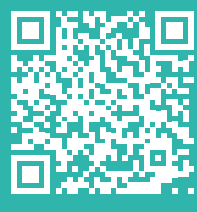




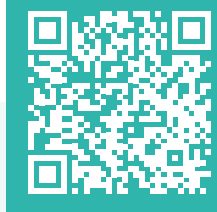
# QA-POWER-M | QA-POWER-M-LV



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QA-POWER-M



QA-POWER-M-LV

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## 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.



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



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



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 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.



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.



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.

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.

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.



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:



**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.

[www.qeed.it](http://www.qeed.it)

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

[technical@qeed.it](mailto:technical@qeed.it)



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



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.



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





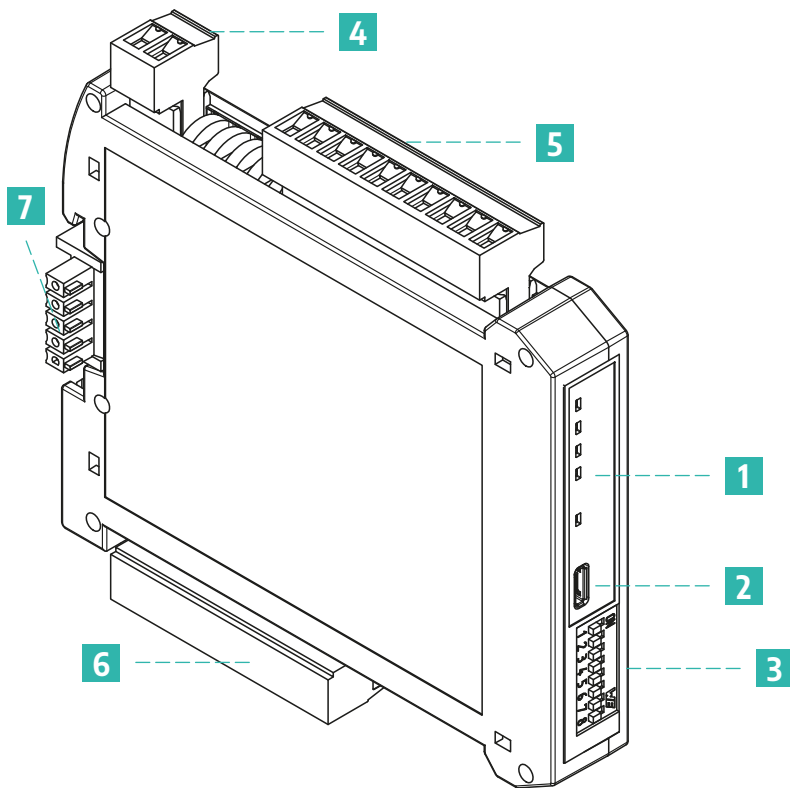
### PRODUCT OVERVIEW

The QA-POWER-M is a single phase AC/DC direct insertion power analyser that can also be used as a voltage/current isolator. It can be used as a 1000V<sub>DC</sub> - 600V<sub>AC</sub> (100V<sub>DC</sub> - 60V<sub>AC</sub> for LV version), 10A AC/DC direct insertion or current transformer and variable frequency measurement. Input for voltage transducers up to 70mV only factory adaptable to customer specification. Complete galvanic isolation between power supply, serial and USB interface, inputs and outputs. Power/error/communication/output status LEDs are on the front of the case. 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 (download at link)**, or with third party Modbus masters by acting on register map registers.

Data logger with non-volatile memory for managing the totalisation of input pulses. Allows data to be recorded on a pendrive or PC via USB and downloaded in .csv format, including date and time (RTC - Real Time Clock - built in).

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



- 1 Status LEDs
- 2 MicroUSB Port
- 3 Settings DIP switch
- 4 Power supply terminals
- 5 Input terminals
- 6 Output terminals
- 7 T-BUS terminal for both power supply and Modbus RTU communication (optional)



## Inputs

- **Voltage:** up to 1000V<sub>DC</sub> / 600V<sub>AC</sub> (or 100V<sub>DC</sub> / 60V<sub>AC</sub> for the -LV version)
- **Current:**
  - direct insertion up to 10A AC/DC (Transformation ratio = 1)
  - via CT with current output
  - via CT with voltage output up to 100mV (0 5V factory configurable)

## Outputs

- **Voltage:** configurable\* 0-10V, minimum load resistance 2k $\Omega$
- **Current:** configurable\* 0...20mA, maximum load resistance 600 $\Omega$
- **Alarm contact:** Optomos contact, NO on alarm (configurable) or pulse retransmission for totalization, configurable via **Q-WIZARD** software

## 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
- **USB** for configuration

\* Using the configuration software, it is possible to scale the inputs and outputs as required, selecting the input measurement interval (BEGIN SCALE INPUT and END SCALE INPUT parameters in the configuration software) to which the analogue output signal is assigned (BEGIN SCALE OUTPUT and END SCALE OUTPUT parameters in the configuration software).

If manual control via Modbus RTU is selected from the interface, it is possible to manage the module as if it were an AO (Analogue Output) or a DO (Digital Output), thus freeing the analogue and digital output from the selected input. The analogue output is managed via the RS485 Modbus RTU (see register map).

## Reports and alerts

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

- Input signal below threshold
- Input signal above threshold
- HW error in the measurement chain
- LOG problem of the real time clock storing the date and time
- RTC problem during data acquisition (no memory on USB stick, USB stick not recognised)
- EEPROM problem on the configuration microprocessor (module out of order, configuration lost)

These anomalies can also be associated with the analogue and/or digital output (even simultaneously) in the form of alarms.

