Single-Channel Electric Meter

QBrick 1

User Manual

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Read me

Read this user manual carefully before installing, operating, or maintaining the QBrick 1 Multi-Channel Electric Meter. Safety must be the primary consideration when reviewing all the installation guidelines described in this document. Installation, operation, and maintenance of the QBrick 1 Multi-Channel Electric Meter must be performed by qualified and trained professionals with experience in high voltage and current devices and metering equipment. Quadlogic Controls Corporation is not responsible or liable for any injuries caused by improper meter installation, operation, or maintenance.

De-energize and ground the meter prior to any maintenance or repair.

Observe the following guidelines before installing or using the meter:

1. Verify that the power supply has the necessary approvals and certifications and that it meets the specifications of the **QBrick 1.**

2. Terminate the secondary conductors of all CTs before allowing current to flow in the CT primaries. CT leads must be shorted together when not connected to the meter.

3. Dangerous voltage levels may be exposed when the meter cover flaps are open. Use caution when working with the meter under these conditions.

4. Verify that all terminals for communication signals (RS-485) are protected from any line voltage or current.

5. Verify that all instrument wiring (e.g. CT wiring) is consistent with the internal system settings and meter specifications.

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1. Package Contents

1 **QBrick 1**
1 User manual
1 QBrick service kit
- 1 CT shorting PCB (P/N QBrick-JQ-KIT)
- 20 spare lead sealing screws
- 1 pair of header removal tweezers
- 20 spare current input header plugs
- 1 Phillips/flathead screwdriver (pull bit shaft and flip around to switch drivers)
- 1 tool/connector carrying case

2. Overview

The **QBrick 1** power meter is a revenue/utility grade, compact, and robust electrical metering solution. It enables reliable monitoring of building electrical loads with a low installation cost-per-point, making it an ideal solution for utility metering or sub-metering applications. The meter can record up to 60 days of energy data at 5 minute intervals, and offers real-time power diagnostics on each phase. The meter can be wired to monitor 1 three-phase, three-wire(“3P3W”) or three-phase, four-wire(“3P4W”) circuit loads.

The **QBrick 1** is UL (UL61010-1-2012, UL61010-2-030:2012) CSA(CSA C22.2 NO 61010-1, CAS C22.2 NO 61010-2-030)and ANSI approved (ANSI-C12.20:2015).

Features include MODBUS RTU via RS-485, 1 pulse output , and 6 digital inputs. Multiple units can be daisy-chained together on the RS-485 lines. The versatility of the **QBrick 1** makes it the ideal meter for applications in office towers, condominiums, apartment buildings, shopping centers, data centers, and any other environment.

Measurement Functions:

Function	Detect Parameter	Per metering point	Per channel	Unit
Real-time Parameters	Voltage	/	●	V
	Current	/	●	A
	Active Power	●	●	kW
	Reactive Power	●	●	kVAr
	Apparent Power	●	●	kVA
	Power Factor	●	●	/
	Frequency	●	/	Hz
Accumulated data Energy	Active Energy +	●	●	kWh
	Active Energy -	●	●	kWh
	Inductive Reactive Energy +	●	●	kVARh
	Capacitive Reactive Energy -	●	●	kVARh
	Inductive Reactive Energy -	●	●	kVARh

	Capacitive Reactive Energy +	•	•	KVARh
	Apparent Energy +	•	•	kVAh
	Apparent Energy -	•	•	kVAh
Interval Data (5 min records)	Active Energy +	•	•	kWh
	Active Energy -	•	•	kWh
	Inductive Reactive Energy +	•	•	kVARh
	Capacitive Reactive Energy -	•	•	kVARh
	Inductive Reactive Energy -	•	•	kVARh
	Capacitive Reactive Energy +	•	•	kVARh
	Apparent Energy +	•	•	kVAh
	Apparent Energy -	•	•	kVAh

Event Log
The **QBrick 1** meter saves up to 1000 event logs for use in meter diagnostics or troubleshooting. These logs are stored as Sequence of Events (SOE) records. See section 5.3.4. for more information.

Digital Input Port
The **QBrick 1** meter comes with 6 Digital Input (DI) ports that can be used for detecting an external open/closed circuit or for looping back its own pulse output for on-site remote diagnostics. The DI ports can also be used for pulse inputs from other utility metering devices such as gas, thermal/BTU, or water meters.

Pulse Output
The meter has 1 pulse output that can be used for external accuracy verification. The pulses can be configured to represent Wh, VAh. or VARh.

Communication
MODBUS RTU/RS-485 protocol

Connectivity Options

QTao -- The **QBrick 1** may be connected by RS-485 to an optional Quadlogic meter data hub (QTao). The QTao allows remote access to meter data over a hardwired network connection and local access to meter data over its secure wifi hotspot. Up to 247 QBrick devices may be daisy chained to a single QTao allowing for access to data for a combination of 2-phase and 3-phase loads. See QTao user documentation for more details.

Display Unit -- The **QBrick 1** meter can be connected to an external Display Unit (“D-Unit”) to display metering data values including real-time parameters and metering point energy values. A single Display Unit can be connected to a maximum of 16 QBrick units. Refer to D-Unit Manual for more details.

Other -- Alternatively, the **QBrick 1** may be connected by MODBUS/RS-485 to an existing building management system or to a BACnet system using an RS-485 to BACnet converter. The meters may also be connected by 900 MHz mesh radio network to a QTao or other modbus devices. Contact Quadlogic customer support for more information on implementing these options.
Manual Lock Switch

QBrick 1 provides a manual lock switch to prevent any modification to critical configuration registers while in the “locked” state. The K-485 switch is located inside the meter shell. The shell is secured by lead seal screws located on the base of the unit. Refer to Section 3.5 for more details.

3. Specifications

Reference Standards:

Basic electricity: IEC 61557-12:2007
Energy: ANSI-C12.20:2015
Safety: UL61010-1-2012, UL61010-2-030:2012
CSA C22.2 NO 61010-1, CSA C22.2 NO 61010-2-030

Accuracy Specifications:

Parameter	Accuracy (+/-)	Resolution（Primary side）
Voltage	0.2%	0.01 V
Current	0.2%	0.01 A
Active Power	0.5%	0.01 W
Reactive Power	0.5%	0.01 VAR
Apparent Power	0.5%	0.01 VA
Power Factor	0.3%	0.001
Active Energy	0.5%	0.001 kWh
Reactive Energy	0.5%	0.001 kVARh
Apparent Energy	0.5%	0.001 kVAh
Frequency	0.05%	0.01 Hz

V-REF and Current Input Ratings

Reference voltage range: Autoranging, 90-600VAC (L-L), 90-347 VAC (L-N) and ANSI tested for 120VAC (L-N) (+/- 10% tolerance)
Current: 100 mA
Frequency: 60 Hz
Measurement category CAT III 600V
Measurement burden: < 1VA

Overload Capacity

Current: 1.2 times the rated current, continuous; 10 times the rated current for 5 seconds
Voltage: 2 times the rated voltage for 30 seconds

Service Configurations:
347/600 V Wye grounded/ungrounded
600 V Delta grounded/ungrounded
480 V single phase two wire
120/240 V single phase three wire

Dielectric strength

4 kV AC RMS 1 minute, between input / output / case / power supply

Digital Input Port
Input for external dry-contact closures
Excitation voltage: +15VDC; From internal, isolated power supply. Ground for this power supply is not accessible.
Contact-closed current: 5 mA
These ports will never exceed 15 VDC and 5mA.

Universal Output (for future use)
Dry contact closure: Maximum voltage 30VDC; Maximum current 100 mA

Working Temperature

Temperature: -20 °C to +55 °C
Pollution degree: 2
Humidity: RH 0% to 95% (Non-condensing)
Altitude: up to 2000m

Storage Conditions

Temperature: -25 °C to +70 °C
Humidity: RH 0% to 95% (Non-condensing)

