FCC Part 15.247/15.249
Transmitter Certification

Composite Device

Test Report

FCC ID: SK9AMI-1

FCC Rule Part: 15.247/15.249

ACS Report Number: 06-0239-15C-DSS, 06-0239-15C-DXX

Manufacturer: Itron Electricity Metering Inc.
Trade Name: CENTRON Open Way
Model(s): CVSO, CVSOD, CVSOC

Manual

CENTRON® OpenWay™ Meter

Technical Reference Guide
Effective Date: September 26, 2006

Draft

Putting knowledge to work.

This manual contains the trade secrets and confidential information of Itron, Inc., which are not to be divulged to third parties and may not be reproduced or transmitted in whole or part, in any form or by any means, electronic or mechanical for any purpose, without the express written permission of Itron, Inc. All rights to designs or inventions disclosed herein, including the right to manufacture, are reserved to Itron, Inc.

The information contained in this document is subject to change without notice. Itron, Inc. reserves the right to change the product specifications at any time without incurring any obligations.

Trademarks Used in This Manual

CENTRON is a registered trademark of Itron, Inc.

Windows is a trademark of Microsoft Corporation

Compliance With FCC Regulations

FCC Part 15, Class B

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications to this device not expressly approved by Itron, Inc. could void the user's authority to operate the equipment.

Co-existance of Transmitter

This device is authorized to operate simultaniously with GPRS transmitter FCC ID MIVGSM0108

RF Exposure

In accordance with FCC requirements of human exposure to radiofrequency fields, the radiating element shall be installed such that a minimum separation distance of 20 cm.

Canadian Interference Causing Equipment Regulations

This Class B digital apparatus meets all requirements of the Canadian Interference Causing Equipment Regulations. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Cet appareillage numérique de la classe B répond à toutes les exigences de l'interférence Canadienne causant des règlements d'équipement. L'opération est sujette aux deux conditions suivantes: (1) ce dispositif peut ne pas causer l'interférence nocive, et (2) ce dispositif doit accepter n'importe quelle interférence reçue, y compris l'interférence qui peut causer l'opération peu désirée.

Factory Repair of Meters

Itron recommends that all repairs be performed at the factory. Certain repairs may be performed by the user; however, unauthorized repairs will void any existing warranty. All surface mounted parts must be replaced by the factory.

Repair of Meters Under Warranty

If the meter is under warranty, then Itron, Inc. will repair the meter at no charge if the meter has failed due to components or workmanship. A return authorization number must be obtained before the equipment can be sent back to the factory. Contact your Itron Sales Representative for assistance.

Repair of Meters Not Under Warranty

The same procedure as above applies. Itron will charge for the necessary repairs based on the failure.

Service Return Address

Itron, Inc.
Customer Repair Department
313 North Highway 11 Dock C
West Union, SC 29696

Recycling Information

The product you have purchased contains a battery (or batteries), circuit boards, and switches. The batteries are recyclable. At the end of the meter's useful life, under various state and local laws, it may be illegal to dispose of certain components into the municipal waste system. Check with your local solid waste officials for details about recycling options or proper disposal.

Although polycarbonate is not a commonly recycled plastic, the recycling number for the polycarbonate inner cover, outer cover, and base is seven (7).

Table of Contents

Table of Figures

Notes:

C H A P T E R   1

General Information

In This Chapter

This technical reference guide describes the installation, operation, and maintenance of the Itron CENTRON OpenWay meter. Itron urges you to read the entire manual before attempting installation, testing, operation, or maintenance of a meter. To operate the Itron PC-PRO+ Advanced Programming Software discussed in this manual, refer to the online user manuals that are installed with the PC-PRO+ Advanced software.

The online software manuals are in Adobe® Portable Document Format (PDF) and are accessible from the Windows Start menu. The Adobe Reader is required to view and print these manuals. The Adobe Reader is free and can be downloaded from http://www.adobe.com.

About This Manual

This manual contains the following information as listed in the chapter descriptions below:

Chapter Title	Description
General Information	Provides a general description, operation, physical and functional descriptions, and complete CENTRON OpenWay meter specifications.
Installation	Gives instructions for the proper handling and installation.
Operation: Base Metrology	Describes the measurement technique used for the base on the CENTRON OpenWay meter.
Operation: CVSO	Provides detailed information and theoretical operation for the OpenWay module with TOU, Demand, and Load Profile capabilities.
Operation: Zigbee Radio	Provides a physical description and the operational characteristics of the Zigbee 2.4 GHz radio.
Testing, Troubleshooting, and Maintenance	Provides an explanation of the testing, troubleshooting, and maintenance of the CENTRON OpenWay meter.

Chapter Title	Description
Specification Numbers and Drawings	Provides a reference to meter part numbers and shows meter form drawings.

General Description

The CENTRON OpenWay meter is used for measuring electrical energy consumption. The CENTRON OpenWay meter incorporates a two-piece design combining a base metrology with a variety of OpenWay registers or options. The metrology portion of the meter contains all measurement circuitry and calibration information, while the personality modules contain the register functionality and communication mediums.

Each version of the meter is distinguished by the various personality modules or option boards that mount to the standard meter metrology base. The CENTRON OpenWay meter is also available with a remote disconnect which is located in the bottom of the meter housing. The CENTRON OpenWay meter is available in the following versions:

- Standard-CVSO
- Integrated disconnect/reconnect - CVSOD
- Integrated cell relay - CVSOR, CVSOC
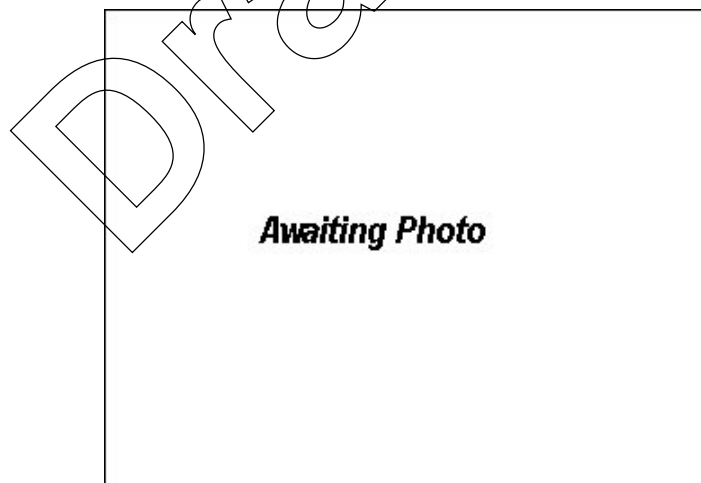
Figure 1: CENTRON OpenWay Meter Personality Modules

Physical Description

The CENTRON OpenWay meter features a common meter base to which various personality modules are attached. The cover is polycarbonate. Meters with the disconnect or integrated cell relay have an extended cover.

Meter Base

The CENTRON OpenWay meter base contains all of the measurement circuitry and calibration information on the metrology board.
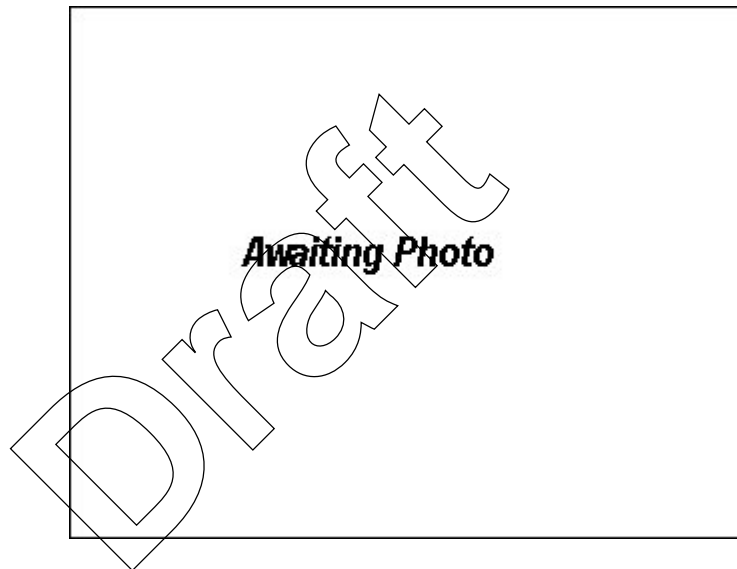
Figure 2: CENTRON OpenWay Meter Metrology

Personality Modules

All of the personality modules in the CENTRON OpenWay meter snap into the module holder located on the standard meter base as shown below. From the base metrology, the energy data is transmitted to the OpenWay module, which contains the meter display, communication mediums, and register functionality.

Figure 3: CENTRON OpenWay Module Assembly

Product Availability

The current offerings for the CENTRON are:

Metrology   Class 200, 240V , Form 2S

Personality Modules   Standard OpenWay Register
                                   OEM Communications Modules

Additional Base Functionality   CellRelay
                                   Remote Disconnect/Reconnect

Display Functions

The CVSO module can display up to 80 items between Normal and Test mode.

Specifications

Electrical

Voltage Rating   240V

Operating Voltage   ± 20% (60 Hz); ± 10% (50 Hz)

Frequency   60 Hz, 50 Hz

Operating Range   ± 3 Hz

Battery

   Type: TADIRAN type 4902/PT

   Itron Part Number: 512766-001

   <u>Voltage</u>

   Operating Range: 3.6 V nominal; 3.4 V - 3.8 V

   Carryover: 10-12 years

   Shelf Life: 15 years

Operating Environment

Temperature   -40°C to +85°C

Humidity   0% to 95% non-condensing

Accuracy   ± 0.5% @ unity power factor

Transient/Surge Suppression ANSI C62.45 - 1992
             IEC 61000-4-4

Characteristic Data

Temperature Rise   Meets ANSI C12.1 Section 4.7.2.9

Burden Data

Voltage	Energy Only		R300		(V&I) D/T/L		R300CD/CD3	
	Watts	VA	Watts	VA	Watts	VA	Watts	VA
120	0.773	1.38	0.791	1.22	1.25	1.86	1.25	1.86
240	1.03	1.91	1.09	1.79	1.53	2.6	1.53	2.6
277	1.38	2.13	1.16	2.18	1.65	2.87	1.65	2.87
480	1.84	3.38	1.91	3.57	2.39	4.43	2.39	4.43

Technical Data

Meets applicable standards:

- ANSI C12.1 - 2001 (American National Standard for Electric Meters - Code for Electricity Metering)
- ANSI C12.18 - 1996 (American National Standard - Protocol Specification for ANSI Type 2 Optical Port)
- ANSI C12.19 - 1997 (American National Standard - Utility Industry End Device Data Tables)
- ANSI C12.20 - 2002 (American National Standard for Electricity Meters - 0.2 and 0.5 Accuracy Classes)
- ANSI/IEEE C62.45 - 1992 (Guide to Surge Testing on Low-Voltage AC Power Circuits)
- IEC 61000-4-2
- IEC 61000-4-4

Type Codes

The type code indicates the metrology, version, base, functionality, and RF options in the meter. The type code is found on the nameplate of the meter. The following is a depiction of how type codes are displayed for the CENTRON OpenWay meter:

C   V   S   O   ___

Meter Type
(Blank) = Standard
C = Cellrelay, 1 Zigbee (GPRS, Ethernet, GPRS+Ethernet)
D = Disconnect
R = Cellrelay, 2 Zigbee (GPRS, Ethernet, GPRS+Ethernet)
X = Third Party Comm

System
O = OpenWay

Base Style
S = Socket

Metrology Type
V = VA

Product Family
C = CENTRON
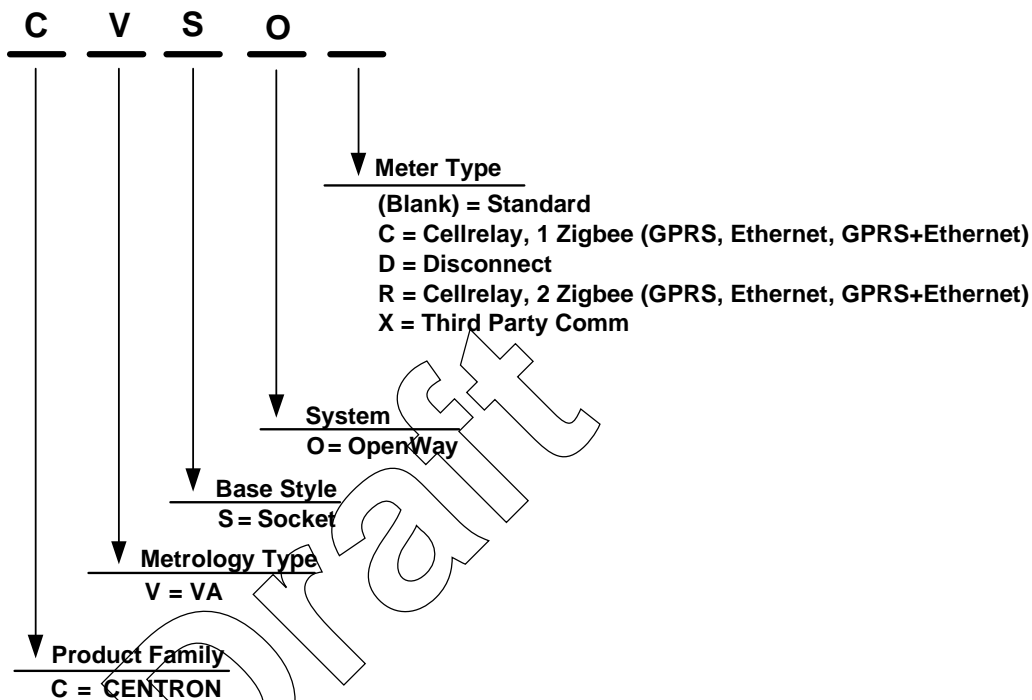
Figure 4: CENTRON OpenWay Meter Type Codes

Dimensions

The following dimensional measurements are shown in inches and (centimeters).

