# 2008

# [LIBRA-1B SINGLE PHASE METER HANDBOOK]

- ■ Product Description
- ■ Operating Instructions
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# 1.0 Product Description

The LIBRA meter is a solid-state, single-phase residential electricity meter that provides utilities with unparalleled digital accuracy, reliability, serviceability and cost-effectiveness. The LIBRA meter is one of the most adaptable meters on the residential market, providing an array of communications.

The LIBRA metering performance meets and exceeds ANSI industry standards (and ANSI protocol) with 50 or 60 Hz models available to operate at 120vac and 240vac for Class 20, Class 100, Class 200 and Class 320 socket based residential or commercial installations. It is designed to be compatible with new or existing socket based single phase residential or commercial metering installations. The advanced electronic design offers superior accuracy and performance advantages over electromechanical. meter.



Figure 1-1: LIBRA-1B Electronic Single-phase Meter

## 1.1    General Information

The solid-state LIBRA meter is a breakthrough metering platform designed to grow and change with the utility industry. With its low starting watts and low watts lost, the LIBRA meter captures more energy consumption than was measured in the past by electromechanical meters.

- **Four options for Energy Accumulation** - Delivered only, Delivered + Received, Delivered - Received, Received only); one option must be specified at time of order.

- **Reliability** - Unique simplified sensor design and mechanical construction; no welded joints in terminal blades

- **Large LCD display** - Easy to read, Easy to use!
- **Nocturnal visibility** - When the environment low light, the LCD backlight automatically open.
- **Low cost** - the single board design and CT sense bring low cost.
- **Low starting watts** - Captures energy consumption at levels not registered by electromechanical meters
- **Low burden** - Minimizes utility system losses
- **Tamper-resistant design** - Minimizes the risk of meter-tampering. ordered to register energy when meter inverted (turning the meter upside down)

### 1.1.1    Physical Description

The meter uses a poly carbonate cover. The cover is molded in one piece. It's base assembly contains the CT.

The Liquid Crystal Display (LCD) indicates energy consumption, instantaneous power, a display segment check, and an alarm icon. The display is covered in detail in Chapter 2, Operation Instructions. The 6 large of the LCD display digital information.
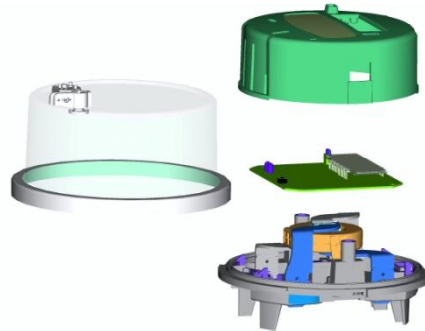


Figure 1-2: LIBRA-1B Electronic Single-phase Meter

**Form**: 1S, 2S, 3S, 4S

**Voltage**: 240V/120V Operating Voltage: +20% / -50%

**Frequency**: 46-64Hz line frequency range with same calibration

**Temperature**: -30° to +65℃

**Humidity**: 0% to 95% non-condensing

**Typical Accuracy**: ANSI C12.20 – 0.5 Accuracy Class

**Temperature Rise Specifications**: Meets ANSI C12.1 Section 4.7.2.9

### 1.1.2    Hardware options

Each of the features described in this section is a hardware option that can be added to the meter.

### 1.1.2.1 Battery

The LIBRA-1B meter offers a cover battery port enabling changing of the meter battery without removing the meter inner-cover. This battery is used for display and time keeping during power outages. Covers with battery ports may be ordered with the meter or retrofitted in the field.

### 1.1.2.2 Communication option boards

Two communications options boards are offered for the Libra. One is an internal 2400 baud telephone modem circuit board (type T-2). The second is the WH109 board (type WH109-2), which is used to connect the meter to an external modem via a RS-232 interface or to provide for data connection to a RS 485 system. Either the internal modem or WH109 board may be installed, but not both at the same time. These communications options may be ordered with the meter or installed in the field.

User can add other mudule, cantact our sales please.

### 1.1.2.3 Input/output option boards

One types of I/O option boards are available for the Libra-1 meter.

The Simple I/O board (type LBS-1) provides two form C outputs, one form A output, and one Real Time Pricing input to the meter. The outputs are programmable to provide a variety of functions including energy pulses, alerts, or else.

These options may be ordered with the meter or installed in the field.

### 1.2 Normal Operating Mode

The meter accumulates and displays kWh/kVARh. The meter provides various features, some of which are configurable at the factory.

- kWh energy measurement accumulated in 4 ways:
    1. Delivered kWh: The Delivered energy as a positive quantity (In IEC standard "Delivered" means from consumer to utility)
    2. Received kWh: The Received energy (In IEC standard "Received" means from utility to consumer)
    3. Received + Delivered kWh: The Received and Delivered energy are added together.
    4. Received - DeliveredkWh: The net energy is calculated.
- kVARh energy measurement accumulated in 2 ways:
    1. Delivered kVARh: The Delivered energy is accumulated as a positive quantity
    2. Received kVARh: The delivered energy is accumulated
- Received energy and Delivered energy average demand
- Instantaneous quantities: power, voltage, current, frequency, temperature etc, display on the LCD.

- Display of Energy is 4*2, 5*1 or 6 digits
- Disk Analog functionality on LCD – The disk analog is simulated on the display as explained in Chapter 2.
- Received and Delivered indicators on LCD
- Relay state indicators on LCD
- Alarm indicators on LCD
- Scroll key – can be used to scroll display all quantities
- Reset energy to zero in field –  Authorized personnel can reset the energy accumulation to zero on site with MeterBuddy Software or Press the seal-key.
- Simple energy overflow – The energy will restart from 000,000 again.
- Optical  IR(Optional), which used to communicate with the MeterBuddy software
- Cover tamper detected

### 1.2.1   On site user features

### 1.2.1.1   Operation

The meter has many features for ease of use on site.

- Nameplate and label information
- Numeric display with key annunciators
- Several display parameters including Energy accumulation, Instantaneous power/voltage/current/frequency/temperature, demand, Received/Delivered indication and Disk analog etc.

These features are described in detail in Section 2, "Operating Instructions" of this manual.

### 1.2.1.2   Maintenance

Maintenance instructions are covered in Section 3 of this manual.

### 1.3   Technical Information

This section contains the theory of operation and general circuit configuration of the Meter.