Power Supply Requirements

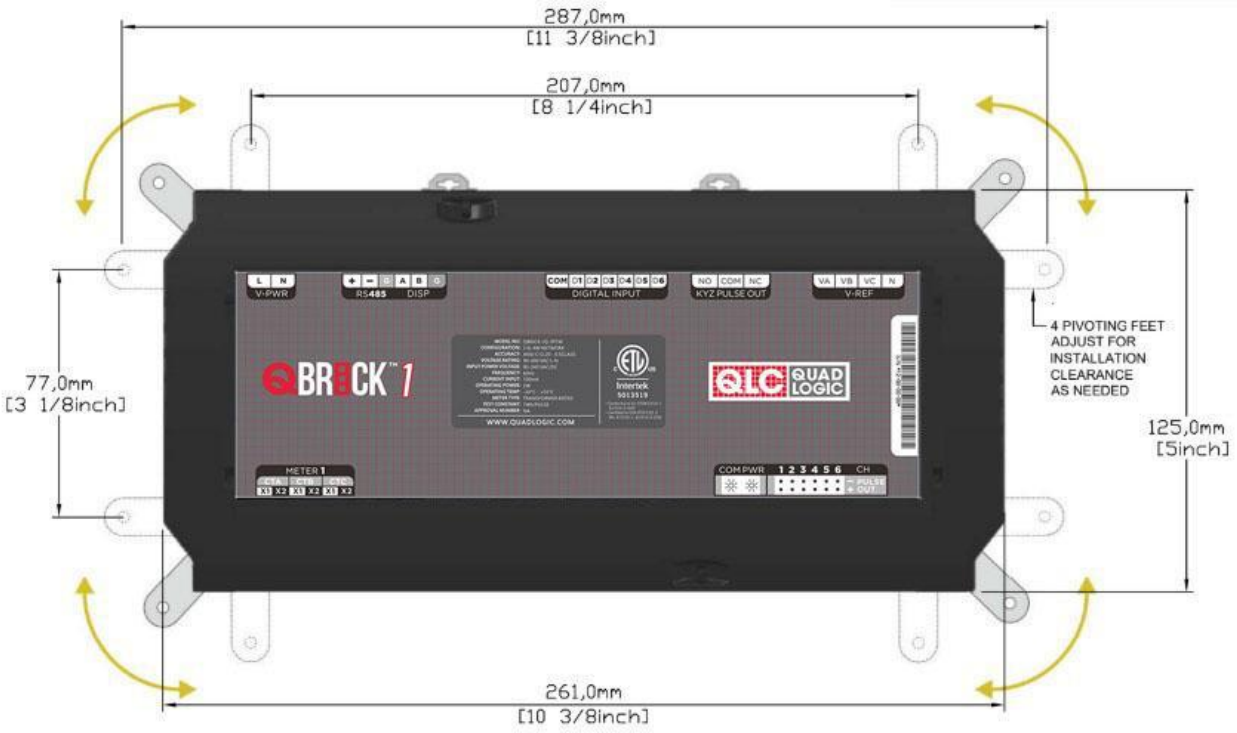
90-240 VAC +/-10%, 60 Hz, CATIII
Power consumption burden: <12 VA

Memory size:

Flash	16 MB
EPROM	256 kB
FRAM	64 kB

Dimensions

L × H × D = 261 mm×125 mm×71 mm



Mounting Options

35 mm Din-Rail
Pivoting feet for wall mounting

4. Installation

This chapter contains installation instructions and wiring diagrams for **QBrick 1** installations. The installation instructions start with a general procedure which applies to all meter models, then continues with specific wiring and CT installation information for each particular **QBrick 1** configuration. When installing the meter it is critical that you use the correct wiring instructions.

Follow instructions and warnings to ensure proper operation of equipment and to reduce risk of electric shock or other hazardous conditions.

The following is an overview of the installation steps. Use the detailed instructions in the rest of chapter three to complete the installation. Installation Overview:

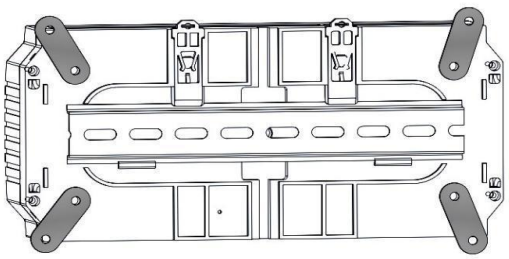
1. Mount the meter
2. Review meter connections
3. Connect meter communication (RS-485/DISP) to optional devices
4. Connect measurement voltage (V-REF) inputs
5. Connect current inputs
6. Connect auxiliary power inputs (V-PWR)
7. Verify wiring
8. Test the installation

4.1 Installation

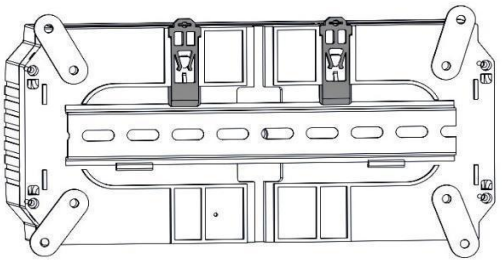
4.1.1 Mounting

The **QBrick 1** meter has 2 mounting options. The meter can either be mounted on a 35 mm DIN rail or it can be directly fastened onto a wall by using the 4 fold-out feet located in the rear corners of the meter housing (See diagrams below).

Note: This meter must be installed inside a fire/electrical enclosure or panel.



Wall Mounting



Din Rail Mounting

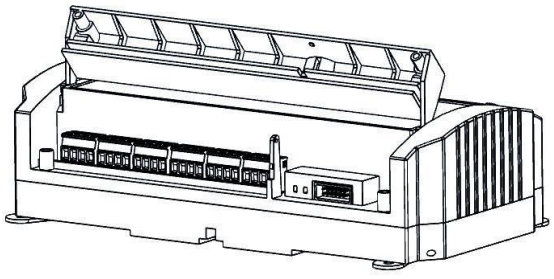
Choose a mounting option below and mount the meter:

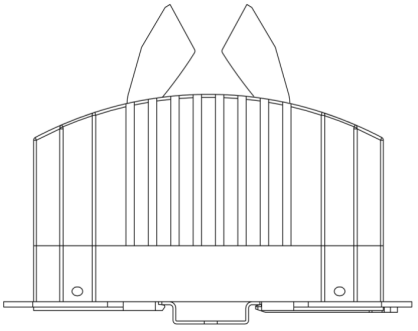
a. Wall Mounting (left diagram above)
   i. Unfold 4 mounting feet located near the rear corners of the meter.
   ii. Arrange these feet so they can be fastened to an appropriate surface.
   iii. Secure feet to wall with appropriate screws.
   iv. Verify that meter is securely fastened to the wall.

b. DIN Rail Mounting (right diagram above)
   i. Fasten a section of 35 mm DIN rail (at least 8 inches long) to the mounting surface with appropriate hardware.
   ii. Use the white plastic clips on the back of the QBrick meter to clip the meter onto the rail.
   iii. Verify that the meter is securely fastened to the wall.

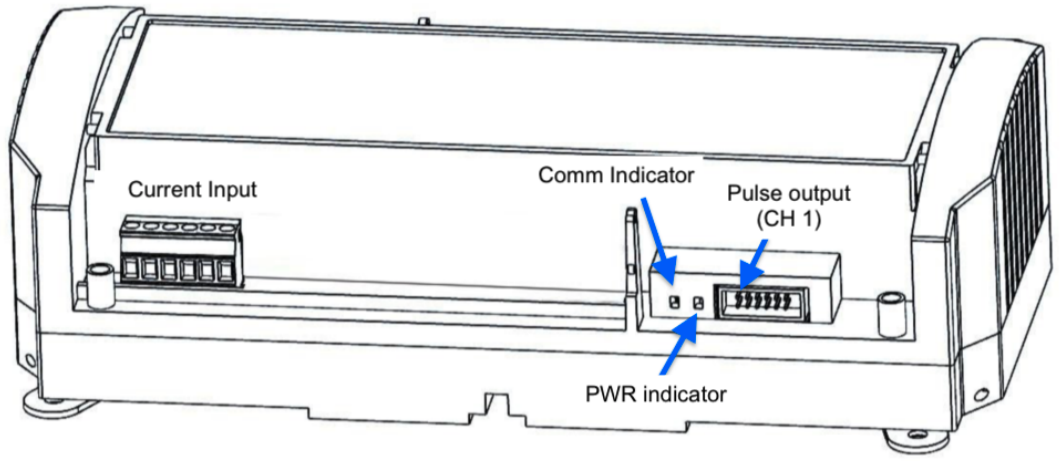
4.1.2 Connection Terminals and Switches

The **QBrick 1** wiring terminals are protected by two (2) flaps. Open these flaps before connecting any wires to the meter. See diagram below for details. The flaps should be in the open position, as shown below, prior to connecting any wiring to the meter:

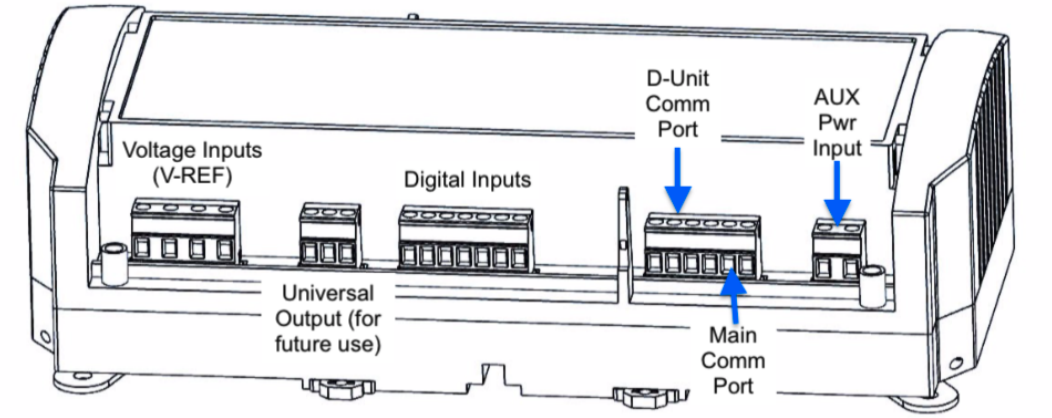




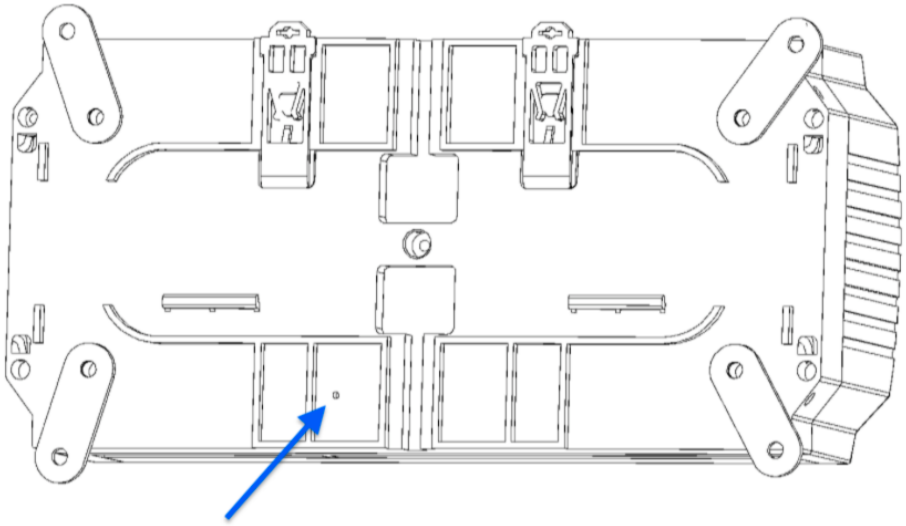
Refer to the following diagrams for descriptions and locations of each meter terminal:



Side 1:



Side 2:



Back of meter: COMM Port "RESET" button (Refer to section 5.3.2)

4.1.3 Installing Optional Communication Wiring

The **QBrick 1** has several communication options. The meter can be connected to a display unit (D-Unit) for local data access via the DISP header. It can also be connected to the QTao meter data hub or a different building management system via the RS-485 header for remote meter data access. Refer to the QTao user manual for more information on this system option. If a wireless communication system is needed, contact Quadlogic Controls Corp. for more info.

Install any necessary communication wiring at this point. WARNING: Power must be off when connecting these wires! Refer to the D-Unit or QTao installation manuals for detailed instructions.

4.1.4 Installing Measurement Voltage (V-REF) Inputs

Measurement voltage (V-REF) input requirements:

a. The measurement voltage inputs (V-REF) should not exceed the rated input voltage of the meter, 600 VAC. If voltage inputs exceed 600 V then potential transformers (PTs) must be used to step-down the voltage to a level within the meter's rated input voltage range. PTs must maintain the measurement accuracy of the **QBrick 1**. Approved revenue grade PTs must be used for revenue grade metering applications.

b. Follow all applicable local and national electrical codes when wiring the measurement voltage inputs. Install fuses where necessary.

c. The meter must be installed with a local disconnect (switch, breaker, etc.) and branch service protection (fuse, breaker, etc.) on the V-REF lines. The disconnect and service protection may be provided by the same device. The service protection should be rated for at least 4 Amps at 250V, the maximum rating should be determined by wire gauge and local electrical code.

d. For V-REF wiring use 14-20 AWG wire rated for the appropriate voltage.

Measurement Voltage Installation Steps:

WARNING: Power should be off when making these connections.

1. Locate the V-REF header plug on the **QBrick 1.**
2. Loosen the header terminals with a small flat head screwdriver
3. Locate the incoming measurement voltage wires in the distribution panel.
4. Use the appropriate wiring diagram as a guideline for connecting the incoming voltage wires to the V-REF header on the meter.

4.1.5 Installing the Current Inputs

Current input requirements:
The standard input current for the **QBrick 1** is 100 mA.
Use class 0.1 CTs to maintain ANSI class 0.5 meter accuracy
CT wires must be between 20 AWG and 14 AWG.
CTs must meet or exceed the following guidelines: UL 61010-1, 61010-2-032, CSA C22.2# 61010-1, 61010-2-032, CAT III 600V.

⚠ This meter requires the use of UL listed energy monitoring and utility grade CTs rated for the maximum voltage of the installation

Safety Guidelines:

- Always open or disconnect circuit from power-distribution system (or service) of building before installing or servicing current sensors
- The current sensors may not be field installed in the wiring space of enclosures for switches or overcurrent devices if the area of all current sensors, conductors, splices, taps and equipment at any cross section of the wiring space exceeds 75 percent of the cross-sectional area of that space
- The current sensor should not be installed in an area where it will block ventilation openings
- The current sensor should not be installed in or near breaker arc venting equipment
- “Not suitable for Class 2 wiring methods” and “Not intended for connection to Class 2 equipment”
- Secure current sensor and route conductors so that the conductors do not directly contact live terminals or bus. This instruction is optional if the integrated field wiring lead or associated cable insulation of the current sensor is rated for 105°C (221°F) or greater. Current sensors with terminals (where the conductors are supplied during installation) are still subject to this requirement
- Current sensors marked “BASIC INSULATION” shall be installed on insulated conductors only and should never contact live parts;

WARNING:
To reduce the risk of electric shock, always open or disconnect circuit from power-distribution system (or service) of building before installing or servicing current sensors.

Current Transformer Installation notes:

- Never install a CT on the live feeder wire with open secondary leads. This can be extremely dangerous. The provided CT shorting PCB may be used to short secondary CT leads during the installation process.
- Always observe physical orientation of CT (LINE/LOAD) when installing on the feeder wire.
- Always pay attention to wiring polarity and phasing when terminating the CT leads to the **QBrick**.
- Always follow the table below if you need to extend the CT lead length.
- If extending CT lead length, always use the same lead color as the original.
- Always label the CT leads near the CT and at the end so you don't cross up two similarly colored leads when terminating to the **QBrick**.

  ** Failure to follow the termination procedure outlined in this manual may result in incorrect readings, damage to the metering equipment, and/or physical harm to the installer.

CT secondary wire size (AWG)	CT secondary wire length (feet)
# 20	88
# 18	140
# 16	223
# 14	355

Current Inputs Installation Steps:

1. Locate the branch load hot wires that supply current from the distribution panel to the metered loads.
2. Turn off power to these loads if possible.
3. For solid core CTs disconnect the load wires one at a time and properly run each phase wire through a CT.
4. For split core CTs place the two halves of the core around the load wire and close them together.
5. Follow direction indications on the CTs to ensure they are installed in the correct orientation.
6. Reconnect each branch load wire after the CT is installed.
7. Run the CT secondary wires to the **QBrick**.
8. Connect the secondary wires to the terminal plugs on the current inputs of the **QBrick**. Use the appropriate wiring diagram as a reference for making these connections. Note: It is very important that the 2 wires from an individual CT go to the proper terminals on the meter.
9. If necessary, restore power to the branch load wires, otherwise keep power off until the installation is complete.

4.1.6 Installing Auxiliary Power Supply:

Installation Requirements:

The **QBrick 1** operates from power supplied to the V-PWR terminals. The meter requires a power source with the following specifications: 90-240 VAC, 60 Hz, >12 Watts. V-PWR may be the same as the power connected to the measurement voltage inputs (V-REF), or it can be from a separate source. The meter must be installed with some type of local disconnect (switch, breaker, etc.) and branch service protection (fuse, breaker, etc.) on the V-PWR lines. The disconnect and service protection may be provided by the same device. The service protection should be rated for at least 4 Amps at 250V, the maximum rating should be determined by wire gauge and local electrical code.

Installation instructions:

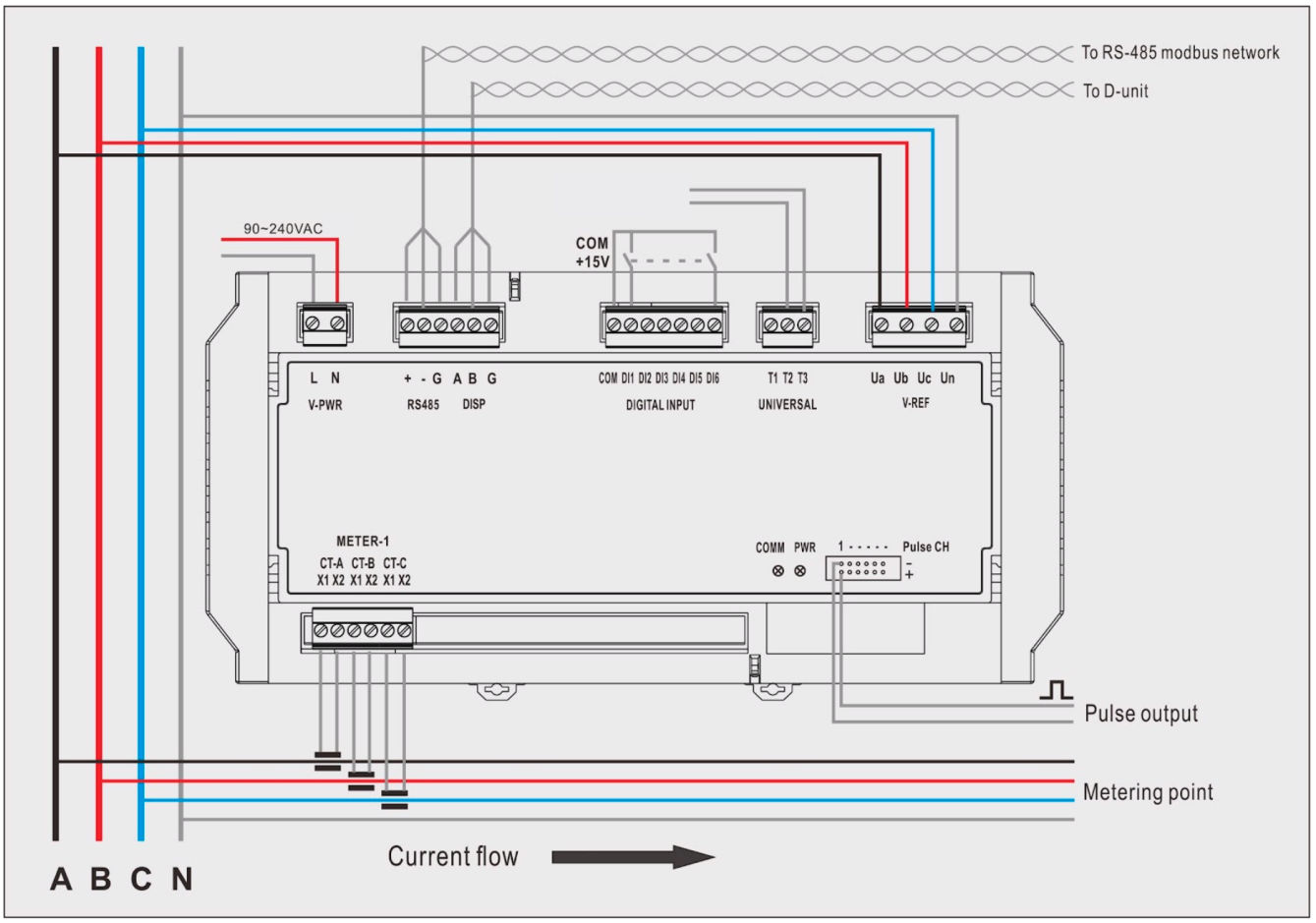
1. Locate source of power (90-240 VAC, 60 Hz, >12 Watts).
2. Turn the power source off.
3. Connect the power source wires to the terminals on the V-PWR meter plug. Note: the polarity of these connections does not matter.