CVSO
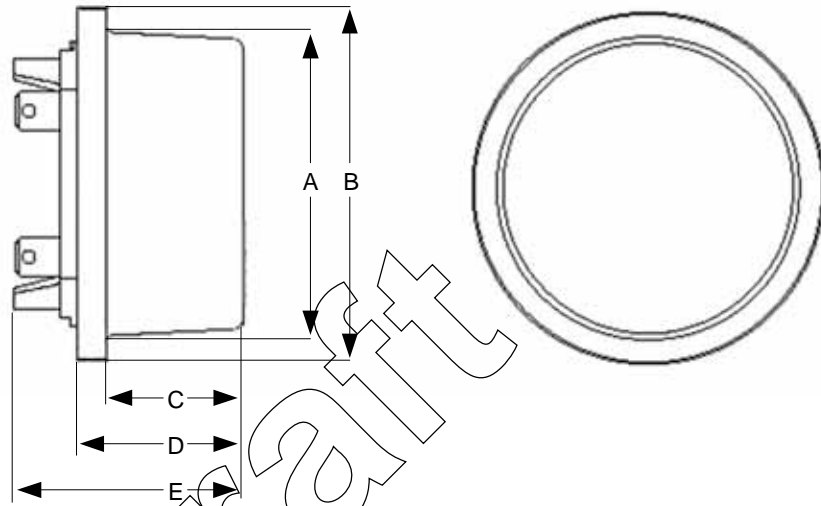
Figure 5: CVSO Dimensions

A	B	C	D	E
6.29 (16.00)	6.95 (17.70)	3.84 (9.80)	4.30 (10.90)	5.67 (14.40)

CVSOD, CVSOR, CVSOC
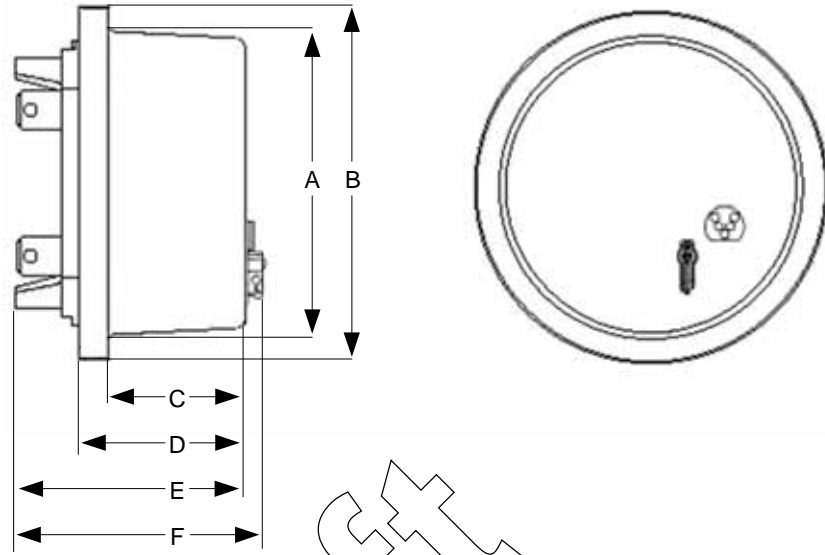
Figure 6. CVSOD, CVSOC Dimensions

A	B	C	D	E	F
6.29 (16.00)	6.95 (17.70)	3.84 (9.80)	4.30 (10.90)	5.67 (14.40)	6.11 (15.50)

Notes:

C H A P T E R 2

Installation

In This Chapter

This chapter provides information about installing the CENTRON OpenWay meter.

Inspection

Perform the following inspections when you receive the meter:

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

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

▪ Save the original packing materials.

Battery

The CENTRON OpenWay module contains a battery that powers the clock circuit during a power outage. The battery is permanently soldered to the module and is expected to last the life of the meter.

Storage

Store the CENTRON OpenWay meter in a clean, dry (Relative Humidity < 50%) environment between -40° C to +85° C (-40° F to +185° F). Avoid prolonged storage (more than one year) at temperatures above +70° C (+158° F). Store the meter in the original packing material.

Unpacking

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

- Avoid damaging the meter base, cover, reset mechanism (if supplied), and optical connector (if supplied).
- When handling personality modules, grip the circuit board by its edges. Do not touch the liquid crystal display.
- Save the original packing materials.

Preliminary Inspection

A preliminary inspection should be performed immediately upon receipt of your order. The following sections suggest the minimum requirements of the preliminary inspection.

Meters Without Batteries

Upon receipt, do the following:

1 Inspect for obvious shipping damage to the cover and the meter assembly.

2 Ensure that the demand reset mechanism (optional) is secure and not damaged.

3 From the meter nameplate, verify that the information in the following table is as specified on the original order.

Meter Type	Kh	Class
Voltage (Range)	Service	Test Amps
Form Number	Frequency	Serial Number
Bar Code Data	Functional Options	Communication Options
I/O Options		

Meters With Batteries

The CENTRON OpenWay meter battery is a 3.6 volt lithium battery (TADIRAN type 5276/C).

The product you have purchased contains a battery which is recyclable. At the end of its useful life, under various state and local laws, it may be illegal to dispose of this battery into the municipal waste stream. Check with your local area solid waste officials for details about recycling options or proper disposal.

Selecting a Site

The meter is designed and manufactured to be installed in an outdoor environment, at operating temperature ranges between -40° C and +85° C (-40° F to +185° F). Operation in moderate temperatures increases reliability and product life.

Installing the Meter into Service

Install the meter base using standard meter installation practices.

The current and potential terminals extend as blades, or bayonets, from the back of the meter. The meter is plugged into the socket so that the bayonets engage the main socket jaws that connect to the service lines. Clamping pressure on the bayonets is provided by the heavy spring pressure of the socket jaws. In some heavy-duty sockets, jaw clamping pressure is provided by a handle or wrench.

Retrofitting with Personality Modules

CENTRON OpenWay meters can be upgraded to increase functionality by changing the Personality Modules.

Do not power ON the meter without the inner cover in place. Power the meter OFF before removing the inner cover. Personality modules are sensitive to ESD damage. Take appropriate grounding measures before retrofitting.

To change or add a Personality Module:

1 De-energize the meter.

2 Remove the outer cover.

3 Remove plastic inner cover by holding the meter with both hands and applying equal pressure on either side of the three and nine-o'clock positions. The inner cover is held in place by four plastic tabs on the meter base.

4 Remove the black board-to-board connector (① in the figure below) between the circuit board and the metrology board by pulling it by its middle while moving it side-to-side. To maintain the integrity of the connector, only remove it when you are upgrading the meter.

5 Remove the register module, one side at a time, by pulling gently outward on the meter frame snaps (② in the figure above) while lifting the module up.

6 Snap the new module into the meter frame by aligning the notches at bottom of the circuit board with the lower two snaps.

The module must be aligned properly in the snaps to avoid damaging the connector or circuit board.

7 Replace the board-to-board connector by aligning the top of the connector with the notches in the circuit board and pressing gently at the bottom of connector to mate the connector to metrology board. Then, gently press the top of the connector to mate it to the register module. The connector is seated correctly when you hear it snap into place.

Be sure to use the meter base for leverage instead of the LCD holder. Pressure on the LCD holder may damage the personality module.

8 Ensure the board-to-board connector is fully seated by pressing firmly in on the middle of the connector.

9 Carefully replace the inner protective cover. Engage the top snaps first, taking care to place the slot at the top of the cover over the IR light pipe. Failure to do so could break the light pipe. Ensure that all four meter base tabs are engaged with the slots at the top and bottom of the inner cover.

10 Place the cover over the meter base until the flange on the cover is flush with the flange on the meter base.

11 Turn the cover clockwise until the locking tabs are fully engaged with the meter base.

C H A P T E R 3

Operation: Base Metrology

In This Chapter

Metrology

The CENTRON OpenWay meter is a solid-state meter which uses the Hall Effect (one per phase) to measure metered current and voltage dividers (one per phase) to measure metered voltage as indicated in block diagram below.
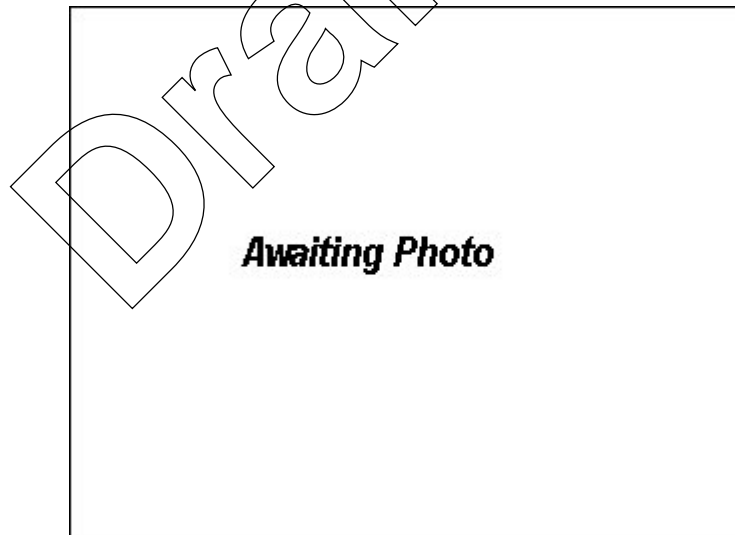
Figure 7: CENTRON OpenWay Metrology

The metrology performs the direct sampling of the voltage and current waveforms and the raw processing of these samples to compute all the energy quantities. It is comprised of a dedicated microprocessor and an analog-to-digital (A/D) converter. Low level signals proportional to the service voltages and currents are connected to the analog inputs of the A/D converters. These converters, which are contained in one package, individually sample the signals and send the digital results to the microprocessor 1,920 times per second. The microprocessor takes these samples, applies precision calibration corrections and computes all the quantities required for the specific meter configuration.

Surge Protection

Surge protection for the electronics in the CENTRON OpenWay meter is provided by Metal Oxide Varistors (MOVs). MOVs are clamping devices that allow voltage up to a limit, and then increasingly conduct current to prevent the voltage from exceeding the limit. The MOVs on the power supply board are connected directly across the voltage inputs to the meter. Although this approach requires very large MOVs, it prevents high voltages from appearing on or near the electronic boards giving the CENTRON OpenWay meter superior performance when exposed to extremely high-voltage surges.

Sampling

The analog-to-digital converter samples each phase voltage and current signal (independent of the line frequency) and sends the digital values immediately to the microprocessor. Each time a new set of digital samples are received by the microprocessor, it calculates all of the selected metrological quantities.
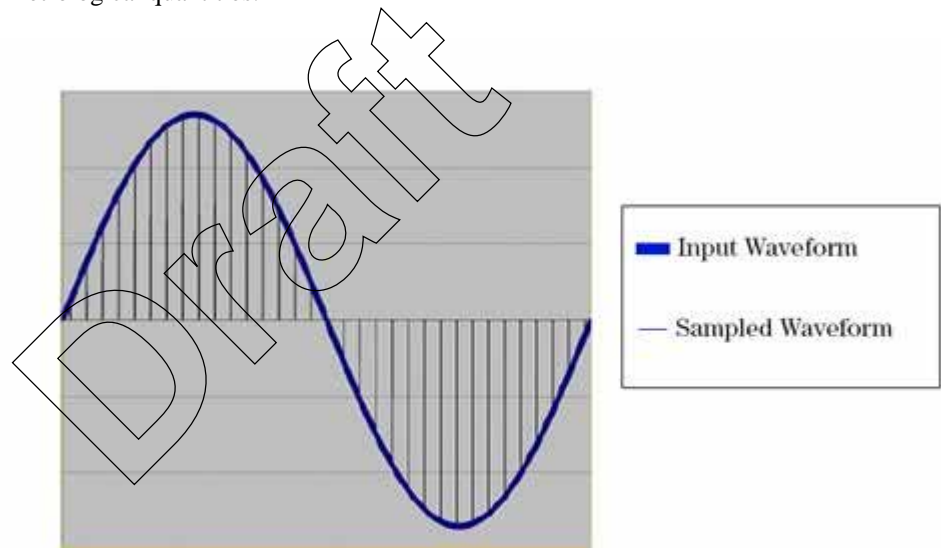
Figure 8: Sampled Waveform

At this sampling rate, harmonics to the 15th are measured. The high rate of the sampling enables the CENTRON OpenWay meter to measure energy quantities accurately under high harmonic distortion conditions. The sampling continues uninterrupted as long as the meter is powered up. All other processing is done in the background between samples. From the continuous train of digital samples on each of the six channels, current, voltage, active energy, reactive energy, and apparent energy quantities are computed.

Voltage and Current Measurement
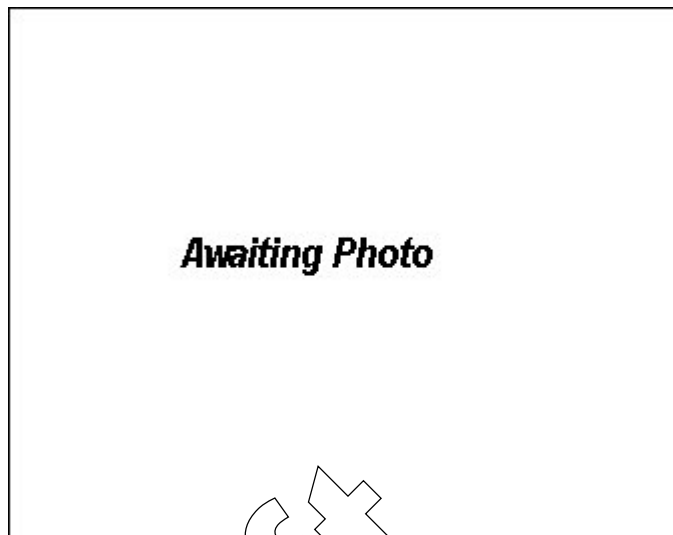
Figure 9: Voltage and Current Measurement

Watthour (Wh) Measurement

Watt-hours are measured by multiplying the instantaneous value of the voltage on each phase times the instantaneous value of the current on the same phase.

The resulting values are added to the Wh accumulator. After the completion of two cycles, the registers are compared to a threshold. This threshold represents 0.025 watt-hours. The value in the accumulator is then divided by this threshold, and the registers are updated accordingly. This means that under bidirectional measurement, if the consumption changes from delivered to received within one second, the meter will respond correctly to the change and accumulate in both the delivered and received registers. The CENTRON OpenWay meter can be programmed to register watt-hours either in the delivered quadrants only, or under bidirectional measurement, in the delivered and received quadrants. When only delivered watt-hours are measured, any negative watthour value is ignored. This has the same effect as a detent mechanism on an induction watthour meter.

When delivered and received watt-hours are measured, there will be one register for each quantity available—Wh delivered and Wh received, as well as one combined register—Wh net.

Volt-amperehour (VAh) Measurement

The CENTRON OpenWay meter measures either Vectorial or RMS volt-amperes using arithmetic phase summation. The arithmetic method of measurement ensures that the resulting VAh value contains as much of the harmonic information as possible.

Volt-ampere values are calculated by multiplying the RMS voltage value times the coincident RMS current value.

The voltage and current values from each phase are squared and then stored in their respective accumulators. At the end of one second, each accumulator contains the sums of the square of the voltages or currents for each phase. The contents of these accumulators are passed to the consumption routine where they are averaged (divided by the sample count) and the square root is taken, yielding the RMS voltage and RMS current for each phase.

Every second the RMS voltage and the RMS current for each phase are multiplied together to establish a VA-second value for each phase. These values are scaled and corrected.

The total VAhour value is calculated by adding the VA-second quantities for each phase and dividing the total by 3600. This value is added to the appropriate register. If the harmonics on the Voltage waveform differ from the harmonics on the Current waveform, then the harmonic energies will fall out of the Watthour and Varhour calculation, and thus the VA Vectorial measurement, but they will not fall out of the VA Arithmetic measurement.

The VA Vectorial and VA Arithmetic measurements will also differ when there is imbalanced power. Imbalanced power is generated when the phases of the service are not in balance with one another.

Demand Calculations

To calculate demand, the selected quantities are accumulated over a programmable time period (1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, or 60 minutes) depending on the programmed demand interval length. At the end of the interval, the accumulated values are stored in separate demand storage registers and the accumulating registers are cleared. Incremental values for the next demand interval are then accumulated.

The maximum demand in a billing period is determined by comparing the demand values for the most recently completed interval to the respective readings presently stored in the peak demand registers. If the previous demand is greater than the value in the corresponding peak demand register, the lower value (the maximum demand recorded so far) is replaced. If the previous demand is less than the value in the corresponding peak demand register, the maximum demand value remains unchanged. This update process is carried out when a demand interval is completed, when a power outage occurs, when Test Mode is initiated, or when a Real Time Rate change occurs.

The CENTRON OpenWay meter demand calculations are performed using one of two possible methods: block or rolling. The demand method is selected when the register is programmed.

Block Interval Demand Calculation

Block Demand calculations are based on user-defined interval lengths. The demand is the total energy accumulated during the interval divided by the length of the interval. At each end of interval (EOI), demand calculations are made and "EOI" can be displayed on the LCD.

For block interval, demand calculations are made at the end of each completed demand interval. This method is similar to the way mechanical demand meters operate. As load is applied to the demand register, an indicating pointer and maximum demand indicator are driven upscale. At the end of each interval, the indicating demand pointer is returned to the zero position, and the maximum demand pointer retains its highest or maximum position.

