Preliminary

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Technical Manual

TM42-2210C

REX™ Meter

ELSTER

Printed in the United States of America.

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Contents

FCC and Industry Canada Compliance

Compliance Statement (Part 15.19)

The REX meter complies with Part 15 of the FCC Rules and with RSS-210 of Industry Canada. 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

Warning (Part 15.21)

Changes or modifications not expressly approved by Elster Electricity, LLC could void the user's authority to operate the equipment.

RF Radiation Safety Guidelines per Part 2 of FCC Rules and Regulations

The meter should be installed in a location where there will be a separation greater than 20 cm from locations occupied by humans on other than an incidental or transitory basis.

User Information

The REX meter 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, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Move the receiving equipment farther away from the REX meter.
- Consult the dealer or an experienced radio/TV technician for help.

Industry Canada Statement

The term "IC" before the certification/registration number only signifies that the Industry Canada technical specification were met.

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Safety Information

Installation, operation, and maintenance of this product can present potentially hazardous conditions (for example, high voltages) if safety procedures are not followed. To ensure that this product is used safely, it is important that you:

- Review, understand, and observe all safety notices and recommendations within this manual.
- Do not remove or copy individual pages from this manual, as this manual is intended for use in its entirety. If you were to remove or copy individual pages, cross references and safety notices may be overlooked, possibly resulting in damage to the equipment, personal injury, or even death.
- Inform personnel involved in the installation, operation, and maintenance of the product about the safety notices and recommendations contained in this manual.

Within this manual, safety notices appear preceding the text or step to which they apply. Safety notices are divided into the following 4 classifications:

NOTICE

Notice is used to alert personnel to installation, operation, or maintenance information that is important but not hazard related.

⚠ CAUTION

Caution is used to alert personnel to the presence of a hazard that will or can cause minor personal injury, equipment damage, or property damage if the notice is ignored.

⚠ WARNING

Warning is used to alert personnel to the presence of a hazard that can cause severe personal injury, death, equipment damage, or property damage if notice is ignored.

⚠ DANGER

Danger is used to alert personnel to the presence of a hazard that will cause severe personal injury, death, equipment damage, or property damage if the notice is ignored.

Revisions to This Document

The *REX Meter Technical Manual* can be referred to by its document number: TM42–2210. Each revision of this manual is designated with a letter, with the first revision being "A," the second being "B," and so forth. The document number and its revision are located at the bottom of each page.

The following table lists the revisions to this document, the date of the release, and any notes about the changes made.

Revision	Date	Brief Description
A	12 August 2003	First release of the document.
B	30 July 2004	Changed layout of the document. Changed name of "service disconnect switch" to "service control switch" in Chapter 1. Added information about firmware release 2.0 & 3.0 in "Load Profiling" (Chapter 2), Table 2-2, Table 3-1, and Appendix B. Corrected the number of load profiling pulses REX meter can store in Chapter 2. Corrected entries in Table 2-2. Expanded "Demand Reset" section in Chapter 3. Added "Clear Billing Data" to Chapter 3. Corrected Chapter 4. Corrected caption in Figure C-3. Other minor edits were made to clarify the text already in the manual.
C		Added information regarding Form 12S meters.

1 Introduction

The REX Meter

The REX meter, manufactured by Elster Electricity, is an all-electronic meter focused exclusively on residential electricity revenue metering applications. This meter meets or exceeds ANSI C12.1, C12.10, C12.20, and other appropriate industry standards.

While capable of operating as a stand-alone meter for certain functions, the REX meter is primarily designed to provide a flexible metering platform that can operate with a variety of communications technologies to provide remote or automated meter data collection, also referred to as automated meter reading (AMR).

The meter consists of a socket-mounted meter enclosure with current and voltage sensors connected to a powerful microprocessor-based metering calculation engine. The unit measures, processes, stores, and locally displays energy (kWh) and other related metering data via an integral liquid crystal display. Metering data is also made available to AMR communications modules that can either be mounted onto the main metering circuit board or added as optional separate circuit boards for which space is provided under the meter cover.

The REX meter can include an integral Elster Electricity-designed radio frequency (RF) transmitter and receiver module that operates in the 900 MHz unlicensed spectrum. The 900 MHz module allows the REX meter to support two-way communications with other meters in an Elster Electricity-designed RF-based local area network (LAN) for automated meter reading. The Elster Electricity RF LAN technology includes such functions as automatic registration upon installation, network time synchronization, downloading of time-of-use (TOU) metering schedules, scheduled demand reset, reprogramming of REX functions, and numerous other features.

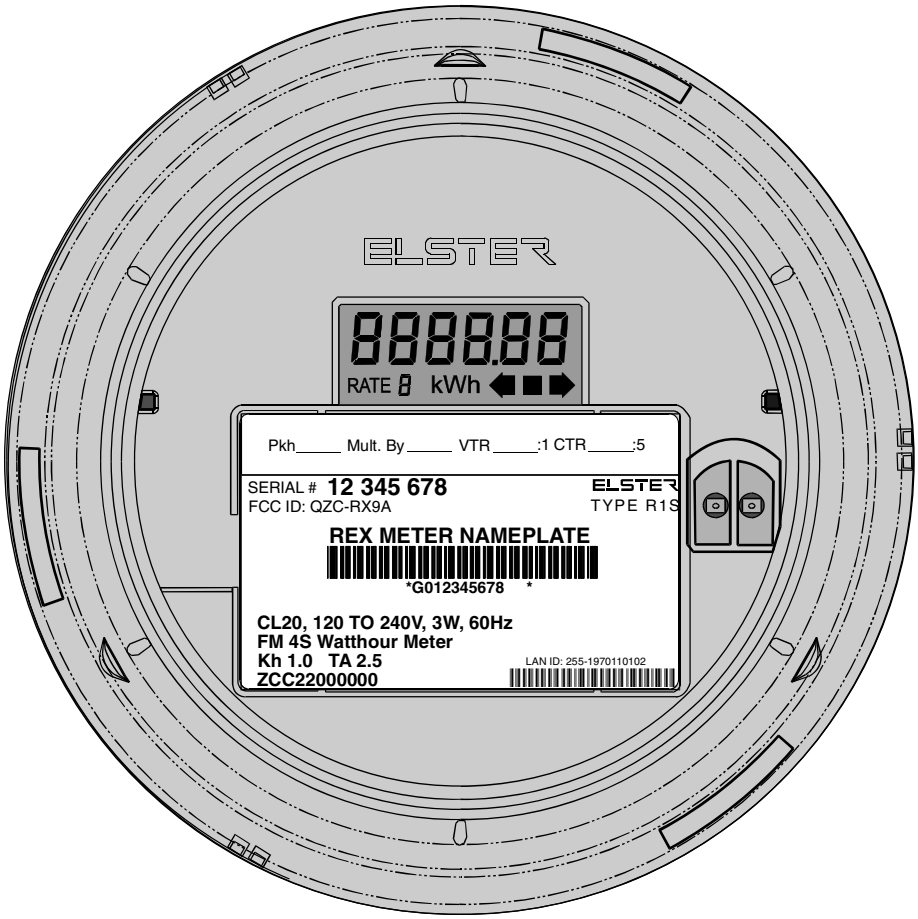
The REX meter and its 900 MHz LAN module are part of the Elster Electricity EnergyAxis® System for meter data collection and management, which is designed to support full two-way AMR capability to every REX meter.

By using the full capabilities of its meter engine and the Elster Electricity 900 MHz RF LAN, the REX meter offers a highly flexible metering platform, allowing implementation of metering functions such as basic energy measurement (kWh), power (kW demand), TOU metering, load profile interval recording, and critical tier pricing. With the Elster Electricity EnergyAxis System, any of these features can be engaged or disengaged remotely at any time, thus offering operational flexibility without the costs of manual meter reading, equipment change-outs, site visits, meter reprogramming, and other expenses.

This manual is a guide to the features and operating characteristics of the REX meter. Other technical manuals or operator guides provide additional information on other EnergyAxis System components, including the Elster Electricity Metering Automation Server (MAS), the A3 ALPHA® meter/collector, and the Elster Electricity 900 MHz RF LAN.

See Figure 1-1 for an illustration of a REX meter.

Figure 1-1. REX meter



Standards Compliance

The REX meter meets or exceeds the American National Standards Institute (ANSI) standards for electricity metering, and it is intended for use by single phase utility customers.

Number	Date	Title
ANSI C12.1	2001	American National Standard for Electric Meters – Code for Electricity Metering
ANSI C12.10	1997	Electromechanical Watthour Meters
ANSI C12.20	1998	American National Standard for Electricity Meters 0.2 and 0.5 Accuracy Classes

Benefits

Reliability. The REX meter design is patterned after the ALPHA meter technology which has established a reputation as a reliable and accurate meter for electrical energy measurement. The highly selective choice of meter components provides for a very reliable meter. The REX meter uses nonvolatile electrically erasable programmable read only memory (EEPROM) to store its customer-specific configuration parameters and all meter data. If power is interrupted, the data will be preserved.

Maintainability. The design provides easy access to the meter circuit board and all option boards. Circuit boards may be added or exchanged without special tools or rewiring.

Adaptability. The REX meter is designed so that it may be easily upgraded to support additional option boards. The REX meter has also been designed to support an internal service control switch that can connect and disconnect electrical service to a consumer. The service control switch must be specified at the time of ordering.

Economy. The REX meter saves both time and money. It can increase personnel productivity due to the following features:

- no user calibration required (factory-calibrated)
- reduced test time
- LED test pulse output through the front of the meter
- light weight for easy handling

Security. The REX meter is tamper-resistant. Since there are no moving parts, traditional tampering techniques on the REX meter will be less successful than on electromechanical meters. The REX meter is also a bidirectional meter. It always measures kWh received as well as the selected energy quantity. A polycarbonate cover resists cracking and breakage due to physical abuse. The meter counts and stores the number of power failures, which can be used to help detect tampering with the meter service.

Accuracy. The REX meter is a 0.5 % accuracy class meter (as defined by ANSI C12.20) and meets or exceeds ANSI and IEEE requirements. The meter precisely measures and displays energy usage consistently with the meter class purchased and through a range of the following variations:

- current
- temperature
- voltage
- power factor
- frequency

The low current sensor burden may also improve the accuracy of external current transformers when measuring light loads.

Features

The REX meter comes with many features, such as:

- kWh energy measurement of the selected metered quantity
- kWh received energy measurement
- TOU kWh energy measurement
- kW demand measurement
- test LED and K_h = 1.0 Wh/pulse period
- load profile recording
- 6-digit liquid crystal display (LCD)
- inner housing
- polycarbonate meter cover
- versatile packaging allowing for future options
- two-way, 900 MHz radio communications module

Meter Forms

The REX meter is available in the following ANSI form factors:

- Form 1S
- Form 2S
- Form 3S
- Form 4S
- Form 12S

A-base (bottom-connected) meter requirements can be met using one of the above meters with an appropriate socket adapter.

2 Product Description

System Overview

System Architecture

The REX meter main circuit board contains all the electronics that make up the meter and integral registers. See Figure 2-1 for the single phase REX meter block diagram (including the integral 900 MHz radio). See Figure 2-2 for the Form 12S REX meter block diagram (including the integral 900 MHz radio).