4.1.7 Final steps:

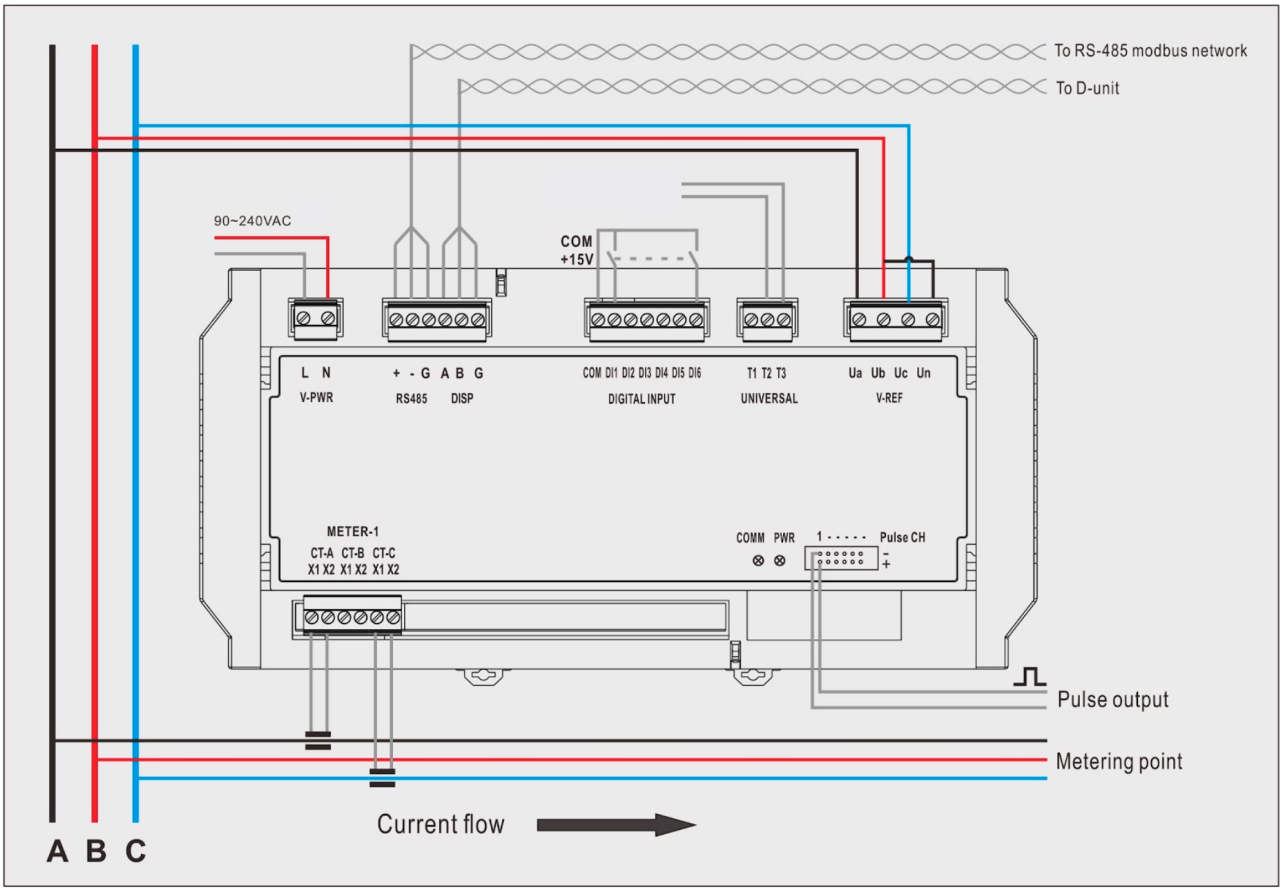
1. Verify that all wiring has been installed correctly.
2. Restore power to the metered loads and to the V-PWR header.
3. The PWR LED should be illuminated

4.2. Typical Wiring Diagram

Typical wiring - 3P4W



Typical wiring - 3P3W-2CT

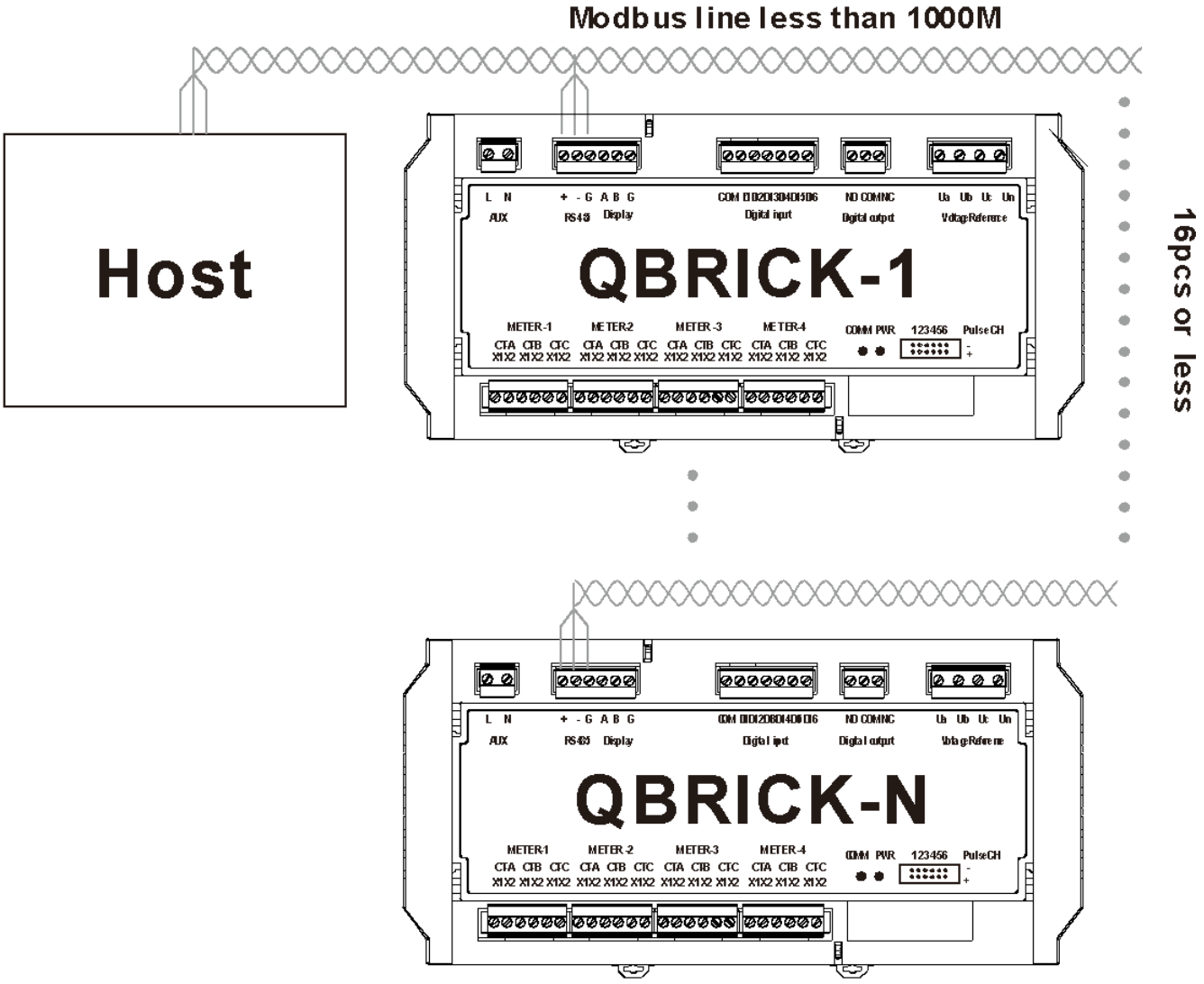


4.3. Connecting Multiple QBrick units to the RS485 Bus

The **QBrick 1** system allows for a maximum of 16 units connected together on one RS-485 circuit. If more than 16 units are to be connected to a single RS-485 line, use an RS-485 repeater to expand the network.

