# Summarize

…provides a compact and robust metering solution, enable reliable monitoring of building electrical loads with a low installation cost-per-point by combining sub-metering. The unit performs real-time metering, measures energy consumption, multi-tariff time-of-use (TOU) and monitors power quality of minimally **24 channels and optimally 48 channels** circuits for **one, two, or three phase** circuits.

Advanced communications options including Modbus via RS485, I/O communications provide for extensive reliable data exchange. Multiple units can be connected together to meter a **minimal of 48 and optimally unlimited** number of circuits. The versatility of meters are ideal for multi-tenant or departmental metering applications within office towers, condominiums, apartment buildings, shopping centers and other multi-user environments.

Measurement Function

**Voltage:** Line Voltage; Phase Voltage

**Current:** Total Current; Current per channel

**Power and Power Factor:** Total power Reactive Power, Apparent Power for per channel

**Power Factor:** Down to 0.001 for per channel

**Frequency:** System Frequency

**Demand:** Total Power, Reactive Power, Apparent Power and Current Demand and for per channel

Display

* **Display Height**: The minimum height of the metered quantity displayed shall be 5 mm.
* Able to read data through wired connection
* KWH Requirements: minimum accumulation of 0.01 WH
* KVARH Requirements: minimum accumulation of 0.01 VarH
* Instantaneous Values:
  + Voltage. Minimum Resolution 0.01V
  + Current. Minimum Resolution 0.001A
  + Watts. Minimum Resolution 0.01W
  + Vars. Minimum Resolution 0.01Var
  + Frequency. Minimum Resolution 0.001Hz
  + Phase Angle. Minimum Resolution 1 Degree

Energy Function

Energy (kWh) measurement meeting international standards, accuracy is Class **0.2**. It optional

Time of Use feature: 12 Seasons, 4 Tariffs record, **min 12** month data for each channel.

Over/Under Limit Alarming

Users can select parameters and set their set points. An alarm will be triggered when the set point is reached, user can get the info from MODBUS reading. At the same time, sound and light signals could be sent out via relay output. The time and reason of an alarm event will be recorded. Alarms can be configurable.

Individually ratio CT

Power Quality Analysis

Optional power quality parameters such as voltage and current THD, Odd harmonic distortion (Total Odd HD), even harmonic distortion (Total Even HD), 2 ~ 31 times the harmonic content, Current K-factor (KF), crest factor (CF), telephone interference factor (THFF), voltage and current unbalance etc.

I/O Option

Standard output ports provide energy (kWh) pulse output and time pulse output; optional 6 channel digital inputs (DI) provide pulse counting from water, electricity and gas meter, and monitor switch status; optional 2 channel relay outputs (DO) react upon alarming conditions.

Communication and Network

Supports RS485 communication open protocol: Modbus RTU; Configurable

Data/Event Logging

Energy, real-time metering, power quality and I/O data can be stored in the non-volatile memory. The event log data shall be encrypted or secured by the manufacturer to prevent manipulation of or unauthorized access to the data. The event log shall have a capacity equal to at least ten times the number of configurable parameters, however, not more than one thousand events are required to be retained for all parameters combined. The exported event log shall be retained for a period of at least 12 months after the date the device ceases to be used, and includes the remainder of any verification period for which the device is eligible or which is applied to the device.

# Electricity Metering

|  |  |  |  |
| --- | --- | --- | --- |
| Function | | Parameter | QLC |
| Real-time  Parameter | Voltage | Va, Vb, Vc / Vab, Vbc, Vca | ● |
| Current | per channel / per phase | ● |
| Power | per channel / per phase | ● |
| Reactive Power | per channel / per phase | ● |
| Apparent Power | per channel / per phase | ● |
| Power Factor | per channel / per phase | ● |
| Frequency | per channel | ● |
| Energy | Active Energy + | per channel | ● |
| Reactive Energy + | per channel | ● |
| Active Energy - | per channel | ● |
| Reactive Energy - | per channel | ● |
| TOU | 4 Tariffs, 12 Segment | ● |
| Power Quality | THD | THD | ○ |
| Individual Harmonic | 2nd-31st | ○ |
| Current K Factor | KF | ○ |
| Crest Factor | CF | ○ |
| Voltage Unbalance | U\_unbl | ○ |
| Current Unbalance | I\_unbl | ○ |
| Voltage telephone interference factor | THFF | ○ |
| Demand | Power Demand | Demad\_P | ● |
| Power Demand Max | Demad\_P\_max | ● |
| Reactive power  Demand | Demad\_Q | ● |
| Reactive power  Demand Max | Demad\_Q\_max | ● |
| Apparent Power  Demand | Demad\_S | ● |
| Apparent Power  Demand Max | Demad\_S\_max | ● |
| Alarming | Over/Under Limit  Alarm |  | ● |
| I/O | 6DI & 2DO |  | ○ |
| Display | External LCD display | (RS485 connection) | ● |
| Communication | RS485 | Modbus-RTU | ● |