Figure 2-1. REX meter block diagram (single phase meters)

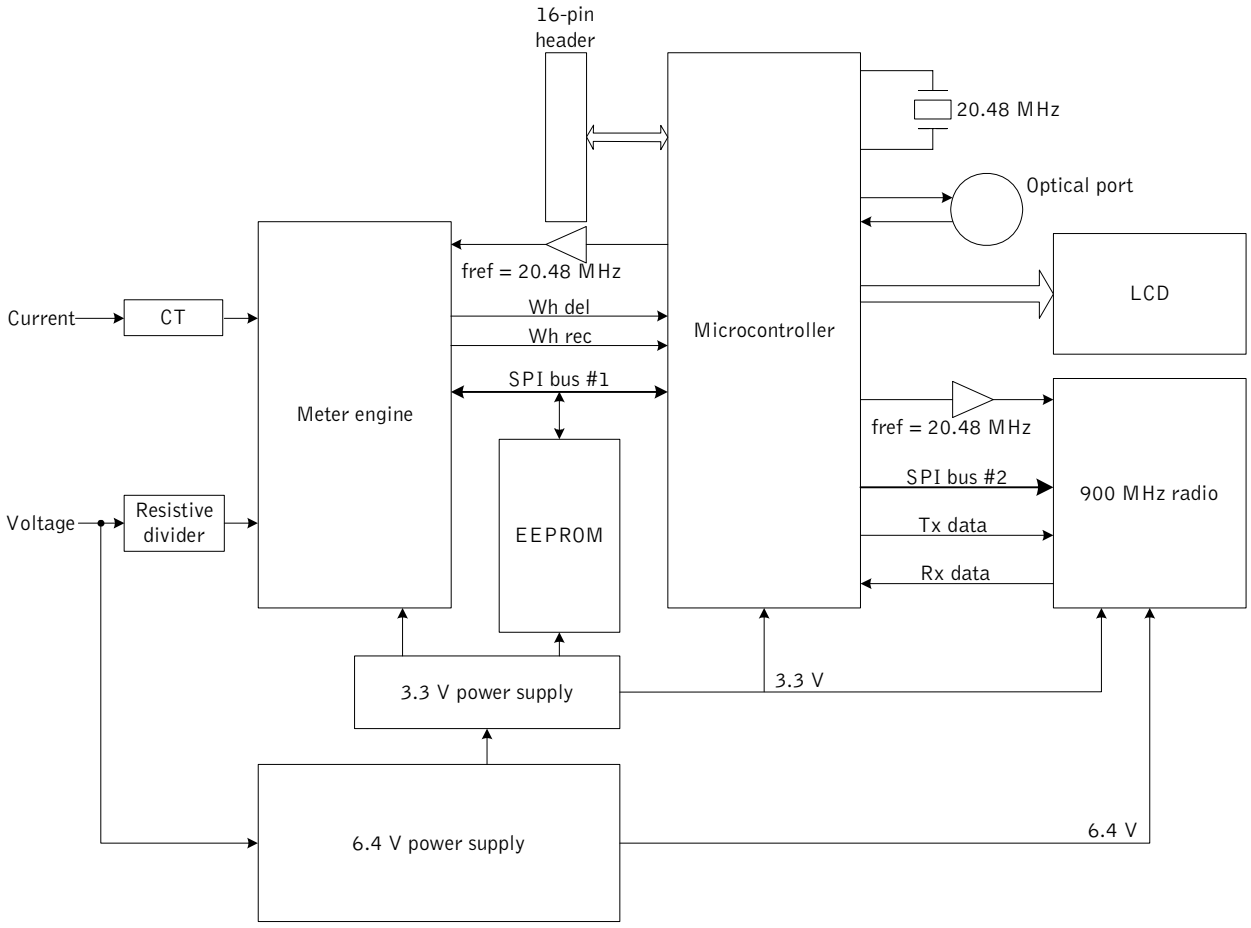
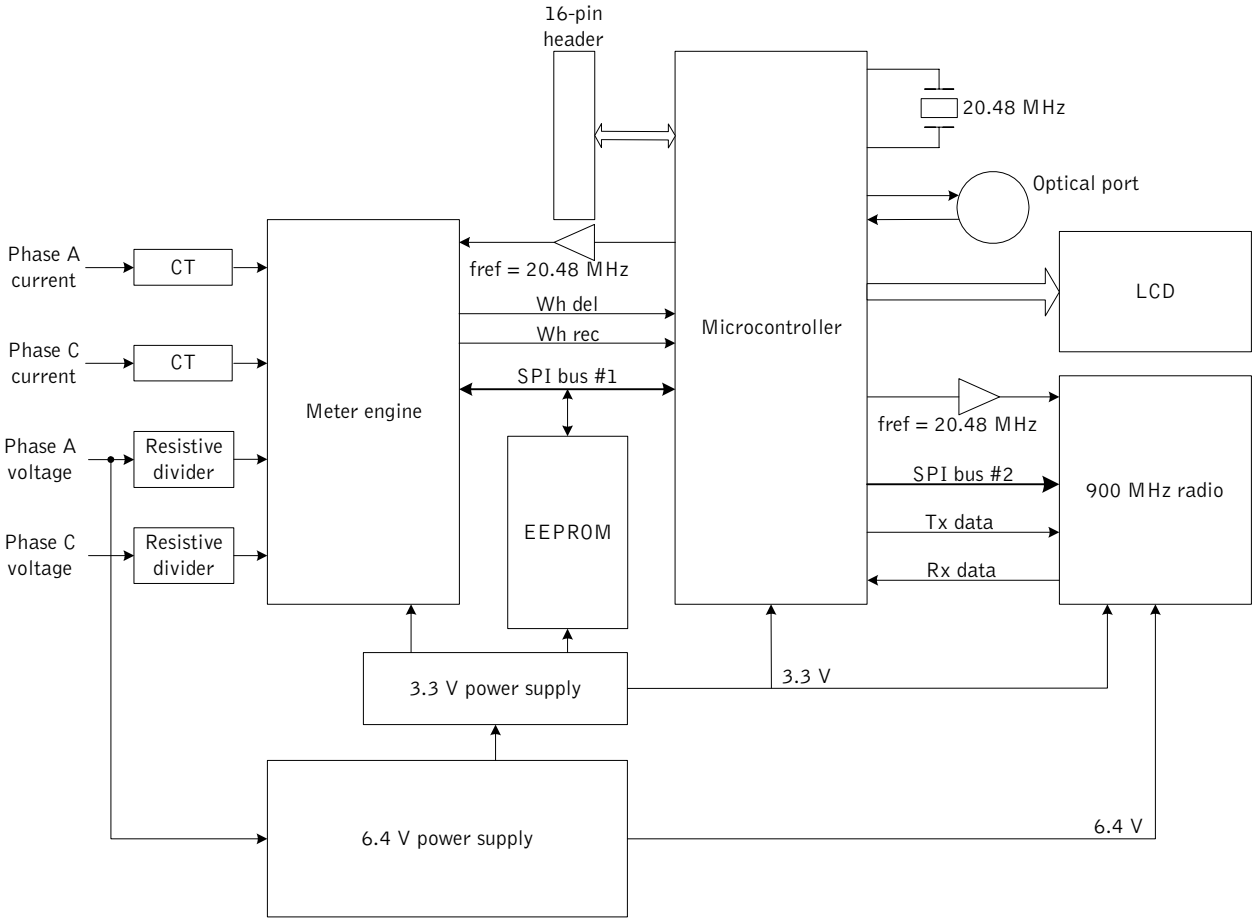


Figure 2-2. REX meter block diagram (Form 12S meters)



General Theory of Operation

Power Supply. The single phase (Forms 1S, 2S, 3S, and 4S) REX meter can accept a line voltage of 120 VAC to 240 VAC ± 20 % (96 VAC to 288 VAC). The Form 12S meter can accept a line voltage of 120 VAC ± 20 % (96 VAC to 144 VAC). Using this input voltage, a power supply generates a 6.4 V and 3.3 V supply. On Form 12S meters, phase A voltage must be present to power the meter circuitry.

Current and Voltage Sensing. Power line currents and voltages are sensed using specialized current sensors and resistive dividers, respectively. Multiplication and other calculations are performed using an integrated circuit (called the *meter engine*).

The meter receives the current through a precision-wound current transformer that reduces the line current proportionally. The meter engine samples the phase current to provide accurate current measurements.

The meter receives the voltage through resistive dividers to ensure that a linear logic level voltage is maintained. This also serves to minimize phase shift over a wide dynamic range. The meter engine samples the scaled inputs provided by the resistive dividers to provide accurate voltage measurements.

Meter Engine. Multiplication and other calculations are performed using the meter engine. The meter engine contains the digital signal processor (DSP) with built-in analog-to-digital (A/D) converters capable of sampling each current and voltage input. The DSP multiplies the signals appropriately, using the factory-programmed calibration constants.

Microcontroller. The microcontroller performs many different functions, for example:

- communicates with the meter engine and EEPROM
- accumulates energy usage data and computes kWh, kW, TOU kW, and load profiling data
- sends output pulses
- controls the LCD
- controls the optical port
- provides an option board interface

The microcontroller and the meter engine communicate with each other constantly to process and accumulate energy measurements. When the microcontroller detects a power failure, it initiates a shutdown. A shutdown is the process that stores billing and status information in EEPROM.

EEPROM. The REX meter uses EEPROM for nonvolatile storage of manufacturing data, meter configuration data, and energy measurement data. During a power failure, the EEPROM provides storage of all the information needed to ensure the integrity of the energy calculations, including the following:

- configuration data
- billing data
- meter status
- constants
- energy usage

Billing Data

Metered Energy. The meter engine samples the voltage and current inputs, computes energy, and sends these measurements to the microcontroller. In the meter engine, each pulse is equal to one K_e defined as secondary-rated Wh per pulse. The K_e is specific for each meter form factor, as defined in Table 2-1.

Table 2-1. K_e for each REX meter form factor

Form	K_e	K_h
1S	0.1	1.0
2S	0.1	1.0
3S	0.01	1.0
4S	0.01	1.0
12S	0.1	1.0

The REX meter can measure any one of the following quantities:

- kWh delivered

- kWh received
- kWh sum (kWh delivered + kWh received)
- kWh net (kWh delivered - kWh received)

The metered quantity is used to calculate total energy, energy on a TOU basis, demand, and load profiling data.

Note: When the selected metered quantity is kWh net, the meter calculates demand from kWh-delivered and stores kWh-delivered pulses for load profiling.

Demand Calculation. Demand is the average value of power over a specified interval of time. The REX meter supports the block interval method for demand calculation. The demand interval is specified in minutes and must be 15, 30, or 60 minutes.

The block interval calculates demand using the following equation:

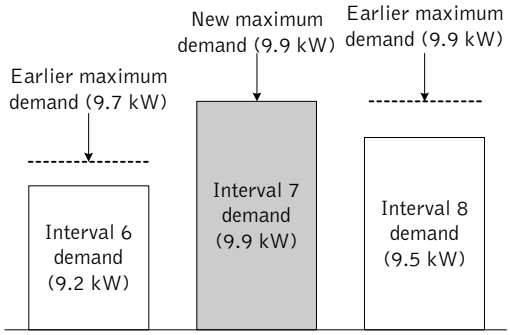
$$D = \frac{total\ accumulated\ energy}{t_{hours}}$$

For example, if the demand interval is 15 minutes and the total accumulated energy is 50 kWh, then the demand is 200 kW.

$$D = \frac{50\ kWh}{0.25\ h} = 200\ kW$$

Maximum Demand. Maximum demand (also referred to as *indicating demand*) is the highest demand value that occurs in a billing period. The demand for each demand interval is calculated and compared to an earlier maximum demand value. If the new interval value exceeds the previous maximum demand, then the new demand is stored as the maximum demand (see Figure 2-3). When a demand reset occurs, the maximum demand is reset to zero. The demand for the first full interval after the demand reset becomes the maximum demand.