An additional alarm can also be associated with the analogue and/or digital output on the input measurement reported at the output; depending on the configuration software settings, this alarm can be triggered when the measurement is above/below a set threshold or between/beyond 2 set thresholds.

**PLEASE NOTE:** in the event of an alarm, the output is set to 21mA or 10.5V depending on the analogue output mode setting (current or voltage) selected via the configuration software.

## Data logging

It is possible to activate the LOG function for data acquisition on a USB flash drive from the configuration software's dedicated menu.

The extension of the log file can be of the following types: .xls, .xlsx, .csv, .txt, .dat, .log and can be changed by simply changing the extension to the file name in the configuration tool's save box. The default extension is text.

The minimum sampling time is 1 second and the maximum is approximately 18 hours.



## TECHNICAL SPECIFICATIONS

### Electrical characteristics

	QA-POWER-M	QA-POWER-M-LV
Voltage input	up to 600V <sub>AC</sub> , 1000V <sub>DC</sub>	up to 60V <sub>AC</sub> , 100V <sub>DC</sub>
Power supply	10÷40 V <sub>DC</sub> or 20÷28 V <sub>AC</sub> @50/60Hz	
Current consumption	250mA	
Isolation	4kV <sub>RMS</sub> between power supply and measurement inputs 4kV <sub>RMS</sub> between RS485 and measurement inputs 1.5kV <sub>RMS</sub> between power supply and RS485	
Outputs	<ul style="list-style-type: none"> <li>- Analog:               <ul style="list-style-type: none"> <li>• Voltage: configurable* 0-10V, minimum load resistance 2kΩ</li> <li>• Current: configurable* 0...20mA, maximum load resistance 600Ω</li> </ul> </li> <li>- Digital (optoMOS NO, 1-form-A, 30V, &lt;50mA)</li> </ul>	
Communication interface	RS485 Modbus RTU microUSB port	
Visual interface	Status LEDs	
Measurement type	TRMS, DC	
Measurement frequency	DC or 40÷400Hz	
Sampling frequency	5000 samples/s	
Measurement update	Every 100ms	
CT Current Ratio	Settable via software	
Precision class	0,5% F.S.	
<b>Voltage input</b>		
Input impedance	1MΩ	
Rated capacity (U <sub>n</sub> )	300V <sub>LN_AC</sub> (1000V <sub>DC</sub> )	
Continuous Overload (U <sub>MAX</sub> )	1100V <sub>LN_DC</sub>	
Overload for 500 ms	1200V <sub>LN_DC</sub>	
<b>Current input</b>	Isolated	
Direct insertion	up to 10A AC/DC	
Using current output type CT	Rated capacity (I <sub>n</sub> )	5A <sub>AC</sub>
	Crest factor	<3
	Impedance	<0,5Ω
	Continuous overload (I <sub>MAX</sub> )	6A <sub>AC</sub>
	Overload for 500 ms	40A <sub>AC</sub>
<b>Precision (@25°C, 50Hz)</b>		
Voltage (U <sub>n</sub> : 230/400 V)	± 0,5% F.S.	
Current (I <sub>n</sub> = 5A)	± 0,5% F.S.	
Frequency (40÷70Hz)	± 0,1Hz	
Power	ACTIVE: ± 0,5 F.S. REACTIVE: ± 0,5 F.S.	
Energy	1% on reading	
Power factor	± (0,001 +1%(1.00-PF))	
Passband (-3dB)	>2kHz	
Temperature coefficient	<200ppm/°C	



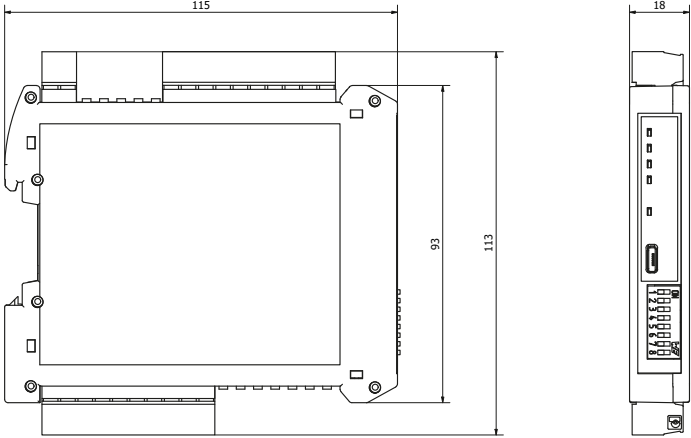

## Available measurements

$I_{rms}$ - $V_{rms}$	Frequency
$I_{pk}$ - $V_{pk}$	$\cos\Phi$
Active power (W), Reactive power (VAR), Apparent power (VA)	THD
Bi-directional energy (kWh), positive and negative	

## 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	115x113x18 mm 
Weight	120 g
Terminal cable cross-section	0.05÷1.5 mm <sup>2</sup> (30÷14 AWG)
Energy values storage	Flash, min. 100k writings
Appliance class	Cat. III (IEC 60664, EN60664)
Approvals and certifications	EN 61000-6-3 + A1 2011; EN64000-6-2/2005; EN61010-1/2010 
Installation	DIN rail mounting