### 1.3.1   Theory of Operation

The theory of operation of Single Phase meter is explained in conjunction with the block diagram shown in Figure 1-3.
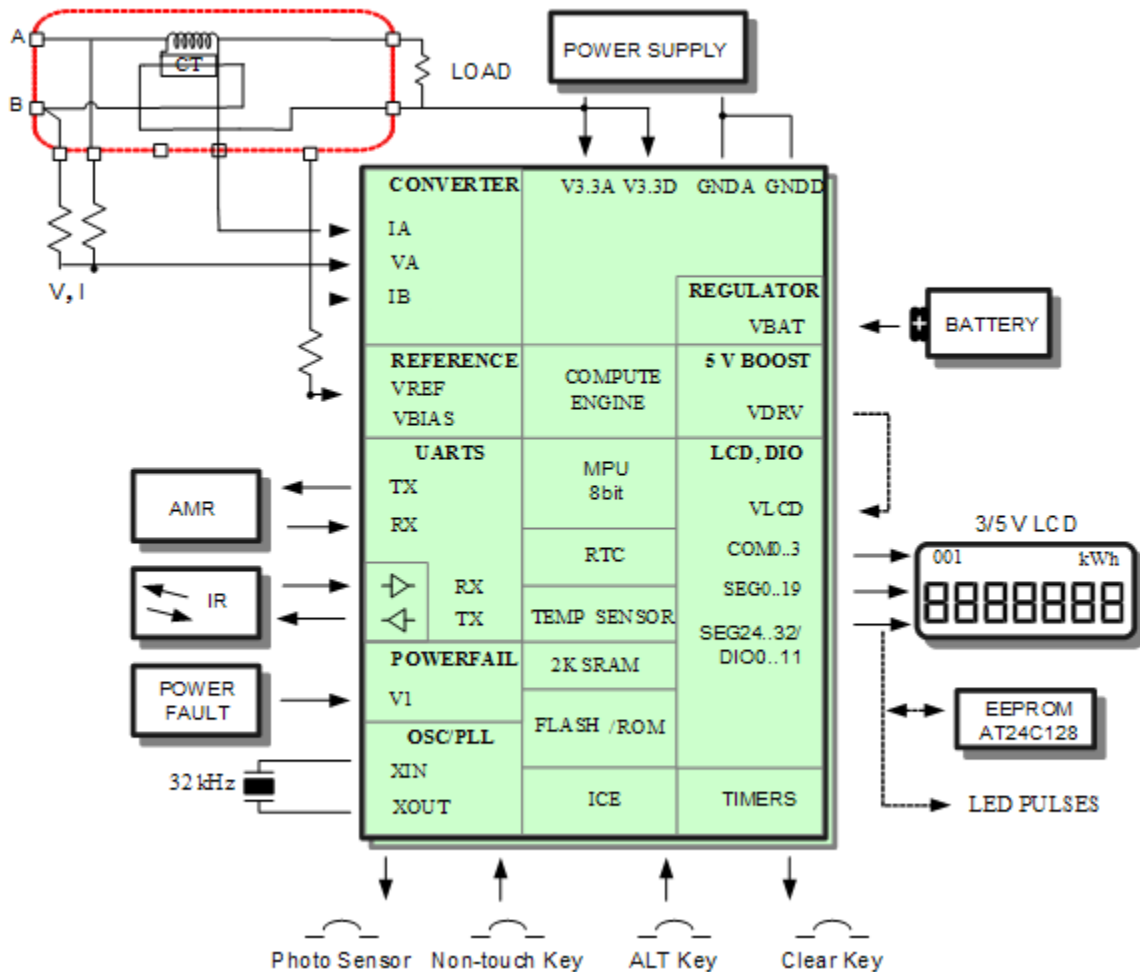
Figure 1-3 Meter Block Diagram

#### 1.3.1.1 Sensing Devices

A CT that feed the scaled current signals to the meter chip senses current. The voltage signal is scaled for measurement using a precision resistor divider circuit.

#### 1.3.1.2 Meter Chip

❖ Single Converter Technology™ with a 21-bit delta-sigma ADC

❖ 4 analog inputs plus auxiliary inputs

❖ On-chip temperature measurement for digital temperature compensation

❖ Precision voltage reference

❖ 32-bit compute engine

❖ 8051-based MPU (80515), 1 clock cycle per instruction

❖ Real Time Clock (RTC)

❖ 152 segments for LCD drive

&#10022;      2 UARTs.

&#10022;      Voltage comparator(s)

&#10022;      Hardware Watch Dog Timer.

&#10022;      Synchronous serial interface (SSI) for real time data.

&#10022;      Real-time monitoring of CE variables ("scope")

### 1.3.1.3  EEPROM

The IEC meter is equipped with a non-volatile memory that is used to store the metered data, calibration parameters, configuration constants and the program parameters. The non-volatile memory does not require a battery to retain information when line power is not present.

&#10022;      Schmitt Trigger, Filtered Inputs for Noise Suppression

&#10022;      Write Protect Pin for Hardware and Software Data Protection

&#10022;      High Reliability

&#10022;      Data Retention: 40 Years

### 1.3.1.4  LCD

LCD is designed to meet all requirements of C12.19, e.g. kWh, kVARh, VA, Voltage, Current, Demand, TOU, Relay control etc. But the IEC meter only implement basic function.

### 1.3.1.5  Pulses output IED

The IEC meter is equipped with an IR LED that is used to output kWh pulses.

### 1.3.1.6  LED, key and annunciator

**ALT Key**,  Normally, Meter's LCD is auto-scroll. When this key is pressed, the meter changes into manual mode. If no key is pressed for a period, it will turn back auto-scroll mode.

THE  INFORMATION CONTAINED HEREIN IS VITAL TO THE SECURITY OF WASION GROUP AND MUST NOT BE DISCUSSED WITH OR DISTRIBUTED TO OUTSIDE SUPPLIERS.