Rolling/Sliding Demand Interval Calculation

A selected number of subintervals make up the demand interval. At the end of each subinterval, new demand calculations occur based on the last full demand interval and "EOI" can be displayed on the LCD.

See Demand Registers (on page 38) for a list of the quantities that can be selected for rolling demand.

Block interval demand calculation is subject to peak splitting, whereby it is possible for an electricity consumer to manipulate the load for limited periods within the demand interval. The registered demand reading will be less than the actual maximum demand of the load.

To counter this situation, the concept of rolling demand was introduced. Rolling demand is calculated as follows:

1 For illustration purposes, assume a 15 minute billing demand interval with three five-minute subintervals has been selected. Then, at any given moment, the meter has three complete sets of five-minute information available for demand calculations.

2 At the end of the present five-minute subinterval, the information on the oldest five-minute subinterval is discarded, and demand calculations are performed on the three newest sets of subintervals. In this manner, the CENTRON OpenWay meter with the rolling demand option updates the demand calculations every five minutes.

3 If the billing demand interval is 30 minutes with five-minute subintervals, then six sets of five-minute information or updates will be used for calculating previous demand.

Cumulative Demand Values

Cumulative Demand is the summation of previous maximum demands after each demand reset. When a demand reset occurs, the maximum demand values are added to the existing corresponding cumulative demand values, and the sums are saved as the new cumulative demands. These values will not increase until the next demand reset. This feature not only protects the user from false or erroneous readings, but also provides the customer with extra security against tampering. Cumulative demand may be used for block, rolling and thermal demand types.

Continuous Cumulative Demand Values

Continuous Cumulative Demand is the sum of the maximum demand and the cumulative demand at any point in time. At the end of each demand interval, if a new maximum demand is reached, continuous cumulative demand will also be adjusted to reflect this new maximum demand value. A demand reset will clear the maximum demand value, but will not affect the continuous cumulative demand. Continuous cumulative demand may be used for block, rolling and thermal demand types.

Present Demand

Present Demand is the value that would be used if an EOI were to occur when the data is being viewed. It is calculated by dividing the accumulated energy in the current interval by the time of a full interval. For block demands, present demand starts at zero for each interval and ramps up to the demand value at the EOI. For rolling demands, the energy from the oldest subinterval is discarded and the present demand is calculated using the energy in the remaining subintervals and the energy in the current subinterval. At the beginning of a new subinterval, it drops by the demand of the oldest subinterval and ramps up to the demand value at the next EOI.

Present demand is not affected by a demand reset.

Previous Demand

Previous Demand is the demand from the most recently completed demand interval. When a demand interval ends, the present demand is transferred to the previous demand. When using rolling demand, this quantity is updated after each subinterval.

Peak Demand (Maximum Demand)

Peak Demand is the largest demand value that has occurred during any demand interval since the last demand reset. At the end of a demand interval, the present demand is compared with the current maximum demand register. If the present demand is greater, it is transferred to the maximum demand. The maximum demand is reset to zero on a demand reset. The date and time of the maximum demand are also recorded. Maximum demand is used for block, rolling, and thermal demand types.

Demand Thresholds

The table below describes parameters that define the configuration of demand thresholds. A threshold is a value against which a meter quantity is compared. If the quantity is beyond the threshold, an alarm is generated.

Threshold Alarm Parameters	
Parameter	**Description**
Quantity	Selects the demand register to which this threshold will apply.
Threshold Value	Sets the limit for this threshold event to be activated. • The valid range for Power Factor (PF) is 0.0 - 1.0 • For all others, the valid range is 1.0 - 500.000

Coincident Demand

Coincident Demand is the energy accumulated in an interval where a second trigger energy attained a peak. For example, Var demand when Watt demand attained a peak. Coincident demands are programmable.

Notes:

CHAPTER 4

Operation: CVSO OpenWay Register

In This Chapter

This chapter describes the basic operation of the CENTRON OpenWay meter register operation. It also explains how to configure the OpenWay register while providing detailed information on energy and demand functions, as well as Time of Use (TOU), Load Profile, and communications board options.
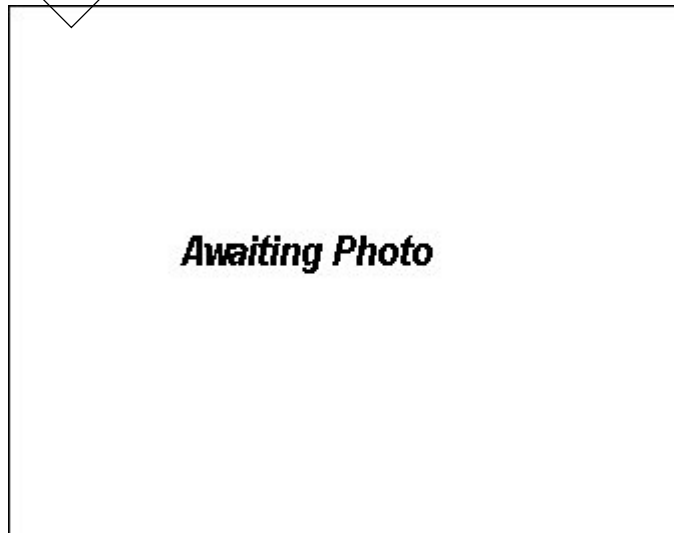
Figure 10: CENTRON CVSO Meter

Controls and Indicators

All controls and indicators are shown in the figure below.
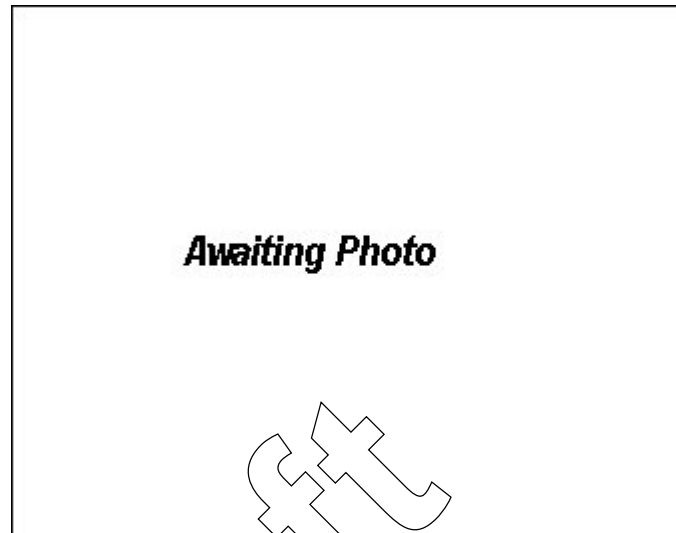
Figure 11: Controls and Indicators

Callout	Description
①	Liquid Crystal Display (LCD)
②	Magnetic Switch
③	Demand Reset Button
④	Test Mode Button
⑤	Optical Port
⑥	Infrared Test LED
⑦	Nameplate

Infrared Test LED

One infrared (IR) LED is located at the 3 o'clock position of the meter nameplate. The LED can be configured to pulse based on any of the following energy quantities:

- Wh delivered, received
- VAh delivered, received (arithmetic or vectorial)

Liquid Crystal Display (LCD)

The CENTRON OpenWay meter features a versatile ANSI C12.10-compliant, 104-segment liquid crystal display (LCD). The LCD with all segments lit is shown in the figure below. There are several static indicators available on the LCD as described in the table below the figure.
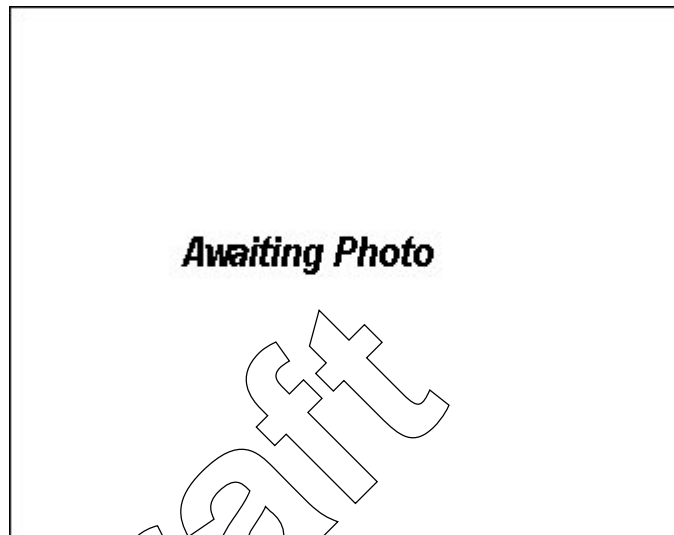
Figure 12: CENTRON OpenWay LCD

Static Indicators	
Indicator	**Description**
◀ ■ ■ ▶	Load Emulator (-> for positive, <- for negative)
888 888888	Nine digits (7 segments each) for display of alphanumeric information
120 240	Nominal Voltage Indicator (one value appears at a time)
EOI	End of Interval (Registers - Dmd)
Scr Loc	Scroll Lock (indicates temporary scroll lock of a display item)
nor diSP	Entry into Normal Mode.
TEST	Entry into Test Mode.

The indicators shown in the table above actually display in a digital readout font; some characters may display as upper case.

Load Emulator

The Load Emulator follows the Infrared Test LED. For each pulse of the Test LED, the Load Emulator increments one segment. The operation of the Load Emulator depends on the quantity being pulsed.

- If the quantity being pulsed is "Delivered-Only", then the Load Emulator scrolls to the right when energy is being delivered and lights the left arrow when energy is being received.
- If the quantity being pulsed is "Received-Only", then the Load Emulator scrolls to the left when energy is being received and lights the right arrow when energy is being delivered.
- If the quantity being pulsed is "Delivered and Received", then the Load Emulator scrolls to the right when energy is being delivered and scrolls to the left when energy is being received.

The figures below represents a typical progression of the Load Emulator segments:
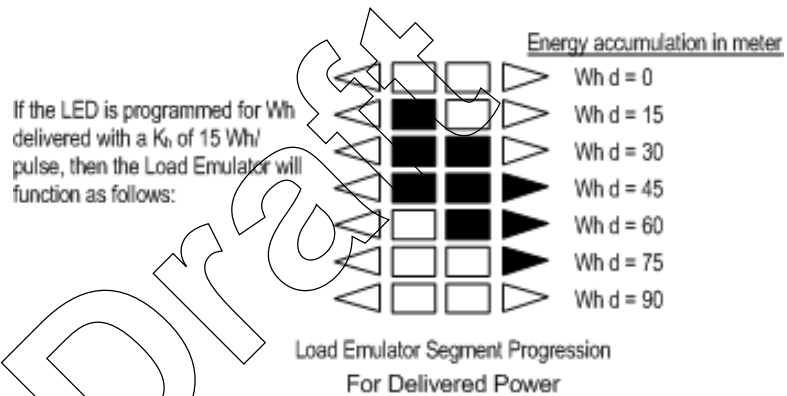
Figure 13: Load Emulator Segment Progression for Delivered Power
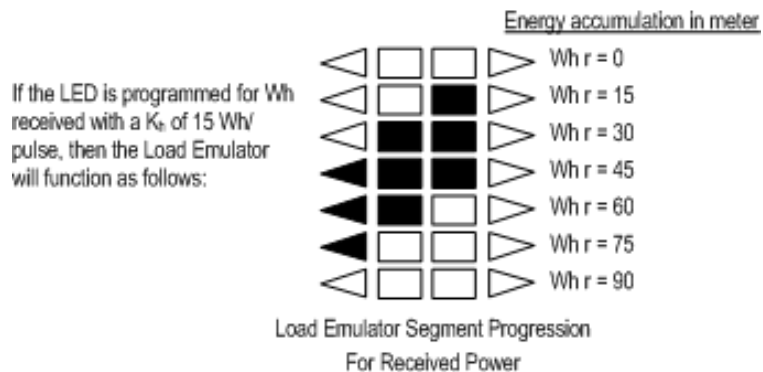
Figure 14: Load Emulator Segment Progression for Received Power

Several uni-directional quantities are available. When these quantities are programmed to LED, both the LED and the load emulator will function for delivered and received quantities.

Power Circle Quadrants

The following power circle diagram shows the quadrants for watts and vars delivered and received.

Figure 15: Power Circle Diagram

The directional calculations in the CENTRON OpenWay meter are as follows:·

- Watts delivered = (wattsQ1) + (wattsQ4)·

- Watts received = (wattsQ2) + (wattsQ3)·

- VA delivered = (VA while watts are in Q1) + (VA while watts are in Q4)·

- VA received = (VA while watts are in Q2) + (VA while watts are in Q3)·
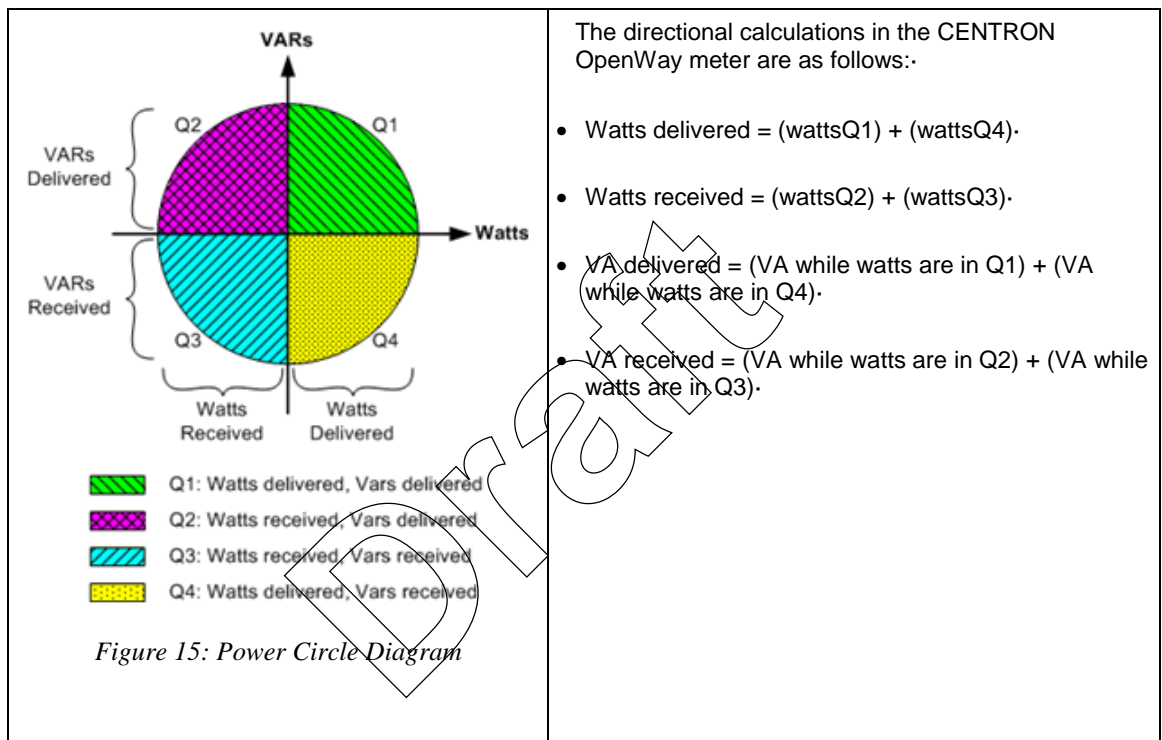
Optical Port

The optical port is mounted on the meter cover. The optical port is a communication interface from the meter to a PC. Interface to a PC is accomplished through a communication cable which attaches to the optical port on one end and a PC serial port on the other end. This interface cable can be powered by a DC TAP, an AC Adaptor, or the PC's COM Port. Communication through the optical port may be at 9600, 14400, 19200, or 28800 bps.