## Order codes

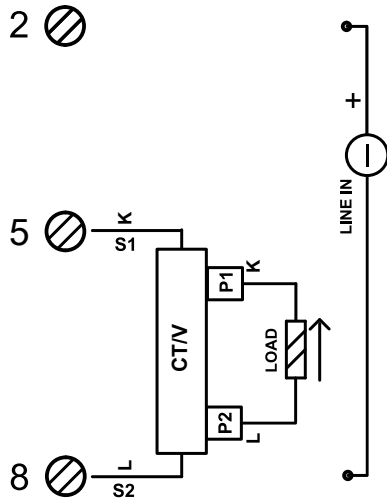
Standard version	QA-POWER-M
Low voltage version	QA-POWER-M-LV
T-BUS	QA-TBUS-22



**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:

	<p>Device power supply. <b>Please note:</b> Wiring must be protected against short circuits and/or accidental faults</p>
	<p>Voltage/current input (direct insertion): Input voltage (LINE) must be connected to terminals 2(+) and 8, Load must be connected to terminals 1(+) and 6</p> <p>The measurement range can be set using the configuration software, or via RS485 using Modbus RTU registers</p>
	<p>Input with external current transformer (CT) and current output: Input voltage (LINE) must be connected to terminals 2(+) and 8. External current transformer connected as described below:</p> <ul style="list-style-type: none"> <li>- Terminal S1 of the CT connected to terminal 6</li> <li>- Terminal S2 of the CT connected to terminal 8</li> <li>- Connection of the load to the CT, input side P1 and output side P2 (see side diagram on the product box)</li> </ul> <p>With this configuration, the transformation ratio can be set via programming software or via RS485 using Modbus RTU registers.</p>



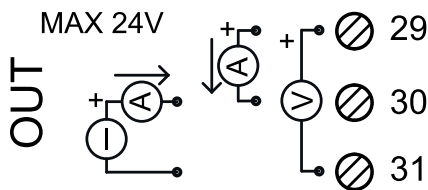
Input with external current transformer (CT) and voltage output (max. 100mV peak):

The input voltage (LINE) must be connected to terminals 2(+) and 8.

External CT connected as follows

- Terminal S1 of the CT connected to terminal 5
- Terminal S2 of the CT connected to terminal 8
- Load connection to CT, input side P1 and output side P2

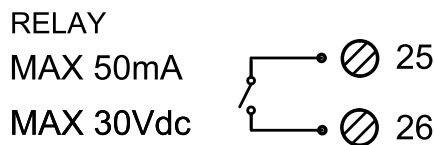
With this configuration, the transformation ratio is set only from the programming software.



Analogue output:

- For analogue output in voltage, connect terminals 31 and 29 (positive).
- For analogue output in active current, connect terminals 29 (positive) and 30
- For analogue output in passive current, connect terminals 30 (positive) and 31

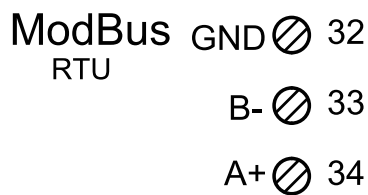
Sensor power supply from analogue output: 13VDC, 30mA maximum



Digital output:

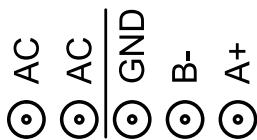
The relay output is an OptoMOS contact. It is connected between terminals 25 and 26. The contact can be used as a pulse output (pulse value configurable via programming software or via RS485 using Modbus RTU registers) or as an alarm contact (parameter configurable via programming software or via RS485 using Modbus RTU registers).

The digital output is inactive by default



RS485 serial interface:

available on terminals 32 (GND), 33 (B-), 34 (A+), or via accessory T-BUS accessory to be placed on the base 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)