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# 2.0 Operating Instructions
## 2.1    Mechanical Structure

### 2.1.1    Cover
See Figure 2-1 for a graphic representation of the meter cover.
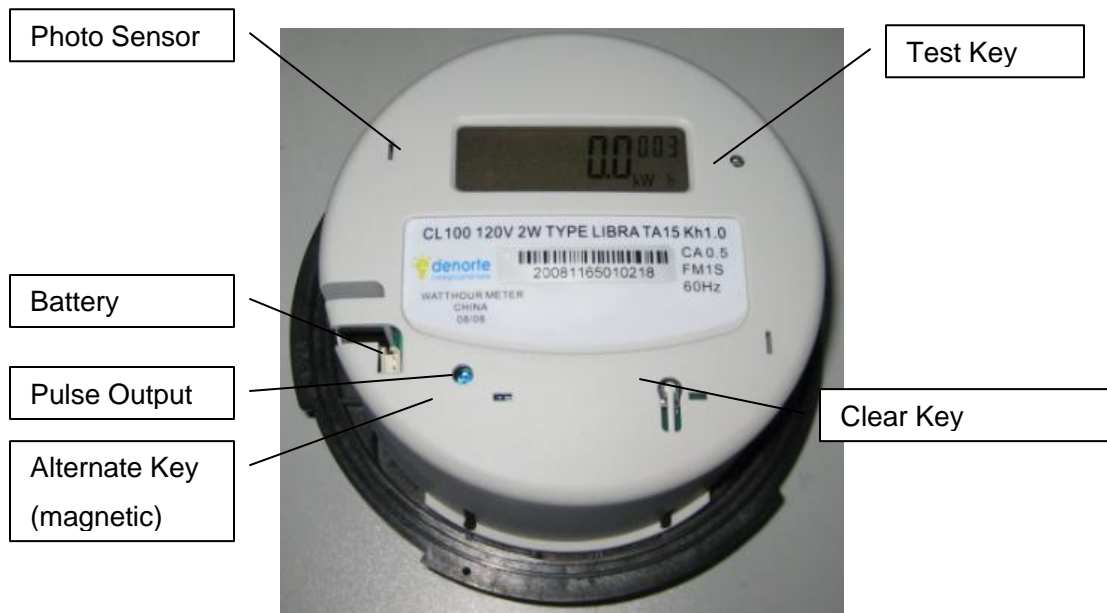


Figure 2-1 Meter Cover

Description:

1) **Photo Sensor**, nocturnal visibility.

2) **Alternate Key**, Switch display contents. (this is a magnetic switch)

   ◇   When the power on, the screen is in auto-scroll mode.

   ◇   In auto-scroll mode, it will switch one page per 3 seconds.

   ◇   When the Alternate Key pressed, it will stop auto-scroll.  Then the next press will switch one page.

   ◇   If there isn't any press for 30 seconds, it will revert back to auto-scroll mode.

3) **Non-touch key**, the function is samed as Alternate key.

4) **Pulse Output,** it is used to output the kWh pulse.

5) **Clear Key,** Used to clear energy and demand.(optional)

6) **Test Key,** Used to start Test calibration. (Both Demand Reset Key and Test Key are pressed will activate Test auto calibration procedure. )

   *Caution: this key is only used in factory or metershop.*

## 2.2    Nameplate Information and Labels

See Figure 2-4 for a graphic representation of the meter nameplate. The meter nameplate is found on the front of the meter.



Figure 2-4 Meter Nameplate

### 2.2.1    Nameplate Information

The nameplate information is shown in Figure 2-4. The following numbered list coincides with the numbers in the figure.

- ✧ **CL200** - Current Class
- ✧ **240V** - Nominal Voltage operating range
- ✧ **3W** - Number of wires for the metered service
- ✧ **TYPE LIBRA** - The type of meter: Libra
- ✧ **TA30** - Test amperes:30A
- ✧ **Kh2.0** - Watthour test constant
- ✧ **CA 0.5** - ANSI C12.20 Accuracy Class│ S-base CA 0.5
- ✧ **FM2S** - ANSI C12.10 Form Number
- ✧ **60Hz** - Nominal Frequency

## 2.3    Display

### 2.3.1    Display elements

The Liquid Crystal Display (LCD) indicates energy consumption, instantaneous power, demand, frequency and other. All values are refreshed every second.
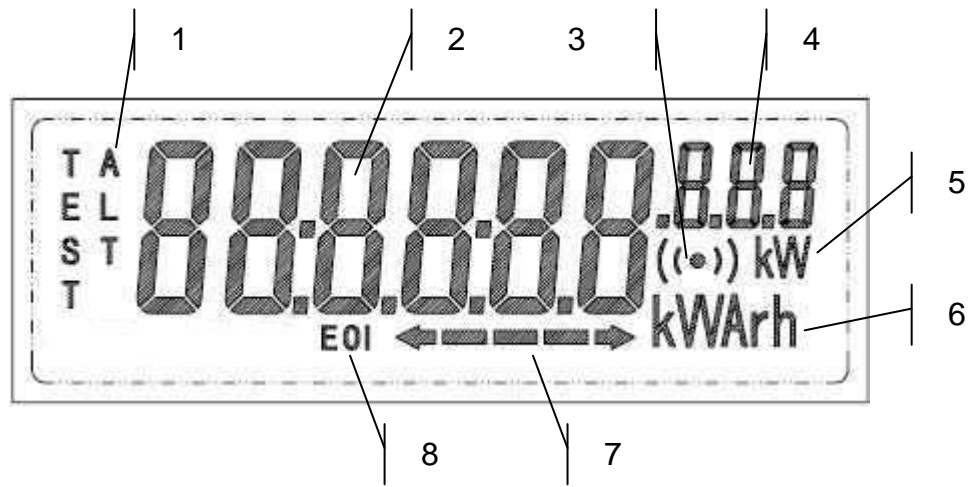
Figure 2-5 Liquid Crystal Display infomation

Discription:

1. Alternate Display Mode indicator. In Nomal Display Mode, the icon will hide.

2. These six characters display alphanumeric quantities.

    1) The kWh energy value is displayed during Normal Display Mode.

    2) Other quantities value is displayed during Alt Display Mode.

    3) "ER xxxx" is displayed if the meter detects an error. See chapter 3.9.1.

3. **Alarm**, when an internal error occurs, this icon will display.

4. These three characters display alphanumeric quantities.

    1) If enabled, the instantaneous power reading is displayed on the LCD during Nomal Display Mode. The auto-ranging kW value can be displayed as: XXX, XX.X, X.XX, .XXX.

    2) During Alt Display Mode, it is displayed as menu ID.

5. The kW Annunciator is on when the instantaneous power reading is displayed by the meter.

6. **Unit**. The unit icon can display individually as:
   "kWh", "kVArh", "kVAh", "kW", "V", "A", "VA".

7. **DPI** and **DIR**.

    1) **DPI, Digital Power Indicator**. These are the disk analog blocks to indicate the percentage of energy accumulated in comparison to the 1 Wh value. If the energy direction is "Received", this icon will blink.  See section 2.3.5

    2) **DIR, The energy direction**. Real time energy direction indicators, appear with "Received/Delivered".  See section 2.3.6

8. **EOI**. End Of Interval. When a demand period is over, this icon will display for 3 seconds.

### 2.3.2   Display Mode

There are four display modes:

✧  Nomal

✧  Alternate

✧  Frozen

The user can switch between display mode using the Alternate Key.