Factory Reset

To return the meter to its original factory settings, you must perform a factory reset. A factory reset is also referred to as a "three button reset".

All programming of the meter will be lost when a factory reset is performed. All security codes are also cleared.

When you perform a factory reset, the original factory settings of the meter are restored.

Application of Power and Power-up

To energize all electronics, apply 240V (50/60 Hz).

Do not power up the meter if the upper and lower housing are not properly secured. Line-level voltages are present inside the housings. Failure to follow this procedure could result in serious personal injury or death.

Power Down Procedures

To de-energize all electronics, remove power from the meter.

A power outage is recognized any time the line voltage drops 20 percent below the lowest nominal point of the voltage range. With a standard single phase power supply, a power outage occurs when line voltage drops below XX volts; with a OpenWay power supply, a power outage occurs when line voltage drops below XX volts. When a power outage is recognized, the OpenWay Register saves all billing values to non-volatile Flash memory.

Demand Meter

Restoration of AC power energizes the electronics and causes the meter to perform self-diagnostic check procedures. The meter then retrieves all billing data from non-volatile memory, begins measuring energy, and starts the process of calculating any demand values.

TOU/Load Profile Meters

All OpenWay meters have a battery installed. The battery allows the TOU and Load Profile data in RAM to be maintained during a power outage. The battery also allows the timekeeping circuitry in the meter to maintain the meter's clock during an outage. If a battery is removed on a TOU/Load Profile meter during an outage, then the meter's clock will be off by the duration of the outage and the TOU data and some Load Profile data will be lost. Load Profile data is periodically committed to flash as described in the Load Profile section.

Upon the return of AC power, the register undergoes a procedure similar to the initial power-up. The meter performs self-diagnostic checks, data is retrieved from non-volatile memory, and normal operation is resumed. The number of minutes of power outage maintained while the meter was in carry-over operation, is added to the Time on Battery register. Since the demand interval is synchronized to the top of the hour, the first demand interval after a power outage may be shorter than the programmed interval value.

Cold Load Pickup

Normally, when power is restored to the meter after an outage, a new demand interval is started and demand calculations begin immediately. The meter can be configured to recognize a demand delay or cold load pickup (CLPU) time. If a CLPU is configured in the meter, the meter will delay demand calculations for the configured amount of time—0 to 255 minutes in one-minute increments. For example, if a CLPU time of five minutes is programmed into the meter, a power outage will cause the meter to wait five minutes after power restoration before resuming demand calculations.

Defining CLPU as zero will cause demand calculations to restart immediately after any recognized power outage.

Interval Make-up

During power-up processing, the Load Profile component checks if the duration of the outage exceeds the configured minimum duration time. If it does, then at least one interval will be tagged with an outage status. The interval that was active when outage occurred is tagged as a partial interval due to the outage. If the outage ended in the middle of another interval, then that interval is also tagged as a partial interval due to the outage. If any intervals occurred in between, then those intervals are tagged as skipped intervals due to the outage and their data will be all zeroes.

Operating Modes

The OpenWay Register has two operating modes: Normal Mode and Test Mode.

When the meter is placed in Test Mode, it ceases all normal billing functions. The TEST switch can be used to control the operating mode of the OpenWay Register.

Normal Mode

Normal Mode is the standard mode of operation and the mode in which the meter automatically starts when energized. Selected quantities are measured and processed in billing registers. During this mode of operation, billing registers are saved in non-volatile memory during power outages.

Test Mode

The meter can be placed into Test Mode through software communications.

While in Test Mode, the "TEST" annunciator is displayed on the LCD. When the Test Mode is activated, all billing registers and certain non-billing registers are preserved in non-volatile memory and restored when Test Mode is exited.

Test Mode Timeout

If the meter is left in Test Mode, the meter will automatically exit after a user-configurable Mode Timeout. This action prevents someone from accidentally leaving a meter in Test Mode and thus losing billing data.

Display Modes

The OpenWay Register has five display modes as shown in the table below: Normal, Alternate, Test, Test Alternate, and Toolbox. Each display mode has a separate list of items (quantities) it can display. The aggregate of items associated with a display mode is called a display list. Test and Test Alternate modes employ the same display list. The CENTRON OpenWay meter can display a maximum of 80 items. The display list is dynamically configured through PC-PRO+ Advanced. The user can select as many items per mode totaling up to 80 with at least one item in each display mode. The display items and sequence of display, along with any desired annunciators or ID code number, are selected during program setup, a feature of the PC-PRO+ Advanced programming software.

Operating Mode	Display Mode	Metrological LED Quantity
Normal	Normal	Normal Mode Quantity
	Alternate	Alt Mode Quantity
	Toolbox	Normal Mode LED Selection
Test	Test	Test Mode Quantity
	Test/Alternate	Test Alt Mode Quantity

The following types of displayable items are available for the user-defined display lists:

- Energy registers
- Demand registers
- Instantaneous registers
- Self Read registers
- SnapShot registers
- Informational items (configuration, state informational items)

Numerical values may be displayed in various formats depending on configuration. For example, kilo units, mega units, fixed decimal point, floating decimal point, and leading zeros can all be configured.

The following tables show items programmable for display in the modes indicated.

All of the display items in the next two tables may be selected by TOU Rate. They also may be selected from the four Self Read buffers, the two Demand Reset Snapshot buffers, and Last Season Self Read buffer.

Energy Data Display Items

Energy Data Display Item	Display Mode			
	Normal	Alternate	Test	Toolbox 1
Wh (delivered, received, net, uni-directional)	X	X	X	
Varh (delivered [lag], received [lead], Net, net delivered, net received, Q1, Q4)	X	X	X	
VAh (delivered, received; arithmetic & vectorial)	X	X	X	
VAh lag (vectorial)	X	X	X	
Qh (delivered, received)	X	X	X	
Vh (Phase A, Phase B, Phase C, Average)	X	X		
Ah (Phase A, Phase B, Phase C)	X	X		
V^2h Aggregate	X	X		
A^2h Aggregate	X	X		

Demand Data Display Items

Demand Data Display Item	Display Mode			
	Normal	Alternate	Test	Toolbox2
W Delivered (Max, Present, Previous, Projected, Cumulative, Continuous Cumulative)	X	X	X	
W Received (Max, Present, Previous, Projected, Cumulative, Continuous Cumulative)	X	X	X	
W Net (Max, Present, Previous, Projected, Cumulative, Continuous Cumulative)	X	X	X	
W Uni-directional (Max, Present, Previous, Projected, Cumulative, Continuous Cumulative)				
Var Q1, Var Q4 (Max, Present, Previous, Projected, Cumulative, Continuous Cumulative)	X	X	X	
Var Delivered [lag: Q1+Q2] (Max, Present, Previous, Projected, Cumulative, Continuous Cumulative)	X	X	X	
Var Received [lead: Q3+Q4] (Max, Present, Previous, Projected, Cumulative, Continuous Cumulative)	X	X	X	

Demand Data Display Item	Display Mode			
	Normal	**Alternate**	**Test**	**Toolbox2**
Var Net				
VA Delivered [arithmetic or vectorial] (Max, Present, Previous, Projected, Cumulative, Continuous Cumulative)	X	X	X	
VA Received [arithmetic or vectorial] (Max, Present, Previous, Projected, Cumulative, Continuous Cumulative)	X	X	X	
VA Lag (Max, Present, Previous, Projected, Cumulative, Continuous Cumulative)	X	X	X	
Max A (per phase: A, B, C)	X	X		
PF Average	X	X		
Min P.F.	X	X		
Coincident Demands (up to 4)	X	X		

Instantaneous Data Display Items

Instantaneous Data Display Item	Display Mode			
	Normal	**Alternate**	**Test**	**Toolbox3**
Instantaneous W	X	X	X	
Instantaneous Var	X	X	X	
Instantaneous VA (arithmetic & vectorial)	X	X	X	
Instantaneous Volts (A, B, C)	X	X		X
Instantaneous Amps (A, B, & C)	X	X		X
Instantaneous P.F.	X	X		
Instantaneous Frequency (Hz)	X	X		
Instantaneous Current Phase Angles (A, B, C)				X
Instantaneous Voltage Phase Angles (A, B, C)				X

Informational Data Display Items

Informational Data Display Item	Display Mode			
	Normal	**Alternate**	**Test**	**Toolbox4**
Calibration Date & Calibration Time	X	X		
Cold Load Pickup Outage Time	X	X		
Current Transformer Ratio	X	X		
Current Date, Day & Current Time	X	X		
Days Since Demand Reset	X	X		
Demand Reset Count	X	X		

Informational Data Display Item	Display Mode			
	Normal	Alternate	Test	Toolbox4
Diagnostic Counters 1-4				X
Display On Time	X	X		
Firmware Revision	X	X		
Last Outage Date & Last Outage Time	X	X		
Last Program Date & Last Program Time	X	X		
Last Reset Date & Last Reset Time	X	X		
Last Test Date & Last Test Time	X	X		
Load Profile Pulse Weight 1-8	X	X		
Load Research ID	X	X		
Last Season Self Read Registers	X	X		
Meter ID & Meter ID 2	X	X		
Minutes on Battery	X	X		
Normal Kh & Normal Kh #2 (Alternate Kh)	X	X		
Number of Subintervals	X	X		
Number of Test Subintervals			X	
Last Interrogate Date & Time	X	X		
Option Board Fields 1 - 3	X	X		
Outage Count	X	X		
Program Count	X	X		
Program ID	X	X		
Register Fullscale	X	X		
Register Multiplier	X	X		
RF ID 1-3	X	X		
Segment Test	X	X		
Service Type	X	X		
SiteScan Diagnostic Count	X			
Software Revision Number	X	X		
Subinterval Length	X	X		
Test Kh & Test Kh #2 (Test Alternate Kh)			X	
Test Subinterval Length			X	
Time Remaining in Demand Subinterval	X	X	X	
Time Remaining in Test Mode			X	
TOU Expiration Date	X	X		

Informational Data Display Item	Display Mode			
	Normal	Alternate	Test	Toolbox4
Transformer Ratio	X	X		
User Data 1-3	X	X	X	
Voltage Transformer Ratio	X	X		

Magnetic Switch

The magnetic switch enables scroll lock of display items as well as manual switching between display modes. The magnetic switch is located near the front of the meter face in the 9 o'clock position.

Scroll Lock

When the magnetic switch is activated for one second and removed, the "ScrLoc" message appears on the LCD and the display locks on the current display item. The value displayed on the locked screen will continue to be updated every second. The user may scroll to the next item by again momentarily activating the magnetic switch. The display will remain in the scroll lock condition until a mode timeout occurs or until the display mode is changed.

Changing Display Modes

When the magnetic switch is activated for four seconds, the display may indicate the "ScrLoc" condition (if not already in scroll lock) and then, enter into a display mode selection menu. The menu options are: "SELnor", "SELALt", and "SELtooL". The desired mode can be selected by removing the magnet when it is being displayed.

Mode Timeout

When the display is put into display modes other than Normal display (Alternate, Toolbox, Scroll Lock, Test, or Test Alternate display modes), the meter will return to normal operation after a programmable Mode Timeout expires. The Mode Timeout can be configured from 1 to 255 minutes using the meter programming software.

Normal Display Mode

The Normal Display Mode is the default display when the meter is energized and when the meter is in Normal Operating Mode. When Mode Timeout occurs from any other display mode, the display returns to Normal Display Mode.

Alternate Display Mode

The Alternate Display Mode is functionally identical to the Normal Mode. The meter itself still operates under normal measurement, but the display sequence can be programmed to show a different set of displayable items from those in the Normal Display Mode.

While in Alternate Display Mode, the "ALT" annunciator on the lower left of the display designates activation of the Alternate Display Mode. Upon completion of the Mode Time-out period, the meter automatically returns to the Normal Display Mode.

Toolbox Display Mode

Toolbox Display Mode is identical to Normal Mode except that the list of displayable items is a fixed list dependent on the service type.

You can enter the Toolbox Mode from either Normal or Alternate Mode. While in Toolbox Mode, a flashing "TEST" appears on the right side of the display.

Once activated, the Toolbox Mode scrolls through the list of per-phase items and diagnostic counters. The table below shows an example of a 3-element meter.

Description	Display		
Phase A voltage angle	PhA	0.0°	U
Phase A voltage	PhA	xxx.x	U
Phase A current angle	PhA	xxx.x°	A
Phase A current	PhA	xxx.x	A
Phase B voltage angle	PhB	xxx.x°	U
Phase B voltage	PhB	xxx.x	U
Phase B current angle	PhB	xxx.x°	A
Phase B current	PhB	xxx.x	A
Phase C voltage angle	PhC	xxx.x°	U
Phase C voltage	PhC	xxx.x	U
Phase C current angle	PhC	xxx.x°	A
Phase C current	PhC	xxx.x	A
# of Diagnostic 1 errors	d1	xxx	
# of Diagnostic 2 errors	d2	xxx	
# of Diagnostic 3 errors	d3	xxx	
# of Diagnostic 4 errors	d4	xxx	

All "PhA", "PhB", "PhC" quantities are displayed with a fixed decimal and no leading zeros. While displaying phase information, the load emulator cycles at a fixed rate in the direction of energy flow for that phase. The Load Emulator is not displayed while the diagnostic counters are displayed. The diagnostic counters are displayed with leading zeros (000-255).

The per-phase Volt and Amp readings are Root-Mean-Square (RMS) values which are updated every second. The voltage and current angles are updated every five seconds. The direction of the load emulator is the same as the direction of energy flow for the phase being displayed. If any quantity is undefined due to the meter's service, the per-phase information for that quantity will not be displayed.

If the magnitude of the current for that phase is too low, the current magnitude and angle for a particular phase (A, B, or C) are displayed as zeros.

The SiteScan diagnostic counters represent the number of times each diagnostic error occurred since the last time the counters were reset.

The diagnostic counters range from 0 to 255 and can only be reset to zero through the PC-PRO+ Advanced programming software.

Upon completion of the Mode Timeout period, the meter automatically returns to the Normal Display Mode.

Test Display Mode

The Test Mode can be accessed from either the Normal, Alternate, or Toolbox Mode by removing the meter cover and pressing the Test button.

To activate this mode with a programming device, refer to the appropriate software user's manual.

The Test Mode annunciator ("TEST") is displayed while the D/T/L Register is in Test Mode.

Activating Test Mode causes all billing data to be transferred to non-volatile memory. Upon entry of Test Mode, if any calculated demand values of the present interval are higher than the stored maximum demand values, the new values are stored as maximum demands. All Test Mode program parameters are then retrieved from non-volatile memory for use in Test Mode. The parameters are demand test interval length, number of subintervals, and test Kh. Each is independent from those specified for Normal Mode. Activating the demand reset while in Test Mode initializes the demand test interval. (This interval is not synchronized to the top of the hour.)

To exit Test Mode and place the register in Normal Mode, perform one of the following:

- Press and then release the manual Test Mode button *a second and a third time*. The "TEST" annunciator will go away.
- Wait for selected Test Mode timeout to occur; if the meter is inadvertently left in Test Mode, it will return to Normal Mode at the completion of Mode Timeout.
- Removal of power for a brief period will force Test Mode to end.

Values calculated in Test Mode are not added to previous billing values or stored for retrieval. After exiting Test Mode, all billing data previously transferred to non-volatile memory is retrieved, an end-of-interval (EOI) is initiated, and a new demand interval begins.