Use the following diagram to daisy chain multiple QBricks to the same RS-485 line. Refer to the product documentation page on Quadlogic's website for more modbus related wiring diagrams (ie. repeaters, radios, etc.)

Typical wiring of Single MODBUS Circuit



4.4 Tamper Protection of QBrick 1

4.4.1 Software tamper protection

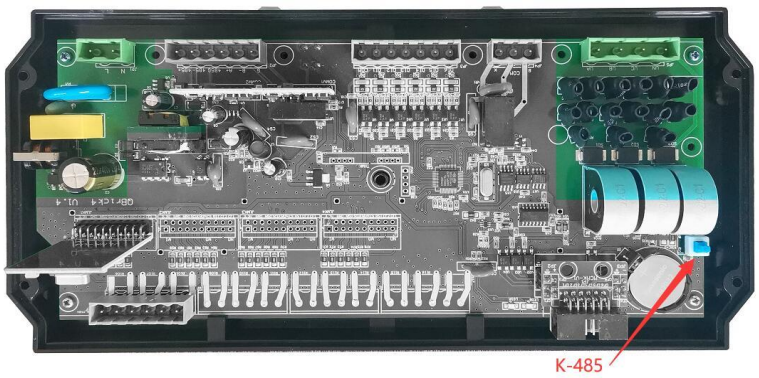
Overview

Certain **QBrick 1** configuration registers can be protected by the K-485 switch. The switch can only be accessed by removing the meter shell. Write access to these registers is permitted when the switch is in the “unlocked” position. For the details on the secure register maps, refer to Chapter 5.3.2. Note: if the meter is sealed, then accessing the K-485 switch will break the seal.

Accessing the K-485 switch requires opening the **QBrick 1** shell and will expose the high voltage and current connections. Only trained technicians should attempt this procedure.

K-485 access instructions (see photo below):

1. Turn off power (V-PWR and V-REF if possible) to the **QBrick 1**.
2. Remove all the terminal headers from the front side of the **QBrick 1**. Use the CT shorting PCB to store the CT header plugs during this process so that they do not get mixed up. It is critical that each CT plug gets returned to the proper metering point current input.
3. Remove the **QBrick 1** from the wall.
4. Remove the 5 screws from the bottom of the **QBrick 1** and remove the **QBrick 1** shell. **This will require breaking the meter seal.**
5. Activate the K-485 switch by toggling the switch to the down position. The shell should be used as a cover to prevent electrical shock.
6. Connect the RS-485 terminals to a MODBUS master device.
7. Apply power to the V-PWR terminals. **If the housing is removed, hazardous voltages are accessible on the unit.**
8. Use the MODBUS master device to write to the **QBrick 4** configuration registers. Allow 5 seconds to pass to ensure that the writing of the configuration registers completes properly. Refer to Communication Interface Reference Section for details on writing to the configuration registers.
9. Open the **QBrick 1** shell and disable the K-485 switch by toggling the switch to the up position after the configuration is complete.
10. Replace the **QBrick 1** shell and tighten the 5 screws on the back of the meter.
11. Re-install the terminal headers on the front of the unit. Take care to place each CT plug in the correct position.
12. The configuration is now complete and the **QBrick 1** is ready to be sealed or powered on again.



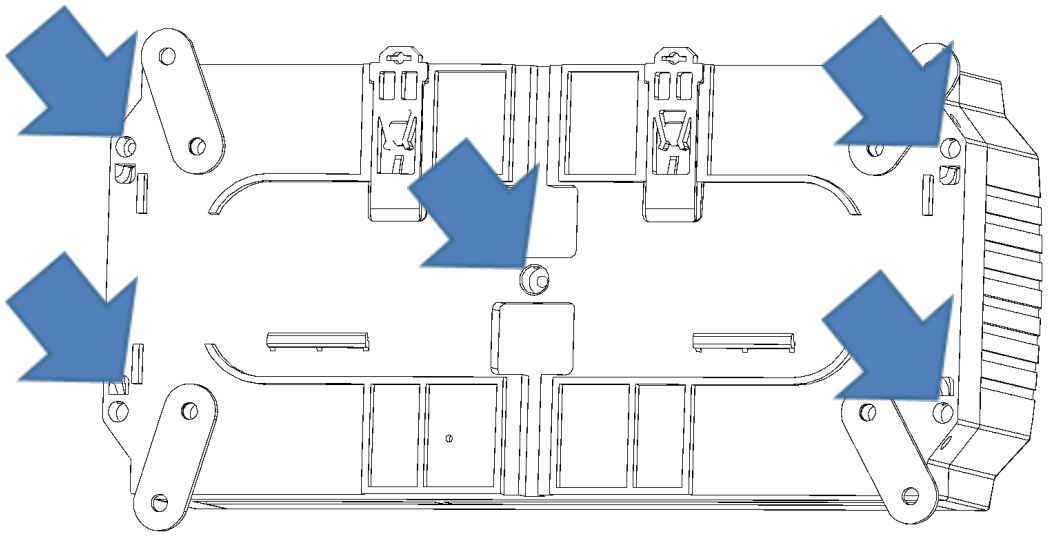

K-485 Unlocked


K-485 Locked

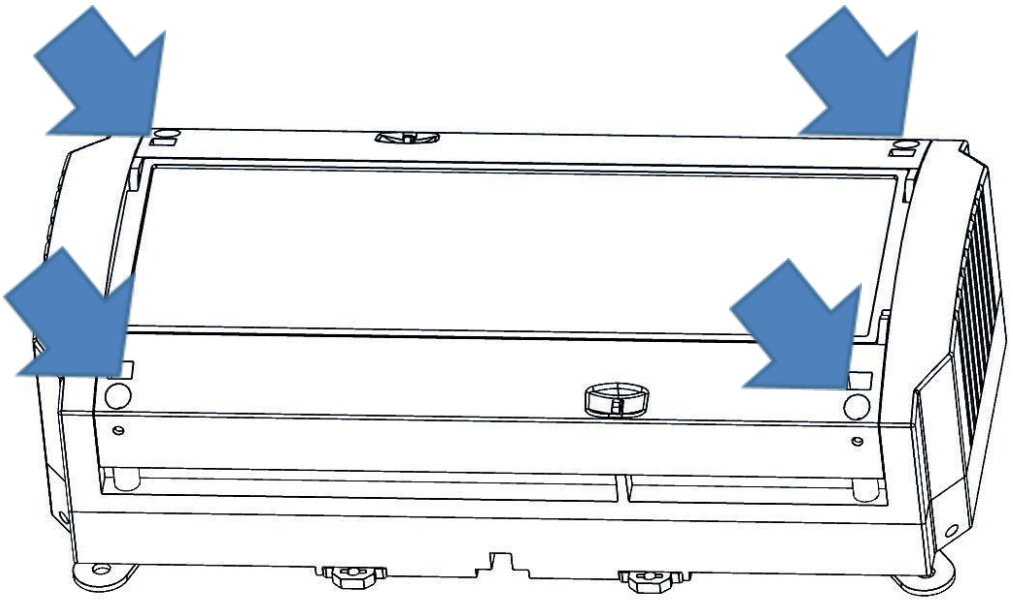
Notes: When the K-485 switch is in the unlocked state the D-unit will display a notice on the screen. Refer to D-Unit User manual for more information.

4.4.2 Hardware tamper protection

The **QBrick 1** shell uses lead seal screws to prevent access to the meter. The back of the unit has five (5) seal screws to lock the meter shell, after initial configuration. A lead seal can be used across each screw hole to lock/seal the screw position



Each flap on the top of the meter has two lead seal screws. See diagram below for locations. A lead seal can be placed through the hole to prevent tampering and access to the terminal headers.



5. COMMUNICATION INTERFACE

5.1. Connection for the RS-485 BUS

The composition of the RS-485 cabling must be shielded cable (1 twisted pair RX/TX with communication ground) with a diameter of not less than 0.5mm^2 (suggested: 20 AWG to 14AWG). The maximum allowed distance between the **QBrick 1** and the master device or repeater is 1,000 meters. If more than 16 QBricks are connected to the same RS-485 network RS-485 repeaters must be used.

Use a cable that complies with the Electronics Industry Association (EIA) standards for RS-485 communications. Refer to RS-485 application note/wiring diagram for more information.

