QI-50-DO-485

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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.

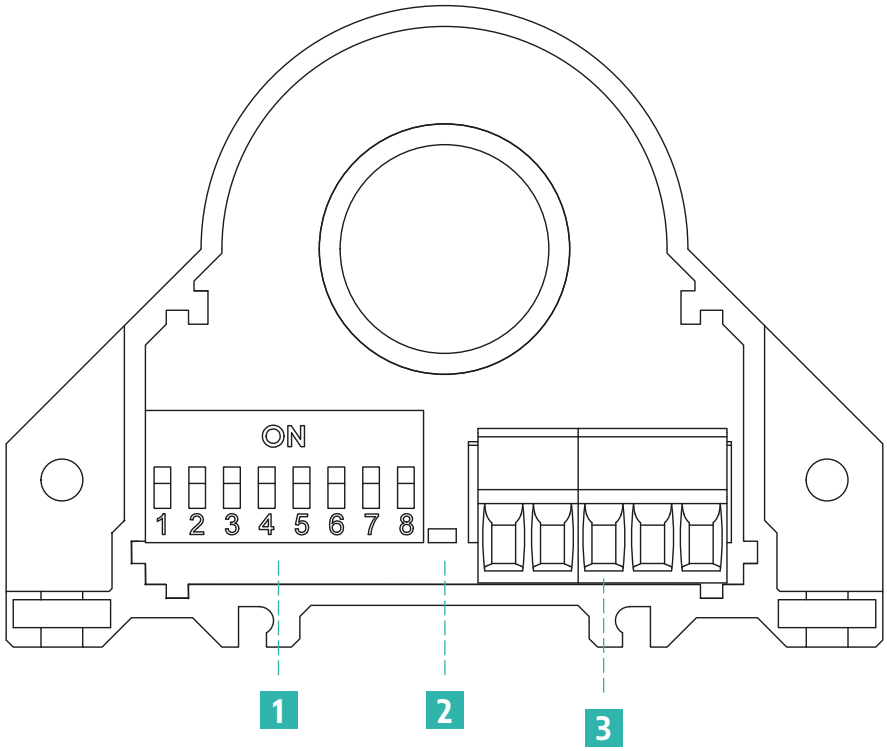
PRODUCT OVERVIEW

The QI-50-DO-485 is a DC and AC transformer that is galvanically isolated from the measurement circuit. It is similar in function and appearance to a standard active transducer, but is capable of measuring both the DC and AC TRMS components.

The unit is equipped with a potential-free digital output.

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.

Mounting accessories supplied as standard for DIN rail mounting.



1 Status LED:
- OFF: product not powered
- STEADY YELLOW: product powered
- FLASHING YELLOW: communication in progress

2 DIP Switch

3 Power supply, D_{out}, RS485 terminals

TECHNICAL SPECIFICATIONS

Electrical characteristics

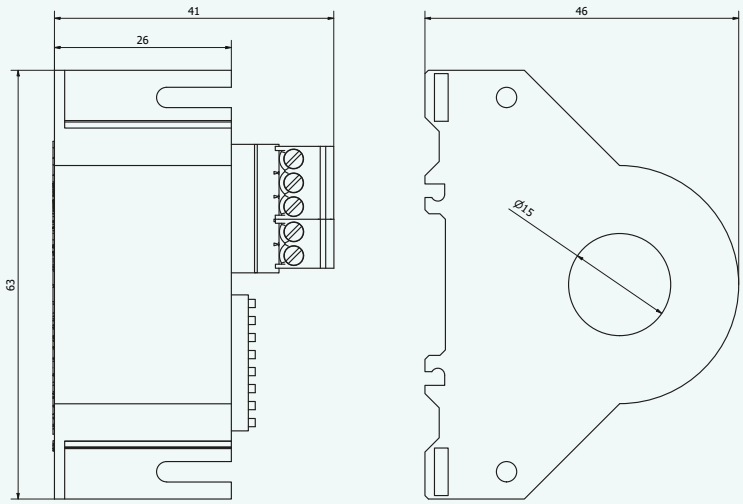
Power supply	12÷30VDC with reverse polarity and overtemperature protection	
Current consumption	20mA max	
Measureable current range	0÷50 A AC/DC	
Measurement type	TRMS(AC)/DC	
Accuracy class @25°C, 50Hz, PF = 1	<0,5% F.S.	
Resolution	12 bits	
Measurement Hysteresis	0,15% F.S.	0,2% F.S.
Crest factor	1,4	
Response speed	30ms on serial port	
Passband (-3dB)	DC or 20÷2000Hz	
Isolation	3kV on bare cable for current measurement	
Overload	50A continuos, 2kA pulsed	
Output	open drain NPN (GND referred) - (30 VDC max, 50mA max)	
Communication interfaces	RS485 Modbus RTU	