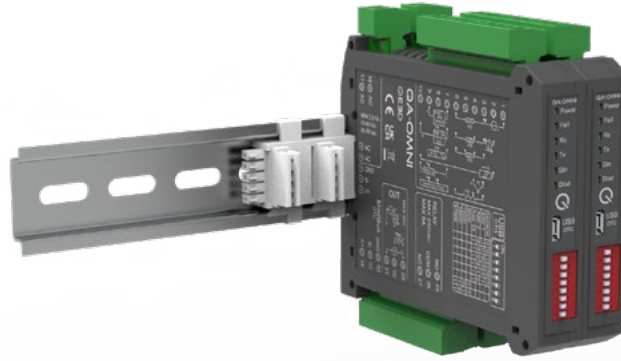


Figure 1: DIN-rail installation with T-BUS

### 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:

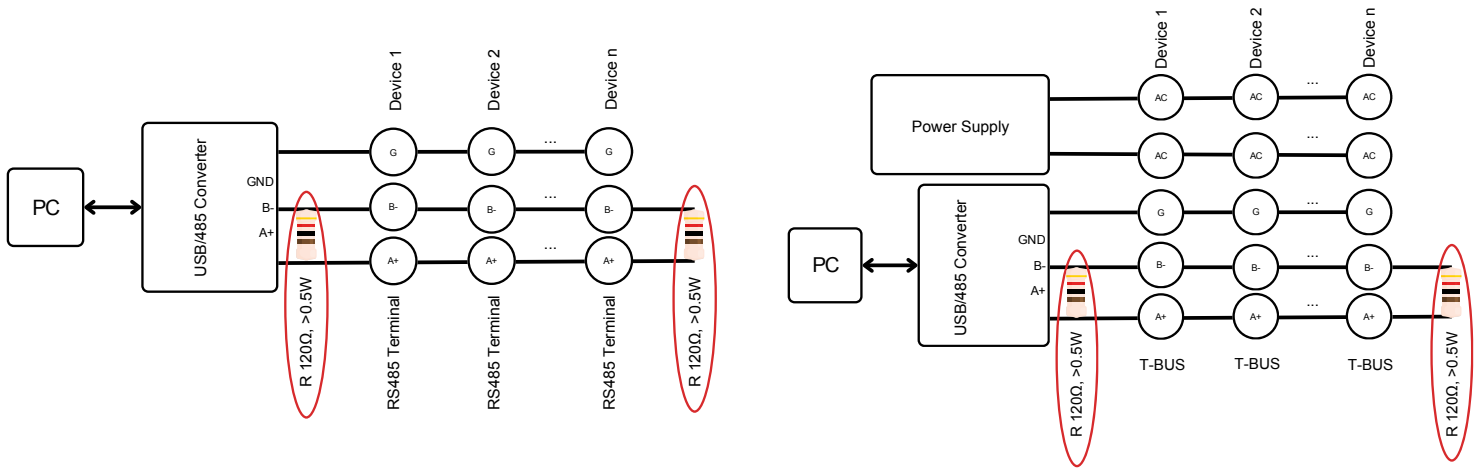


Figure 2: RS485 dynamic bus termination



## STATUS LEDS

Function	Status	Meaning
Power (green)	ON	Powered device
Fail (yellow)	ON	Presence of one or more module anomalies/errors (configurable via <b>Q-WIZARD</b> or via dedicated registers - see page 16)
RX (red)	Flashing	The system is receiving data from the RS485
TX (red)	Flashing	The system is transmitting data on RS485
Dout (green)	ON	Active digital output

## DATA LOGGING – DATA ACQUISITION

The QA-POWER-M is able to provide a series of information regarding the module operation, alarm status, input type, output type, measured data reading, totalization, period and frequency measurement and module output value on a local USB PENDRIVE type memory (USB KEY) connected to the module via the microUSB port. The module is equipped with an RTC Real Time Clock powered by a backup battery, allowing the recording of data with year-month-day-hour-min-sec.

Log file example

Serial	Data (yyyy-mm-dd) & Time	Status	V <sub>pk</sub>	I <sub>pk</sub>	V <sub>rms</sub>	P	CosΦ	Freq.	Energy	Energy+
12345678	2015/03/12-14-23-25	0	270	0	123	85,7	0,91	52	21	0
12345678	2015/03/12-14-23-26	0	270	0	123	88,3	0,92	52,6	21	0
12345678	2015/03/12-14-23-27	0	273	0	123	87,8	0,92	52,4	21	0
12345678	2015/03/12-14-23-28	0	270	0	123	88,1	0,93	52,1	21	0

**Serial Number:** is the serial number of the module, which allows it to be uniquely identified

**Data & Time:** log time information (year/month/day-hours-min-sec)

**Status ID:** STATUS register in 16-bit binary mode

- bit [0] = fail global
- bit [1] = alarm
- bit [2] = over range
- bit [3] = under range
- bit [4] = riservato
- bit [5] = dout status
- bit [6] = fail HW
- bit [7] = fail log
- bit [8] = fail RTC
- bit [9] = fail EEPROM

**V<sub>pk</sub>:** voltage peak

**I<sub>pk</sub>:** current peak

**V<sub>rms</sub>:** voltage root mean square value

**I<sub>rms</sub>:** current root mean square value

**P:** active power

**Q:** reactive power

**S:** apparent power

**CosΦ:** phase shift

**Freq.:** frequency signal

**Energy:** measured energy

**Energy +:** positive measured energy

**Energy -:** negative energy

**Output value:** analog output value expressed in uA or in mV

**Output type:** represents the analogue output configuration

- bit [0] = Voltage/Current
- bit [1-4] = input V<sub>rms</sub>, I<sub>rms</sub>, Active Power, Reactive Power, Apparent Power, Cosφ, Frequency
- bit [5] = fail under-range
- bit [6] = fail over-range



- bit [7] = fail HW
- bit [8] = fail log
- bit [9] = fail RTC
- bit [10] = fail EEPROM
- bit [11] = fail alarm
- bit [12-13] = 0 above threshold /1 below threshold /2 outside thresholds /3 inside thresholds
- bit [14] = Manual mode

## 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

- Transformation ratio [Reg. 40102]
- Filtering on measurement [Reg. 40131 – 40133]
- Voltage, current and power measurement display limits [Reg. 40135 – 40139]
- Energy (Wh) per pulse [Reg. 40110]
- Analog voltage or current output selection [Reg. 40101]
- Selection of retransmitted analogue output measurement among those available [Reg. 40101] or with manual management via Modbus RTU [Reg. 40101] (with setting of input scaling ranges [Reg. 40104 - 40106] and output [Reg. 40108 - 40109])
- Enabling digital output and its status at start-up [Reg. 40112]