Any time-related activities, such as TOU rate changes or Daylight Savings Time (DST) changes that occur while the meter is in Test Mode, are performed upon exiting Test Mode.

Test Alternate Display Mode

Test Alternate Mode is functionally identical to Test Mode. To enter Test Alternate Mode, press the Test switch a second time. The "TEST" and "ALT" annunciators will be displayed. The meter will return to Normal Mode at the completion of Mode Time-out.

Diagnostic Displays

The user may program the behavior that the meter should exhibit for every specific error condition. The possible actions in order of increasing severity are to ignore the error (do not display the error code); scroll its error code (an error code is automatically displayed after each display item); or lock the display, showing only the error code (do not display anything else).

Registers

There are five register types in the D/T/L Register: Energy, Demand, Instantaneous, Self Read (or Snapshot), and Information.

Energy Registers

The D/T/L Register can measure numerous energy quantities (as shown in the table below) from which the user can configure any eight to be registered.

If an energy register that is being used in the Load Profile is edited, the current interval for that quantity will be affected.

Measured Energy Quantity Type	Phases	Directions
watt-hours	aggregate	delivered received net uni-directional
Varhours	aggregate	delivered received net net delivered net received Q1, Q4
VA-hours (vectorial or arithmetic [RMS])	aggregate	delivered received lagging

Measured Energy Quantity Type	Phases	Directions
Volt-hours (Vh)	phase A phase B phase C average	
Amp-hours (Ah)	phase A phase B phase C	
V^2h	aggregate	
A^2h	aggregate	
Q-hours	aggregate	delivered received

Demand Registers

Demands can be calculated from any of the eight selected energy quantities. The user can configure up to ten demand registers. The D/T/L Register can compute three types of demand: Block Demand, Rolling Demand, or Thermal Demand.

Measured Demand Quantity Type	Demand Registers	Phases	Directions
watt-hours	Block, Rolling, Thermal	aggregate	delivered received net uni- directional
Varhours	Block, Rolling, Thermal	aggregate	delivered received net per quadrant
VA-hours (vectorial or arithmetic [RMS])	Block, Rolling, Thermal	aggregate	delivered received lagging
Amp-hours (Ah)	Block	phase A phase B phase C	

Instantaneous Registers

The D/T/L Register is capable of displaying Primary or Secondary Instantaneous registers, with the following exceptions: Frequency, Power Factor (PF), and Phase Angles. The user can configure the CT and VT multipliers (transformer ratios) using PC-PRO+ Advanced programming software.

Instantaneous Register Quantity	Directions (Types) [Range]	Phases
W	Signed (+) Delivered or (-) Received	Aggregate
Var	Signed (+) Delivered or (-) Received	Aggregate
VA (Vectorial or Arithmetic)	None	Aggregate
V	None	A, B, C
A	None	A, B, C
PF	None	Average
Frequency	None	A
Phase Angles	Va = 0°	Vb, Vc, Ia, Ib, Ic

Self Read and Snapshot Registers

There are up to fifteen self-read registers available in the D/T/L Register, depending on the particular version. All meters have two snapshot registers that store self read data triggered by a demand reset. Snapshot 1 is taken at the most recent demand reset. Snapshot 2 is the next most recent set of self read data at demand reset. Meters with time keeping functionality have an additional twelve self-reads registers used for scheduled self-reads, and one Last Season self-read register triggered at a season change in TOU meters.

Information Registers

The D/T/L Register also stores a significant amount of informational data. These non-registered values are listed in Informational Data.

Interrogation and Programming

Interrogation

The meter can be interrogated via the ANSI C12.18 optical port using PSEM (ANSI C12.18-1996) protocol.

Programming

The software for programming this meter (PC-PRO+ Advanced) is a 32-bit Windows NT/2000/XP application. User-definable security codes in both the programming software and the meter prevent unauthorized access to the meter.

Programming and/or interrogation of the meter can be accomplished through the optical port using a laptop PC and an optical probe.

Time-of-Use (TOU)

The Time-of-Use (TOU) functionality is designed for use in billing applications where multiple rates (bins) are required for energy and demand. The TOU option provides 4 Rates plus Total.

TOU is a clock-dependent feature; therefore, a battery is required in the meter.

TOU Schedules

Schedule information is programmed using the PC-PRO+ Advanced Programming software. The CENTRON OpenWay meter TOU calendar is programmable for up to 25 years and accommodates leap years, daylight savings time, and recurring holidays.

When using the TOU functions of the meter, energy and demand registrations are segmented into time blocks during the day. Each time block is assigned one of four rate periods. In addition to these four rate periods, a total rate is always available.

Calendar Schedule

The calendar schedule contains all daily and yearly information needed for the meter to measure and register data in real time. The schedule contains daily patterns, seasons, and up to 44 holidays with programmable day types, rates and outputs. For information concerning the entry of these parameters into the PC-PRO+ Advanced software package, consult the *PC-PRO+ Advanced System Manual*.

Rates

Four independent rates are available for TOU registration. These are designated A, B, C, and D. Only one of these rates can be active at a time. The Total register, designated Rate **T**, is always active, regardless of the active rate period.

The D/T/L Register TOU rates are applied to all energy and demand registers that have been selected for measurement. Therefore, all energy and demand registers are segmented as per the TOU schedule and available in each rate period, in addition to the Total rate.

Daily Patterns

Each pattern defines the times during the day that rate period A, B, C, or D begins and ends. Up to 24 rate period changes may be specified for each daily pattern.

Day Types

There are four day types: Weekday, Saturday, Sunday, and Holiday. Each day of the week is assigned to one of the four day types. Each day type is assigned one of the four daily patterns when each season is defined. Any of the daily patterns can be used in any combination with the day types.

Seasonal Schedules

A season is a period of weeks during the year when a particular rate structure is in effect. The year can be divided into a maximum of eight seasons. The day types with associated daily patterns can be defined differently for each season. Up to eight season change dates are specified for each year in the calendar schedule. If multiple seasons are not used, the TOU schedule contains one year-round season.

Season changes occur at midnight of the season change date (where midnight corresponds to 00:00 hours) or can be designated through programming to occur at the first demand reset following the season change date.

TOU Registers

The D/T/L Register can measure up to eight energies and ten demands. When the meter is configured for a TOU calendar, all energies and demands that are selected for measurement also have the configured TOU rates applied to them, with the exception of previous, projected, and instantaneous registers. The TOU energy and demand registers are available for display as well.

Current Season Registers

All energy and demand registers selected are considered current season registers. If a single rate schedule is applicable year-round, then only current season registers are used.

Last Season Registers

Last season registers are available when two or more seasons are used during the year. For every current season register (with the exception of Cumulative and Continuous Cumulative registers), there is a last season register for the same quantity. Last season registers are designated "LS" in the programming software. Last season registers can be selected for display in Normal and Alternate Display Lists.

TOU Operation

This section describes TOU operation specific to the meter display. Several TOU indicators are available on the liquid crystal display (LCD).

Rate Annunciators and Active Rate Indicators

Rate annunciators are available with each demand and energy register. An A, B, C, or D will be displayed on the far right side of the LCD to indicate the rate period for each quantity being displayed. The rate annunciator that may be displayed for the Total Rate is **T**.

If the rate annunciator is flashing while a demand or energy value is displayed, the annunciator indicates that it is the current rate in effect. This gives a quick indication that the register is programmed with the correct TOU schedule and that it is currently set to the correct time.

Season Change

At the end of a specified season, all last season registers are updated with current season register data. The meter can be programmed to either delay the season change until a demand reset occurs, to activate an automatic demand reset at season change, or to change the season without performing a demand reset. A season change occurs at midnight at the end of the programmed season change date or at the first demand reset following the season change date, depending on how the meter has been programmed. Some utilities program the season change to occur at the first demand reset following the season change date to make season changes concurrent with the meter reading cycles.

The following events take place when an automatic demand reset occurs at a season change:

1 The current season energy registers are copied directly to the last season energy registers.

2 The current season maximum demand registers are copied directly to the last season maximum demand registers, and **T** rate is added to the cumulative demand register.

3 After the demand reset, the maximum demand registers are reset to zero, and the **T** rate cumulative demand register is copied to the last season cumulative demand register.

If there is no demand reset at season change, all current season registers are directly copied to last season registers at season change, but no current season registers are zeroed.

Battery Carryover

When the meter recognizes a power outage, it begins battery carryover operations. Billing data is transferred to non-volatile memory at this time, and all circuits, except the RAM and timekeeping circuit, are de-energized. The timekeeping circuitry, powered by the lithium battery, keeps time while the meter is in battery carryover mode.

Upon restoration of AC power, all self-diagnostics are completed, and data is retrieved from non-volatile memory. The real time is retrieved from the real time clock. The elapsed time of the outage is also added to the stored value for the time spent on battery.

During programming of the D/T/L register using PC-PRO+ Advanced, as an option the user can choose to enable or disable the clock. Disabling the clock will prevent battery carryover; however, all programming parameters will be set. Prior to meter installation, the clock must be set to activate time-keeping functionality and features.

Load Profile

Load Profile (mass memory) data is stored in blocks (records) of 128 intervals. The profile interval length is the same for all channels and is independent of the interval length for demand quantities. Each interval of load profile data is identified by date and time. Each interval contains status bits indicating the occurrence of outages, Test Mode, and other significant events or errors. Refer to the PC-PRO+ Advanced online help for a list of Load Profile Status Codes. Register readings are also stored for each channel for data validation.

The Load Profile functionality is designed for use in billing and load research applications where multi-channel high resolution data is needed.

Load Profile Specifications

Capacity

The load profile option is available in 144 KBytes of memory. The amount of memory actually used for load profile recording is programmable in 1 KByte increments. There are up to 8 channels available for interval load profile data.

Bit Resolution

The load profile operates with 16-bit data resolution. Equivalent pulse count resolution is as follows:

Bits	Pulse Counts
16	65,535
15[1]	32,767

1 When a Net quantity (i.e., Net Wh) is chosen as a load profile channel, all load profile channels have 15-bit data resolution.

There is a difference between MV-90 and the D/T/L Register concerning load profile data. The D/T/L Register can accommodate a maximum of 65,535 pulses (16 bit) per interval. (A maximum of 32,767 pulses per interval is allowed when using bidirectional quantities because the 16th bit is used for "+" or "-"). MV-90 is a 16 bit system, however the 16th bit is always used for "+" or "-". Since the 16th bit is always signed, the maximum allowed pulses per interval is always 32,767. If MV-90 receives a number of pulses per interval larger than 32,767, MV-90 will record a negative number (received value) for that interval.

Itron recommends programming any D/T/L Register with load profile that is interrogated by MV-90 or any system that exports load profile information to MV-90 to use 15 bit resolution or 32,767 pulses per interval.

Interval Lengths

The load profile records data on a block interval basis. The interval length is programmable for 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, or 60 minutes. The interval length is the same for all channels and is independent of the interval length for demand quantities.

Power Outage

The D/T/L Register flags an interval when a power outage exceeds a specified number of seconds. The range for power outage length is programmable from 0 to 255 seconds and must not exceed the programmed interval length.

- During power outages the CENTRON OpenWay meter maintains all meter data as well as timekeeping functions.

- During an outage, billing data is stored in non-volatile memory.

- When power is restored, data is returned to active memory and normal metering resumes.

- The meter records the date and time of the power outage and the power restoration (for meters with batteries).

Channel Configuration

The D/T/L Register can be programmed to have one to eight channels of interval load profile data. Each channel corresponds to an energy register selected during the programming process. In order to load profile an energy, the energy must first be selected as a quantity to be measured.

Selection of channel configuration and pulse constants is accomplished through the programming software. Each data channel is programmed to record load profile data from a user-selected register. The energy registers allowed for load profile are listed in Energy Data.

Pulse Constants

For each load profile channel, the pulse constant is programmable from 0.01 to 10 unit hours per pulse in 0.01 increments. The load profile pulse constants apply to secondary readings only.

Example: Calculation of pulse weight from kWh

A meter, 3-element, 120 Volts, CL20 is programmed to record kWh in load profile with 15 minute intervals.

First, calculate the maximum watthour accumulation during 15 minute intervals:

$$Wh_{max} = (120V)\,X\,(20A)\,X\,(3\,phases)\,X\,(0.25\,hours)$$

$$Wh_{max} = 1,800\,watthours$$

The maximum number of pulses is 65,535; therefore, the smallest pulse weight (PW) that can be used is:

$$PW\,min = \frac{1800Wh}{65,535} = 0.0275$$

Since the pulse weight value must be a multiple of 0.01 in the meter, 0.03 Wh could be programmed as the pulse weight (Ke) for the kWh channel in load profile in this example.

Data Storage

The D/T/L Register uses non-volatile flash memory to record load profile data. Data is stored in load profile memory at the end of each interval. Each channel has 16 bits written to load profile memory. For example, consider 8 channels of load profile. At the end of an interval, a 16-bit number is written into load profile memory for channel 1; a 16-bit number for channel 2 follows immediately; and so on, up to the last 16-bit number for channel 8, which follows immediately.

The process continues for each interval until 128 intervals (one block or record) have been recorded. In addition to the profile data, each interval contains eight types of status bits written into each data interval.

1   **Partial Interval**—The status bit is set for a partial interval due to a time adjust, power outage, or beginning interval.

2   **Long Interval**—The status bit is set for a long interval due to a time adjust backwards.

3   **Skipped Interval**—The status bit is set for a skipped interval due to either a power outage, Test Mode, or time adjusted forward during the interval.

4   **Test Mode**—The status bit is set for Test Mode due to the meter being in test mode during the interval.

5   **DST**—The status bit is set for DST due to DST being in effect during the interval.

6   **Power Outage**—The status bit is set for each interval during which a power outage occurs (greater than the minimum time programmed in software).

7   **Time Adjust Forward**—The status bit is set for time adjust forward during the interval.

8   **Time Adjust Backward**—The status bit is set for time adjust backward during the interval.

Refer to the PC-PRO+ Advanced online help for a list of Load Profile Status Codes.

In addition to the interval profile data and the interval status data, each block contains a time tag specifying the month, day, hour, and second of the end of the data block.

Recording Duration

The following equation can be used to determine the recording duration of the load profile:

Recording Duration (days) = (M x I x 1024) / (1,440 x [(2 x C + 2) + ((6 x C + 4) / 128)])

M = Memory size in kilobytes

C = Number of channels

I = Interval Length in minutes

The table below shows the recording duration (in days) for 144 kilobytes (KB) load profile memory size.

Number of Channels	INTERVAL LENGTH (Minutes)											
	1	2	3	4	5	6	10	12	15	20	30	60
1	25	50	75	100	125	150	251	301	376	502	753	1506
2	16	33	50	66	83	100	167	200	250	334	501	1003
3	12	25	37	50	62	75	125	150	187	250	375	751
4	10	20	30	40	50	60	100	120	150	200	300	601
5	8	16	25	33	41	50	83	100	125	166	250	500
6	7	14	21	28	35	42	71	85	107	143	214	429
7	6	12	18	25	31	37	62	75	93	125	187	375
8	5	11	16	22	27	33	55	66	83	111	166	333

Event Log

The D/T/L Register has an Event Log that records historical events that have taken place in the meter. The events to be logged must be configured via the PC-PRO+ Advanced programming software. To aid in troubleshooting, Itron recommends enabling all events to be logged.

In order to have date and time associated with an event, Time-of-Use or Load Profile is required. A Demand-only D/T/L Register allows for event log recording. However, in the event of a power outage, the date and time will not be reliable.

The D/T/L Register Event Log is circular in nature, allowing for the capture of the most recent events in the meter at all times. The CENTRON OpenWay meter is capable of retaining 420 events prior to wrapping.