Communication characteristics

Protocol	Modbus RTU
Baudrate	1200÷115200 bps (default 2400)
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 5-pin terminal

General data

Working temperature	-15÷60° C
Storage temperature	-40÷85° C

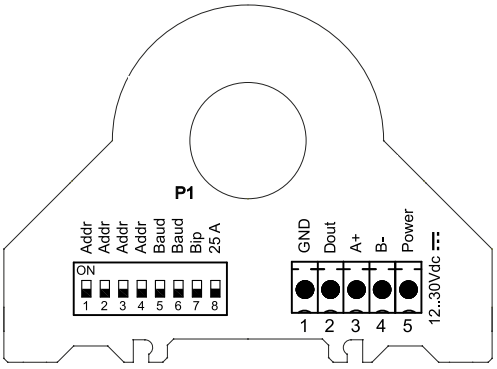
Relative humidity	10÷90% not condensing
Elevation	Up to 2000 m s.l.m.
Temperature coefficient	< 200ppm/°C
Protection degree	IP20
Measurements	41x63x46 mm 
Weight	72 g
Terminal cable cross-section	0.05÷1.5 mm² (30÷14 AWG)
Installation category	Cat. III (IEC 60664, EN60664)
Approvals and certifications	EN61000-6-4/2006 + A1 2011; EN61010-1/2010
Installation	Inside electrical panels and mounted on a DIN rail with attachment clips provided

Order codes

Product	QI-50-DO-485
Product without logo	QI-50-DO-485-T-NL
Attachment clips	900000009

CONNECTION AND INSTALLATION

The instrument is designed to be installed inside electrical panels and mounted on a DIN railin four different ways (DIN rail or panel mounting, vertical or horizontal).
All connection terminals are shown on the pad print on the product and correspond to the figure belo

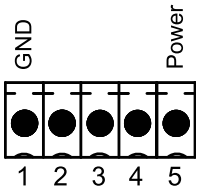
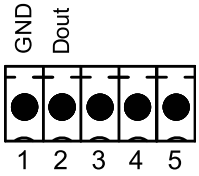
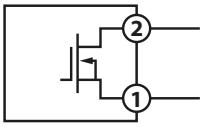
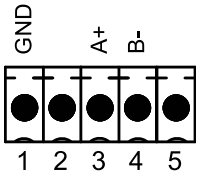


The system installation is as in the following image:

The conductor must be positioned as close to the product centre as possible to ensure correct current measurement.
The incoming direction of the current is represented by the nomenclature P1 and, where present, by the arrow pad-printed on the product.

WARNING: strong magnetic fields can alter the values measured by the instrument. Avoid installation near permanent magnets, electromagnets or ferrous masses that can significantly alter the magnetic field. In the event of anomalies, we recommend reorienting the instrument or moving it to a more suitable location.

The connection of the terminals is described below:

	Device power supply. **Please note:** Wiring must be protected against short circuits and/or accidental faults
	Digital output 
	RS485 Modbus RTU connection: terminals 3 (A+), 4 (B-), 1 (GND)

MEASUREMENT CONFIGURATION

By means of DIP switches 7 and 8, a different measuring range and type can be set according to the table below:

Description	DIP 7	DIP 8
TRMS	0	
DC	1	
50A AC/DC		0
25A AC/DC		1

NOTE: To make the above settings effective, DIP switches 1-4 must not be set to 0000, which would force the use of the configuration from EEPROM.