Notes: "●" for Standard; "○" for Optional

## Specifics to Include in Register Address Tables

### Basic Power Data – Primary & Secondary Side

* Phase to Phase Voltage (V)
* Three Phase Current (A)
* Individual Phase Active Power (kW)
* Total Active Power (kW)
* Individual Phase Reactive Power (kVar)
* Total Reactive Power (kVar)
* Individual Apparent Power (kVA)
* Total Apparent Power (kVA)
* Individual Power Factor (0~1.000)
* Total Power Factor (0~1.000)
* Frequency (0.01 Hz)
* Total Positive Active Energy (kWh)
* Total Negative Active Energy (kVarh)
* Total Positive Reactive Energy (kVarh)
* Total Negative Reactive Energy (kWh)
* A,B,C Phase Positive Active Energy (kWh)
* A,B,C Phase Negative Active Energy (kVarh)
* A,B,C Phase Positive Reactive Energy (kVarh)
* A,B,C Phase Negative Reactive Energy (kWh)

# Specifications

Reference standard:

For any referenced standards in this document, please refer to “QLC Testing”.

## Mapping & Configurations

### Mapping of Current Inputs to Voltage Inputs

**Minimum Requirements**

* Current channels multiplied by voltage channels A, B, C

**Preferred Requirements**

* Selectable 3 x N Setup
* For 3 x N, current channels multiplied by voltage channels A, B, C. Repeated N times

**Optimum requirements**

* Selectable 3 x N or 2 x N Setup
* For 2 x N, current channels multiplied by voltage channels A, B, then C, A, then B, C Repeated N times
* For 3 x N, current channels multiplied by voltage channels A, B, C. Repeated N times

### Metering Configuration

**Minimum requirements**

Each input is treated as a 1-phase meter

**System of 48 channels**

**Optimum requirements**

* Unlimited channels
* Current inputs grouped as either 2 x N or 3 x N
* Readings reported as the sum of the input channels
* 3 x N configuration reads as N 3-phase meters
* 2 x N configuration is either:
  + (Wye) Current phases mapped in groups of 2 of 3 voltage phases as follows:
    - Voltage A, B
    - Voltage B, C
    - Voltage C, A
  + (Delta) Current phases mapped in groups of 2 of 2 voltage phases
    - Voltage A, C

## Accuracy Standards

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Accuracy | A phase | B phase | C phase | All |
| Voltage  Current  Active Power  Reactive Power Apparent Power  Power Factor  Active Energy  Reactive Energy Frequency | 0.1  0.1  0.1  0.1  0.1  0.01  0.2  0.2  0.01 | V1  A1  W1  var1  VA1  PF1 | V2  A2  W2  var2  VA2  PF2 | V3  A3  W3  var3  VA3  PF3 | W  var  VA  PF  Wh  varh  Hz |

**Notes:** Final metering accuracy depends one sampling CT and PT accuracy. Values are %

**Meter must be able to measure the accuracy with 0.05% resolution**

## Input

**As per:** LMB-EG-07e 3-2.5.3.1

Input terminals must accept AWG 12 solid conductor

Voltage:

Rated 40~400V at 50 or 60 Hz

Current:

* Full-Range input current (Imax) of 100 mA RMS
* Burden 10 Ohms or less
* Fully differential inputs
* Protected from ESD damage
* 3 input channels (3 phase or 3x single phase)

## Creep

**As per:** LMB-EG-07e 6-4.3

With rated voltage and zero current applied and under steady state conditions, there shall be no change in the meter reading over a four hour period.

## Starting Load

**As per:** LMB-EG-07e 6-4.8

The meter shall start and continue to register with unity PF load current of 0.05% of maximum rated current.

## Data Loss

**As per:** S-E-06 (5.3.7, 5.3.8)

A device used as a master timing reference for other devices and not having access to external timing information shall have a battery carry-over feature to maintain the timing reference over the temperature range specified for the device over the following minimum intervals:

1. 24 hours for a device with automatically recharges the standby battery upon the restoration of power following an electrical outage.
2. 7 days for all other devices.