Each event log record includes an event description, a time and date stamp, and additional information on certain events.

For meters with batteries, all logged events are retained through a power outage. For meters without batteries, the Event Log is periodically written to non-volatile memory. Events that occur just prior to a power outage may be lost depending on whether they were backed-up or not.

The contents of the event log can be viewed using the meter programming software.

The following events may be configured for recording in the D/T/L Register Event Log:

- **Clear Billing Data**—billing data has been cleared upon initialization of the meter, or as a secondary activity by authorized personnel
- **Configuration Error**—meter configuration was not successful
- **Demand Reset**—a demand reset occurred

- **Diagnostic 1 On**—diagnostic 1 condition occurred
- **Diagnostic 1 Off**—diagnostic 1 condition went away
- **Diagnostic 2 On**—diagnostic 2 condition occurred
- **Diagnostic 2 Off**—diagnostic 2 condition went away
- **Diagnostic 3 On**—diagnostic 3 condition occurred
- **Diagnostic 3 Off**—diagnostic 3 condition went away
- **Diagnostic 4 On**—diagnostic 4 condition occurred
- **Diagnostic 4 Off**—diagnostic 4 condition went away
- **DST Time Change**—DST adjustment forward or backward has occurred
- **Event Log Cleared**—Event Log was cleared by programming software
- **Full Scale Overflow**—see Non-Fatal Error 6 (see "Non-Fatal Errors" on page 63) for description
- **Load Profile Error**—see Non-Fatal Error 5 (see "Non-Fatal Errors" on page 63) for description
- **Logon Successful**—a user or option board logged on successfully to the meter
- **Loss of Phase**—see Non-Fatal Error 2 (see "Non-Fatal Errors" on page 63) for description
- **Loss of Phase Restored**—phase voltage was restored
- **Low Battery**—see Non-Fatal Error 1 (see "Non-Fatal Errors" on page 63) for description
- **Meter Reprogrammed**—meter was initialized or reconfigured
- **Power Outage**—power was lost
- **Power Restored**—power was restored
- **Rate Change**—TOU rate change occurred
- **Register Self Read**—self read occurred
- **Reverse Power Flow**—see Non-Fatal Error 4 (see "Non-Fatal Errors" on page 63) for description
- **Reverse Power Flow Restored**—delivered power flow resumed after reverse flow exceeded a configured threshold
- **Season Change**—TOU season change occurred
- **Security Fail**—logon with security code failed
- **Security Pass**—logon with security code succeeded
- **SiteScan Error**—a SiteScan error occurred
- **Test Mode Entered**—Test Mode or Alternate Test Mode was entered
- **Test Mode Exited**—Test Mode or Alternate Test Mode was exited
- **Time Changed**—a time adjustment forward or backward occurred
- **TOU Schedule Error**—see Non-fatal Error 3 (see "Non-Fatal Errors" on page 63) for description

Security Codes

The meter security codes provide protection for meter register and load profile data. Four levels of security are inherent in the D/T/L Register. The table below describes the level of access to the meter provided by each device security code. Once security codes are programmed and stored in the meter, users are required to logon to the meter with an appropriate password. The user may choose not to use security codes in the meter's program.

D/T/L Register Security Code Levels		
Level	Access Level	Description
Primary/Firmware Download	Read/Write access and firmware download	Access to the meter is unrestricted. All read/write functions are available including all programming options and the ability to download new firmware to the meter. New security codes can be programmed into the meter using the level of access provided by this security code.
Limited Reconfigure	Read/Limited Write access	Provides read and limited write access including the ability to reset demand, change the time in the device, and reconfigure the device. You cannot clear billing data, change display modes, or change security codes.
Secondary	Read-only access plus Demand Reset and Reset Time	Read-only access is provided as well as the ability to reset demand and change the time.
Tertiary	Read-only access	Access to the meter is limited to reading information from the meter. No operation that writes information to the meter is available. This code can be used by other applications that contact the meter.
Previous Security Code	Read-only access	This code is not programmed into the meter; it allows a user to save an alternate password in the software to use for logging on only; can be any security level.

Implementing Security Codes

When a customer file is created, security codes are entered by the software (PC-PRO+ Advanced) operator. Each security code may be from 1 to 20 characters long. For example, the primary code is selected to be ABC and the secondary code is to be 123. When the software first attempts to communicate with a meter that has just been delivered from the factory, the meter has only null security codes. The software downloads and unlocks the meter with these null security codes. When the meter is initialized, the software downloads security codes ABC and 123 to the meter.

When unlocking a meter with security codes, the software downloads the primary code that is in the PC-PRO+ Advanced Device Security Codes dialog— in this case ABC. If this code matches the meter primary code, the operator can read and/or program the meter. If it does not match the primary, but matches the secondary, 123, the operator can only read data from the meter.

For example:
Three PCs are set up to interrogate D/T/L Registers. One PC is designated as the Master PC. The Master PC programs D/T/L Registers for installation and interrogates meters in the field. In this example, the Master PC programs a meter with a primary security code of SEN1 and a secondary security code of 222. The Master PC can then read data from and reprogram the meter. The remaining two PCs are configured so that the same customers are in each database, but each PC-PRO+ Advanced software is configured with a security code that matches the meter's secondary security code only. In this case, the two additional PCs have been given security code 222. When the two PCs interrogate the meter, the security code they download provides them with secondary security code privileges only.

To set up a meter so that the Master PC can perform all meter functions, but any other PC has limited access, program the meter through the Master PC with a primary security code, but leave the secondary security code blank. Any PC other than the Master PC will connect to the meter using a blank security code and thereby gain secondary access only.

Clearing Security Codes

To clear the existing security codes in the meter, perform a Three Button Reset.

If security codes are cleared from the meter in this manner, the PC will have no record of a security code change. The PC will go through the following attempts to gain access to the meter:

- If the **Options** | **Default Values** | **Device Security Codes** | **Override Security Code** menu option *IS NOT* checked, PC-PRO+ Advanced will:
- Use the security code in the device **Primary** field.
- Use the security code in the device **Previous Security Code** field.
- Use all nulls.
- If the **Options** | **Default Values** | **Device Security Codes** | **Override Security Code** menu option *IS* checked, PC-PRO+ Advanced will:
- Use the security code entered in the **Security Code** field on the logon screen.
- Use the security code in the device **Previous Security Code** field.
- Use all nulls.

Firmware Upgrades

PC-PRO+ Advanced 7.2 and higher supports upgrading firmware for D/T/L Registers. When the firmware is upgraded, all billing data in the D/T/L Register is erased. After a D/T/L Register's firmware is upgraded, you must re-initialize the meter.

You can determine which version of D/T/L Register firmware is installed on your PC by looking at Add/Remove Programs in the Control Panel (Start | Settings | Control Panel) and reading the Support Information for the D/T/L Register firmware. The firmware version is also displayed each time you begin a firmware upgrade while logged on to a D/T/L Register.

This feature is not available for meters that have been initialized (sealed) for Canadian installations. If a Canadian meter has not been sealed, the firmware can be upgraded.

Installing D/T/L Register Firmware on the PC

You must install the D/T/L Register firmware on your computer to make it available to PC-PRO+ Advanced. You can obtain firmware upgrades through your Itron, Inc. Sales Representative. You can install only one version of D/T/L Register firmware on a computer.

For more information, refer to your PC-PRO+ Advanced online help files and the *PC-PRO+ Advanced CENTRON Device Online User's Manual*.

After you have installed the D/T/L Register firmware on your computer, if you attempt to initialize a D/T/L Register that has a different version of firmware, a message is displayed stating that the firmware in the meter is different and asks if you want to change the meter firmware.

R300CD/CD3

As an option the D/T/L register can be ordered with R300 functionality. The R300CD/CD3 continuously transmits Standard Consumption Messages (SCM) and Interval Data Messaging (IDM), if available, using radio frequency in the unlicensed frequency band which can be read by handheld, drive-by or fixed network systems. The table below describes the various versions of the R300 option:

Option	SCM ERT Type	IDM Type	Description
R300CD	04	N/A	Two ERT register w/o IDM
R300CD3	08	24	Three ERT register w/IDM

Each SCM message contains tamper information. Below is a chart that indicates the tamper information available in each SCM:

SCM #	Indicator #	Group
1	1	Meter Inversion
1	2	Meter Removal
2	1	Demand Reset (Push Button)
2	2	Low Battery or End of Billing Schedule (1 Year from end) Warning
3	1	Billing Events
3	2	Non-Billing Warnings

- Tamper, Event, and Alarms Indicator Behavior: Two bits are used to log the above alarm, event, and tamper occurrence Groups.
- All Indicators are "Non-Latching", meaning the R300 board continues to increment for each and every alarm, event, or tamper occurrence each time they happen.

Event, Alarm, and Tamper Assignments for the CENTRON R300CD/CD3 and CENTRON Polyphase R300CD/CD3 Meters:

- For all Fatal Errors, the R300 stops transmitting.
- For the Diagnostic Checks and Non-Fatal Errors, transmission can be controlled via PC-PRO+ Advanced software.

Tamper/Event/Alarm	1 SCM	2 SCMs	3 SCMs
Meter Inversion (Tamper Circuitry)	SCM 1 - Indicator 1	SCM 1 - Indicator 1	SCM 1 - Indicator 1
Meter Removal (Tamper Circuitry)	SCM 1 - Indicator 2	SCM 1 - Indicator 2	SCM 1 - Indicator 2
Demand Reset (Push Button)	N/A	SCM 2 - Indicator 1	SCM 2 - Indicator 1
Low Battery	N/A	SCM 2 - Indicator 2	SCM 2 - Indicator 2
End of Billing Schedule (1 Year from end) [1]	N/A	SCM 2 - Indicator 2	SCM 2 - Indicator 2
Clear billing data	N/A	N/A	SCM 3 - Indicator 1
Energy Register Edit	N/A	N/A	SCM 3 - Indicator 1
Test Mode Entered	N/A	N/A	SCM 3 - Indicator 1
TOU Schedule Error	N/A	N/A	SCM 3 - Indicator 1

Tamper/Event/Alarm	1 SCM	2 SCMs	3 SCMs
Mass Memory Error	N/A	N/A	SCM 3 - Indicator 1
Self Read Cleared	N/A	N/A	SCM 3 - Indicator 1
Meter Reconfigured	N/A	N/A	SCM 3 - Indicator 1
Energy Reconfigured	N/A	N/A	SCM 3 - Indicator 1
ANSI Security Fail	N/A		SCM 3 - Indicator 2
Reverse Power Flow	N/A	N/A	SCM 3 - Indicator 2
Loss of Phase	N/A	N/A	SCM 3 - Indicator 2
SiteScan Error	N/A	N/A	SCM 3 - Indicator 2

1 Requires register firmware addition for all meters

Using the PC-PRO+ Advanced programming software, you can:

- Configure the quantity(s) to be transmitted.
- Select the type of registers to be transmitted.
- Select the number of digits for the data to be transmitted as well as the number of decimal place digits for the data.
- Select one of three date formats to be transmitted as ERT information.
- Enable TOU and select the TOU rate to be transmitted.
- Select whether transmission shall be stopped based on SiteScan.

When using Type 8 ERTs the format for the kWh value should be 7.2 (XXXXXXX) and the format for the Demand value should be 7.4 (XXXX.XXX). Date format should be MM/DD/YY.

Testing, Troubleshooting, and Maintenance

This section provides information and instructions to help you test and maintain the CENTRON OpenWay meter. Topics covered include:

- Visual indicators
- Energy testing
- Demand testing
- Recommended testing procedures
- TOU schedule testing
- Field testing

- Troubleshooting (fatal and non-fatal errors)
- Maintenance

Visual Indicators

The Infrared Test LED, as well as several other annunciators, assist you in testing and troubleshooting the CENTRON OpenWay meter.

Infrared Test LED

The meter is equipped with an Infrared (IR) Test Light Emitting Diode (LED) for testing meter accuracy; the LED is located at the top of the meter. The pulse weight represented by the LED is programmable through the PC-PRO+ Advanced programming software for a CP1SD/T/L meter. The programming software allows a different pulse weight value for the LED in the following display modes: Normal, Alternate, Test, and Test Alternate. The meter can be programmed to drive the Test LED with a variety of energy values, depending upon the energy quantities selected in the configuration.

Annunciators

The CENTRON OpenWay meter is equipped with a variety of annunciators for a more meaningful display.

Load Indication/Direction Annunciator

The CENTRON OpenWay meter is equipped with a Liquid Crystal Display (LCD) load emulation indicator. The Load Emulator follows the Infrared Test LED. For each pulse of the Test LED, the Load Emulator increments one segment. The operation of the Load Emulator depends on the quantity being pulsed.

- If the quantity being pulsed is "Delivered-Only", then the Load Emulator scrolls to the right when energy is being delivered and lights the left arrow when energy is being received.
- If the quantity being pulsed is "Received-Only", then the Load Emulator scrolls to the left when energy is being received and lights the right arrow when energy is being delivered.
- If the quantity being pulsed is "Delivered and Received", then the Load Emulator scrolls to the right when energy is being delivered and scrolls to the left when energy is being received.

When the meter is in Toolbox mode, the Load Emulator does not follow the Test LED. Instead, the operation of the Load Emulator depends on the quantity that is currently being displayed. If the quantity being displayed is a Phase quantity, then the Load Emulator scrolls to the right if energy flow on that phase is currently delivered or scrolls to the left if energy flow on that phase is currently received. If the quantity being displayed is a Diagnostic Counter, then the Load Emulator is turned off.
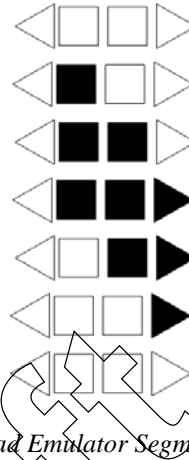
Figure 16: Load Emulator Segment Progression

Phase-Voltage Indication Annunciators

The CENTRON OpenWay meter is equipped with three LCD voltage indicator annunciators. They are located in the lower left portion of the LCD display. Illuminated annunciators (VA, VB, and VC) indicate active voltage for these respective phases. Depending on how the user configures the meter, a loss of voltage may be indicated with either a missing or flashing annunciator.

Nominal Voltage Indication Annunciator

The CENTRON OpenWay meter is equipped with a nominal voltage indication annunciator. This annunciator indicates the voltage value to which the nominal voltage is nearest. Nominal voltage indication values are 120, 240, 277, and 480.

Test Mode Annunciator

The CENTRON OpenWay meter is equipped with a Test Mode LCD annunciator. Located in the lower left portion of the display, this annunciator is present when Test Mode or Test Alternate Mode is activated. The word "TEST" appears on the display during Test Mode activation. The words "ALT" and "TEST" appear on the display during Test Alternate Mode activation. The "TEST" annunciator will also flash when the meter is in Toolbox Mode.

Energy Testing

The CENTRON OpenWay meter is a CL 0.2 accurate meter and requires no calibration adjustments. Verification of accuracy of energy and demand may be verified in many ways.

Testing With the Infrared Test LED

Verification of metered energy values by the meter can be accomplished by using the pulsing infrared LED located in the 12 o'clock position of the faceplate.

With a constant load applied, the IR LED pulses are compared to the output of a conventional high accuracy watthour standard. This is accomplished using an IR-compatible optical pickup device and a pulse counter.