Wire Type	Twisted Pair
Characteristic Impedance	120 Ω
Shunt Capacitance	17pF Max
Acceptable Wire Gauges	22, 20, 18, 16, 14 AWG

5.2. MODBUS © Protocol

MODBUS RTU Frame Format:

Address code	**1 BYTE**	*MODBUS device address **1-247***
Function code	**1 BYTE**	*Indicates the function code*
Data code	**4 BYTE**	*Starting address, high byte* *Starting address, low byte* *Number of registers, high byte* *Number of registers, low byte*
Error Check code	**2 BYTE**	*Cyclic Redundancy Check (**CRC**)*

MODBUS FUNCTIONS

Code:	**Meaning:**	**Description:**
FUNCTION 03H	Reading single or multiple registers	*This function is used to read all the electrical parameters*
FUNCTION 06H	Writing to a single register	*Write value in to the relevant register*
FUNCTION 10H	Writing to multiple registers	

The default data values use the IEEE754 standard single precision float format, little endian (lower byte first). Each value is 32 bits long, and is represented by two 16-bit modbus registers.

Example MODBUS read data value: (1st register)199AH (2nd register)435CH
Bytes re-ordered before conversion: 435C199A (HEX)
Converted to an IEEE754 float: 220.100006(DEC)

Energy data is an exception to the default. This data is stored as a value precise to three decimal places and shifted to the left (multiplied by) 1000. This means that the values are stored as Wh, VARh, and VAh in a 4 byte “long” integer. To convert this energy data to kWh, kVARh, or kVAh, these values must be divided by 1000.

5.3. MODBUS Register Map

5.3.1. Realtime Values (Read only, MODBUS function code 03H read)

Real-time parameter, Primary side value

Addr.	Parameter	Data	byte	Description
0	Ua of Metering point	float	2	Phase to line voltage, unit V
2	Ub of Metering point	float	2	
4	Uc of Metering point	float	2	
6	Uab of Metering point	float	2	Phase to phase voltage, unit V
8	Ubc of Metering point	float	2	
10	Uca of Metering point	float	2	
12	Ia of Metering point	float	2	Phase ampere, unit A
14	Ib of Metering point	float	2	
16	Ic of Metering point	float	2	
18	Pa of Metering point	float	2	Phase active power, unit kW
20	Pb of Metering point	float	2	
22	Pc of Metering point	float	2	
24	P∑ of Metering point	float	2	
26	Qa of Metering point	float	2	Phase reactive power, unit kvar
28	Qb of Metering point	float	2	
30	Qc of Metering point	float	2	
32	Q∑ of Metering point	float	2	
34	Sa of Metering point	float	2	Phase apparent power, unit KVA
36	Sb of Metering point	float	2	

38	Sc of Metering point	float	2	
40	S∑ of Metering point	float	2	
42	PFa of Metering point	float	2	Phase power factor, 0~1.000 (Following IEC Convention)
44	PFb of Metering point	float	2	
46	PFc of Metering point	float	2	
48	PF∑ of Metering point	float	2	
50	FR of Metering point	float	2	Frequency, unit 0.01Hz
52	Ep1+ of Metering point	long	2	CT_1 active energy consumption, unit 0.001 kWh
54	Ep1- of Metering point	long	2	CT_1 active energy generation, unit 0.001 kWh
56	Eq1i+ of Metering point	long	2	CT_1 inductive reactive energy consumption, unit 0.001 kVARh
58	Eq1c- of Metering point	long	2	CT_1 capacitive reactive energy generation, unit 0.001 kVARh
60	Eq1i- of Metering point	long	2	CT_1 inductive reactive energy generation, unit 0.001 kVARh
62	Eq1c+ of Metering point	long	2	CT_1 capacitive reactive energy consumption, unit 0.001 kVARh
64	Es1+ of Metering point	long	2	CT_1 apparent energy consumption, unit 0.001 kVAh
66	Es1- of Metering point	long	2	CT_1 apparent energy generation, unit 0.001 kVAh
68	Ep2+ of Metering point	long	2	CT_2 active energy consumption, unit 0.001 kWh
70	Ep2- of Metering point	long	2	CT_2 active energy generation, unit 0.001 kWh
72	Eq2i+ of Metering point	long	2	CT_2 inductive reactive energy consumption, unit 0.001 kVARh
74	Eq2c- of Metering point	long	2	CT_2 capacitive reactive energy generation, unit 0.001 kVARh
76	Eq2i- of Metering point	long	2	CT_2 inductive reactive energy generation, unit 0.001 kVARh
78	Eq2c- of Metering point	long	2	CT_2 capacitive reactive energy consumption, unit 0.001 kVARh
80	Es2+ of Metering point	long	2	CT_2 apparent energy consumption, unit 0.001 kVAh
82	Es2+ of Metering point	long	2	CT_2 apparent energy generation, unit 0.001 kVAh
84	Ep3+ of Metering point	long	2	CT_3 active energy consumption, unit 0.001 kWh
86	Ep3- of Metering point	long	2	CT_3 active energy generation, unit 0.001 kWh
88	Eq3i+ of Metering point	long	2	CT_3 inductive reactive energy consumption, unit 0.001 kVARh
90	Eq3c- of Metering point	long	2	CT_3 capacitive reactive energy generation, unit 0.001 kVARh
92	Eq3i- of Metering point	long	2	CT_3 inductive reactive energy generation, unit 0.001 kVARh
94	Eq3c- of Metering point	long	2	CT_3 capacitive reactive energy consumption, unit 0.001 kVARh
96	Es3+ of Metering point	long	2	CT_3 apparent energy consumption, unit 0.001 kVAh
98	Es3+ of Metering point	long	2	CT_3 apparent energy generation, unit 0.001 kVAh

100	Ep∑+ of Metering point	long	2	Active energy consumption, unit 0.001kWh
102	Ep∑- of Metering point	long	2	Active energy generation, unit 0.001kWh
104	Eq∑i+ of Metering point	long	2	Inductive reactive energy consumption, unit 0.001 kVARh
106	Eq∑c- of Metering point	long	2	Capacitive reactive energy generation, unit 0.001 kVARh
108	Eq∑i- of Metering point	long	2	Inductive reactive energy generation, unit 0.001 kVARh
110	Eq∑c+ of Metering point	long	2	Capacitive reactive energy consumption, unit 0.001 kVARh
112	Es∑+ of Metering point	long	2	Apparent energy consumption, unit 0.001kVAh
114	Es∑- of Metering point	long	2	Apparent energy generation, unit 0.001kVAh

Real-time fundamental parameter, Primary side value

Addr.	Parameter	Data	byte	Description
28000	Ua of Metering point	float	2	Phase to line voltage, unit V
28002	Ub of Metering point	float	2	
28004	Uc of Metering point	float	2	
28006	Uab of Metering point	float	2	Phase to phase voltage, unit V
28008	Ubc of Metering point	float	2	
28010	Uca of Metering point	float	2	
28012	Ia of Metering point	float	2	Phase ampere, unit A
28014	Ib of Metering point	float	2	
28016	Ic of Metering point	float	2	
28018	Pa of Metering point	float	2	Phase active power, unit kW
28020	Pb of Metering point	float	2	
28022	Pc of Metering point	float	2	
28024	P∑ of Metering point	float	2	
28026	Qa of Metering point	float	2	Phase reactive power, unit kvar
28028	Qb of Metering point	float	2	
28030	Qc of Metering point	float	2	
28032	Q∑ of Metering point	float	2	
28034	Sa of Metering point	float	2	Phase apparent power, unit KVA
28036	Sb of Metering point	float	2	
28038	Sc of Metering point	float	2	

28040	S∑ of Metering point	float	2	
28042	PFa of Metering point	float	2	Phase power factor, 0~1.000 (Following IEC Convention)
28044	PFb of Metering point	float	2	
28046	PFc of Metering point	float	2	
28048	PF∑ of Metering point	float	2	

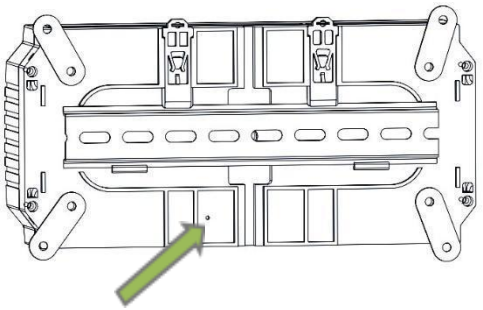
Meter status

Addr.	Parameter	Data	byte	Description
1200	DO	Int	1	Valid for Remote control mode, Bit0 valid 1 for closed. 0 for opened
1201	DI	Int	1	Valid for level output mode, Bit0~5 for DI channels 1~6 status 1 for closed. 0 for opened
1202	Reserved	/	/	/
1203	Battery status	Int	1	0: Normal: Above 2.7 V 1: Low voltage: Lower than 2.7 V
1330	Software version	Int	1	
1331	Series number low 16bit	Int	1	
1332	Series number high 16bit	Int	1	

5.3.2. Meter configuration

Modbus/RS-485 comm port reset instructions:

1. Verify that the meter is powered on.
2. Locate the **"RESET" button** on the rear side of the meter (at the tip of the green arrow in image to the right).
3. Press and hold the "RESET" button for 5 seconds.
4. This will reset the configuration to Address 1, 9600 Baud, 8.N.1, for both the system modbus link and the D-Unit modbus link.



General MODBUS registers:

The following registers can be both read from and written to. For reads use 03H code. For writes use 06H/10H.