### 2.3.2.1   Alternate Key Actions

The Alternate Key is actuated using a non-touch key. Press your hand next to the Alternate Key for varying lengths of time causes the meter to change display modes:

***Less than 3 seconds:*** Enters the Alternate Display mode for one scroll then returns to the Nomal Display mode.

***3 to 6 seconds:*** Restarts the Normal Display scroll or produces one Normal Display scroll if an Error, Caution or Diagnostic is frozen on the display.

### 2.3.2.2  Nomal display mode

In Nomal Display mode, the meter display is always visible. Normal Display items are selected by the customer at the time of ordering the meter and are loaded into the meter at the factory.

| Display Item | |
|---|---|
| **Quantities** | |
| | **Energy in kWh** |
| | **Instantaneous Power** |
| **Segment Check** | |
| **Real Time Indicators** | |
| | **Watthour Disk Emulator** |
| | **Energy Direction with Indicator Arrows** |
| **Static Indicators** | |
| | **kWh/kVArh/kVAh** |

In Normal Display mode, the meter display scrolls continually through the Normal Display items until one of the following occurs:

✧   Alternate Key is actuated.

✧   Communication is initiated.

✧   A frozen Error, Caution, or Diagnostic message is triggered.

### 2.3.2.3  Alternate Display Mode

In Alternate Display mode, the meter will scroll display the default item as below. Alt Display items can be selected by the customer at the time of ordering the meter and are loaded into the meter at the factory.

| ID | Name | Accuracy | Disp Mode | Description |
|---|---|---|---|---|
| 00 | Sr | | Alternate | Software version and revision |
| 01 | +kWh | 1kWh | Nomal | Received active energy |
| 02 | -kWh | 1kWh | Alternate | Delivered active energy |
| 03 | Added kWh | 1kWh | Alternate | Received  + Delivered active energy |
| 04 | Net kWh | 1kWh | Alternate | Received  - Delivered active energy |
| 05 | VA | 1kVAh | Alternate | Apparent energy |
| 06 | +kVARh | 1kVArh | Alternate | Received reactive energy |
| 07 | - kVARh | 1kVArh | Alternate | Delivered reactive energy |
| 08 | Power | 0.001kW | Alternate | Instantaneous power |
| 09 | Vrms | 0.1V | Alternate | Voltage |
| 10 | Irms | 0.1A | Alternate | Current |
| 11 | +Demand | 0.001kW | Alternate | Received active demand |
| 12 | - Demand | 0.001kW | Alternate | Delivered active demand |
| 13 | Frequency | 0.01Hz | Alternate | Working frequency |
| 14 | Temperature | 0.1℃ | Alternate | The temperature measured by the Chip. |
| 15 | Date | | Alternate | yy.MM.dd  Comment: should this be |

| | | | configurable (e.g., "dd.MM.yy" as an option)? |
|---|---|---|---|
| 16 | Time | Alternate | hh:mm:ss |
| 17 | Status | Alternate | The Status code of Meter |
| 18 | Error | Alternate | The Error code of Meters |

The Alternate Display is used to display information for the meter technician that is not contained in the Normal Display.

- ✧ Display Items: refer to chapter 2.3.1.

- ✧ Initiate: actuate the Alternate Key for 3 to 6 seconds.

- ✧ Scroll: the meter automatically scrolls through the Alternate Display items.

- ✧ Exit: the meter automatically returns to the Normal Display mode after the last Alternate Display item.

#### 2.3.2.4 Frozen Display Mode

The Frozen Display mode stops the Normal Display to draw attention to an Error, Caution, or Diagnostic in the meter.

- ✧ Display Items: Errors, Cautions and Diagnostics to freeze the display.

- ✧ Initiate: automatic when the meter detects a frozen Error, Caution or Diagnostic.

- ✧ Scroll: Press you hand on meter to activate the Alternate Key. The meter will perform one Normal Display scroll and then return to the Frozen Display.

- ✧ Exit: clear the condition that caused the error, caution or diagnostic to return to the Normal Display mode.

### 2.3.3 Energy Accumulation

The meter displays the energy accumulated using up to six digits in the central row of the LCD. Each energy quantity has its own register except ADDED energy and NET energy.

**+kWh**: Received active energy is accumulated individually.

- **kWh**: Delivered active energy is accumulated individually.

**Added kWh**: Received + Delivered. The magnitudes of the Received energy and Delivered energy are added together. This mode of operation is often referred to as "unidirectional" because the meter registration will always be positive, regardless of the direction of energy flow. This accumulation mode may deter tampering by meter re-wiring. This can be programmed as the default displaymode.

**Net kWh**: The Delivered energy is subtracted from the Received energy: Received - Delivered. This mode of operation is often referred to as "net energy".

**+kVARh**: Received reactive energy is accumulated individually.

**- kVARh**: Delivered reactive energy is accumulated individually.

**Energy**

The customer has an option, at the time of ordering, to select 4,5 or 6 digit display of the accumulated energy(kWh,kVArh,kVAh etc). this is settable only at the factory. The LCD also has an annuciator, **kWh,kVArh,kVAh**, which is displayed whenever energy is indicated. The energy display is refreshed every second.

### Accumulation Mode

The energy accumulation depends on the energy direction and the mode that is selected.

If the energy is continuously delivered, the energy accumulated will progress from zero to 999,999 (or 9999.99, 99999.9 for 4, 5 or 6 digit display) and the energy will rollover to 000,000 after 999,999.

If the energy is continuously received, the energy accumulated, will decrement from 999,999 to 000,000 and the energy will roll down to 999,999 after 000,000.

### Instantaneous Power

The LIBRA-1B can be configed to display instantaneous power in the right corner of the LCD. This value is refreshed every second. The customer has an option of whether the meter should display instantaneous power value is displayed. The instantaneous power display is auto-ranging to display the most appropriate precision for the current load conditions.

### 2.3.4 Display Detail

These characters display alphanumeric quantities. The display scroll sequence is programmable at the factory or by the user with MeterBuddy Software. The scroll sequence can consist of up to 16 individual displays.

Duplicate display choices are permitted as long as the total number of display choices in the scroll sequence does not exceed 16.

The time of display can be programmed from 1 to 15 seconds in one-second increments.

When internal meter errors occur, error codes will be added to the end of the scroll sequence.

The segment check display does not affect the DPI and DIR. This permits a user to use the DPI and DIR for timing when a segment check is being displayed during a scroll sequence.

A two character programmable alphanumeric label can be associated with each display. This two-character field is used to identify the value displayed. It can be left blank if desired.