DIGITAL OUTPUT ALARM

The output can be configured according to one of 4 types as shown in the pictures below:

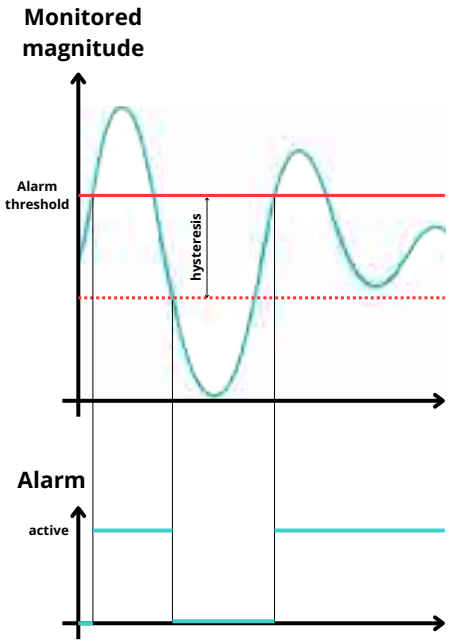


Figure 2: Alarm above threshold

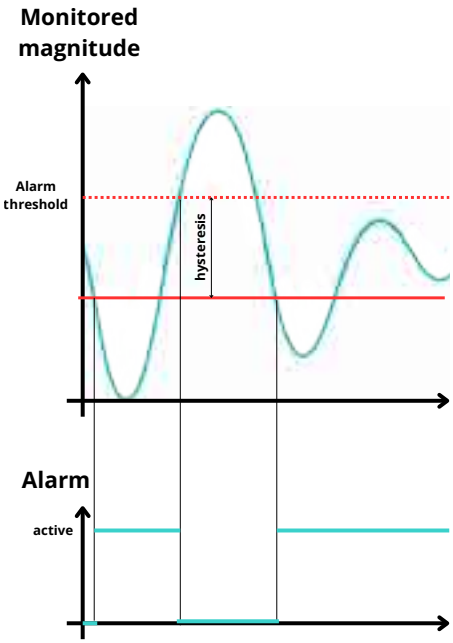


Figure 3: Alarm below threshold

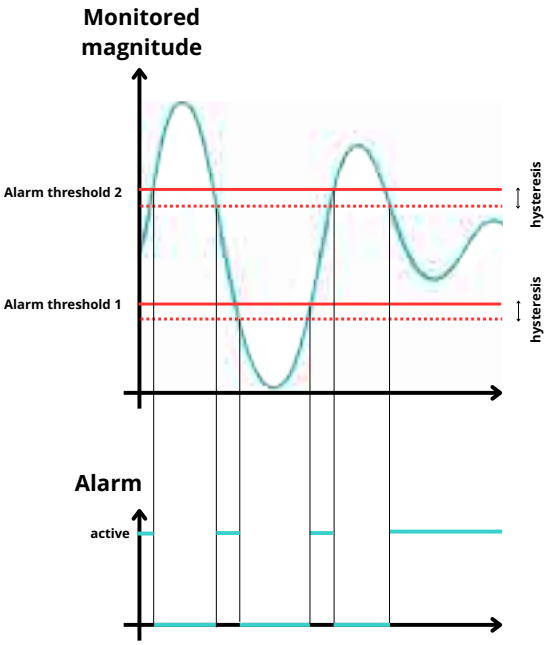


Figure 4: Alarm inside thresholds

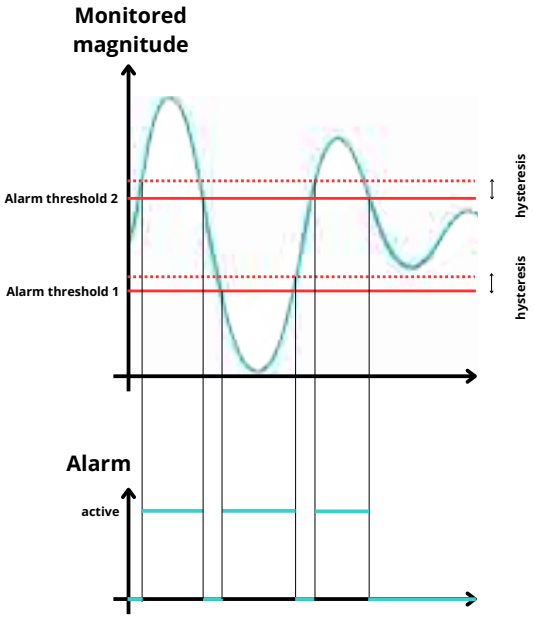


Figure 5: Alarm outside thresholds

PRODUCT FEATURES

Using the configuration software or acting on the dedicated registers, the following functions can be configured:

Modbus

Address, baud rate, parity and response delay can be set.

Digital output

Possibility of enabling the digital output, the status of the outputs when the instrument is switched on (normally open or closed) and the associated alarm type and thresholds.

DEVICE CONFIGURATION

Baudrate setting via DIP switch

Before connecting and powering up the product, the baud rate can be set by DIP switch.