The carry-over time base shall be accurate to within ±30 seconds over a period of 7 days.

Electronic registers shall be non-volatile (they shall be capable of storing the last recorded value of a measured quantity if the meter is subjected to a power failure). Stored values shall not be overwritten and shall be capable of being retrieved upon restoration of power.

Electronic registers shall be capable of storing measurement information in a manner which provides for at least 5 digits of resolution at the display.

## Start-Up Time

The meter must begin measuring accurately within 15 seconds of power being applied.

## Overload

**As per**: LMB-EG-07e 3-3.4.3

Current: 10 times Imax for 0.5 seconds and at 50% Imax at unity power factor

Variation in error shall not exceed ± 0.5%

Voltage:

Minimally 1 seconds for 2 times the rated

Optimally 30 seconds for 2 times the rated

## Demand Requirements

**As per:** LMB-EG-07e 7-3

1. Connections - The voltage circuit, if connected internally shall be connected on the supply side of the current circuit.
2. Insulation - The insulation shall meet the requirements of clause 4-3.4.
3. Maximum Current Rating - The maximum rated current shall in no case be less than 50 times the minimum rated current.
4. Full-Scale Demand Rating- The full-scale demand rating shall conform to the limits given in Table 18.

**TABLE 18**

**DEMAND METER FULL-SCALE LIMITS**

|  |  |  |
| --- | --- | --- |
| Meter | Full-Scale Value | |
| Lower Limit | Upper Limit |
| Single-Phase | 0.5 x V x Im | 1.05 x V x Im |
| 2 el. & 2 ½ el. Delta | 0.5 x V x Im x ·3 | 1.05 x V x Im x ·3 |
| Network | 0.5 x V x Im x 2 | 1.05 x V x Im x 2 |
| 2 ½ el. & 3 el. Wye | 0.5 x V x Im x 3 | 1.05 x V x Im x 3 |

V = Rated Voltage, Im = Maximum Rated Current

1. Demand Interval or Response Period - The demand interval or response period shall be not less than 15 minutes.

For testing requirements for demand meters please refer to the following:

* S-E-02 7.3.2.7
* S-E-02 7.3.2.8
* S-E-02 7.3.2.9
* S-E-02 7.3.3.3
* S-E-02 6.6.2

## Dielectric Strength

**As per:** LMB-EG-07e 3-3.4.1

1.5 kV AC RMS 1 minute at 60 Hz, between input / output / case / power supply

**As per:** LMB-EG-07e 3-3.4.2

5 kV Peak impulse 1.2/50 microseconds applied ten times with the same polarity in both the transverse and the common modes at a repetition rate no greater than one pulse every 3 seconds. The test shall be repeated with the polarity of the pulses reversed.

## EMC Test

|  |  |  |
| --- | --- | --- |
|  | Standard | Specifics |
| Electrostatic discharge immunity test: | IEC-61000-4-2 level 4 | 8Kv |
| Electrical fast transient burst immunity test | IEC61000-4-4 level 4  Or  ANSI C12.1 4.7.3.11 | * Test severity level: 4 * Test voltages on the voltage and current circuits: 4 kV * Test voltage on I/O signal, data and control lines: 2 kV * Repetition rate 5 kHz * Duration of the test: minimum 60 seconds * Voltage and auxiliary circuits energized with reference voltage * Without any current in the current circuits and the current terminals shall be open circuit |
| Surge Withstand Capability Test | LMB-EG-0.7e 3-3.4-3  Or  IEEE Std.472/ANSI C37.90 a. | * 2.5 to 3.0 kV * 20% of rated max. current * MHz to 1.5 MHz * 50% Envelope decay in 6+ microseconds * Source Impedance: 150 ohms * ≥50 Tests per second * Period of ≥ 2.0 seconds |

## EMI/RFI Conformance and Susceptibility

Please see the following standards:

* LMB-EG-07e 3-5.2
* MIL-STD-461B
* ANSI C12.1 4.7.3.12.1

## Voltage, Frequency, and Power Factor Variation Testing

Please see the following standards:

* LMB-EG-07e 6-4.7, ANSI C12.1 4.7.2.5
* LMB-EG-07e 6-4.9
* LMB-EG-07e 7-5.2.4
* LMB-EG-07e 15-5.3

## Load Testing

Please see the following standards:

* LMB-EG-07e 6-4.11
* ANSI C12.20 4.7.3.4

## Environment

### Work Environment

Temperature:

Minimally -15C ~ +55C

Optimally -40 ~ +50C

Humidity: RH 20% ~ 95% (No condensation

### Storage Conditions

Temperature: -25C ~ +70C

Humidity: RH 20% ~ 95%

### Testing

Please see the following standards:

* ANSI C12.20 5.4.3.6 **(Modified)**

## Working Power

AC 80-400V, 45-65Hz, DC 100-350V

DC 20-60V (Optional)

Maximum power consumption 6W

## Physical

### Display

**Display Height**: The minimum height of the metered quantity displayed shall be 5 mm.

**Remote Readings**: Must be able to read data through wired connection (232,485, SPI, etc)

**KWH Requirements**:

1. Minimum accumulation: 0.01WH
2. KWH accumulation updated every 15 seconds, optimally every second
3. Phase angle readings must be accurate to <1 degree

**KVARH Requirements**:

1. Minimum accumulation: 0.01VarH
2. KVarH accumulation updated every 15 seconds, optimally every second
3. Phase angle readings must be accurate to <1 degree

**Instantaneous Values**:

1. Voltage. Minimum Resolution 0.01V
2. Current. Minimum Resolution 0.001A
3. Watts. Minimum Resolution 0.01W
4. Vars. Minimum Resolution 0.01Var
5. Frequency. Minimum Resolution 0.001Hz
6. Phase Angle. Minimum Resolution 1 Degree

### Sealing / Securing

**As per:** LMB-EG-07e 3-2.5.2

Sealing of Terminals - Except in the case of S-base meters and back-connected switchboard meters, provision shall be made so that the terminals may be effectively sealed against tampering.

**As per:** LMB-EG-07e 3-2.6

Sealing - The meter or device shall be so constructed that access to the working parts and adjustments may be effectively prevented by such sealing arrangements as may be approved by the director.

**As per:** LMB-EG-07e 3-2.6.1

Replacement of Batteries - Devices fitted with carryover batteries which must be periodically replaced within the sealing period of the device, shall be sealed in such a manner to allow replacement of the battery without having to break the seal.

**As per:** S-E-06 6-2.2.4

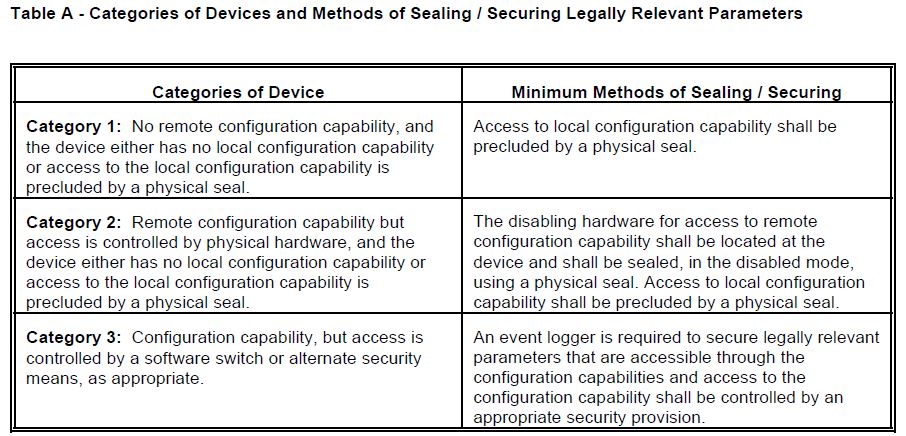
Access to the means for testing shall be available with the meter cover in place, without the need to break the verification seal at either the operational location or at another location.

**As per:** S-E-06 7-2.1.1.3

Reset Device - The device shall be such that, in its normal position, it does not affect either the maximum demand indicator or the driving element. Means shall be provided for sealing the reset device in this position. Resetting of the maximum demand indicator shall only be possible either after breaking the seal or with a special tool.

**As per:** S-E-06 13-6.3

Security - The basic operating constants, Kp, Kh, demand period etc. used in calculating meter quantities (e.g. kW·h) shall be stored within the device in such a manner that they cannot be changed without breaking the meter seal. This means these constants shall not be alterable by a meter reader, communications signal, power outage or any other technique which does not require breaking the meter seal.

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# Software Requirements

Please refer to S-EG-05 “Specifications for the approval of software controlled electricity and gas metering devices”, S-E-02, and LMB-EG-07e 6-3.3.

# Safety

**Minimum Requirements**

Must meet or exceed IEC61010-1:2010+AMD1:2016 CSV

**Optimum Requirements**

Certified under UL61010-1 3rd Edition