Addr.	Item	Data	Byte	Description
1210	RS485 Address(1)	Int	1	1-247
1211	RS485 Baudrate(1)	Int	1	0: 2400 1: 4800 2: 9600 3: 19200
1212	RS485 Data format(1)	Int	1	0: n.8.1 1: o.8.1 2: e.8.1 3: n.8.2
1270	Year & Month(2)	Int	1	Bit15-8 for year, range: 0-99 Bit7-0 for month, range: 1-12
1271	Day & Hour(2)	Int	1	Bit15-8 for Day, range: 1-31 Bit7-0 for Hour, rang: 0-23
1272	Minute & Seconds(2)	Int	1	Bit15-8 for Minute, range: 0-59 Bit7-0 for Second, rang: 0-59
1273	Day of the Week2)	Int	1	Bit15-8 for Day of the Week, range: 1-7 Bit7-0 reserved
1278	Pulse constant	Int	1	Range: 100-65535 (per kWh, kVARh, kVAh)
1279	Pulse output signal type	Int	1	0: kwh 1: kVARh 2: kVAh

1285	DI1 counter	Int	1	Use the MODBUS read command (function code 03H) to get the value. To reset the counter, use the MODBUS single or multiple write command (function code 06H or 10H) to set the value to “0” (Any other value will be ignored). **06H**, **10H** code Write “0” to reset counter, other value invalid
1286	DI2 counter	Int	1	
1287	DI3 counter	Int	1	
1288	DI4 counter	Int	1	
1289	DI5 counter	Int	1	
1290	DI6 counter	Int	1	

Note:

1. If multiple MODBUS settings are to be changed at once use the multi-write MODBUS command (10H) to write to those registers (1210-1212). Wait for 5 seconds after the operation before making any other MODBUS requests.
2. For security purposes, the QBrick clock can only be changed once a day. After writing to the clock registers (1270-1273) the user has 5 minutes to make any further changes before the meter locks out further writes to the clock registers for the next 24 hours. Power cycling the meter will reset the lock. Use the multi-write MODBUS command (10H) to write to the clock registers if multiple settings are to be changed at once. Wait for 5 seconds after the operation before making any other requests.

The D-Unit display configuration registers:

Add	Item	Data	Byte	Description
1213	D-unit Address	Int	1	To be used during commissioning of meters with D-Unit. Reference D-Unit Manual for more details.
1214	D-unit Baudrate	Int	1	
1215	D-unit Data format	Int	1	

5.3.3. Logged Data Records

The **QBrick 1** can log up to **60 days** of 5 minute interval data in its own internal non-volatile memory. The user can access these records with standard MODBUS commands.

Since the number of available MODBUS registers are limited, only a quarter of a day's worth of data (6 hours, 72 records) can be displayed at a time. These values are dynamically loaded into registers 2000 - 22807 (See Logged Data register map), based on one of two request procedures (see section 5.3.3.1 and 5.3.3.2).

Logged Data register map (Read only, 03H to read)

Addr.	Item	Data	Byte	Description
2000	Ep1+ of Metering point, record_1	long	2	Data record_1, CT_1 active energy, unit kWh
2002	Ep1- of Metering point, record_1	long	2	
2004	Eq1i+ of Metering point, record_1	long	2	Data record_1, CT_1 reactive energy(4quadrant), unit kvarh
2006	Eq1c- of Metering point, record_1	long	2	
2008	Eq1i- of Metering point, record_1	long	2	
2010	Eq1c+ of Metering point, record_1	long	2	
2012	Es1+ of Metering point, record_1	long	2	Data record_1, CT_1 apparent energy, unit kVAh
2014	Es1- of Metering point, record_1	long	2	
2016	Ep2+ of Metering point, record_1	long	2	Data record_1, CT_2 active energy, unit kWh
2018	Ep2- of Metering point, record_1	long	2	
2020	Eq2i+ of Metering point, record_1	long	2	Data record_1, CT_2 reactive energy(4 quadrant), unit kvarh
2022	Eq2c- of Metering point, record_1	long	2	
2024	Eq2i- of Metering point, record_1	long	2	
2026	Eq2c+ of Metering point, record_1	long	2	
2028	Es2+ of Metering point, record_1	long	2	Data record_1, CT_2 apparent energy, unit kVAh
2030	Es2+ of Metering point, record_1	long	2	
2032	Ep3+ of Metering point, record_1	long	2	Data record_1, CT_3 active energy, unit kWh

2034	Ep3- of Metering point, record_1	long	2	
2036	Eq3i+ of Metering point, record_1	long	2	Data record_1, CT_3 reactive energy(4 quadrant), unit kvarh
2038	Eq3c- of Metering point, record_1	long	2	
2040	Eq3i- of Metering point, record_1	long	2	
2042	Eq3c+ of Metering point, record_1	long	2	
2044	Es3+ of Metering point, record_1	long	2	Data record_1, CT_3 apparent energy, unit kVAh
2046	Es3+ of Metering point, record_1	long	2	
2048	Ep∑1+ of Metering point, record_1	long	2	Data record_1, Metering Point 1 active energy, unit kWh
2050	Ep∑1- of Metering point, record_1	long	2	
2052	Eq∑1i+ of Metering point, record_1	long	2	Data record_1, Metering Point 1 reactive energy(4 quadrant), unit kvarh
2054	Eq∑1c- of Metering point, record_1	long	2	
2056	Eq∑1i- of Metering point, record_1	long	2	
2058	Eq∑1c+ of Metering point, record_1	long	2	
2060	Es∑1+ of Metering point, record_1	long	2	Data record_1,Metering Point 1 apparent energy, unit kVAh
2062	Es∑1- of Metering point, record_1	long	2	
2064-2286	Reserved	long	/	/
2288	Data record_1 Timestamp	Int	1	Bit15-8 for Hour, range: 0-23 Bit7-0 for Minute, range: 0-59
2289-2577	Data record_2 of metering point			Refer Data record_1
2578-2866	Data record_3 of metering point			Refer Data record_1
2867-3155	Data record_4 of metering point			Refer Data record_1
…	…	…	…	…
…	…	…	…	…
22519-22807	Data log_72 of metering point			Refer Data record_1

Logged Data access methods

Logged data records can be accessed by one of the following two methods:

5.3.3.1. Get Logged Data by date:

Step_1: Use the MODBUS multi-write command (code **10H**) to write the date and quarter of the day (1 = 00:00 to 06:00, 2 = 06:00 to 11:55, 3 = 12:00 to 17:55, 4 = 18:00 to 23:55) to registers 1910-1911. This will request the meter to retrieve the logged data for the given date, and load them into registers 2000 to 22807 (Refer to the Logged Data register map)

Registers to request record data from memory:

Addr.	Item	Data	Byte	Description
1910	Date / Quarter of the day	Int	1	Bit15- 8: Year Bit7- 0: Month
1911		Int	1	Bit15-8: Day Bit7-0: Quarter 1-4

Step_2: Verify data request: Use the MODBUS read command (code **03H**) to read register 1912 to get the status of the data request. See table below for possible responses. After making a request for data wait a few seconds before reading register 1912. The MODBUS master device should make sure the loading operation was successful before trying to read the logged data, otherwise errors may occur.

Status register for logged data request:

Addr.	Item	Data	Byte	Description
1912	Status response for operation described in Step_1	Int	1	00 00: Loading of logged data records successful FF FF: Loading of logged data records unsuccessful 00 FF: Logged data records for the given date do not exist(1) 02 FF: There are 2 pages(1) for the given date 03 FF: There are 3 pages(1) for the given date …. 3C FF: There are 60 pages(1) for the given date

(1) A “page” is 24 hours worth of records (288 total) saved in flash memory. A page has an associated index number and a date. There are situations where multiple pages can share the same date. This is caused by changing the meter’s internal clock to a previous time or date (See Notes 2 and 3 of section 5.3.3.2). When this happens, register 1912 will show the number of pages that exist with the same date. Data will not load from memory if you request data by date. Please refer to the second method, Get logged data by page index (5.3.3.2) if you run into this issue.

5.3.3.2 Get Logged Data by page index:

If the previous method (Get interval data by date 5.3.3.1) returns an error due to multiple pages with shared dates, the logged data must be loaded from memory by the page index reference instead. This is to ensure that the user is getting the correct version of the dated records (see Notes 2 and 3).

Read from registers 1600-1719 to view all of the pages and locate where the date duplication has occurred. The pages are organized chronologically by creation (with the latest pages in 1600-1601 and oldest in 1718-1719). so the user can see the sequence of pages with corresponding dates.

Step_1: Read registers 1600 to 1719 (Page Reference Table below) with the MODBUS read command (code **03H**) to get the list of pages ordered by when they were created. Each list record has the page date and page index number. Look for the page index number corresponding to the desired version of the record date to load the data from memory into registers 2000 to 22807 (Refer to the data log register map for data details).