Follow these steps to test the Wh with the LED:

1   Program the meter with the desired pulse quantity(s) and pulse weight(s) Ke.

2   Apply a constant delivered watts load (Wapp) to the meter.

3   Verify that the LED pulses properly either by counting the pulses or using a pulse counter to compare pulses from the meter under test to the standard. To determine the number of pulses per second, use the following equation:

$$\# \ pulses \ per \ second = W_{app} \bullet N \bullet \frac{1 \, hour}{3600 \, seconds} \bullet \frac{1}{Ke}$$

where *N* is the coil factor for single phase test method as shown in the table below.

If the meter is being tested using single phase test methods, a coil factor must be included in the calculations. See the table below for the appropriate factor.

Meter Coil Factors				
Form	**Series**	**A Phase Only**	**B Phase Only**	**C Phase Only**
9(8)[1], 16(15,14)	3	1	1	1

1   When testing under true polyphase conditions, Forms 9 and 16 can only be tested as a 4-Wire Wye. These forms cannot be tested as 4-wire deltas because of present limitation inherent in the test equipment.

> If accuracy or repeatability is poor, the Kh may be incorrect or the "settling time" in the test bench must be adjusted. (Itron recommends a 4–5 second settling time.)

Testing Using the Load Indication Annunciator

The CENTRON OpenWay meter is capable of visually being tested by using the load emulation annunciator shown in Load Indication/Direction Annunciator. As further discussed in the load emulation annunciator section, the load emulation annunciator scrolls at a rate proportional to the programmed energy constant.

Testing Using the Energy/Time Method

As an alternate to the above methods, the energy accumulated by the registers and a reference standard can be read directly from the display and compared over a period of time. Energy readings displayed while the meter is in the Test Mode are in floating decimal format. This will result in maximum resolution for short duration tests.

Recommended Energy Testing Procedures

Testing solid-state meters on test boards designed primarily for electromechanical meters may sometimes give unexpected results. Erroneous readings could occur on light-load (LL) tests when the test sequence calls for a light-load test following a full-load (FL) or power-factor (PF) test. In some cases, PF readings could also be in error when following a FL test. The errors are always positive and may be a few percent for PF and even greater for LL. The problem is aggravated on lower voltages and when using large test constants, Kt, similar to the typical Kh values of comparable induction meters. This problem does not exist on modern test boards with their latest software.

Test Description

A typical meter test sequence consists of:

1   The voltage and current ramp up at unity power factor to the FL level.

2   A pulse from the meter starts the FL test and another pulse ends it.

3   The phase angle then changes for the PF test. The current may stay at the FL level or ramp down to zero and back up for the phase angle change.

4   A pulse from the meter starts the PF test and another pulse ends it.

5   The current ramps (directly or through zero) to the LL current level at unity power factor.

6   A pulse from the meter starts the LL test and another pulse ends it.

Most test boards use jogging (slewing) immediately following a FL or PF test to shorten the time required for the next test to start. The energy used for jogging may be more than enough to cause the next pulse from the meter even before the ramping of current or changing of phase angle is completed. If the trigger to start the next test is armed and ready during the jogging or transition to the next test level, an unexpected pulse may cause the test to start too soon. This obviously will result in erroneous readings. Some settling time is necessary for the test board power, the reference standard, and the meter under test to stabilize after the change to a new test level.

Most test boards provide a settling time (programmable or fixed) and will not recognize another test pulse following the completion of a test until the jogging, ramping, and settling time have all transpired. The CENTRON OpenWay meter needs a settling time of about three to five seconds after the new test level has been reached before the test starts.

Recommendations

Erroneous test results caused by the problems previously described can probably be corrected by implementing one of the following suggestions. Even if there are no bad readings, Solution 3 can cut the total test time significantly without sacrificing test verification certainty. The suggested solutions are:

1   Change the test sequence to avoid jogging before the light-load test.

2   Upgrade the test board to meet the requirements listed previously.

3   Program the meter and test board for a small test constant. This will avoid jogging and also give the added benefit of shorter test time.

Solution 1

This is the preferred solution, since it results in shorter test times and can be implemented simply by programming the meter for a smaller test constant and settling the test board accordingly.

The CENTRON Polyphase and most other solid-state meters have the capability of being programmed for a much smaller test constant (Kt), such as one-tenth or one-twelfth of the energy required for one "disk revolution" of the meter. With the test pulses running 10 to 12 times faster, there is the possibility of shortening the test time considerably, but not by a factor of 10 or 12. It still takes a finite amount of time to obtain meaningful results.

Solution 2

Change the test sequence so that the LL test is first, followed by the PF test and then the FL test. This should prevent all jogging from occurring between tests and will probably eliminate the erroneous readings. This is the quickest solution to implement since it requires no changes to the test board or the meter.

Solution 3

Install the latest test board software revision. A test board ideally should recognize no new test pulses after the completion of a test until jogging, ramping, and settling time have all transpired. Settling time should be programmed for three to six seconds. There is nothing to be gained by using settling times greater than six seconds.

Recommended Test Setup for Minimizing Test Time

The following settings are recommended for obtaining test uncertainties of less than 0.1% and at minimum test times:

1   Program the test board settling time for five seconds.

2   Program the meter and test board for a small test constant, Kt, in some convenient fractional value of the traditional Kh. For this example, 1/12 of the traditional Kh of the equivalent electromechanical meter is used. (The use of decimal values may be preferred for simplification of math.)

3   Use 12 pulses (1 rev) for FL.

4   Use 12 pulses for PF.

5   Use 1 pulse for LL.

6 For element tests, the FL and PF pulses can be divided by the number of elements, always rounding up for fractional values.

The total test time for a series FL, PF, LL sequence can be shortened by more than one minute compared to the time required for an electromechanical meter or a solid-state meter using the equivalent test constants. If LL element tests are used, the time savings will be much greater.

Recommendations for Minimum Variability

The variability of testing a CENTRON OpenWay meter can be reduced by lengthening the test times (using more pulses). Doubling or tripling the recommended minimum test time will reduce the variability by a factor of two or three. Very little improvement is realized by running longer than about 45 seconds for each test.

Demand Testing

Testing consists of comparing the readings displayed on the CENTRON OpenWay meter to the actual demand as determined using a high-accuracy RMS responding reference standard. The standard should have pulse outputs proportional to Wh/pulse (or VAh/pulse).

Pulses from the reference standard are accumulated over one demand interval, and then the total pulse count representing watt-hours or volt-ampere-hours is converted to an average demand value using the formulas in Demand Calculations.

Because of the high accuracy of the CENTRON OpenWay meter, the following is the recommended procedure for testing these meters.

Demand Test Method

1   Connect the meter under test and the reference standard in the same circuit with all voltage coils in parallel and current coils in series as per standard meter testing procedures.
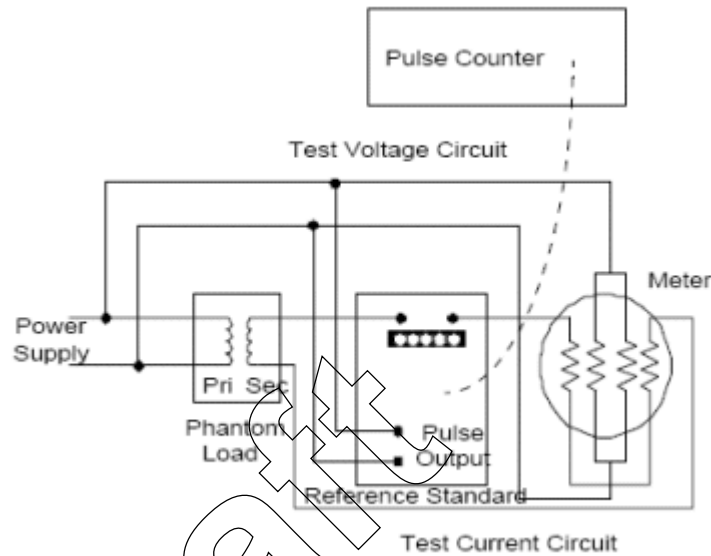
Figure 17: Test Connections

2   Apply rated voltage to the meter under test and the reference standard. Set the test current to the desired level (FL, LL, or PF test amps or any desired level within the meter rating). To ensure that the supply polarities are correct, check that the Load Emulation Annunciator is traversing in the forward direction. Switch off only the current to both the meter and the standard.

3   Reset and enable the pulse counting device.

4   Put the CENTRON OpenWay meter into Test Mode by pressing the Test switch. Once this has been done, push in the Demand Reset switch to zero the test registers and start a new demand interval.

5   Start the test by switching on the current to all meters and the reference simultaneously.

6   The End-of-Interval (EOI) flag will appear for five seconds in the display after the end of the demand interval. At this time, switch off the current to all meters simultaneously and stop the pulse count. Do *not* disconnect the voltage to the meter.

7   Record the pulse counter total and the values displayed on the CENTRON OpenWay meter.

8   Perform calculations A, B, C, and D (if applicable) in the demand calculations section and compare the results.

Meter Single Phase Test Constants (SPTC)					
Form		Series	A Phase Only	B Phase Only	C Phase Only
9 or 16	3Ø, 3W,	0.911	.866	.0866	1
9, 16, or 14	3Ø, 4W, wye	1	1	1	1

This test method is valid for kWh, kVAh, kvarh, kW, kVA, and kvar at any load or power factor.

Demand Calculations

With solid-state metering, conducting energy and demand tests may be considered redundant since they are both results of the same measurement.

Calculation A: Actual Active Energy (kWh)

Actual active energy is calculated using the following formula:

kWh = P_T x Kh x N/1000

where: Kh = watt-hours per pulse output value from the reference standard. (A watt and/or a VA standard must be used.)

P_T = Total pulses accumulated from the reference standard

N = Coil factor (See Testing With the infrared Test LED)

Pre-calculate the total pulses expected with the following formula to ensure that the pulse counter display does not overflow:

P_T x Kh = V x I x T/(Kh x 60)

where: V = Voltage applied to standard

I = Current applied to standard

T = Test Mode demand interval length in minutes

If Test Mode display is in watt-hours (Wh), divide by 1000 to get kWh.

Calculation B: Actual Active Demand (kW)

Actual active demand is calculated using the following formula:

kW = kWh x 60/T

where: T = Test Mode demand interval length in minutes

Calculation C: Actual KVA Hours

$kVAh = P_T \times Kh \times N / (1000 \times SPTC)$

where: N = Coil factor (See Testing With the Infrared Test LED)

           SPTC = Single phase test constant (See the table in Demand Test Method)

Calculation D: Actual kVA Demand

$kVA = kVAh \times 60/T$

where: T = Test Mode demand interval length in minutes

Field Testing

Field testing of the CENTRON OpenWay meter may be accomplished with conventional methods using either the infrared test pulses or the load emulation annunciator.

Required Hardware

The typical field test setup consists of a phantom load, a portable standard, and an infrared test pulse adapter with counter or snap-switch assembly.

Test Method Using Infrared Pulse Adapter

The pulse adapter runs the test for a programmed number of pulses. The number of pulses is set on the test pulse adapter by the use of counter switches. The adapter will automatically start the test when the START COUNT button is pressed.

When the test begins, the test pulse adapter counts the pulses it receives from the meter until the programmed number of pulses have been received.

When this occurs, the pulse adapter automatically shuts off the portable standard. The standard then displays the number of equivalent disk revolutions which is then compared to the number of pulses for the test.

Test Method Using a Snap Switch Assembly

This method is similar to the above except starting and stopping of the standard is performed manually.

To conduct the test, the technician observes the position of the load emulation annunciator and simultaneously starts the standard through the snap switch. After observing a predetermined number of emulated disk rotations, the technician stops the standard with the snap switch. A comparison is then made between the predetermined number of emulated disk rotations and equivalent disk rotations indicated on the watthour standard.

Troubleshooting

Typically, meters are placed in a very unfriendly environment. While the CENTRON OpenWay meter is designed to perform within this harsh environment, things can go wrong with the meter or installation.

Fatal Errors

Fatal errors cause the display to lock on the error code because of the possibility that billing data may have been corrupted or that the meter may not be operating correctly. If multiple fatal errors occur, the one with the lowest number will be the error code that locks on the display.

The CENTRON OpenWay meter will check for fatal errors:

- when a meter reconfigure is performed.
- when power is initially energized and upon future power restoration.
- while performing key operations.

The different fatal errors should be handled as described in the table below. Fatal errors can only be cleared by performing a Factory Reset on the meter. A Factory Reset will wipe out all information in the meter, so be sure to try to retrieve any meaningful data from the meter prior to performing the Factory Reset. After this is performed, the meter must be reprogrammed.

Sometimes when a battery is plugged into a meter while the meter is powered down, it will result in a fatal error when the meter is powered up. This is due to an unstable voltage on the battery. In this case, the fatal error can be ignored and a Factory Reset performed on the meter. To prevent these fatal errors from occurring, always power up the meter before plugging a battery into it.

Fatal Errors			
Error Code	**Error**	**Possible Cause**	**Error Description**
[FAt]Error1	MCU FLASH Error	The meter has detected a problem with the program memory.	If this error occurs, Factory Reset the meter, reprogram the meter and check for proper operation. If the error continues to exist, return the meter for repair.
[FAt]Error2	RAM Error	The meter has detected a problem with the RAM.	If the meter detects this problem, return the meter for repair.
[FAt]Error3	DATA FLASH Error	The meter has detected a problem with the data flash (non-volatile memory).	If this error occurs, Factory Reset the meter, reprogram the meter and check for proper operation. If the error continues to exist, return the meter for repair.

Fatal Errors			
Error Code	**Error**	**Possible Cause**	**Error Description**
FAtError4	Front End Processor Error	A problem has occurred with the metrology portion of the meter.	If the meter detects this problem, return the meter for repair.
FAtError5	Power Down Error	A problem has occurred while saving billing data at time of a power outage.	The billing data has been corrupted. Factory Reset the meter, reprogram the meter and check for proper operation, including several power cycles. If the error continues to exist, return the meter for repair.
FAtError6	File System Error	The meter has detected a problem with the file system	If the meter detects this problem, return the meter for repair.
FAtError7	Operating System Error	The meter has detected a problem with the operating system	If the meter detects this problem, return the meter for repair.

Non-Fatal Errors

Non-fatal errors can be programmed to scroll during the one second display off-time or lock on the meter display. If multiple non-fatal errors occur, the meter will display a combined error message. For example, if a Low Battery error and a Loss of Phase error exist, the error display will read Err 12----. In this case, if one of the errors had been programmed to lock, and the other error had been programmed to scroll, the display will lock on the combined error message.

Selecting a display mode by holding the magnet near the cover's magnet icon at the 9 o'clock position allows that display mode sequence to scroll one time during a locked non-fatal error. At the end of the display sequence, the error message locks onto the display again.

Non-Fatal Errors			
Error Code	**Error**	**Possible Cause(s)**	**Error Description**
Err 1-----	Low Battery Error	Battery Voltage Low Battery Not Connected Properly	A low battery check is performed once a day and upon a set clock procedure. A low battery continues to function; however, its reliability decreases over time. As long as the meter is not powered down with a dead or missing battery, the meter will continue to function as normal. If the meter is powered down with a dead or missing battery, then, when power is restored, the meter's clock will be off by the duration of the outage, and Load Profile and TOU will be halted.
Err -2----	Loss of Phase Error	The voltage on one of the phases dropped below 45 volts.	The voltage on each phase is checked every five seconds. A phase must fail twice in a row to cause an error. A Demand Reset will clear this error.
Err --3---	Time-of-Use (TOU) Error	• Current Season is not programmed. • Current Year is not programmed. • TOU halted due to power down with dead or missing battery.	This is tested at power-up, at midnight crossings, at season changes, upon reconfigures and upon set clocks. Depending on the cause of the error, it can be cleared with a corrective reconfigure or with a set clock with a good battery present.
Err ---4--	Reverse Power Flow Error	The configured reverse power threshold has been reached	Reverse power is tested every second and an accumulator for it is maintained. If power is delivered during the second, then the accumulator is cleared. If power is received during the second, then the accumulator is incremented. If the accumulator reaches the configured reverse power threshold, then the error is triggered. A Demand Reset will clear this error.