Figure 2-3. Maximum demand



Demand Forgiveness. Demand forgiveness is the time during which demand is not calculated or stored after a power failure. The demand forgiveness may be set to a number between zero (disabled) and 255 minutes.

TOU Data. The REX meter stores the energy data for up to 4 rates. The meter stores demand data for 2 quantities where each quantity is configured to be one of the following:

- total demand
- demand for a specific rate

The REX meter receives the TOU switch point information from the collector, and stores this information for each of the following day types:

- weekday
- weekend
- special day type #1 (that is, holiday #1)
- special day type #2 (that is, holiday #2)

The switch point information received from the collector is associated with a specific season, and once received, the information is stored in nonvolatile memory in the REX meter and is valid until a season change occurs. When a season change occurs, the REX meter invalidates the switch point information until new switch points are downloaded from the collector. The REX meter stores energy in the default tier (rate C) if the switch points are invalid or if the REX meter does not know the real time.

Without the collector, the REX meter does not know day type information. The collector downloads calendar information to the REX meter to specify the day type for the next 32 days. This 32-day calendar is stored in the REX meter and allows the REX meter to set the day type correctly at each midnight crossing.

In addition to the switch points for the 4 day types, the REX meter has a separate table that allows for tier overrides or critical tier pricing. In conjunction with the MAS, the collector may be told a start time and a stop time for a tier override. When in a tier override condition, the collector writes the tier override table in the REX meter forcing the REX meter to use the override switch points for a specific period of time. At the end of the override period, the REX meter will revert to the standard switch points that are stored in the REX meter's nonvolatile memory.

Load Profiling

The REX meter supports load profiling.

- REX meter firmware releases 1.0 and 2.0 support 104 load profiling records.
- REX meter firmware releases 3.0 and higher support 480 load profiling records.

Each load profiling record stores one of the following:

- K_h pulses of the metered quantity (scaled by a K_h pulse divisor) with status flags to indicate if a power failure or time change has occurred during the interval
- date and time

The load profiling interval is specified in minutes and must be 15, 30, or 60 minutes. The load profiling interval length can be different from the demand interval length.

Interval length[1]	Maximum storage capacity	
	Release 1.0 & 2.0	**Release 3.0 and higher**
15 minutes	26 hours	120 hours
30 minutes	52 hours	240 hours
60 minutes	104 hours	480 hours

[1] An A3 ALPHA meter/collector is required to read the REX meter and accumulate larger load profiling records.

Note: If the metered quantity is kWh net, load profiling stores the number of kWh delivered pulses.

K_h pulse divisor. A pulse divisor is used to scale down the number of K_h pulses recorded in each load profiling interval. This allows recording of data that may exceed the maximum number of pulses that can be stored in each load profiling interval (each interval can store 4095 pulses before overflowing).

The standard value of K_h for all REX meters is 1.0. If the divisor is set to 10, then each load profiling pulse count represents 10 Wh.

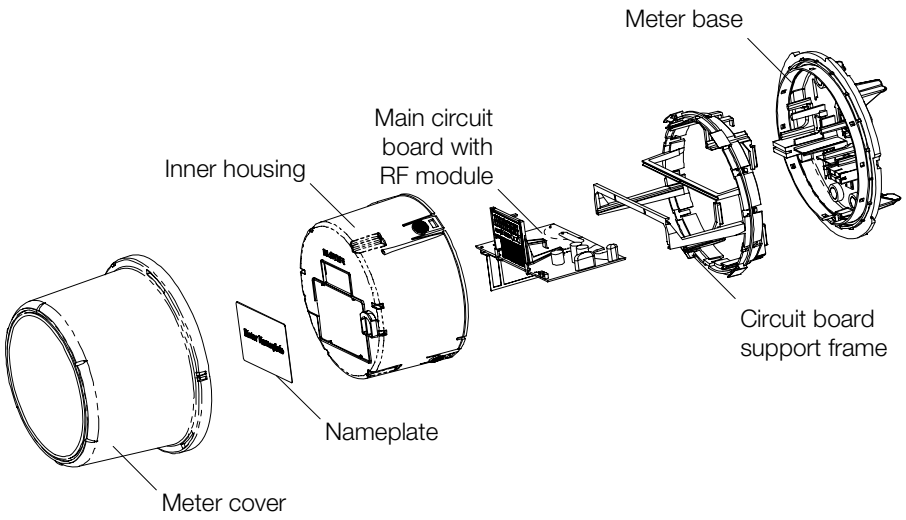
Physical Description

The physical components of the REX meter consist of the following:

- meter cover
- nameplate
- inner housing
- main circuit board
- circuit board support frame
- meter base

See Figure 2-4 for an illustration of the REX meter physical components.

Figure 2-4. Exploded view of the REX meter



Meter Cover

The meter cover of the REX meter is a polycarbonate housing designed to protect the inner assemblies of the meter. The ultraviolet (UV) stabilized polycarbonate cover reflects solar radiation, resulting in minimized discoloration and reduced internal heating. The gray polycarbonate side walls of the meter cover reduce the internal temperature rise caused by sun loading, which may extend the life of the electronic components. The cover has a clear plastic window that allows the meter LCD to be viewed.

Removing the cover reveals the inner housing.

Nameplate

The nameplate is mounted on the inner housing. The nameplate identifies important information about the meter. For more information on the nameplate, see Appendix C, “Nameplate Information.”

Inner Housing

The polycarbonate inner housing is designed to provide extra protection to the electronic components and to allow the REX meter to be safely handled when the meter cover is removed.

Removing the inner housing reveals the main circuit board, option boards, circuit board support frame, and meter base.

Main Circuit Board

The main circuit board consists of the following components:

- LCD
- power supply
- EEPROM
- meter engine
- microcontroller
- 900 MHz radio
- supporting electronics

See “General Theory of Operation” on page 2-2 for an explanation of the general operation of the REX meter.

Circuit Board Support Frame

The REX meter circuit board support frame is designed to house the main circuit board and up to three option boards efficiently and conveniently. Two option boards can be installed above the main circuit board and one below the main circuit board using the circuit board support frame.

Meter Base

The meter base contains the following components:

- base housing
- current and voltage blades
- either 1 or 2 current sensing transformers (depending on form)
- disconnect link (Form 2S meters only)
- hanger

Table 2-2 shows the available ANSI compatible configurations for a socket-connected (S-base) REX meter according to the type of service being metered.

Table 2-2. REX meter available wiring forms

Meter style[1]	Form	Test Amps	Class	Elements	K_h	Type of service
ZCA3xxxxxxx	1S	30	200	1	1.0	2-wire single phase
ZCA4xxxxxxx	1S	50	320	1	1.0	2-wire single phase
ZCC3xxxxxxx	2S	30	200	1	1.0	3-wire single phase
ZCCWxxxxxxx	2S	30	200	1	1.0	3-wire single phase (without voltage disconnect link)
ZCC4xxxxxxx	2S	50	320	1	1.0	3-wire single phase
ZCA2xxxxxxx	3S	2.5	20	1	1.0	2- or 3-wire single phase
ZCC2xxxxxxx	4S	2.5	20	1	1.0	3-wire single phase
ZC5Wxxxxxxx	12S	30	200	2	1.0	3-wire wye, network meter (without voltage disconnect link)

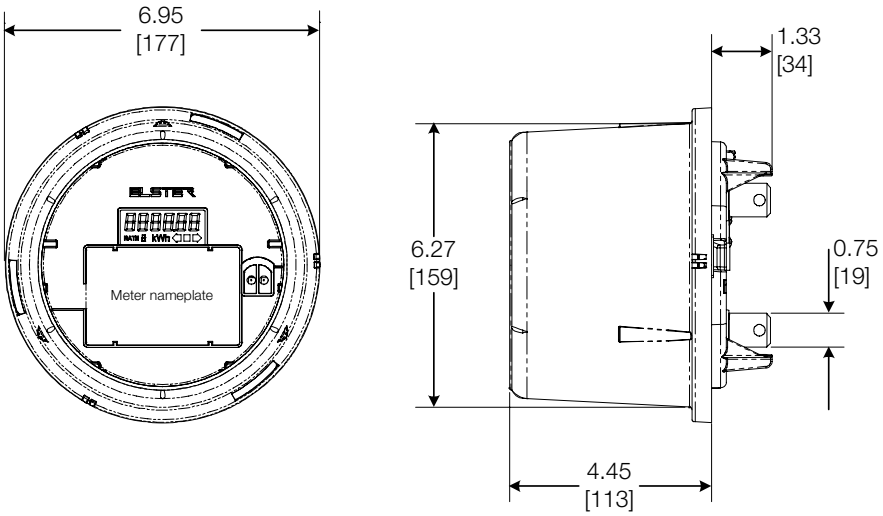
Meter style[1]	Form	Test Amps	Class	Elements	K_h	Type of service
ZC53xxxxxxx	12S	30	200	2	1.0	3-wire wye, network meter
ZC54xxxxxxx	12S	50	320	2	1.0	3-wire why, network meter

[1] The fifth character in the style number identifies the amount of storage in EEPROM available.
2 = 1 KB of storage; 9 = 2 KB of storage.

Physical Dimensions

The REX meter fits Forms 1S, 2S, 3S, 4S, and 12S. See Figure 2-5 for an illustration of a 2S meter and its dimensions.

Figure 2-5. Form 2S meter and dimensions in inches [millimeters], front and side view[1]



[1] Dimensions are provided for reference only. Do not use for construction. If exact dimensions are required, contact Elster Electricity.