Page Reference Table:

Addr.	Item	Data	Byte	Description
1600	Date of most recent Page	Int	1	Bit15-8 for Year, range: 0-99 Bit7-0 for Month, range: 1-12
1601		Int	1	Bit15-8 for Day, range: 1-31 Bit7-0 page index
1602-1603	Date of second most recent page	Int	2	Refer Date of Page_1
1604-1605	Date of third most recent page	Int	2	Refer Date of Page_1
	…			
1718-1719	Date of oldest page	Int	2	Refer Date of Page_1

Step_2: To request data by page index use the MODBUS write command (code **06H**) to write to register 1910 Request the record interval by page index and quarter of the day (1 = 00:00 to 06:00, 2 = 06:00 to 11:55, 3 = 12:00 to 17:55, 4 = 18:00 to 23:55):

Command structure:

Add	Item	Data	Byte	Description
1900	Page index / Quarter of the day	Int	1	Bit15-8: Page index 1-60 Bit7-0: Quarter 1-4 Both default 1 when power ON

Note:

1. If the clock is changed to a future time on the same day, the meter will start recording data for the new time. The time slots between the new time and the old time will be filled with 0xFF to indicate a blank entry.
2. If the clock is changed to a previous time within the same date, a new page will be created with the same date and the meter will start recording data for the new time. Any data from before will be stored in the previous page.
3. If the clock is changed to a different date than the current one, the meter will create a new page and the meter will start recording in the time slots of the new date. If the date is set to a previous date, the meter will create pages with the same dates as pages that already exist. The Page Reference Table should be used to determine which page the user is interested in.

5.3.4. Sequence Of Events(SOE) records (Read only, "03H" code to read)

Addr.	Item	Data	Byte	Description
30000	SOE record_1, for the latest event	Int	1	Event code(1)
30001		Int	1	Serious failures counter (2) Bit 15-8 for counter range 0~255 Bit 7-0 for temporary count 1-20
30002		Int	1	Variable data, for CT ratio and other value
30003		Int	1	Event counter(3), range 0~65535
30004		Int	1	Bit15-8 for Year, range: 0-99 Bit7-0 for Month, range: 1-12

30005		Int	1	Bit15-8 for Day, range: 1-31 Bit7-0 for Hour, range: 0-23
30006		Int	1	Bit15-8 for Minute, range: 0-59 Bit7-0 for Second, range: 0-59
30007-30013	SOE record_2	Int	6	Structure refer 30000~30007
30014-30020	SOE record_3	Int	6	
…	…	Int	6	
36993-36999	SOE record_1000, oldest event	Int	6	

Notes: The oldest event will be replaced when the SOE records exceed 1000

(1) Event codes:

1: Power Down - Power to the meter is lost	6: TimechngTo - The time after a change to the real time clock is made
2: Power Up - Power to the meter is restored	7: StoreConfig - A configuration change has been made
3: Watchdog - Internal diagnostic error	8: Log in
4: No Battery - When the battery level is low	9~19: Reserved
5: TimechngFrom - The time before a change to the real time clock is made	

(2) If the same event occurs more than 20 times in a single 24-hour day [00:00:00 to 23:59:59], the Serious failures counter will increment by 1, and the Event counter will remain at 20. The Event counter will start the next day from 0.

(3) Counter will automatically reset to 0 when it overflows.

6. 2020-7 Additional Registers

6.1 Last 6 list interval record copies, (Read only, “03H” code to read)

Addr.	Item	Data	Byte	Description
40000	Ep_A+ of Metering point_1	long	2	Interval record_1, A phase active energy, unit kWh
40002	Ep_A- of Metering point_1	long	2	
40004	Eq_A1 of Metering point_1	long	2	Interval record_1, A phase reactive energy(4 quarter), unit kvarh
40006	Eq_A2 of Metering point_1	long	2	
40008	Eq_A3 of Metering point_1	long	2	
40010	Eq_A4 of Metering point_1	long	2	

40012	Eqs_A+ of Metering point_1	long	2	Interval record_1, A phase apparent energy, unit kVAh
40014	Eqs_A- of Metering point_1	long	2	
40016	Ep_B+ of Metering point_1	long	2	Interval record_1, B phase active energy, unit kWh
40018	Ep_B- of Metering point_1	long	2	
40020	Eq_B1 of Metering point)1	long	2	Interval record_1, B phase reactive energy(4 quarter), unit kvarh
40022	Eq_B2 of Metering point_1	long	2	
40024	Eq_B3 of Metering point_1	long	2	
40026	Eq_B4 of Metering point_1	long	2	
40028	Eqs_B+ of Metering point_1	long	2	Interval record_1, B phase apparent energy, unit kVAh
40030	Eqs_B- of Metering point_1	long	2	
40032	Ep_C+ of Metering point_1	long	2	Interval record_1, C phase active energy, unit kWh
40034	Ep_C- of Metering point_1	long	2	
40036	Eq_C1 of Metering point_1	long	2	Interval record_1, C phase reactive energy(4 quarter), unit kvarh
40038	Eq_C2 of Metering point_1	long	2	
40040	Eq_C3 of Metering point_1	long	2	
40042	Eq_C4 of Metering point_1	long	2	
40044	Eqs_C+ of Metering point_1	long	2	Interval record_1, C phase apparent energy, unit kVAh
40046	Eqs_C- of Metering point_1	long	2	
40048	Epz1+ of Metering point_1	long	2	Interval record_1, Sum active energy, unit kWh
40050	Epz1- of Metering point_1	long	2	
40052	Eqz1_1 of Metering point_1	long	2	Interval record_1, Sum reactive energy(4 quarter), unit kvarh
40054	Eqz1_2 of Metering point_1	long	2	
40056	Eqz1_3 of Metering point_1	long	2	
40058	Eqz1_4 of Metering point_1	long	2	
40060	Eqsz1+ of Metering point_1	long	2	Interval record_1, Sum apparent energy, unit kVAh
40062	Eqsz1- of Metering point_1	long	2	
40256-40286	Reserved	/	/	/
40288	Time stamp of Interval copy _1	Int	1	Bit15-8 for Hour, range: 0-23 Bit7-0 for Minute, range: 0-59
40289		Int	1	Bit15-8 for Month, range: 1-12 Bit7-0 for Date, range: 1-31

40290		Int	1	Bit7-0 for Year, range: 0-99
40291-40581	Interval copy_2 of metering point	/	/	Refer to Interval record_1
40582-40872	Interval copy_3 of metering point	/	/	Refer to Interval record_1
40873-41163	Interval copy_4 of metering point	/	/	Refer to Interval record_1
41164-41454	Interval copy_5 of metering point	/	/	Refer to Interval record_1
41455-41745	Interval copy_6 of metering point	/	/	Refer to Interval record_1

Notes: Interval copy_1 is the latest record data,
Meter will automatically erase the earliest record (Interval copy_6).
This part of the data cannot be cleared manually

7. Troubleshooting

7.1. Meter does not power up

1. Make sure the V-PWR terminal block is wired according to Section 4.1
2. Verify that fuses or disconnects on V-PWR lines are intact.
3. Measure the voltage connections at the V-PWR terminal, if proper voltage is present and PWR LED indicator is OFF then contact Quadlogic Technical Support.

7.2. Issues with meter comm (from D-Unit or MODBUS Master / Reader)

1. Check the red “COM indicator” LED. It should blink when a MODBUS master/reader device sends commands.
2. Make sure that the RS-485 wires are connected properly at the COM port.
3. Check RS-485 wire lengths. If the wires are longer than 1000 m or if the installation is in an electrically noisy environment, wire a signal ground to the system. If there are more than 16 Q-Family devices on the RS-485 network RS-485 repeaters must be used.
4. If a D-Unit is connected, use D-Unit Manual to verify that the D-Unit can contact the meter. If the D-Unit has issues its display will read, “COMM Error”
5. If the “COM indicator” LED does not blink when the MODBUS master is sending commands, check to see if the MODBUS settings on the master are set correctly.
6.

If communication cannot be established, it is possible that the communication port settings on the QBrick are not what is expected. In this case, it is possible to set the communication parameters to the default values using the “com reset button”. If this button is pressed, the QBrick will set its modbus port to: Address = 1, Baudrate = 9600, Format = No Parity, 8 data bits, 1 stop bit. Then make sure that the modbus master device is using these settings.

Use caution when resetting the communication parameters to the default. It may be necessary to set the modbus address back to the correct value for that QBrick after re-establishing communication, to avoid collisions on the modbus network.

7.3. Incorrect meter readings

1. If the meter is reading zero volts:
    a. If using the D-Unit, refer to D-Unit Manual to find the correct display screen for each phase voltage.
    b. Use an AC voltmeter to measure the voltage connections at the voltage input terminals (V-REF) (refer to section 4.2)
    c. If the measured voltage is zero, determine why the reference voltage is off and turn it on in a safe manner. Verify that this solves the meter reading issue.
    d. If the voltage on the V-Ref terminals is non-zero and the meter is still reading zero volts contact Quadlogic Technical Support for help.
2. If the meter is reading negative watts and/or has a power factor below 0.87 on each CT / phase:
    a. Verify proper connection of CT secondaries.
    b. Verify that the CT polarity is correct.

c. Verify that the CT is installed on the correct phase.
d. If metering large inductive loads (such as Elevators, HVAC equipment, and pumps), phase diagnostics may not be an accurate verification of proper meter operation.
e. Contact Quadlogic Technical Support for further diagnostic assistance.

8. Maintenance

The **QBrick 4** does not require any special maintenance. If the system infrastructure requires maintenance the meter should be closed and powered off.

Contact QLC customer support for any issues with the meter.