### 2.3.5 Digital Power Indicator

The meter has a digital power indicator and consists to three segments.

The DPI moves from left to right at a rate proportional to energy Received to the load and moves from right to left at a rate proportional to the energy Delivered from the load.

The DPI  makes one Kh of metered energy.  Comment: this needs to be reworded and we don't understand the intent.

The DPI moves per 1 seconds, if the energy is more than 1 watt, it only moves one segment.

### 2.3.6    Real Time Energy Direction Indicators

The meter LCD has a method of indicating the positive or negative nature of energy accumulation relative to normally correct meter installation. The two arrows indicate whether the energy accumulated is delivered/Received to the load or received /Delivered from the load. The right pointing arrow will illuminate when energy accumulation is positive (delivered). The left pointing arrow will illuminate when the energy is negative (received). If the energy is not above the anti-creep threshold, both indicators will be displayed without any text.

### 2.3.7    Power Up Display Sequence

All meter display segments, including the DPI segments and others, illuminate after the meter is powered up for 1 second regardless of the display. After that the display will display the Firmware version for 2 seconds. Then the display begins its programmed scroll sequence.

# 3.0 Maintenance Instructions

WARNING: The information contained within this document is intended to be an aid to qualified metering personnel. It is not intended to replace the extensive training necessary to install or remove meters from service. Any work on or near energized meters, meter sockets, or other metering equipment presents the danger or electrical shock. All work on these products must be performed by qualified industrial electricians and metering specialists only. All work must be done in accordance with local utility safety practices and the procedures outlined in the current edition of the Handbook for Electricity Metering.

### 3.1 Test Procedures

The Procedures described below are suggested test procedures for use with the Libra meter. They are not intended to replace local utility operating practices.

### 3.1.1 Meter Testing Tools

The meter is equipped with a light-emitting diode (IR LED) for verifying calibration and a liquid crystal display with disk analog.

### 3.1.1.1 Calibration LED

The Infra-Red LED emits optical pulses proportional to kWh accumulation. The output of the calibration LED is compatible with commercially available test equipment designed to verify the calibration of watthour meters in the shop and field. Each calibration pulse represents Kh watt-hours of energy accumulated by the meter. The duration of each output pulse is approximately 10 milliseconds.

### 3.2 Field Accuracy Test

The most accurate way to verify meter calibration is the use of test equipment designed to compare the meter accumulation to a precision watthour standard. This equipment uses the calibration pulse output from the meter to gate (start and stop) the standard at precise times to minimize the measurement uncertainty. The equipment will also typically provide known regulated loads to the meter and standard during the test. In the event such equipment is not available, the Libra meter provides two methods for making a reasonable verification of the meter's accuracy.

1. Disk analog testing

2. Instantaneous demand feature of the Libra.

### 3.2.1 Disk Analog Testing

The disk analog provides a means of checking the calibration of the meter. There are some practical limits to this method of testing. For example, if the load on the meter is very low, the test may take a long time. Conversely, if the load is high, it may be difficult to accurate time the apparent revolutions of the disk analog display.

For a complete description on the operation of the disk analog feature of Libra, refer to 2.3.4 *Digital Power Indicator*.

If a load is applied to the meter in service that is constant and reasonably well known, the accuracy of the meter can be estimated using the time-Watts method of testing. Since the apparent revolution of the disk analog is equal to the meter 1Whour, the amount of time required to accumulate a fixed quantity of energy can be timed with a stopwatch. By observing the disk analog display, the user can time the apparent revolutions by starting and stopping the watch when the disk analog has cycled through the required number of revolutions back to its beginning state.

The accumulation in WH divided by the accumulation time (in hours) will give a value in Watts that can be compared to the known value of the load to estimate the meter accuracy.

***(Meter Kh * number of revolutions) / (t seconds / 3600) = Metered load in Watts***

This method of testing is only applicable to providing a rough estimate of the meter performance since the actual load in operation is not normally known with a high degree of precision.

A more accurate field test of meter calibration can be performed using a reference watthour standard and a controlled load as described above. If the reference standard does not support an interface (optical pickup) for the calibration LED it is often possible to gate the reference standard manually using a switch.

1. Connect the portable standard and test load to the meter according to the wiring instructions provided by the test equipment manufacturer.

2. Reset the standard and apply an appropriate test load. A nominal Test Ampere rating (TA) is indicated on the meter nameplate.

3. Observe the disk analog. One complete apparent revolution of the disk analog display represents Kh Watthours as accumulated by the meter (The Kh value is printed on the meter nameplate.)

4. When the disk analog appears to transition off of the visible display start the standard manually.

5. Let the disk analog scroll through a predetermined number of evolutions(10, for example).

6. Stop the standard manually when the disk analog transitions off of the visible display after the required number of apparent revolutions are complete.

7. Calculate the accumulated Watt-hours as shown in the following equation.

***Accumulated Energy = (Kh) ✕ (the number of complete disk analog cycles)***

8. Compare the results of the calculation to the reading on the reference standard.

The human reaction time in starting and stopping the reference standard is a significant source of measurement uncertainty when using this test technique. Increasing the number of apparent disk revolutions per test can reduce this uncertainty.

### 3.2.2 Instantaneous Power Testing

When programmed, the Libra displays instantaneous power with kW indicator in the LCD. The instantaneous power indication is useful for making a rough estimate of meter performance by comparing the displayed power to the expected load on the meter. The result is similar to the time-Watts test method and depends upon reasonable knowing the applied load and upon the displayed precision of the result. The instantaneous

power value may be useful to obtain meaningful data. The value is also useful to service personnel for providing immediate data on the applied load.

## 3.3 Shop Test

Shop testing consists of verifying the meter's accuracy.

### 3.3.1 Meter Shop Equipment

The Libra meter has a capacitive type power supply designed to operate at a single nominal supply voltage. The low burden design of the Libra should be compatible with most commercially available test equipment. Meters may be tested in any shop that meets the requirements outlined in the current editions of the Handbook for Electricity Metering published by the Edison Electric Institute and the American National Standard Code for Electricity Metering.

### 3.3.1.1 Equipment Setup

The meter mounting equipment and its electrical connections must be used as required for the meter form number on the meter nameplate. For some test equipment, the meter test link(s) must be opened in order to isolate the meter voltage and current circuits. Refer to the instructions provided by the test equipment manufacturer to determine if this is necessary. The Libra meter is also available in non-standard forms without test-links where improved reliability and/or tamper resistance is desired.