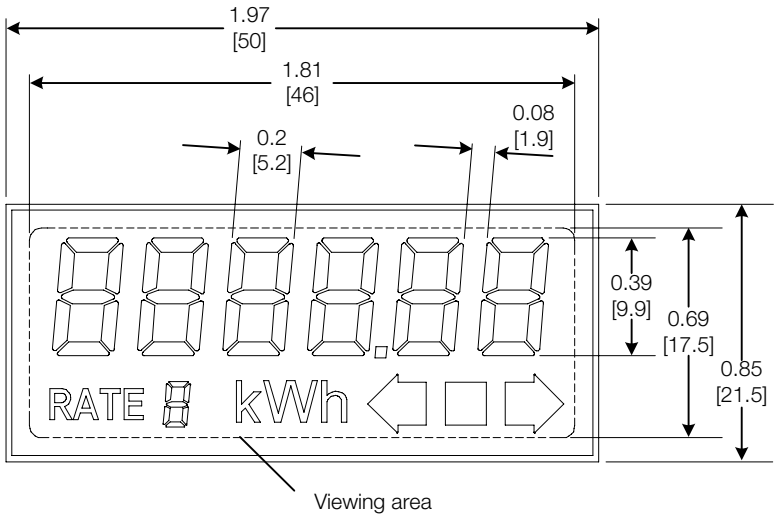
3 Operating Instructions

Indicators and Controls

LCD

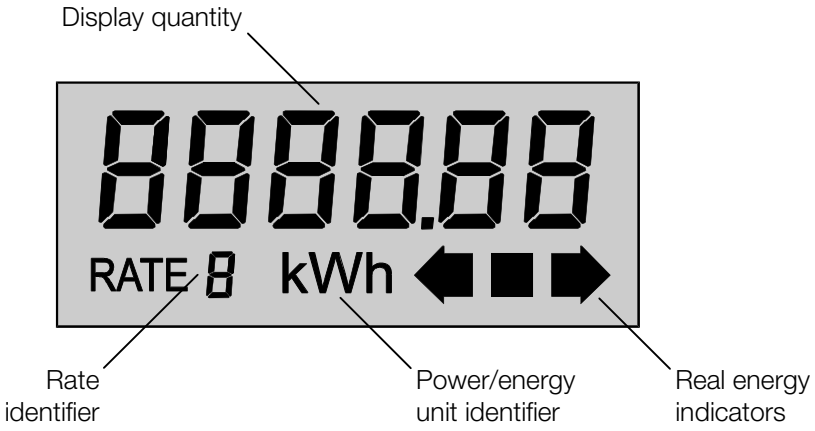
The REX meter liquid crystal display (LCD) displays meter data and status information. Figure 3-1 shows the dimensions of the LCD.

Figure 3-1. LCD dimensions in inches [millimeters]



As shown in Figure 3-2, the LCD is divided into different display regions.

Figure 3-2. LCD regions



Display Quantity. This 6-digit display quantity on the LCD shows either metered quantities or other displayable information, depending upon how the REX meter was programmed either at the factory or using MAS. See Appendix B, “Display,” for more information.

The display quantity digits are used to display the following:

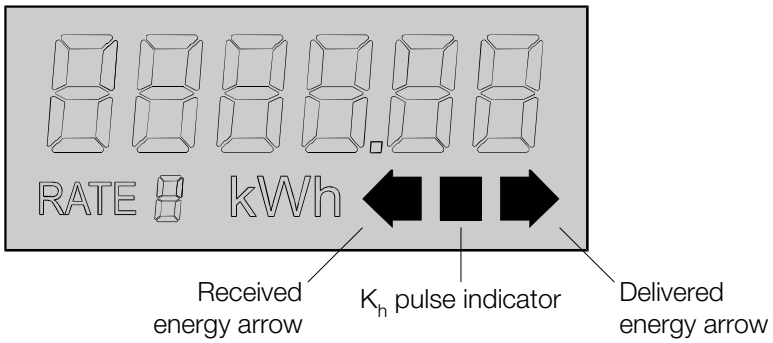
- LCD segment test (all display segments turned on)
- operational errors and status
- kWh and kW values

When displaying energy values, the LCD can be configured to display 4, 5, or 6 digits. The REX meter displays leading zeros if the measured energy value has fewer digits than the number for which it is programmed.

Real Energy Indicators. The real energy indicators pulse at a rate proportional to kWh consumption. The center square indicator pulses to indicate pulses of K_h. Each square indicator pulse (turns on and off) indicates 1 K_h. A single transition (on-to-off or off-to-on) indicates ½ K_h.

The arrows toggle for each K_e. This means that a single transition of an arrow pulse (off-to-on or on-to-off) represents K_e (see Table 2-1 for a list of K_e based on meter form). The left arrow indicates energy being received, and the right arrow indicates energy being delivered.

Figure 3-3. Real energy indicators



Power/Energy Unit Identifier. The power/energy unit identifier is used to indicate that the number displayed on the meter's LCD is either a demand or an energy value. When the value in the display quantity is a demand quantity, kW is displayed on the LCD, as shown in Figure 3-4. When the value in the display quantity is an energy quantity, kWh is displayed on the LCD, as shown in Figure 3-5.

Figure 3-4. LCD displaying a sample demand value for TOU rate D

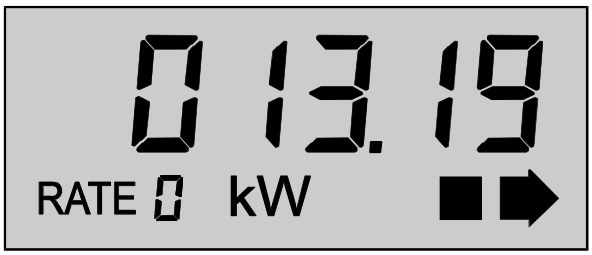
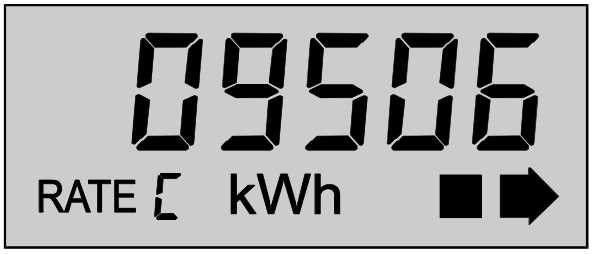


Figure 3-5. LCD displaying a sample 5-digit energy value for TOU rate C



Operating Mode

The normal operation of the REX meter is to process and store metering data while the LCD scrolls through its display list. While operating, the test LED (see Figure 4-1) transmits test pulses proportional to metered energy. Each pulse represents one K_h of energy. See "Optical Pulse Outputs" on page 4-1 for more information.

NOTICE

The LCD test (all 8s) will always display for 2 seconds immediately after power is connected to the REX meter or after a power restoration from a power failure.

After the initial LCD test, the display will then scroll through all programmed displayable items before beginning the display cycle again with the first displayable item.

The meter performs a self test at power restoration and once every 24 hours to make sure it is operating correctly. The self test ensures that the REX meter is functioning properly and that its displayed quantities are accurate. See “Meter Self Test” on page 5-1 for more information on self tests, errors, and statuses.

Resetting the REX Meter

When using the optical port to issue commands to the REX meter, the optical password must be used. The optical password can be specified when the REX meter is ordered. Additionally, the optical password can be changed using Elster Electricity meter support software.

Using the optical port requires removing the meter cover and placing an optical probe onto the optical port that is molded onto the face of the meter’s inner housing.

Demand Reset

A demand reset can be performed in one of two ways:

- issuing a command over the optical port
- issuing a command over the network

When received over the network, the command is typically received before the demand reset date and schedules the demand reset to occur at the next midnight crossing. The meter can also be instructed to perform the demand reset immediately.

Regardless of how the demand was reset, the meter does the following when resetting the demand:

- copies the current billing data to the demand reset data area
- increments the demand reset count
- clears the status flag indicating the demand threshold was exceeded
- resets the maximum demand to zero

Demand reset data area. In all demand reset occurrences, the meter copies the present billing data and stores it in the demand reset data area. This data is referred to as *previous billing data* because its general purpose is to preserve the data as one billing period ends and the next billing period begins. The meter stores only one copy of the previous billing data. The next demand reset overwrites whatever is currently stored as the previous billing data.

Clear Billing Data

This procedure copies the current billing data to the demand reset data area and then zeros the REX meter's current billing register. The demand reset data area copy can be read by MAS. The clear current billing data is performed immediately when the REX meter receives the command over the 900 MHz network.

Clear Data

This procedure is used in the meter shop before installing the meter in the field. Using Metercat support software and an optical probe placed on the optical port, the command does the following:

- clears current and previous billing data
- clears rates and rate overrides
- clears the 32-day calendar
- clears node scan responses
- clears LAN registration and status information
- clears load profiling data
- clears the power fail data save area
- resets kWh DEL and kWh REC lines on the option header
- resets the demand threshold relay
- closes the service control switch, if installed

Reading the REX Meter

The REX meter can be read two ways:

- visually using the LCD
- remotely using the 900 MHz radio and the Elster Electricity AMR system

For more details on the information that can be read on the LCD, see Appendix B, “Display.”

Table 3-1 shows the information that can be obtained from the REX meter using the 900 MHz radio.

Table 3-1. Information read from the REX meter using the radio

Category	Items
Energy	• kWh energy for up to 4 rates of the selected metered quantity • Total kWh received • Total kWh energy of the selected metered quantity (for REX meter firmware releases 2.0 and higher)
Demand	Demand for up to 2 quantities where each quantity may be one of the following: • Total kW • kW for a specific rate In firmware release 1.0, demand data is read in the format of 4.2 (xxxx.xx). In firmware release 2.0 and higher, demand data is read in the format of 3.3 (xxx.xxx).
Counters	• Number of demand resets • Number of power outages Each counter rolls over after 255 events have occurred.
Status flags	• Demand threshold exceeded since last demand reset • Meter is scheduled to perform a demand reset at the next midnight crossing
Error flags	• ROM checksum error • Power fail data save error • General configuration error • Table CRC error • Improper meter engine operation error
Line voltage	per phase rms voltage at the time of the meter read

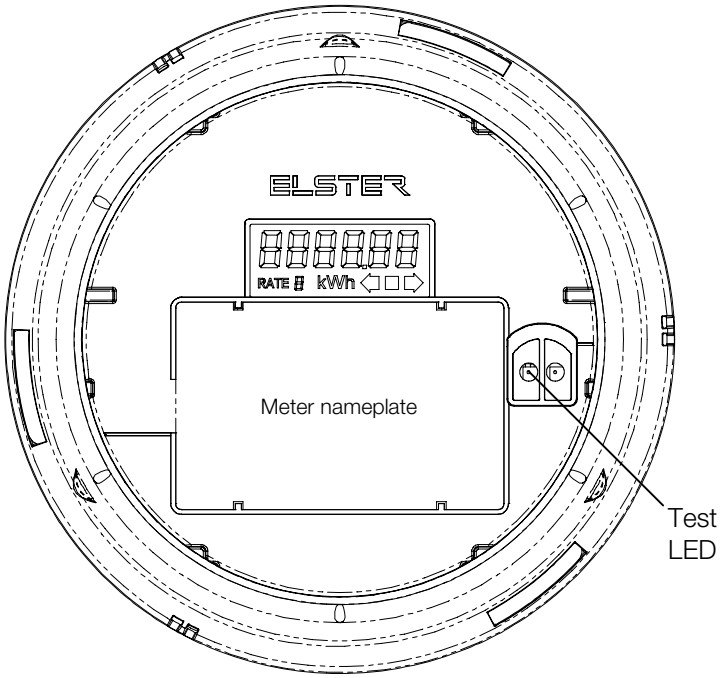
4 Outputs

Optical Pulse Outputs

The REX meter contains a light emitting diode (called the *test LED*) on the face of the meter, as shown in Figure 4-1. The test LED emits a pulse output that can be used to test the REX meter in the shop or in the field without removing the meter from service or breaking the seal. The source for the optical pulse output is kWh of the metered quantity (see “Metered Energy” on page 2-3). The K_h is equal to 1.0 Wh per pulse.

Note: If the metered quantity is kWh net, the test LED output is kWh delivered.

Figure 4-1. Test LED location



5 Testing

Meter Self Test

REX meters are factory calibrated and tested to provide years of trouble-free service. No field calibrations or adjustments are required to ensure accurate operation of the meter. It is normal, however, to test installed REX meters periodically to ensure accurate billing. Testing procedures are the same regardless of the type of meter being tested.

