmonic	Float [32b-LSW]	R		40239
I 40 Rms	40th Harmonic	Float [32b-LSW]	R		40241
I 41 Rms	41st Harmonic	Float [32b-LSW]	R		40243
I 42 Rms	42nd Harmonic	Float [32b-LSW]	R		40245
I 43 Rms	43rd Harmonic	Float [32b-LSW]	R		40247
I 44 Rms	44th Harmonic	Float [32b-LSW]	R		40249
I 45 Rms	45th Harmonic	Float [32b-LSW]	R		40251
I 46 Rms	46th Harmonic	Float [32b-LSW]	R		40253
I 47 Rms	47th Harmonic	Float [32b-LSW]	R		40255
I 48 Rms	48th Harmonic	Float [32b-LSW]	R		40257
I 49 Rms	49th Harmonic	Float [32b-LSW]	R		40259
I 50 Rms	50th Harmonic	Float [32b-LSW]	R		40261
I 51 Rms	51st Harmonic	Float [32b-LSW]	R		40263
I 52 Rms	52nd Harmonic	Float [32b-LSW]	R		40265
I 53 Rms	53rd Harmonic	Float [32b-LSW]	R		40267
I 54 Rms	54th Harmonic	Float [32b-LSW]	R		40269
I 55 Rms	55th Harmonic	Float [32b-LSW]	R		40271
I 56 Rms	56th Harmonic	Float [32b-LSW]	R		40273
I 57 Rms	57th Harmonic	Float [32b-LSW]	R		40275
I 58 Rms	58th Harmonic	Float [32b-LSW]	R		40277
I 59 Rms	59th Harmonic	Float [32b-LSW]	R		40279
I 60 Rms	60th Harmonic	Float [32b-LSW]	R		40281
I 61 Rms	61st Harmonic	Float [32b-LSW]	R		40283
I 62 Rms	62nd Harmonic	Float [32b-LSW]	R		40285
I 63 Rms	63rd Harmonic	Float [32b-LSW]	R		40287
Internal Temperature	Internal Temperature [°C]	Float [32b-LSW]	R		40289
Rtd Temperature	RTD Temperature [°C]	Float [32b-LSW]	R		40291
Rtd Resistance	RTD Resistance [Ω]	Float [32b-LSW]	R		40293
Rtd 3rd Wire Resistance	Third wire Resistance [Ω]	Float [32b-LSW]	R		40295

Register Name	Description	Register Type	R/W	Default	Address Modbus
Ntc Resistance	NTC parallel resistance [Ω]	Float [32b-LSW]	R		40297
I Rms Mean	RMS average [A] over “seconds for mean RMS”	Float [32b-LSW]	R		40299
I Rms Max	MAX RMS [A] over last “seconds for MAX RMS”	Float [32b-LSW]	R		40301
I Rms Min	Min RMS [A] over last“seconds for min RMS”	Float [32b-LSW]	R		40303
I Dc Mean	DC average [A] over “seconds for mean DC”	Float [32b-LSW]	R		40305
I Dc Max	MAX DC [A] over last “seconds for MAX DC”	Float [32b-LSW]	R		40307
I Dc Min	min DC [A] over last “seconds for min DC”	Float [32b-LSW]	R		40309
I Ac Mean	AC average [A] over “seconds for mean AC”	Float [32b-LSW]	R		40311
I Ac Max	MAX AC [A] over last “seconds for MAX AC”	Float [32b-LSW]	R		40313
I Ac Min	min AC [A] over last “seconds for min AC”	Float [32b-LSW]	R		40315
Ah I Rms	Overall Ah for RMS value. Resettable via Command. Optionally storable in flash	Float [32b-LSW]	R		40317
Ah I Dc	Overall Ah for DC value. Resettable via Command. Optionally storable in flash	Float [32b-LSW]	R		40319
Ah I Ac	Overall Ah for AC value. Resettable via Command. Optionally storable in flash	Float [32b-LSW]	R		40321
Ah Storage Count	Number of Ah flash savings (every 20 seconds)	ULong [32b-LSW]	R		40323
I Peak	Current peak	Float [32b-LSW]	R/W		40325
Command	0xC1C0 = Flash settings save command 0xC1A0 = Reboot command 0xBABA = Load Ah command (Ah to be uploaded must be written in Command_aux); 0xBABB = Load Positive Ah command (positive Ah to be uploaded must be written in Command_aux); 0xBABC = Load Negative Ah command (negative Ah to be uploaded must be written in Command_aux); 0xDAAA = Close Switch command 0xDAAB = Open Switch command	UShort [16b]	R/W		40328

LEGEND:

Short [16b] = Signed Short (16 bit)
UShort [16b] = Unsigned Short (16 bit)

Long [32b-MSW] = Signed Long (32 bit - MSW First Register)
Long [32b-LWS] = Signed Long (32 bit - LSW First Register)
ULong [32b-LSW] = Unsigned Long (32 bit - LSW First Register)
ULong [32b] = Unsigned Long (32 bit)

Float [32b-MSW] = Float (32 bit - MSW First Register)
Float [32b-LSW] = Float (32 bit - LSW First Register)

UInt [16b] = Unsigned Integer (16 bit)
UInt [32b-MSW] = Unsigned Integer (32 bit - MSW First Register)
Int [64b-LSW] = Signed Long Long (64 bit - LSW First Register)