Description	DIP 1	DIP 2	DIP 3	DIP 4	DIP 5	DIP 6
Settings from EEPROM	0	0	0	0		
Address = 1	0	0	0	1		
Address = 2	0	0	1	0		
...	...	...	...	...		
Address = 15	1	1	1	1		
Baudrate = 2400					0	0
Baudrate = 9600					0	1
Baudrate = 38400					1	0
Baudrate = 57600					1	1

Addresses greater than 15 and baud rate values other than those selectable by DIP-switch can be configured via the **Q-WIZARD** configuration software or with the Modbus RTU functions below by acting on the dedicated registers.

PLEASE NOTE: to make active all changes via DIP-switch, it is necessary to remove and restore power to the device.

Functionality configuration

Through an RS485 serial device such as our Q-USB485, it is possible to connect to the product using the Modbus RTU input terminals.

Configuration of the module can be done with our **Q-WIZARD** configuration software or with any third-party Modbus master by acting on the registers in the map in the last chapter of this document (see page 13).

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 40048; changes of device communication parameters in addition must also be followed by the command 0xC1A0 = Reboot command in register 40048.

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 5 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**.

Address Modbus	Description	Register Type	R/W	Default	Range
40001	Machine ID	UShort [16b]	R	50	
40002	Firmware version	UShort [16b]	R		
40003	Modbus address	UShort [16b]	R/W	1	1...247
40004	Modbus communication response delay (in machine cycles)	UShort [16b]	R/W	1	1...255
40005	Baudrate Value: 0 = 1200 **1 = 2400** 2 = 4800 3 = 9600 4 = 19200 5 = 38400 6 = 57600 7 = 115200	UShort [16b]	R/W	1	0...7
40006	Parity: **0 = none** 1 = ODD 2 = EVEN	UShort [16b]	R/W	0	0...2
40011	Digital output configuration: bit[0] = Digital Output Enable 0 → Disabled **1 → Enabled** bit[1] = NO or NC 0 → NC output **1 → NO output** bit[2..3] = Alarm activation **0 → Under threshold** 1 → Over threshold 2 → Within Threshold 3 → Outside Threshold	UShort [16b]	R/W	3	
40012	Alarm hysteresis (1 = 10 mA)	UShort [16b]	R/W	0	0 ... 1000
40013	Alarm activation delay (ms)	UShort [16b]	R/W	0	0 ... 65535
40014	Alarm threshold for “above” and “below” types or first alarm threshold for “within threshold” and “Outside threshold” types. (1 = 10mA)	UShort [16b]	R/W	10	0 ... 5000
40015	Second alarm threshold for “within threshold” and “Outside threshold” types. Second threshold value must be higher than first threshold. (1 = 10mA)	UShort [16b]	R/W	0	0 ... 5000
40016	N° of samples for moving average (1=100 ms)	UShort [16b]	R/W	1	1...132
40017	Second level of filtering for ripple problems on AC measurement	UShort [16b]	R/W	4096	1000 ... 20000
40018	Current cutoff threshold - minimum level for measurements [mA]	Ushort[16b]	R/W	250	0 ... 50000
40034	S/N part1	UShort [16b]	R		
40035	S/N part2	UShort [16b]	R		
40036	S/N part3	UShort [16b]	R		
40045	RMS Current Value [A]	Float [32b-LSW]	R/W		
40047	Digital output status: 0 = output switch open 1 = output switch closed	UShort [16b]	R/W		
40048	Command: 0xC1C0 = Flash setting save command 0xC1A0 = Reboot command	UShort [16b]	R/W		
40056	Status Register: bit[0] = Flash settings error bit[1] = Flash calibration error bit[2] = Over range bit[3] = Under range bit[4] = Ah sum (every second) bit[5] = Filter activation status bit[6] = Alarm triggered status	UShort [16b]	R/W		
40058	RMS Current value in hundred [A x 100]	Short [16b]	R/W		
40059	Swapped RMS current value [A]	Float [32b-MSW]	R/W		
40061	Ampere-per-hour count (resettable)	Float [32b-LSW]	R/W		
40063	Max RMS current in hundred [A x 100] (resettable)	Short [16b]	R/W		
40064	min RMS current in hundred [A x 100] (resettable)	Short [16b]	R/W		

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)

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As standards, specifications, and design change from time to time, please ask for confirmation of the information given in this publication.