Additionally, the REX meter performs a self test every 24 hours and after any power restoration to determine if it is operating properly. The self test ensures that the REX meter is functioning properly and its displayed quantities are accurate. Any errors encountered will be displayed on the LCD.

The self test incorporates a series of electronic analyses verifying many aspects of the REX meter. After any power restoration, all of the LCD segments will be turned on briefly before beginning the display sequence. The following is a listing of the specific tests performed during a self test:

- verification of the configuration data and checksums
- verification of normal microcontroller function

Error and Status Codes

Error codes indicate a problem exists with the meter that may be affecting billing data. Elster Electricity does not recommend operating the REX meter when it is displaying an error code.

Status codes indicate the present operating conditions; status codes do not indicate a problem.

Error codes. Error codes are displayed on the LCD by an E and a 5-digit code. The code indicates the specific condition affecting the meter operation. See Figure 5-1 for a sample error code displayed on the meter LCD. Table 5-1 describes the different error conditions and their associated codes.

Error codes are appended to the display list automatically when the condition causing the error code exists. Error codes can be displayed in combination (E00101, for example), indicating that more than one error condition has been detected. In most cases, the meter will need to be returned to the factory for repair or replacement.

Figure 5-1. Sample error code displayed on the LCD

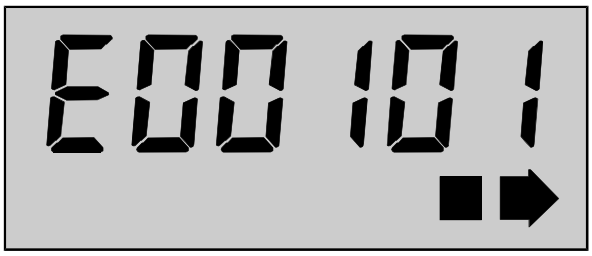


Table 5-1. Error conditions and codes

Condition	Code					
ROM checksum error	E	0	0	0	0	0
Improper meter engine operation error	E	0	0	0	0	1
EEPROM write error	E	0	0	0	1	0
Table CRC error	E	0	0	1	0	0
Configuration error	E	0	1	0	0	0
Power fail data save error	E	1	0	0	0	0

E00000: ROM checksum error. This code indicates a problem with the meter's program. If this code is displayed on the LCD, the REX meter should be returned to the factory for repair or replacement.

E00001: improper meter engine error. This code indicates that the meter engine program may be corrupt or is not executing correctly. This error condition is typically triggered when the microcontroller fails to reinitialize the meter engine. If the code is displayed on the LCD, the REX meter should be returned to the factory for repair or replacement.

E00010: EEPROM write error. This code indicates the meter had a problem storing meter data in its nonvolatile EEPROM. The REX meter should be returned to the factory for repair or replacement.

E00100: table CRC error. This code indicates a possible error in the REX meter's programming. Depending on which area of the meter is affected, billing data may not be reliably accumulated while this error condition exists. The REX meter should be returned to the factory for repair or replacement.

E01000: configuration error. This code indicates a problem with the meter's configuration. If the error continues after reprogramming, the meter should be returned to the factory for repair or replacement.

E10000: power fail data save error. This code indicates that the data saved in nonvolatile EEPROM during a power failure may be invalid. This error will be displayed when power is restored to the meter, and a self check has discovered an error with the EEPROM data after a power fail data save. The REX meter should be returned to the factory for repair or replacement.

Status codes. The REX meter displays status codes as an indication of the operational status of the meter. Unlike error codes, the status code does not indicate a problem with the REX meter. See Figure 5-2 for a sample status code displayed on the meter LCD. Table 5-2 describes the different conditions and their codes.

Status codes are appended to the display list if both of the following items are valid:

- the condition causing the status code exists
- status codes have been selected as a display item

Status codes are indicated on the LCD by an **F** followed by a 5-digit numerical code indicating the specific condition that has occurred. Status codes can be displayed in combination (**F01010**, for example), indicating that one or more status conditions have been detected.

Figure 5-2. Sample status code displayed on the LCD

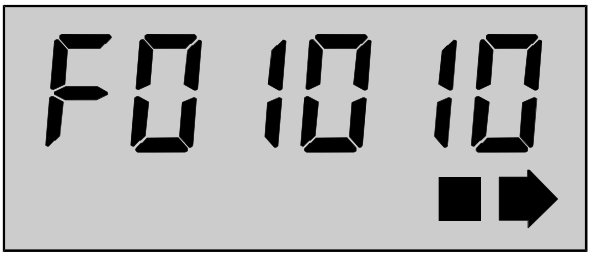


Table 5-2. Status conditions and codes

Condition	Code					
No load side voltage when service control switch is closed[1]	F	1	0	0	0	0
Demand threshold exceeded	F	0	1	0	0	0
Load side voltage present when service control switch is open[1]	F	0	0	1	0	0
Demand reset scheduled	F	0	0	0	1	0
Service control switch open[1]	F	0	0	0	0	1

[1] For more information, see the *REX Meter Service Control Switch* product guide (PG42-1007A or later).

F10000: No load side voltage when service control switch is closed. This code indicates that there is no load side voltage present when the service control switch is supposedly closed. This code can indicate a malfunction with the service control switch. If this status code is displayed, contact Elster Electricity.

F01000: Demand threshold exceeded. This code indicates that the demand has exceeded the programmed demand threshold. It is displayed once the demand threshold has been exceeded and is cleared by a demand reset, clear billing data, or clear data command.

F00100: Load side voltage present when service control switch is open. This code indicates that there is load side voltage present when the service control switch is open. This code can indicate that one of the following conditions exist:

- a malfunction occurred in the service control switch
- the load side is receiving voltage from a different power supply (for example, a gas-powered generator)

If this status code is displayed, follow your utility's procedures for restoring power when power is being supplied to the load side by a different source.

Additionally, the meter can send an exception message to the EnergyAxis System service (MAS) when this condition occurs.

The code remains on the display for as long as the condition exists. When the load side voltage is removed, the code is cleared from the display. The REX meter records that the event occurred since the demand reset, and this latched record can be read from the meter but cannot be displayed on the LCD.

F00010: Demand reset scheduled. This code indicates that the meter has been scheduled to perform a demand reset at the next midnight crossing. This code is displayed when it receives a command to perform a demand reset from the network. The code remains in the display list until the next midnight crossing (the time at which the meter performs a demand reset). See "Demand Reset" on page 3-4 for more information on demand resets.

F00001: Service control switch open

This code indicates that the service control switch is open. The service control switch can be opened when one of the following conditions exist:

- the REX meter has received a command to disconnect power
- the demand threshold was exceeded and the meter is configured to open the switch when demand threshold is exceeded

This code is displayed when the service control switch is opens and is cleared when the service control switch is closed.

Meter Shop Testing

Test Equipment

Meter shops develop testing configurations specific to their own needs. The following is a list of standard test equipment that can be useful when testing a REX meter:

- stable mounting assembly for the REX meter to be temporarily installed to ensure proper orientation and allow the necessary voltage and current connections to be made
- reliable power supply with at least the following characteristics:
  - provides voltage source for energizing the meter at its rated voltage
  - provides unity power factor
  - supplies lagging power factor of 60 ° for 0.5 PF testing
- reference Wh standard
- phantom load device or other loading circuit that has the current capacity ranges suitable for the desired test amperes
- control equipment for counting and timing the pulse output
- precision voltage and current transformers
- voltmeters, ammeters, phase angle meters, power factor meters, and any other measuring equipment
- at least one of the following:
  - an infrared pick-up head for detecting the K_h pulses of the test LED (recommended)
  - a reflective pick-up assembly for detecting the pulse indicators on the meter LCD

Test Setup

Before testing the REX meter, check the nameplate for the following:

- test amperes
- appropriate operating voltage range
- meter K_h

General test setup.

⚠ WARNING

Use only authorized utility procedures and proper test procedures to test metering equipment. Dangerous voltages are present. Equipment damage, personal injury, or death can result if safety precautions are not followed.

The following general procedure should be used to create a test location for the REX meter:

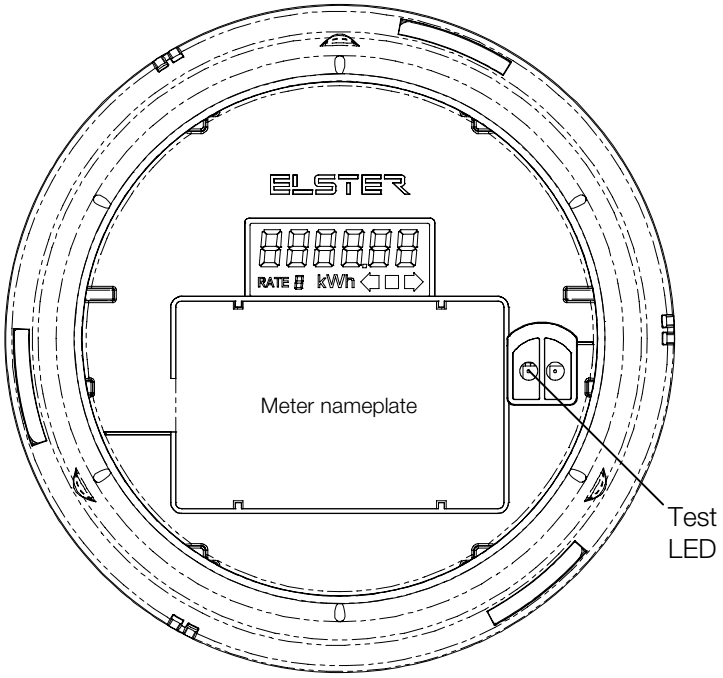
1. Temporarily install the meter in a mounting device that will hold it in the proper operating position.
2. Place the test standard measuring device and precision voltage and current transformers (as required) in series with the meter being tested.

   If voltage transformers are not required, then the voltages of the meter and the standard should be in parallel.
3. Connect the control equipment used for switching the voltage to the test standard device and for counting the standard's output pulses.
4. Apply the rated current and voltage to the terminals of the meter.

After applying the voltages and currents, one of the following should be performed:

- Align the reflective pick-up assembly over the appropriate pulse indicator on the meter LCD, just slightly off of perpendicular with the meter cover. This will minimize reflections from the cover face.
- Position the infrared pick-up head over the test LED to detect the pulse output. Alternatively, the infrared pick-up head could be connected to a test pulse adapter, and that adapter can be positioned over the test LED on the meter (recommended). See Figure 5-3 for the location of the test LED on the REX meter.

Figure 5-3. Location of the test LED pulse output



Formulas Used in Testing

When testing the REX meter, manual calculations may be necessary to verify meter quantities. Table 5-3 shows the naming conventions used to indicate variable quantities in these calculations.