### 3.3.1.2 Testing

The Watthour constant (Kh) of a meter is defined as Watthours per disk revolution. Because electronic meters do not rely on disk revolutions to measure energy, the revolutions of the disk analog, described in Section 2.3.4 *Digital Power Indicator,* are associated with Kh. Kh is printed on the meter label as a reference to an equivalent electromechanical meter as required by applicable meter standards.

### 3.3.2 General Watthour Meter Test Procedure

To test the meter, proceed as follows:

1.  Note the meter Kh value listed on the nameplate.

2.  Select the desired voltage and current level(s) on the test equipment. Observe the appropriate voltage and current ratings for the Device Under Test. Exceeding the device ratings can result in permanent damage to the meter.

3.  Install the meter in the test socket, making certain that the socket is wired and/or configured for the appropriate meter form.

4.  Align the optical pickup of the test equipment with the calibration LED.

5.  Begin testing according to standard test procedures. Allow 15 seconds of setting time after applying voltage before making accuracy measurements.

6.  Under typical test conditions a minimum test time of 30 seconds is needed to reduce test uncertainty to a level compatible with the accuracy of the Libra meter. (Check the instruction book for your test board or standard to determine the actual minimum test time.)

### 3.4 Service

The Libra meter is factory calibrated and requires no routine or scheduled service by the user.

### 3.5 Repair

Factory repair or replacement service is offered when you cannot fix a problem. If a problem can't be corrected, return the whole meter to Wasion in the following paragraph.

### 3.6 Returning a Meter

If you wish to return a meter, call your Wasion sales representative for a Return Authorization. The entire meter should be returned with the Wasion supplied Return Authorization information form completed. Key information includes quantity, catalog number serial number(s) and a complete description of the problem. Your Wasion sales representative will provide return instructions.

### 3.7 Cleaning

| CAUTION | Care must be taken during cleaning not to damage or contaminate any gold-plated contacts of the connectors. |
|---|---|
| CAUTION | Do not immerse the meter in any liquid. Do not use abrasive cleaners on the Polycarbonate covers. Do not use chlorinated hydrocarbon or ketone solvents on the covers. |

### 3.8 Storage

The Libra Meter is a durable device; however, it should be handled and stored with care. The temperature and humidity levels in storage are not critical; but extremes of either factor should be avoided.

### 3.9 Troubleshooting Guide

Table 3-1 Troubleshooting

| Symptom | Probable Cause | Remedy |
|---|---|---|
| **No display** | a. Circuit de-energized. <br> b. Test link(s) open. <br> c. Meter internal wiring defective. | a. Rewire according to applicable diagram. <br> b. Check that voltage and current connectors are seated properly. Check the leads for damage. <br> c. Replace meter. |
| **Meter runs slow** | a. Socket wiring error. <br> b. Meter internal wiring defective. <br> c. Defective sensor. | a. Rewire according to applicable diagram. <br> b. Check that voltage and current connectors are seated properly. Check the leads for damage. <br> c. Replace meter. |
| **Meter overheats** | a. Meter socket has | a. Replace meter socket with a heavy- |

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| | | |
|---|---|---|
| | insufficient capacity or is not adequately wired.<br>b. Meter is overloaded.<br>c. Poor connection at socket terminal. | duty model.<br>b. Use transformer rated installation.<br>c. Replace socket terminal. |
| **ERROR message on display** | a. Meter detected an internal condition that may affect the meter data. | a. Replace the meter and return to factory for service. |

### 3.9.1 Self-Tests and Error Codes

The meter performs self-tests periodically. These self-tests are performed when the meter powers up and once every 24 hours thereafter. The current metering data is stored to non-volatile memory (NVRAM) prior to performing the periodic self-test. If the meter detects an error it will repeat the self-test every minute in order to attempt to recover from the condition causing the error. If the conditions causing the error clear, the meter will resume metering.

If an error occurs, the meter will display "ER" in the primary display. See the *Meter Errors table* as below.

An error display indicates a fault in an electronic subsystem of the meter and indicates a condition that is not user serviceable.

| *Error Code* | *Specification* |
|---|---|
| `no Err` | End Device is in Metering mode |
| `no Err` | End Device is in Test mode |
| `no Err` | End Device is in Meter Shop mode |
| `no Err` | Creep Alert. ( Icurrent < 1.0A ) |
| `no Err` | Calibration is invalid |
| `Er0006` | Clock is not set |
| `Er0007` | Unexpected reset. |
| `Er0008` | Power register data was lost |
| `Er0009` | Meter is not programmed or it is in a factory default state |
| `Er0010` | Meter did detect a configuration error or not |
| `Er0011` | Meter did detect a self check error or not |
| `Er0012` | Meter did detect a RAM Memory failure |
| `Er0013` | Meter did detect a ROM Memory failure |
| `Er0014` | Meter did detect nonvolatile memory failure |
| `Er0015` | Meter did detect a Clock error or not |
| `Er0016` | Meter did detect a measurement element error or not |
| `Er0017` | Meter did detect a low battery error or not |
| `Er0018` | Meter did detect a device potential that is below a predetermined value or not |
| `Er0019` | End Device did detect a demand threshold overload |
| `Er0020` | Sag detected; conductor A |
| `Er0021` | Over max. voltage |
| `Er0022` | Under min. voltage |
| `Er0023` | Over max. current on A |

| Er0024 | Meter cover is opened unexpected |
| --- | --- |
| Er0025 | Min. temperature exceeded |
| Er0026 | Max. temperature exceeded |
| Er0027 | Relay execute connect command, but meter detect a High voltage on output port. |
| Er0028 | Relay didn't execute open/close command |
| Er0029 | Load control emergency alarm |
| Er0030 | Load control power over alarm |
| Er0031 | Load control , supply capacity export over |
| Er0032 | Load control , supply capacity import over |

# 4. Installation Instructions

## 4.1 General

CAUTION: Do not interchange power and meter module assemblies between meters. Calibration data stored in meter is particular to a matched power and meter module. Interchanging these components causes the meter to lose calibration. The meter should never be disassembled. Failure to observe this practice can result in serious injury or death.

This chapter of the guide give instructions for the proper handling and installation of the Libra meter.

## 4.2 Inspection

Perform the following inspections when you receive the meter:

o Inspect for obvious damage to the cover, base, and meter assembly.

o Be sure the optical connector is free of debris.

o Compare the meter and register nameplates to the record card and invoice. Verify the type, class, voltage, form number, and other pertinent data.

o Save the original packing materials.

## 4.3 Storage

Store the meter in a clean, dry (relative humidity < 50%) environment between -30℃ to +65℃ (-30℉ to +165℉). Avoid prolonged storage (more than one year) at temperatures above +50℃ (+138℉). Store the meter in the original packing material.