Non-Fatal Errors			
Error Code	**Error**	**Possible Cause(s)**	**Error Description**
Err ----5-	Clock/ Load Profile Error	Load Profile halted due to power down with dead or missing battery.	This is tested upon power-up. A set clock with a good battery present will clear this error. Be sure to read the Load Profile data prior to setting the clock to clear the error. The dead battery will cause some invalid intervals at the end of the data. When the error is cleared, Load Profile will be restarted from the beginning to purge the bad data.
Err -----6	Full Scale Overflow Error	The calculated W delivered demand at an EOI exceeded the configured full scale value.	This is tested at a demand EOI. The maximum demand register continues to accumulate and W delivered is still correctly displayed. When a demand reset is performed, the correct maximum W delivered will be added to the cumulative register. A Demand Reset will clear this error. If a full scale overflow occurs, check the installation to ensure that the current capacity of the meter has not been exceeded. A full scale overflow error in no way affects the existing billing data.
Err - 9---	SiteScan Error	SiteScan auto service detection could not determine the meter's service type.	This is tested after the power-up delay time has expired following a power-up, an exit Test mode and a reconfigure of SiteScan configuration data. While this condition is present, SiteScan Diagnostics and Voltage Quality are disabled. Once a SiteScan error occurs, SiteScan will continue to test for it every 5 seconds until the service is determined. When the service is determined, the error condition is cleared.

Other Problems

Demand Reset Cannot Be Initiated Through PC or Handheld
- Insufficient security.
- Communication cannot be established. See Programmer Cannot Communicate with Meter.

Incorrect or No Accumulation of kWh or kW
- *Demand Delay Selected*—kW will not accumulate immediately after a power outage if Cold Load Pickup (demand delay) has been selected. Accumulation will begin immediately after demand delay has expired. Verify meter program and reconfigure meter.
- *Component Failure*—Return the meter for repair.
- *Meter is not being tested properly*—See Recommended Testing Procedures.

Reset Mechanism Does Not Initiate Demand Reset
- *Reset Has Occurred Within Last Programmable Time Period, e.g., 60 Seconds*—Manual demand reset cannot occur within 60 seconds of the previous demand reset. Wait 60 seconds before trying again.
- *Reset Switch Disabled*—Reset switch may be disabled through software.
- *Register Board not Properly Installed in Upper Housing*—Verify that the Register board is fully engaged with the upper inner cover.

Blank Display
- *Power Not Applied to Meter*—Apply voltage to A phase (or phase-to-phase voltage with a polyphase power supply).
- *Voltage Too Low for Meter Startup*—the CENTRON OpenWay meter requires at least 45 volts to start up.
- *Voltage Connector Loose*—Voltage connector of the meter loose from the Register board; re-secure the connector.
- *Component Failure*—Return the meter for repair.
- *Board-to-Board Connector Not Seated*—Verify proper connection of board-to-board connector.

Time and Date Wrong (TOU Version)
- *Time/Date Wrong in PC or Handheld Device*—Verify and update time/date in programming device and download new time and date to meter. Refer to the appropriate software manual for more detailed directions.
- *Wrong Line Frequency*—Verify proper line frequency is selected in setup routine in programming software. Select proper frequency and reconfigure meter.
- *Battery Failure During Power Outage*—Verify battery voltage. Replace battery and download new time and date.
- *Daylight Savings Time Not Programmed Correctly*—Verify DST is selected in program. Reconfigure meter with correct program.
- *Component Failure*—Return meter for repair.

Programmer Cannot Communicate with Meter

- *Optical Probe Cable Assembly Failure*—Check cable with known meter that communicates. Check meter against known cable that is functioning. Also check batteries in cable assembly (if applicable).

- *COM Port in Programmer Is Set Wrong*—Verify proper COM port number has been selected in the setup routine of the programming software. If the wrong COM port is selected communications will not occur.

- *Security Code in Meter*—If security codes have been downloaded to the meter, the programming device must have the proper code to make connection to the meter. Verify security codes in the setup routine of the programming software.

- *Cable Not Connected Properly*—Verify optical probe lines up properly over the optical connector. Re-install cover for proper alignment. Verify PC (or handheld) and cable are securely connected and attached to the correct COM port.

- *Incorrect Cable Selection*—Wrong cable selected in Options | Optical Probes section of PC-PRO+ Advanced.

- *Main Register Electronics Failure*—Return meter for repair.

Magnetic Switch Does Not Activate the Alternate or Toolbox Mode

- *Magnetic Field Is Too Weak*—Place magnet closer to switch or use stronger magnet.

- Magnet was not in place for four consecutive seconds.

- *Magnetic Switch Failure*—Return meter for repair.

Test Mode Switch Does Not Place Meter in Test Mode

- *No display items in Test Mode Display List*.

- *Switch deactivated by software*—Activate switch in software and reprogram meter.

- *Register Board not Properly Installed in Upper Housing*—Verify that the Register board is fully engaged with the inner cover.

- *Switch or Electronic Failure*—Return meter for repair.

Diagnostic 1 Condition Incorrectly Active

Verify that meter determined the correct service type.

Diagnostic 2, 3, or 4 Condition Incorrectly Active

Verify that thresholds are not set too tight.

Counters Are Too High

Verify that thresholds are not set too tight.

Maintenance

Preventive Maintenance

No scheduled or preventive maintenance is necessary for the CENTRON OpenWay meter.

Line potential may exist on the battery terminals. Follow these precautions:

- **Never short-circuit batteries (such as by measuring current capability with an ammeter).**
- **Do not recharge batteries.**
- **Do not store or transport batteries in metal or other electrically conductive containers.**
- **Keep batteries separated. If stored in a container where they can contact each other, face them in the same direction to prevent short circuits.**
- **Do not operate batteries at temperatures above 85°C (185°F).**
- **Dispose of batteries where they will not be punctured, crushed, or incinerated.**
- **Discard the battery using proper hazardous waste procedures.**

Corrective Maintenance

Because of the high level of integrated packaging and surface-mount components, on-board component repairs are not recommended. The entire meter should be returned to Itron, Inc. Customer Service for repair.

C H A P T E R 5

Operation: CP1SR Version

In This Chapter

The CP1SR module is a one-way, unlicensed radio frequency (RF) personality module that attaches to the CENTRON OpenWay meter base (See the figure below). It offers a cost-effective solution for the endpoints in automatic and off-site meter reading applications.

Figure 18: CENTRON CP1SR Meter

Physical Description

The CP1SR personality module is constructed of a flame retardant printed circuit board material which supports the discrete, surface-mounted, and integrated circuit components. A microstrip etched on the circuit board serves as the RF antenna. The CP1SR personality module easily snaps into the meter module mounting bracket. This module is then electronically attached to the metrology board via a board to board connector. The following information is sent to the personality module from the base metrology board:

- Line voltages
- Energy data
- Basic status information

The CP1SR contains contacts on the module board, located at the 12 o'clock position behind the LCD, for resetting the energy register and tamper counters. This can be accomplished with the ZRO-C2A Resetter.

The CP1SR uses a unique module (ERT) identification number, provided by Itron. This ID number is contained in each message transmission and is used by the handheld and billing system to determine meter identity and location. This ID number, which is contained on a bar-coded label, is placed on the LCD housing directly above the LCD display.

FCC Regulations

The CP1SR communicates in the unlicensed, 910-920 MHz band governed by the US Code of Federal Regulations (CFR) Title 47, Part 15 Radio Frequency Devices, Sub Part C Paragraph 247 Intentional Radiator.

Changes or modifications not expressly approved by Itron could void the users authority to operate the equipment.

Tamper Detection

The CENTRON Polyphase CP1SR features the Itron patented method of tamper detection that senses both meter removal and meter inversion. The removal tamper (RTPR) increments a counter each time the meter is abruptly removed from a live meter socket. The tamper counter utilizes a tilt switch to detect when the meter is removed from a meter socket.

Testing the CENTRON Polyphase CP1SR Tamper Counter

SCM Testing

In order to test the power removal counter, the meter must sense a shaken condition associated with a power outage.

1   Place the meter in a socket.

2   Apply power to the meter.

3   Remove the meter from the live socket.

4   Replace the meter in the socket.

    The meter has incremented the removal tamper counter.

The CP1SR uses the power outage (the meter being removed from a live socket) in conjunction with the meter being shaken simultaneously to increment the power removal counter.

The inversion counter increments when the meter senses reverse current flow. The metrology board senses reverse power flow and sends this status to the CP1SR personality module. The CP1SR then increments the counter and transmits the count.

As part of the 96-bit Standard Consumption Message, 4 bits are allocated for tamper indications, which include the power removal and meter inversion counters. The table below shows the removal and inversion information based on the reported tamper count.

Tamper Count:

Binary	Tamper Count	Inversion	Removal
0000	0	0	0
0001	1	1	0
0010	2	2	0
0011	3	3	0
0100	4	0	1
0101	5	1	1
0110	6	2	1
0111	7	3	1
1000	8	0	2
1001	9	1	2
1010	10	2	2
1011	11	3	2
1100	12	0	3
1101	13	1	3
1110	14	2	3
1111	15	3	3

Retrofitting the CP1SR Personality Module

The CENTRON R300 is a one-way radio frequency personality module that transmits within the unlicensed 910-920 MHz frequency band governed by the US Code of Federal Regulations (CFR) Title 47, Part 15 Radio Frequency Devices, Sub Part C Paragraph 247 Intentional Radiator. Any device operating within this unlicensed frequency band must contain an FCC Identification number. The retrofit kit includes a CP1SR register with a FCC ID label as shown below.

Figure 19. CENTRON Polyphase CP1SR Meter

Changes or modifications not expressly approved by Itron could void the user's authority to operate the equipment.

To retrofit an existing meter with an R300 module, see Retrofitting with Personality Modules.

Testing, Troubleshooting and Maintenance

Diagnostic	Display OFF Period	Notes
Metrology message stopped for greater than 15 seconds and less than 10 minutes	Error	Missing message with diagnostic flag also written to the memory
Power up with Phase A, B, and C voltage equal to 0 degrees	noSEr	Meter installed in an invalid service configuration.

Testing Support Features

Infrared Test LED

The CENTRON Polyphase CP1SR meter is equipped with an Infrared Test Light Emitting Diode (LED) (① in the figure below) where each pulse represents a fixed value of watthour measurement. The LED is located on the top of the meter as the meter is viewed from a typical installation. The pulse weight represented by the LED pulses is 1.0 watthour per pulse (Kh=1.0) for a Form 9S meter and 10.0 watthour per pulse (Kh=10.0) for a Form 16S meter.
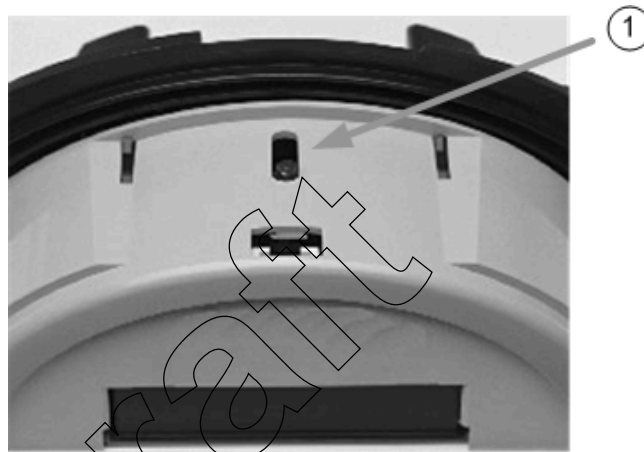

Figure 20: Test LED Location

Pulse Detector

An optional pulse detector is available for the CENTRON OpenWay meter. The pulse detector has an infrared pickup with two visible LEDs. When positioned over the CENTRON Polyphase light pipe, it will produce a visible flash when an infrared pulse is received from the metrology. The right LED will flash once for each infrared Wh pulse while the left LED will flash once for every 10 infrared pulses received. The left LED on the pulse detector is helpful when heavier loads are present on the system being examined. This can be used to verify that the metrology is measuring energy when installed and to conduct timing tests to determine the amount of load on meter.

Figure 21: Pulse Detector

Annunciators

Watthour Annunciators

The CP1SR meters are equipped with three annunciators which show the direction of energy flow. The squares will scroll left to right for positive (line to load) energy flow, and right to left for negative energy flow. Each change in state of the watt disk emulator is equivalent to 1 x Kh.

Glossary of Terms

A

annunciator

A Liquid Crystal Display (LCD) label that is displayed to identify a particular quantity being displayed

B

baud

Unit of data transmission signaling speed, roughly analogous to bits per second (bps)

D

display duration

The programmed number of seconds that a quantity is displayed on the LCD before it is replaced with the next quantity in the display sequence

E

EEPROM

Electrically Erasable Programmable Read Only Memory. A memory chip that can only be erased by an electrical signal (retains data during a power outage)

electronic detent

An algorithm in firmware which restricts the device to metering energy flow only to the customer (unidirectional metering)

EPROM

Erasable Programmable Read Only Memory. Similar to EEPROM except it requires ultraviolet light to be erased

F

firmware

Computer programs stored in non-volatile memory chips (ROMs, PROMs, EPROMs, EEPROMs, etc.)

fixed decimal

A display format that always retains the same number of digits to the right of the decimal point

floating decimal

A display format that allows a maximum number of digits to the right of the decimal, but can display any number of digits to the right of the decimal equal to or less than that number specified

I

IDM

Interval Data Message

L

LCD

Liquid Crystal Display

LED

Light-Emitting Diode

M

magnetic switch

A mechanical switch consisting of a thin metal contact which is closed by an external magnetic field

N

nonvolatile memory

See EEPROM

R

RS-232

A communication media whereby information is transmitted through a serial bit stream

S

SCM

Standard Consumption Message

Index

A

annunciator • 75
antenna
    RF • 70

B

base metrology • 15
baud • 75
button
    test mode • 13

C

circuit board
    metrology • 70
counter
    power removal • 70
cover • 12
Crystal Time synchronization • 13
current/potential terminals • 13

E

EEPROM • 75
electronic detent • 75
EPROM • 75

F

firmware • 75
fixed decimal • 75
floating decimal • 75

I

inversion counter • 70
inversion tamper (ITPR) • 70
ITPR • 70

L

LCD • 75
LCD display • 13
LCD housing • 70
LED • 75
line frequency • 13
lithium battery
    shelf life • 11

M

magnetic switch • 75
meter base • 12, 13, 69

meter cover • 12
meter inversion • 70
meter removal • 70
meter storage • 11
metrology board • 70
module
    R300 • 69

N

nonvolatile memory • 75
non-volatile memory • 69

O

operating temperature range • 13
optical connector • 12

P

PC-PRO+ Advanced Programming Software • 1
personality module
    C1SR • 69, 70
    handling • 12
power removal counter • 70
PRO-READ • 1

R

R300 module • 69
ReadOne Pro handheld reader • 70
removal tamper (RTPR) • 70
removal tamper counter • 70
reset mechanism • 12
Retrofit Kit
    C1SR • 72
reverse current flow • 70
reverse power flow • 70
RF antenna • 70
RS-232 • 75
RTPR • 70

S

segment test • 13
storage
    meter • 11

T

tamper indication • 70
test mode annunciator • 13
test mode button • 13

Z

ZRO-C2 Resetter • 70