Table 5-3. Variables used in manual calculations

Variable	Represents
CTR	Current transformer ratio
Kh_{meter}	Wh test constant of the meter (watthours per pulse-period)
Kh_{std}	Wh constant of reference standard (watthours per pulse-period)
kW	Power in kilowatts
P	Number of pulses of the square indicator on the LCD or pulses from the test LED, where each flash or pulse is 1 Kh_{meter}.
p	Number of pulses of the reference standard
t	Time (in minutes)
VTR	Voltage transformer ratio

Watthour constant. For transformer rated meters, the K_h value is called the secondary K_h (Kh_{sec}) since the transformer ratios are not included. When instrument transformers are included, then K_h is called the primary K_h (Kh_{pri}) and is calculated with the following formula:

$$Kh_{pri} = Kh_{sec} \times CTR \times VTR$$

A REX meter that is being used with 400:5 current transformers would yield the following Kh_{pri} value:

$$Kh_{pri} = 1.0\ Wh/pulse \times \frac{400}{5} = 80\ Wh/pulse$$

Calculating meter accuracy. Meter accuracy (percentage registration) can be calculated by comparing the meter pulse rate to the standard pulse rate and by using the following formula:

$$Accuracy = 100 \times \frac{(P \times Kh_{meter})}{(p \times Kh_{std})}$$

Determining the power. The approximate power of the meter load in kilowatts during a time period can be obtained by measuring the time it takes to receive multiple test pulses (P). The test pulses can be counted from the test LED or the K_h pulse indicator on the meter LCD. The approximate power may then be calculated using the following formula:

$$kW = \frac{P \times K_h \times 60}{t \times 1000}$$

Note: If the primary load on a transformer rated meter is to be calculated, the kW value obtained from the equation shown above must be multiplied by the CTR and VTR.

Meter Testing

Since no field adjustments are required for the REX meter, meter testing is primarily done to ensure operation within factory specifications. This is normally done by simply checking the meter calibration. For precise test results, meters should be tested at the same temperature as the testing equipment. Ideally, this will be at 72 °F (22 °C).

Using the standard K_h of 1.0 Wh/pulse, the number of pulses per minute that the REX meter produces at rated voltage and test current depends on the meter form, as shown in Table 5-4.

Table 5-4. K_h pulses per minute based on meter form

Form	Test voltage	Test current	K_h pulses per minute
1S	120 V	30 A	60 Wh/minute
2S, 200 A	240 V	30 A	120 Wh/minute
2S, 320 A	240 V	50 A	200 Wh/minute
3S and 4S	120 V	2.5 A	5 Wh/minute
3S and 4S	240 V	2.5 A	10 Wh/minute

Form	Test voltage	Test current	K_h pulses per minute
12S, 200 A	120 V	30 A	120 Wh/minute
12S, 320 A	120 V	50 A	200 Wh/minute

Voltage should be applied to the meter for at least 10 seconds before measuring, allowing the power supply circuitry to stabilize.

Watthour Testing

To maintain compatibility between procedures for testing electronic and electromechanical meters, it is recommended that the REX meter be tested at the standard test points. These test points are described in Table 5-5.

Table 5-5. Watthour test points

Test point	Definition
Full load	100% of the nameplate test amperes, test voltage, and rated frequency at unity power factor
Light load	10% of the nameplate test amperes, test voltage, and rated frequency at unity power factory
Lagging power factor	100% of the nameplate test amperes, test voltage, and rated frequency at 0.5 lagging power factor (current lagging voltage by 60 ° phase angle)

Whereas electromechanical meters have adjustments to calibrate the meter at all three test points, the REX meter is calibrated in the factory.

Elster Electricity provides the factory calibration data in a report.

To test the REX meter at the standard test points, the following procedure should be used:

1. Verify the meter calibration at full load using the formula for calculating meter accuracy. See “Calculating meter accuracy” on page 5-8 to determine the percent accuracy.
2. Verify the meter calibration at light load using the same formula in step 1.
3. Verify the calibration of the meter at full load with lagging power factor using the same formula in step 1.
4. Check for creeping at the rated voltage level with no current. The meter must produce one full K_h pulse within 10 minutes to be considered creeping, with creep being defined as continuous output pulses from the meter with normal operating voltage but the load terminals open circuited.

Installation Site Testing

Since no adjustments are required for the REX meter, the main reason to test a meter is to make sure it is operating within factory specifications. Typically, all that needs to be done is to check the meter calibration.

Accuracy Tests

Accuracy tests confirm that the kWh readings meet calibration standards. The method of manually counting pulses requires a stopwatch.

To count pulses manually, the following procedure should be used:

1. Place a known load on the meter.
2. Start the stopwatch when the LCD K_h pulse indicator turns off and start counting the number of pulses made by the indicator. Be sure to count each time the K_h pulse indicator (square indicator) turns off.
3. After a sufficient time to account for various response times, stop the stopwatch when the LCD K_h pulse indicator turns off. Record both the time on the stopwatch and the number of pulses counted.
4. Remove the load from the meter.
5. Calculate the expected number of pulses using the following formula:

$$calculated\ pulse\ value = \frac{kW \times t}{K_h} \times \frac{1000}{60}$$

Note: Time is measured in minutes.

6. Verify that the calculated pulse value matches the observed pulse count. This indicates that the meter is performing accurately.
7. Calculate the kWh using this formula:

$$calculated\ kWh = \frac{K_h \times calculated\ pulse\ value}{1000}$$

NOTICE

The calculated kWh may not be exactly equal to the observed kWh. The time the meter was energized with the load applied and the time between starting and stopping the stopwatch can vary the calculations. This is normal and does not necessarily reflect inaccurate measurements.

8. Verify that the calculated kWh is equal to the change in kWh reported on the REX LCD. This indicates that the meter is calculating kWh accurately.

6 Installation and Removal

Preliminary Inspection

⚠ WARNING

Circuit-closing devices must be used on current transformer secondaries. This applies to Form 3S and 4S meters. Dangerous currents and voltages are present if secondaries are open-circuited. Equipment damage, personal injury, or death can result if circuit-closing devices are not used.

The REX meter is calibrated and tested at the factory and is ready for installation. Follow proper installation and removal procedures for personal safety and protection of the meter.

Before installing and applying power to the REX meter, Elster Electricity recommends a quick inspection of the meter. Check for any of the following items:

- missing or broken parts
- missing or broken wiring
- bent or cracked components
- evidence of overheating

Also, check the nameplate to make sure the meter is appropriate for the service.

Physical damage to the outside of the REX meter could indicate potential electronic damage to the inside of the meter. Do not connect power to a meter that is suspected of having internal damage. Contact your local Elster Electricity representative if you suspect your meter may be damaged.

Placing the Meter into Service

See Appendix D, “Wiring Diagrams,” for illustrations of both internal and connection wiring diagrams.

⚠ CAUTION

Make sure to install the correct meter for the service type, maximum current, and capacity required. Installing mismatched meters can damage equipment. Always verify that the maximum meter voltage and current ratings are equal to or greater than the maximum service voltage and current.

NOTICE

If a REX meter is installed in a meter shop and a collector is powered at the same time, the REX meter may have registered to the collector. Before removing the REX meter from the meter shop, unregister the REX meter from the collector (see “Clear Data” on page 3-5).

Installing the REX Meter

⚠ WARNING

Use authorized utility procedures to install and service metering equipment. Dangerous voltages are present. Equipment damage, personal injury, or death can result if safety precautions are not followed.

To install the REX meter effectively and safely, follow this procedure:

1. Align the meter blades and meter base socket jaws to the service socket.
2. Grasp each meter side and push it into the socket until the meter is firmly in place. If the meter resists sliding into place, rock the meter up and down while pushing forward.
3. Once firmly in place, power can be applied to the meter.

Initial Setup

After installing and powering the REX meter, verify the following:

- If there is a load, the K_h pulse indicator on the LCD is flashing, and the arrows indicate the correct energy flow direction.
- Required meter seals are in place.
- Any information (such as location of the meter) has been recorded.

If the meter is not working correctly after it has been installed, then check for improper installation or wiring. If the installation and wiring are correct, then check these other areas:

- the meter installation matches the meter nameplate
- the correct type of REX meter is installed in the existing service
- no evidence of mechanical or electrical damage to either the meter or the installation location
- the service voltage falls within the operating range as indicated on the nameplate
- the seals are not broken

NOTICE

A broken seal could be an indication of tampering with the REX meter installation.

Removing the Meter from Service

Use caution when removing the REX meter from service.

⚠ WARNING

Use authorized utility procedures to remove metering equipment. Dangerous voltages are present, equipment damage, personal injury, or death can result if safety procedures are not followed.

NOTICE

When the meter is removed from the field, the meter registration status should be cleared before installing the meter in a new location (see “Clear Data” on page 3-5).

Removing the REX Meter

⚠ WARNING

Circuit-closing devices must be used on current transformer secondaries. This applies to Form 3S and 4S meters. Dangerous currents and voltages are present if secondaries are open-circuited. Equipment damage, personal injury, or death can result if circuit-closing devices are not used.

If it becomes necessary to remove a REX meter from service, use the following procedure:

1. Before disconnecting the meter, make sure that the existing meter data has been read from the display.
2. Remove the voltage and disconnect the current circuits.
3. Break the seal holding the REX meter in place.
4. Remove the seal and collar (or other security device).
5. Grasp each side of the meter and gently pull it from the socket. If the meter resists removal, gently rock the meter up and down while pulling back.

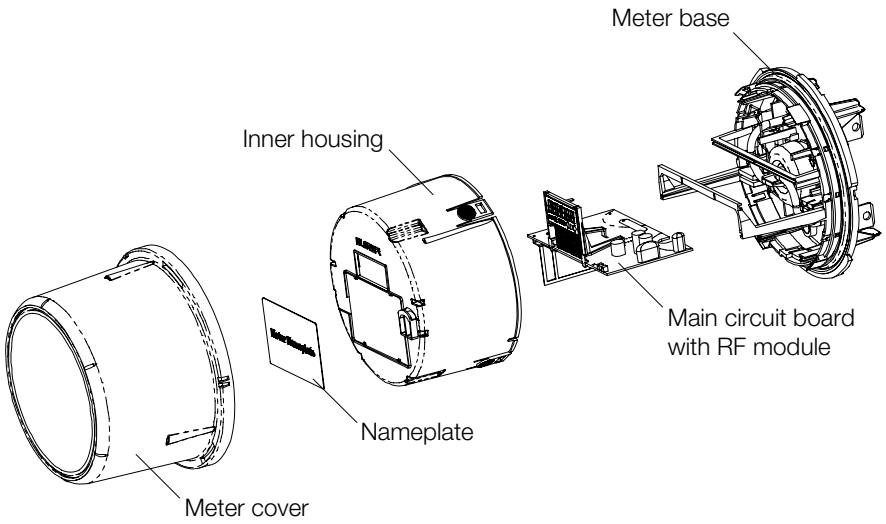
Disassembling and Reassembling the Meter

The REX meter can be disassembled. Figure 6-1 shows a disassembled meter and the various components.

⚠ WARNING

Do not disassemble the meter or remove the electronic components with power present. Doing so could result in exposure to dangerous voltages resulting in equipment damage, personal injury, or death.