## 4.4 Unpackiing

As with all precision electronic instruments, the meter should be handled with care in an outdoor environment. Follow these precautions when handling the meter:

o Avoid damaging the meter base, cover, reset mechanism (if supplied), and optical connector (if supplied).

o When handling personality modules, grip the circuit board by its edges. Do not touch the liquid crystal display.

## 4.5 Selecting a site

The meter is designed and manufactured to be installed in an outdoor environment, at operating temperature ranges between  -30℃ to +65℃ (-30℉ to +165℉). Operation in moderate temperatures increases reliability and product life.

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**4.6 Meter installation**

The meter is plugged into a meter socket using standard meter installation practices. The meter base has current and terminals extending outside from the back of the meter. These terminals engage with the socket jaws, which are connected to the service lines. The socket jaws provide heavy contact force with the help of spring. In some heavy-duty sockets, contact force is provided by a handle or wrench.

On powering-up the meter, verify meter operations by observing the display:

o For the first 3 seconds, the LCD display All Segment Test (all display items shown). If this all segment display is continued after 3 seconds then there is possibly an error in the installation wiring.

o LCD display the software version of the meter for 1 second.

o After that, LCD displays the number of digits for Energy.

o Verify the expected direction of energy flow on the display Annunciator.

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# 5. Site Analysis Guides and Diagram

NOTICE:

These site analyses include basic connection diagrams for identification of metering installation. Caution: these diagrams are not metering installation guides.

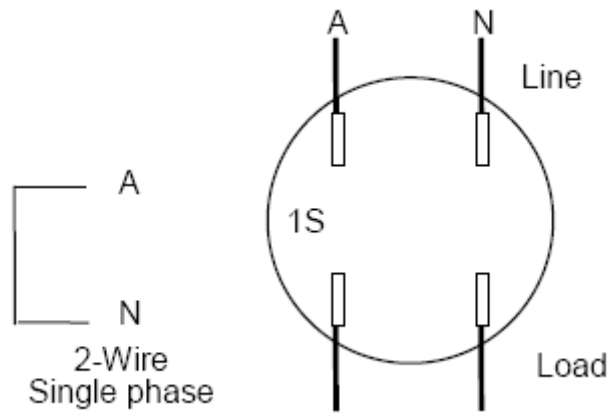## 5.1 Form 1S (Self-Contained)



Figure 5.1 **2-wire, 1-phase, 1-element**

*Caution: Actual installation procedures, equipment, and connections must conform to applicable codes and standards.*
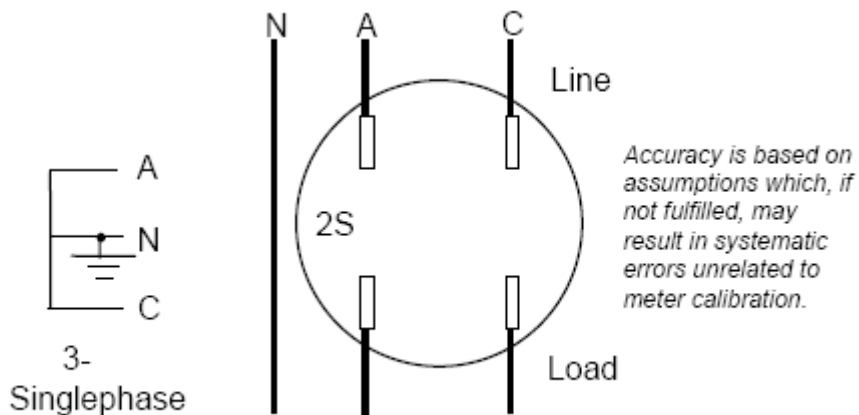
## 5.2 Form 2S (Self-Contained)



*Accuracy is based on assumptions which, if not fulfilled, may result in systematic errors unrelated to meter calibration.*

Figure 5.2 **3-wire, 1-phase, 1-element**

*Caution: Actual installation procedures, equipment, and connections must conform to applicable codes and standards.*
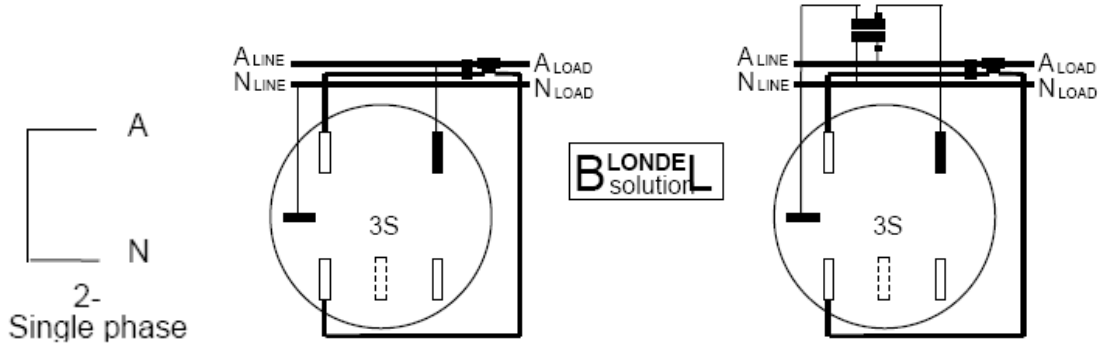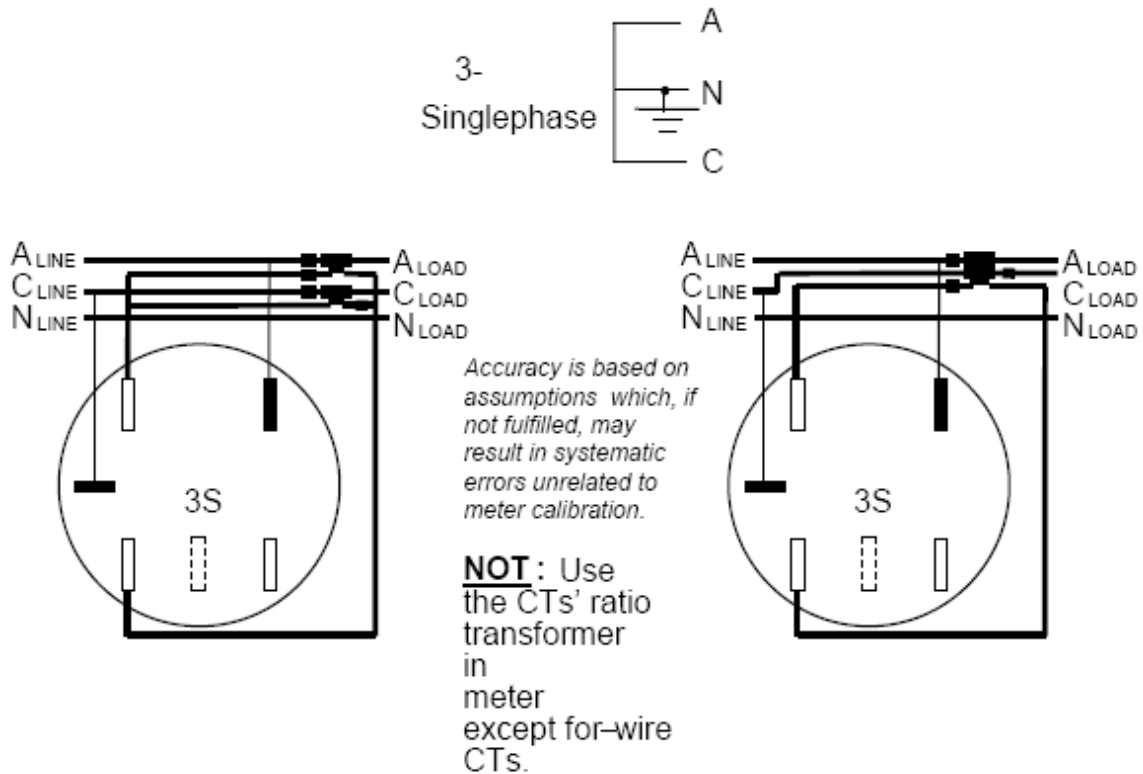
## 5.3 Form 3S (Transformer Rated)