### Analogue output alarm

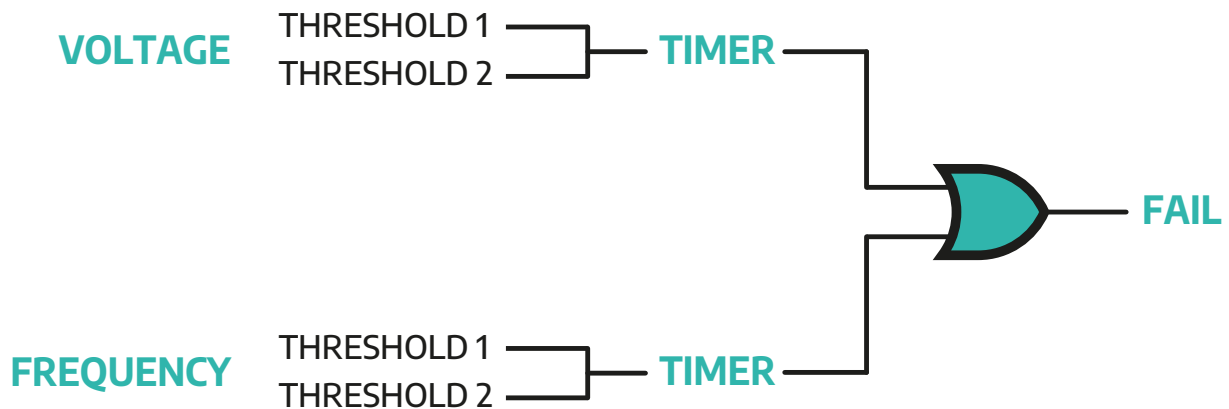
By configuring the register [40101] it is possible to determine whether an alarm is to be associated with the analogue output (in addition to the value already present on the output itself).

**PLEASE NOTE:** in the event of an alarm, the output is set to 21mA or 10.5V depending on the analogue output mode setting (current or voltage) selected via the configuration software.

### Digital output alarm – pulse counter

If bit[8] of register [40112] is 1, the output is managed as a pulse counter, while if it is 0, it is managed as an alarm. By acting on register [40112], it is possible to define which alarms are to be associated (and, if necessary, the threshold [reg. 40113 - 40115] and hysteresis [reg. 40117] of the value that determines the alarm activation) and whether the alarm is active low/high.

**Available from firmware version 005:** configurable AND/OR digital output alarm according to the following diagram



Two input measurements can be selected via registers [40154] and [40155]. For each input it is possible to set two measurement thresholds which, if exceeded, will trigger the corresponding alarm. These thresholds can be set in registers [40142-40149]. Bits [12-13] and bits [14-15] of register [40112] define the type of threshold (below threshold, above threshold, outside two thresholds, within two thresholds).The alarms are combined according to an AND/OR logic that can be set via register [40141].



An alarm signalling delay can be set via registers [40150-40153].  
The alarm status is indicated by bit [11] of register [40112].

## DEVICE CONFIGURATION

### Dip-switch Modbus RTU address and baud rate setting

The DIP switches on the front of the module can be used to change the Modbus RTU address and baud rate. If all DIP switches are set to zero, the module takes the configuration from the EEPROM, otherwise it takes the configuration set by the DIP switches.

USB OTG	ON							
	1	2	3	4	5	6	7	8
EEPROM	0	0	0	0	0	0		
Add: 1	0	0	0	0	0	1		
Add: 2	0	0	0	0	1	0		
Add: 63	1	1	1	1	1	1		
9600							0	0
19200							0	1
38400							1	0
57600							1	1

Addresses greater than 63 and baud rates other than those selected by the DIP switches can be configured using the **Q-WIZARD configuration tool** or the Modbus RTU functions below by acting on the dedicated registers.

Raising DIP switch 1, visible through the hole in the product casing (see figure below), activates the dynamic termination (120Ω) of the Modbus RTU (to be performed only on the last module in the chain - see Figure 2 under RS485 bus termination).

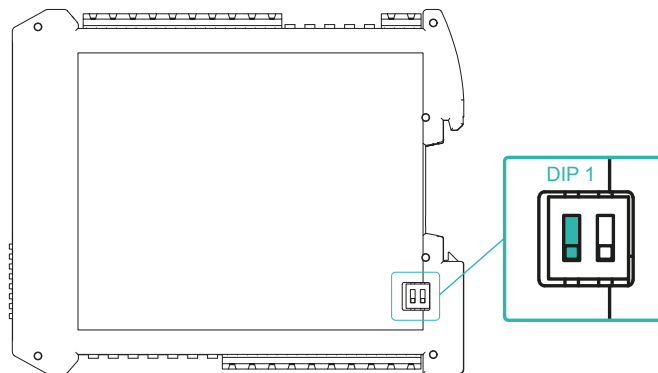


Figure 3: Dip-switch

**PLEASE NOTE:** To activate any DIP switch changes, it is necessary to switch the unit off and on again.

### 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** oonfiguration tool or with any third-party Modbus master, by acting on the registers of the card - see page 16.

### Q-WIZARD

Using the **Q-WIZARD configuration 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 42001; changes of device communication parameters in addition must also be followed by the command 0xC1A0 = Reboot command in register 42001.

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	Length	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	Length	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	Length	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		



## FIRMWARE UPDATE

Using a standard pendrive to hold the file and a micro-USB OTG cable, the product is ready for firmware updates via the USB port.

To update the firmware, simply remove power from the module, insert the pendrive on the card with the file on it and restore the power supply. At this point the card will automatically download the file and update the firmware without changing the settings during programming.

The FAIL LED will flash during the update phase.

## REGISTER MAP

Default values are in **bold**.