Figure 6-1. Disassembled REX meter



Removing the Meter Cover

To disassemble the REX meter, first remove the meter cover. To remove the meter cover:

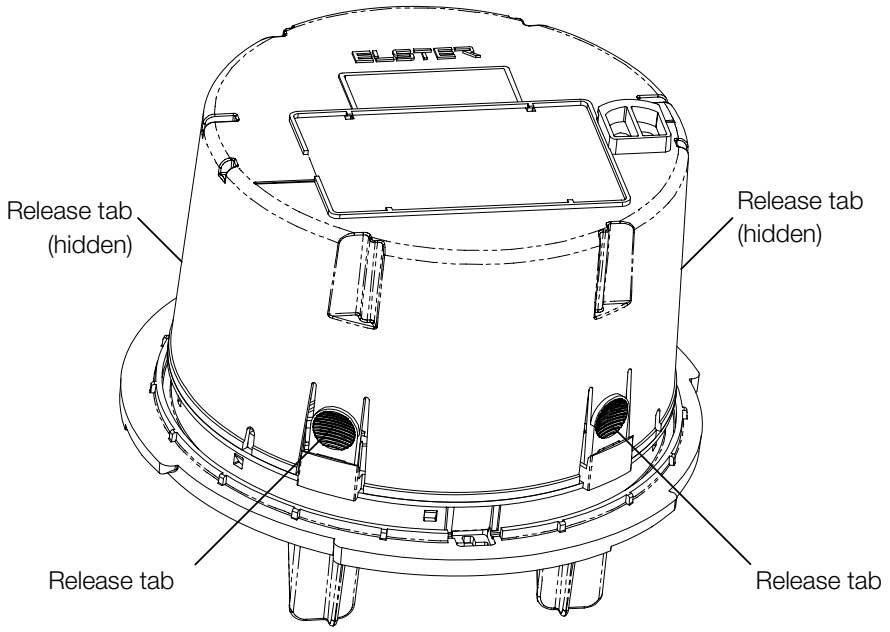
1. Remove the T-seal or wire seal from the back of the meter.
2. While holding the bottom of the meter base, grasp the front of the meter cover and turn counterclockwise until it stops.
3. Pull the meter cover to reveal the inner housing.

Removing the Inner Housing

The meter cover must be off before the inner housing can be removed. To remove the inner housing:

1. Place the meter on a stable, flat surface.
2. While pressing the four release tabs simultaneously (see Figure 6-2), lift the inner housing to reveal the electronic components and circuit board support frame.

Figure 6-2. Release tabs

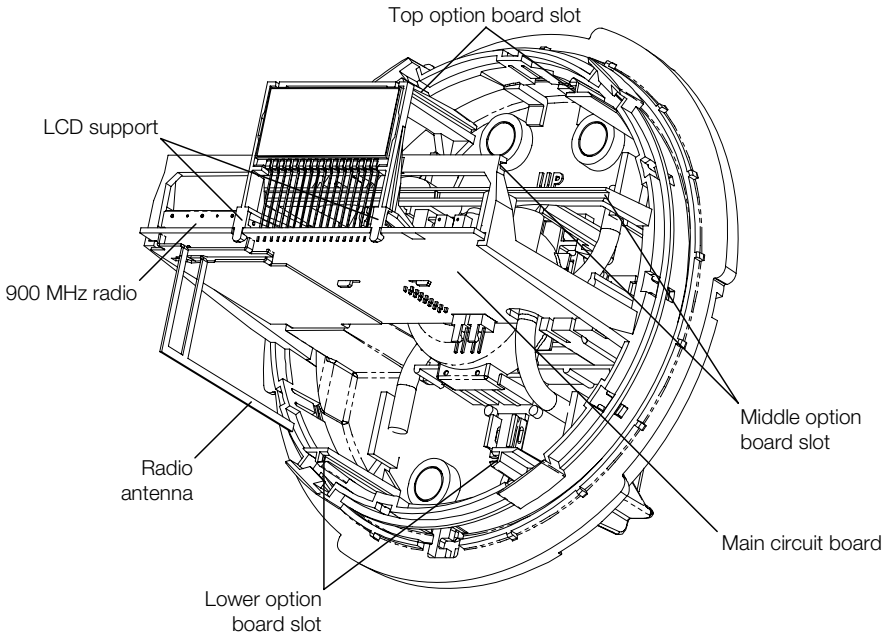


Removing the Electronic Components

The electronic components consist of the following parts:

- main circuit board
- any installed option boards

Figure 6-3. Electronic components and connectors



Removing the Main Circuit Board.

NOTICE

Care must be taken to prevent electrostatic discharge damage when handling any of the electronic assemblies.

The inner housing must be removed to reach the main circuit board. To remove the electronic assembly:

1. Disconnect the current sensor cable (not shown in Figure 6-3) from the main circuit board.
2. If an option board is installed, disconnect the ribbon connector from the main circuit board (not shown in Figure 6-3).
3. Facing the meter LCD, pull the main circuit board towards you and away from the circuit board support frame.

Reassembling the Meter

⚠ CAUTION

The REX meter contains sensitive electronic equipment. Use caution when applying pressure on the main circuit board or any option boards that may be installed. If the main circuit board or option board does not easily snap into place, remove the main circuit board or option board and try again. Applying the incorrect amount of pressure can result in a damaged or broken main circuit board or option board.

The REX meter can be reassembled by reversing the instructions for disassembling the meter as described above.

When reassembling the main circuit board, be sure to push on the LCD support (see Figure 6-3). Pushing on the main circuit board in other locations may result in damage to the electronic equipment on the main circuit board.

A Glossary

billing data The measured quantities recorded and stored by the meter for use in billing the consumer. May also be referred to as *tariff data*.

del see *delivered*.

delivered Used to specify the energy delivered (provided) to an electric service.

demand The average power computed over a specific time.

demand interval The time period over which demand is calculated. In the REX meter, the demand interval must be 15, 30, or 60 minutes.

demand reset The act of resetting the present maximum demand to zero.

demand threshold The present value of demand that, when reached, sets a warning flag.

display quantity Any value available for display on the LCD.

EEPROM Acronym for *electrically erasable programmable read only memory*. This memory retains all information even when electric power is removed from the circuit.

energy Power measured over time.

error code display The method by which the meter displays an error message which consists of E and numeric codes. Error codes indicate that a condition exists or has occurred that may be affecting billing data.

IC see *integrated circuit*.

integrated circuit Generally used to reference the meter circuit used in the REX meter for per phase voltage and current sampling plus energy measurements.

K_e The smallest discrete amount of energy available within the meter. It is the value of a single pulse used between the meter engine and the microcontroller.

K_h A meter constant representing the watthours per output pulse on the optical port or one flash of the LCD K_h indicator. Historically, K_h represents the energy equivalent to one revolution of an electromechanical meter.

LCD see *liquid crystal display*.

LCD test A display showing 8 in all the display areas and all identifiers on the LCD turned on. This confirms that all LCD segments are operating properly.

LP see *load profiling*.

line frequency The frequency of the AC voltage. Depending upon the country or region, the line frequency is either 50 Hz or 60 Hz.

liquid crystal display The LCD displays metered quantities and other information about the REX meter. Display quantities are factory programmable.

load profiling Load profiling records energy usage per a specific time interval while the meter is energized.

maximum demand The highest demand calculated during any demand interval over a billing period.

meter base The part of the meter containing all of the following components:

- base housing
- current sensing transformer
- current and voltage blades
- hanger

microcontroller A single IC that contains the following components:

- main processor
- RAM
- ROM
- clock
- I/O control unit

optical port A photo-transistor and an test LED on the face of the meter that is used to transfer data between a computer and the meter via pulses of light.

previous billing data A copy of the billing data stored at the time of the most recent demand reset.

rec see *received*.

received Used to specify the energy received by the utility at an electric service.

tariff data See *billing data*.

TOU see *time-of-use*.

timekeeping The ability of the meter to keep a real time clock, including date and time. The REX meter obtains time from the network.

time-of-use A billing rate that records energy usage and demand data in separate registers to indicate the time of day that the energy was consumed.

B Display

Display Format

The REX meter uses a 6-digit LCD located on the front of the meter. As shown in Figure B-1, the LCD is divided into different display regions. See “LCD” on page 3-1 for more detailed descriptions of the LCD and its display regions.

Figure B-1. LCD regions

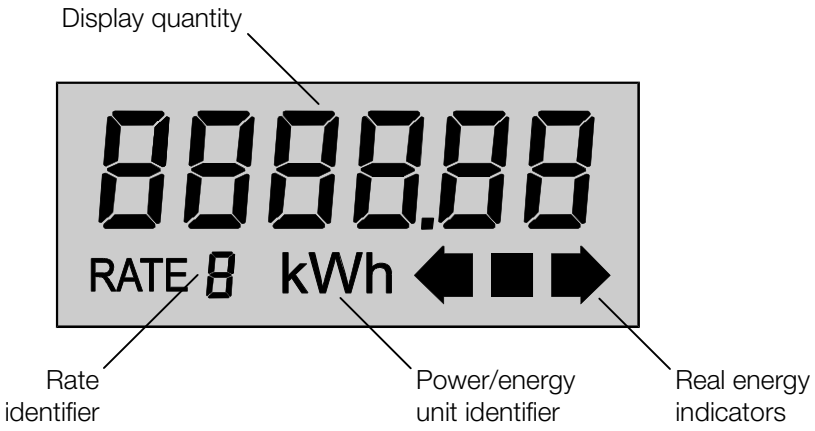


Table B-1. LCD regions

Item	Description
Display quantity	Shows the metered quantity or other displayable information. Four to six digits can be used to display kWh data. These digits are also used to report the following: • energy • demand • per phase voltage present indicators (Form 12S only) • error codes • status codes • time • network registration status
Rate identifier	When lit, indicates the appropriate TOU rate for the quantity displayed on the LCD or the current rate in conjunction with the current time.
Power/energy unit identifier	When lit, indicates the unit of measurement for the quantity displayed on the LCD.

Item	Description
Real energy indicators	Arrows indicate the direction of energy flow; square (K_h pulse indicator) indicates the proportional rate of consumption.

Display Items

The same hold time is used for all items in the display list.

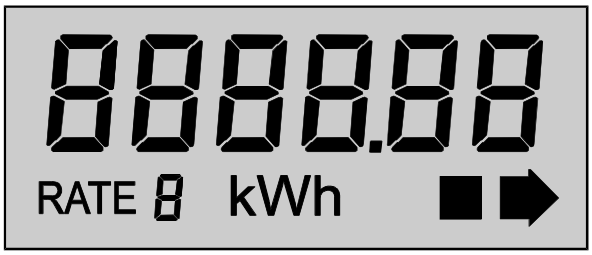
Displayable items can be grouped into the following categories:

- LCD test
- error codes and status codes
- current time and rate
- metered quantities
- received energy quantity
- per phase voltage present indication (Form 12S only)
- network registration status

LCD Test

When selected as a display item, the REX meter tests the display segments by lighting all the segments on the LCD as shown in Figure B-2. During the LCD test, the real energy arrows and the K_h pulse indicator operate normally and are not affected by the LCD test.

Figure B-2. LCD test



Note: After power restoration, the LCD test always displays all segments (including the real energy arrows and square indicator) even if the LCD test is not selected as a displayable item.

Error Codes and Status Codes

Error codes are appended to the display list automatically when the condition exists. Status codes are appended to the display list if both of the following items are valid:

- the condition causing the status code exists
- status codes have been selected as a display item

Error and status codes are removed from the display list automatically when the condition clears. See “Error and Status Codes” on page 5-1 for more information.

Current Time and Rate

When selected as a display item, the REX meter displays the current time and the current rate as shown in Figure B-3. Note that the time is displayed in 24-hour format For example, 8:26 AM is displayed as 08.26, and 8:26 PM is displayed as 20.26.