Figure 5.3 **2-wire, 1-phase, 1-element**

*Caution: Actual installation procedures, equipment, and connections must conform to applicable codes and standards.*

## 5.4 Form 3S (Transformer Rated)



Figure 5.4 **3-wire, 1-phase, 1-element**

*Caution: Actual installation procedures, equipment, and connections must conform to applicable codes and standards.*
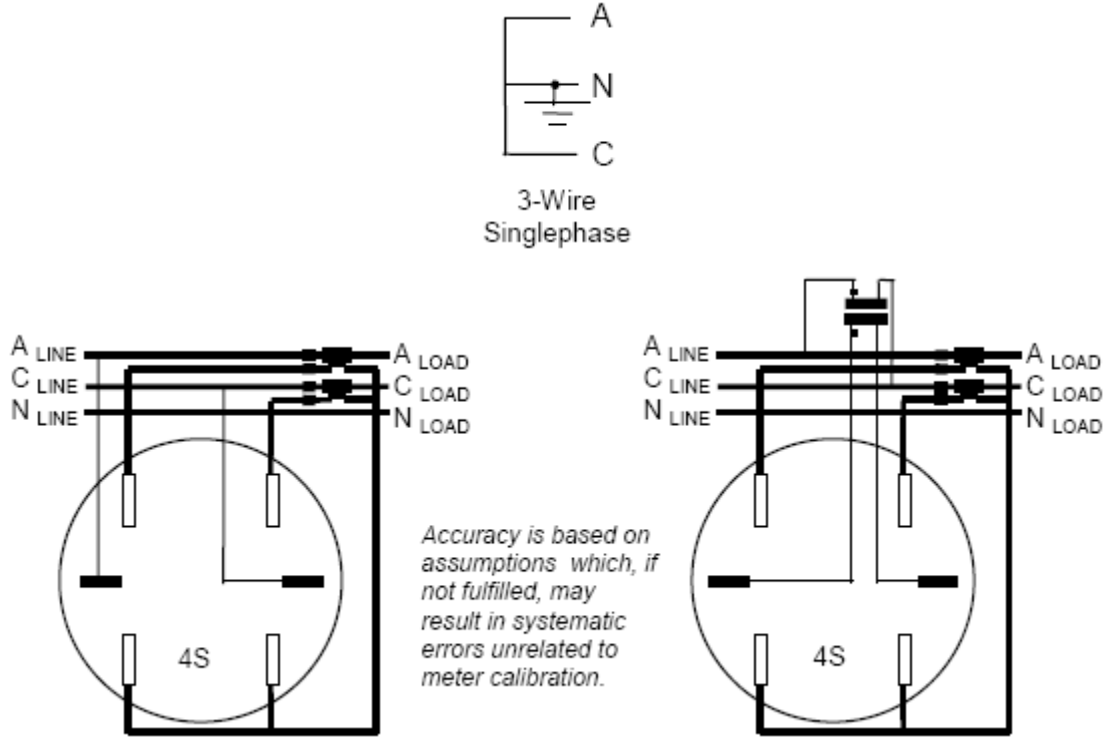
## 5.5 Form 4S (Transformer Rated)



Figure 5.5 **3-wire, 1-phase, 1-element**

*Caution: Actual installation procedures, equipment, and connections must conform to applicable codes and standards.*

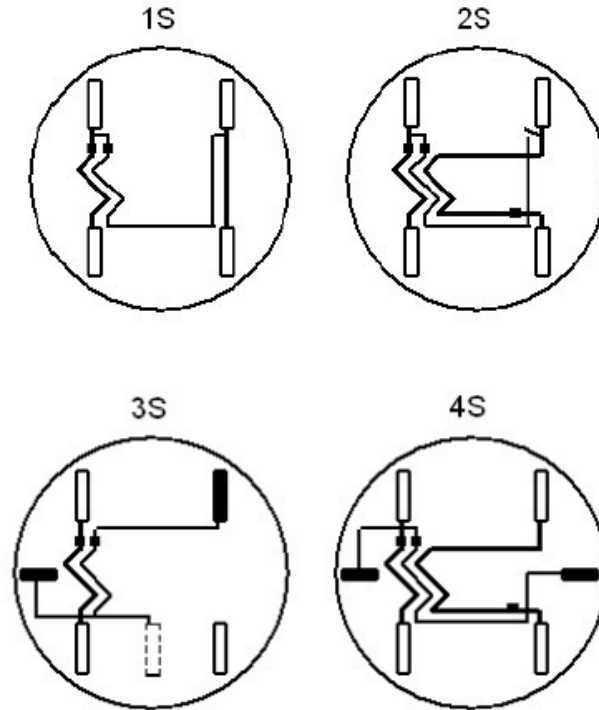## 5.6 Diagrams

### ANSI C12.10 Internal Connections

1S      2S

3S      4S

Figure 5.6 diagrams of ANSI C12.10 Internal Connection