Register Name	Description	Register Type	R/W	Default	Range	Address Modbus
Machine ID	3 = QA-POWER-M 33 = QA-POWER-M-LV	UShort [16b]	R			40001
FW version	Firmware FW (0)	UShort [16b]	R			40002
Status	bit 0 → fail global bit 1 → alarm bit 2 → overrange bit 3 → underrange bit 4 → reserved bit 5 → Dout status bit 6 → fail HW bit 7 → fail log bit 8 → fail RTC bit 9 → fail EEPROM	UShort [16b]	R/W		0...65535	40005
Output Value	Output Value (mV or uA)	UShort [16b]	R/W		0...20000	40006
Digital output	bit [0] = disabled/enabled	UShort [16b]	R/W	0		40007
DIP-switchstatus	bit [0-7]= dip switch status bit [0] = dip switch position 8 bit [1] = dip switch position 7 ... Bit [7] = dip switch position 1	UShort [16b]	R		0...10000	40008
Vrms	Voltage measurement rms (V)	Float [32b-MSW]	R		0...14000	40009
Irms	Current measurement rms (mA)	Float [32b-MSW]	R			40011
Active power	Active Power Measurement (W)	Float [32b-MSW]	R			40013
Q	Reactive Power Measurement (VAR)	Float [32b-MSW]	R			40015
S	Apparent Power Measurement (VA)	Float [32b-MSW]	R			40017
Cos (Φ)	Cosφ Measurement	Float [32b-MSW]	R		0..1	40019
Frequency	Frequency Measurement (Hz)	Float [32b-MSW]	R			40021
THD	THD Measurement (%)	Float [32b-MSW]	R			40023
Energy	Totale Energy Measurement (Wh)	Float [32b-MSW]	R/W			40025
Positive Energy	Positive Energy Measurement (Wh)	Float [32b-MSW]	R/W			40027
Negative Energy	Negative Energy Measurement (Wh)	Float [32b-MSW]	R/W			40029
V peak	Instantaneous Voltage Peak (V)	Float [32b-MSW]	R/W			40031
I peak	Instantaneous Current Peak (mA)	Float [32b-MSW]	R/W			40033
V MAX	Max RMS Voltage (V)	Float [32b-MSW]	R/W			40035
V min	min RMS Voltage (V)	Float [32b-MSW]	R/W			40037
I MAX	Max RMS Current (mA)	Float [32b-MSW]	R/W			40039
I min	min RMS Current (mA)	Float [32b-MSW]	R/W			40041
P MAX	Max RMS Active Power (W)	Float [32b-MSW]	R/W			40043
P min	min RMS Active Power (W)	Float [32b-MSW]	R/W			40045
Q MAX	Max Reactive Power (VAR)	Float [32b-MSW]	R/W			40047
Q min	min Reactive Power (VAR)	Float [32b-MSW]	R/W			40049
S MAX	Max Apparent Power (VA)	Float [32b-MSW]	R/W			40051
S min	min Apparent Power (VA)	Float [32b-MSW]	R/W			40053
Cos (Φ) MAX	Max Cosφ	Float [32b-MSW]	R/W			40055
Cos (Φ) min	min Cos (Φ)	Float [32b-MSW]	R/W			40057
Frequency MAX	Max Frequency (Hz)	Float [32b-MSW]	R/W			40059
Frequency min	min Frequency (Hz)	Float [32b-MSW]	R/W			40061
THD MAX	Max THD (%)	Float [32b-MSW]	R/W			40063
THD min	min THD (%)	Float [32b-MSW]	R/W			40065
Vavg	V avarage(V)	Float [32b-MSW]	R			40067
Iavg	I avarage(V)	Float [32b-MSW]	R			40069
Totalizer	Total pulse Dout	UInt [32b-MSW]	R			40071
Serial Number (min, sec)	Partial serial number (format: mm-ss)	UInt [16b]	R			40073
Serial Number (day, hour)	Partial serial number (format: dd-hh)	UInt [16b]	R			40074





Register Name	Description	Register Type	R/W	Default	Range	Address Modbus
Serial Number (year, Month)	Partial serial number (format: yy-MM)	UInt [16b]	R			40075
Output Analog mode	bit [0] = <b>0 → Voltage</b> 1 → Current bit [1-4] = input: <b>0 → Vrms</b> 1 → Irms 2 → Active Power 3 → Reactive Power 4 → Apparent Power 5 → cos (Φ) 6 → Frequency bit [5] = fail under range bit [6] = fail over range bit [7] = fail HW bit [8] = fail log bit [9] = fail RTC bit [10] = fail EEPROM bit [11] = fail alarm bit [12-13] = <b>0 → 1 threshold over</b> 1 → 1 threshold under 2 → 2 thresholds external 3 → 2 thresholds internal bit [14] = Manual mode	UInt [16b]	R/W	0		40101
Current Ratio	Current Ratio	Float [32b-MSW]	R/W	1		40102
Input Begin Scale	Input Begin Scale for output rescale	Float [32b-MSW]	R/W	0		40104
Input End Scale	Input End Scale for output rescale	Float [32b-MSW]	R/W	300		40106
Output Analog Begin Scale	Output Analog Begin Scale	UInt [16b]	R/W	0		40108
Output Analog End Scale	Output Analog End Scale	UInt [16b]	R/W	10		40109
Delta Energy	Delta Energy (Wh) per pulse (50ms)	Float [32b-MSW]	R/W	1	1	40110
Digital Output	bit [0] = Power-Up Value bit [1] = Fail under-range bit [2] = Fail over-range bit [3] = Fail HW bit [4] = Fail log bit [5] = Fail RTC bit [6] = Fail EEPROM bit [7] = Fail alarm bit [8] = Mode: <b>0 → Alarm mode</b> 1 → Energy pulse mode bit [9] = Don't care bit [10] = Alarm / Fail digital output state: <b>0 → Low</b> 1 → High  <b>From Firmware revision 005:</b> bit[11] = status AND/OR alarm: <b>0 = not active</b> 1 = active bit[12]-bit[13] = threshold type for input measure 1: <b>0 = under threshold</b> 1 = over threshold 2 = extern two thresholds 3 = between two thresholds bit[14]-bit[15] = threshold type for input measure 2: <b>0 = under threshold</b> 1 = over threshold 2 = extern two thresholds 3 = between two thresholds	UInt [16b]	R/W	0		40112
Alarm Low	Alarm Low Trip value	Float [32b-MSW]	R/W	0		40113
Alarm High	Alarm High Trip value	Float [32b-MSW]	R/W	0		40115
Alarm Hysteresis	Alarm Hysteresis value	Float [32b-MSW]	R/W	0		40117
Address, parity, stopbits	MSB: modbus address LSB: bit[0-1] = parity <b>0 → none</b> 1 → Odd 2 → Even LSB: bit[2] = stop bits <b>0 → 1</b> 1 → 2"	UInt [16b]	R/W	256		40119



Register Name	Description	Register Type	R/W	Default	Range	Address Modbus
Baudrate	0 → 1200 1 → 2400 2 → 4800 <b>3 → 9600</b> 4 → 19200 5 → 38400 6 → 57600 7 → 115200	UInt [16b]	R/W	3		40120
Log mode	bit [0] = disabled/enabled	UInt [16b]	R/W	0		40121
Log sample time	Log sample time (s)	UInt [16b]	R/W	0		40122
Log name	Log name (15caratteri MAX)	UInt [16b]	R/W			40123
Log name	Log name (15caratteri MAX)	UInt [16b]	R/W			40124
Log name	Log name (15caratteri MAX)	UInt [16b]	R/W			40125
Log name	Log name (15caratteri MAX)	UInt [16b]	R/W			40126
Log name	Log name (15caratteri MAX)	UInt [16b]	R/W			40127
Log name	Log name (15caratteri MAX)	UInt [16b]	R/W			40128
Log name	Log name (15caratteri MAX)	UInt [16b]	R/W			40129
Log name	Log name (15caratteri MAX)	UInt [16b]	R/W			40130
RMS Filter	RMS Filter Coefficient (0.99990 – 0.99999) 0,997 → 1 second 0,998 → 2 seconds 0,99991 → 3 seconds <b>0,99995 → 6 seconds</b> 0,99997 → 7 seconds 0,99998 → 10 seconds 0,99999 → 20 seconds	Float [32b-MSW]	R/W	0,99995		40131
Average measurement filter	Average measurement filter (0.99990 – 0.99999) <b>0,99 → 1 second</b> 0,993 → 3 secondss 0,999 → 5 seconds	Float [32b-MSW]	R/W	0,99		40133
Cut off Voltage	Cut off Voltage (V)	Float [32b-MSW]	R/W	0		40135
Cut off Current	Cut off Current (A)	Float [32b-MSW]	R/W	0		40137
Cut off P	Cut off P (W)	Float [32b-MSW]	R/W	0		40139
Digital output alarm type	Digital output alarm type: <b>0 = normal behaviour</b> (rev004 and older) 1 = OR of the alarms 2 = AND of the alarms	UShort [16b]	R/W	0	0..2	40141
MAX threshold 1	MAX threshold alarm 1	Float [32b-LSW]	R/W	0		40142
Min threshold 1	Min threshold alarm 1	Float [32b-LSW]	R/W	0		40144
MAX threshold 2	MAX threshold alarm 2	Float [32b-LSW]	R/W	0		40146
Min threshold 2	Min threshold alarm 2	Float [32b-LSW]	R/W	0		40148
Delay alarm 1	Delay alarm 1 (10000 = 1s)	UInt [32b-MSW]	R/W	0		40150
Delay alarm 2	Delay alarm 2 (10000 = 1s)	UInt [32b-MSW]	R/W	0		40152
Measure type input 1	0 = VRMS 1 = IRMS 2 = ACTIVE POWER 3 = REACTIVE POWER 4 = APPARENT POWER 5 = COS(PHI) 6 = FREQUENCY	UShort [16b]	R/W	0	0..6	40154
Measure type input 2	1 = VRMS 1 = IRMS 2 = ACTIVE POWER 3 = REACTIVE POWER 4 = APPARENT POWER 5 = COS(PHI) 6 = FREQUENCY	UShort [16b]	R/W	0	0..6	40155
Vrms SW	Vrms (V) swapped	Float [32b-LSW]	R			40201
Irms SW	Irms (mA) swapped	Float [32b-LSW]	R			40203
P SW	Active Power (W)	Float [32b-LSW]	R			40205
Q SW	Reactive Power (VAR)	Float [32b-LSW]	R			40207
S SW	Apparent Power (VA)	Float [32b-LSW]	R			40209
Cos (Φ) SW	Cos (Φ)	Float [32b-LSW]	R			40211
Frequency SW	Frequency (Hz)	Float [32b-LSW]	R			40213
THD SW	THD (%)	Float [32b-LSW]	R			40215
Total Energy SW	Energy (Wh)	Float [32b-LSW]	R/W			40217
Positive Energy SW	Positive Energy (Wh)	Float [32b-LSW]	R/W			40219
Negative Energy SW	Negative Energy (Wh)	Float [32b-LSW]	R/W			40221
Vpeak SW	Vpk (V)	Float [32b-LSW]	R/W			40223



Register Name	Description	Register Type	R/W	Default	Range	Address Modbus
Ipeak SW	Ipk (A)	Float [32b-LSW]	R/W			40225
Vrms MAX SW	Vrms MAX (V)	Float [32b-LSW]	R/W			40227
Vrms min SW	Vrms min (V)	Float [32b-LSW]	R/W			40229
Irms MAX SW	Irms MAX (A)	Float [32b-LSW]	R/W			40231
Irms min SW	Irms min (A)	Float [32b-LSW]	R/W			40233
S MAX SW	Active Power MAX (W)	Float [32b-LSW]	R/W			40235
S min SW	Active Power min (W)	Float [32b-LSW]	R/W			40237
S MAX SW	Reactive Power MAX (VAR)	Float [32b-LSW]	R/W			40239
S min SW	Reactive Power min (VAR)	Float [32b-LSW]	R/W			40241
S MAX SW	Apparent Power MAX (VA)	Float [32b-LSW]	R/W			40243
S min SW	Apparent Power min (VA)	Float [32b-LSW]	R/W			40245
Cos (Φ) MAX SW	Cos (Φ) MAX	Float [32b-LSW]	R/W			40247
Cos (Φ) min SW	Cos (Φ) min	Float [32b-LSW]	R/W			40249
Frequency MAX SW	Frequency MAX	Float [32b-LSW]	R/W			40251
Frequency min SW	Frequency min	Float [32b-LSW]	R/W			40253
THD MAX SW	THD MAX (%)	Float [32b-LSW]	R/W			40255
THD min SW	THD min (%)	Float [32b-LSW]	R/W			40257
Vrms x 100	Vrms (V) x 100	Long [32b-MSW]	R			40301
Irms x 100	Irms (A) x 100	Long [32b-MSW]	R			40303
S x 100	Active Power (W) x 100	Long [32b-MSW]	R			40305
S x 100	Reactive Power (VAR) x 100	Long [32b-MSW]	R			40307
S x 100	Apparent Power (VA) x 100	Long [32b-MSW]	R			40309
Cos (Φ) x 100	Cos (Φ) x 100	Long [32b-MSW]	R			40311
Frequency x 100	Frequency x 100	Long [32b-MSW]	R			40313
THD x 100	THD (%) x 100	Long [32b-MSW]	R			40315
Energy x 100	Energy (Wh) x 100	Long [32b-MSW]	R			40317
Positive Energy x 100	Positive Energy (Wh) x 100	Long [32b-MSW]	R/W			40319
Negative Energy x 100	Negative Energy (Wh) x 100	Long [32b-MSW]	R/W			40321
Vpk x 100	Vpk (V) x 100	Long [32b-MSW]	R/W			40323
Ipk x 100	Ipk (A) x 100	Long [32b-MSW]	R/W			40325
Vrms MAX x 100	Vrms MAX (V) x 100	Long [32b-MSW]	R/W			40327
Vrms min x 100	Vrms min (V) x 100	Long [32b-MSW]	R/W			40329
Irms MAX x 100	Irms MAX (A) x 100	Long [32b-MSW]	R/W			40331
Irms min x 100	Irms min (A) x 100	Long [32b-MSW]	R/W			40333
S MAX x 100	Active Power MAX (W) x 100	Long [32b-MSW]	R/W			40335
S min x 100	Active Power min (W) x 100	Long [32b-MSW]	R/W			40337
S MAX x 100	Reactive Power MAX (VAR) x 100	Long [32b-MSW]	R/W			40339
S min x 100	Reactive Power min (VAR) x 100	Long [32b-MSW]	R/W			40341
S MAX x 100	Apparent Power MAX (VA) x 100	Long [32b-MSW]	R/W			40343
S min x 100	Apparent Power min (VA) x 100	Long [32b-MSW]	R/W			40345
Cos (Φ) MAX x 100	Cos (Φ) MAX x 100	Long [32b-MSW]	R/W			40347
Cos (Φ) min x 100	Cos (Φ) min x 100	Long [32b-MSW]	R/W			40349
Frequency MAX x 100	Frequency MAX x 100	Long [32b-MSW]	R/W			40351
Frequency min x 100	Frequency min x 100	Long [32b-MSW]	R/W			40353
THD MAX x 100	THD MAX (%) x 100	Long [32b-MSW]	R/W			40355
THD min x 100	THD min (%) x 100	Long [32b-MSW]	R/W			40357
RTC year	RTC: year (2000-2099)	UInt [16b]	R/W			41001
RTC month	RTC: month (1-12)	UInt [16b]	R/W			41002
RTC day	RTC: day month (1-31)	UInt [16b]	R/W			41003
RTC hour	RTC: hour (0-23)	UInt [16b]	R/W			41004
RTC minute	RTC: minute (0-59)	UInt [16b]	R/W			41005
RTC second	RTC: second (0-59)	UInt [16b]	R/W			41006
Command	1=Reboot 2=Flash settings save 3=Set factory configuration 4=Reset Totalizer 5=Load Totalizer	UInt [16b]	R/W			42001



**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)