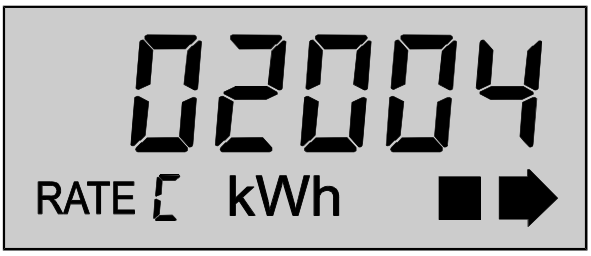
Figure B-3. Sample display of the REX meter’s current time and rate

Metered Quantities

The REX meter can display both energy and demand values.

Energy Quantities. Energy values may be displayed with 4, 5, or 6 digits. If the quantity requires fewer digits, leading zeros are used (see Figure B-4). If TOU metering is being used, the meter can display the energy quantity for each rate. The rate identifier shows the appropriate rate for each quantity.

Figure B-4. Sample 5-digit energy value for TOU rate C



In addition, the REX meter can display the total energy value (see Figure B-5).

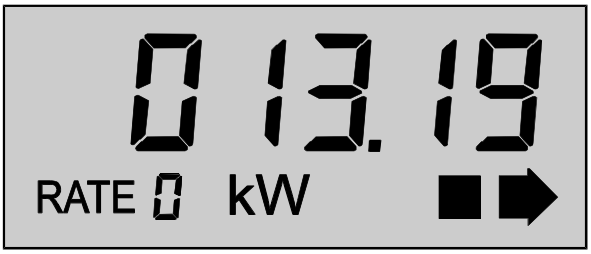
Figure B-5. Sample 5-digit total energy value

Demand Quantities. The REX meter can display two demand values; where each demand can be total kW or kW for a specific rate. The following are valid demand configurations:

- 1 total demand value and the demand for 1 rate (for example, total demand and Rate C demand).
- 2 rates (for example, Rate A demand and Rate C demand). The rate identifier shows the appropriate rate for each quantity.

Demand values are always displayed in the format of nnn.nn (see Figure B-6) regardless of how many numbers are used to display energy values.

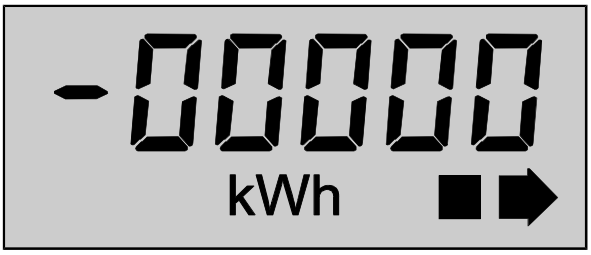
Figure B-6. Sample demand quantity for TOU rate D



Received Energy Quantity

In addition to displaying the selected metered quantity, the REX meter can also display the total received energy value. The received energy quantity can use up to 5 digits. The received energy quantity is always preceded by a minus sign, as shown in Figure B-7.

Figure B-7. Sample 5-digit received energy quantity



Per Phase Voltage Present Indicators

For Form 12S meters, the display can indicate the status of phase A and phase C voltages.

- If phase A and phase C voltages are at or above 50 V, the display will indicate that both voltages are present (see Figure B-8).
- If the phase C voltage is not present (phase C is less than 50 V), the display will indicate that only phase A voltage is present (see Figure B-9).
- If phase A and phase C voltages are below 50 V, the display will indicate that neither voltage is present (see Figure B-10).

Figure B-8. Both phase A and phase C voltages are present

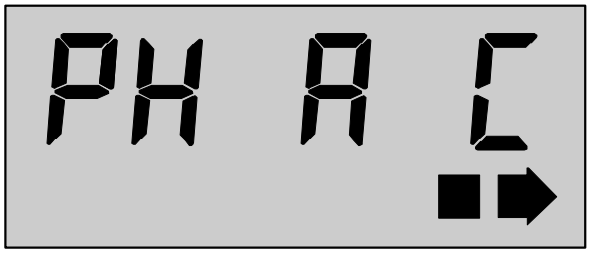


Figure B-9. Phase C voltage is not present (phase C < 50 V)

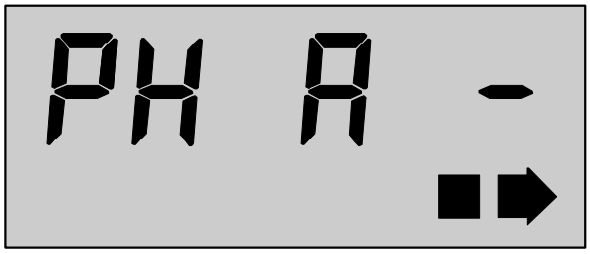
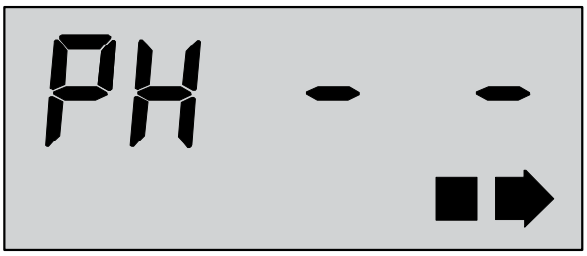


Figure B-10. Neither phase A nor phase C voltages are present (phase A and phase C < 50 V)



Network Registration Status

When selected as a display item, the REX meter displays the following information about its network registration:

- the REX meter is registered with a collector
- the number of communication hops between the REX meter and the collector
- the four least significant digits of the collector's LAN ID

See Figure B-11 for an example of the network registration status display.

Note: If the network registration status is selected as a display item but the REX meter is not registered with the collector, then the network registration status display item is skipped and is not shown on the LCD.

Figure B-11. Sample network registration status sample display

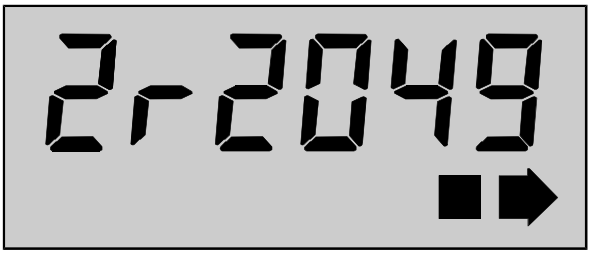


Table B-2. Network registration status sample display description

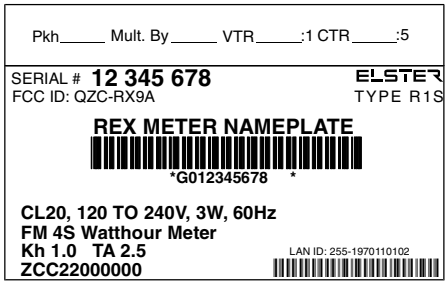
Code	Description
2	The number of communication “hops” between the REX meter and the collector. In the example, the 2 indicates that the REX meter communicates with the collector through one other REX meter.
r	Indicates that the REX meter is registered with a collector.
2049	The last 4 digits of the collector’s LAN ID. • In REX meter release 1.0, the last 4 digits are in hexadecimal format. • In REX meter releases 2.0 and higner, the last 4 digits are in decimal format.

C Nameplate Information

REX Meter Nameplate

The REX meter nameplate provides important information about the meter. Figure C-1 is an illustration of the standard REX meter nameplate for transformer rated meters.

Figure C-1. Sample standard nameplate (transformer rated)



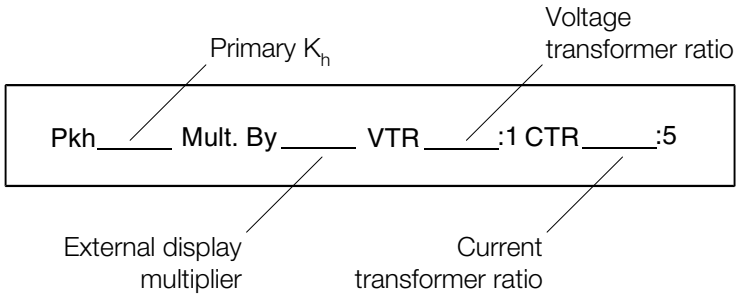
The following figures identify the different areas of the nameplate along with the information they convey.

Transformer Rated Meter Information

Figure C-2 shows the information application to transformer rated meters. The nameplate displays the multipliers for the meter.

Note: This section of the nameplate is not present for self-contained meters.

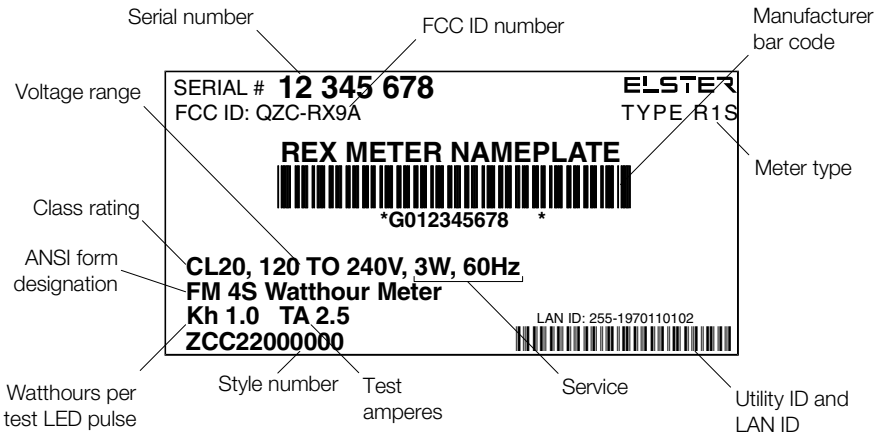
Figure C-2. Nameplate information for transformer rated meters



Lower Portion

The lower portion of the nameplate displays the serial number, barcode, form factor, and meter constants for the meter along with other information as shown in Figure C-3.

Figure C-3. Sample lower portion of standard transformer rated nameplate (self contained is similar)

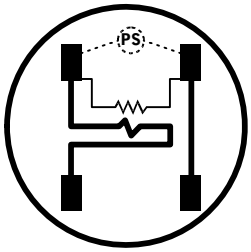


The utility ID is the same for all meters that are part of the same network. The LAN ID is unique for each meter.

D Wiring Diagrams

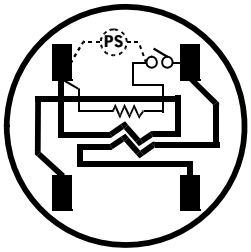
Internal Wiring Diagrams

Form 1S



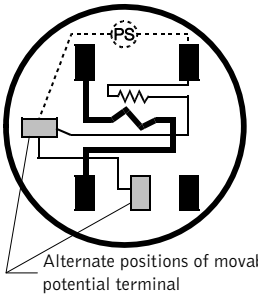
2-wire
Self contained

Form 2S



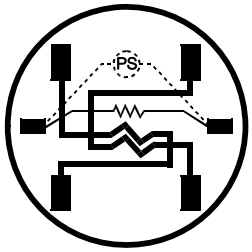
3-wire
Self contained

Form 3S



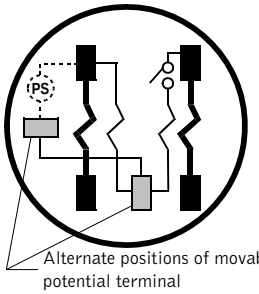
2- or 3-wire
Transformer-rated

Form 4S



3-wire
Transformer-rated

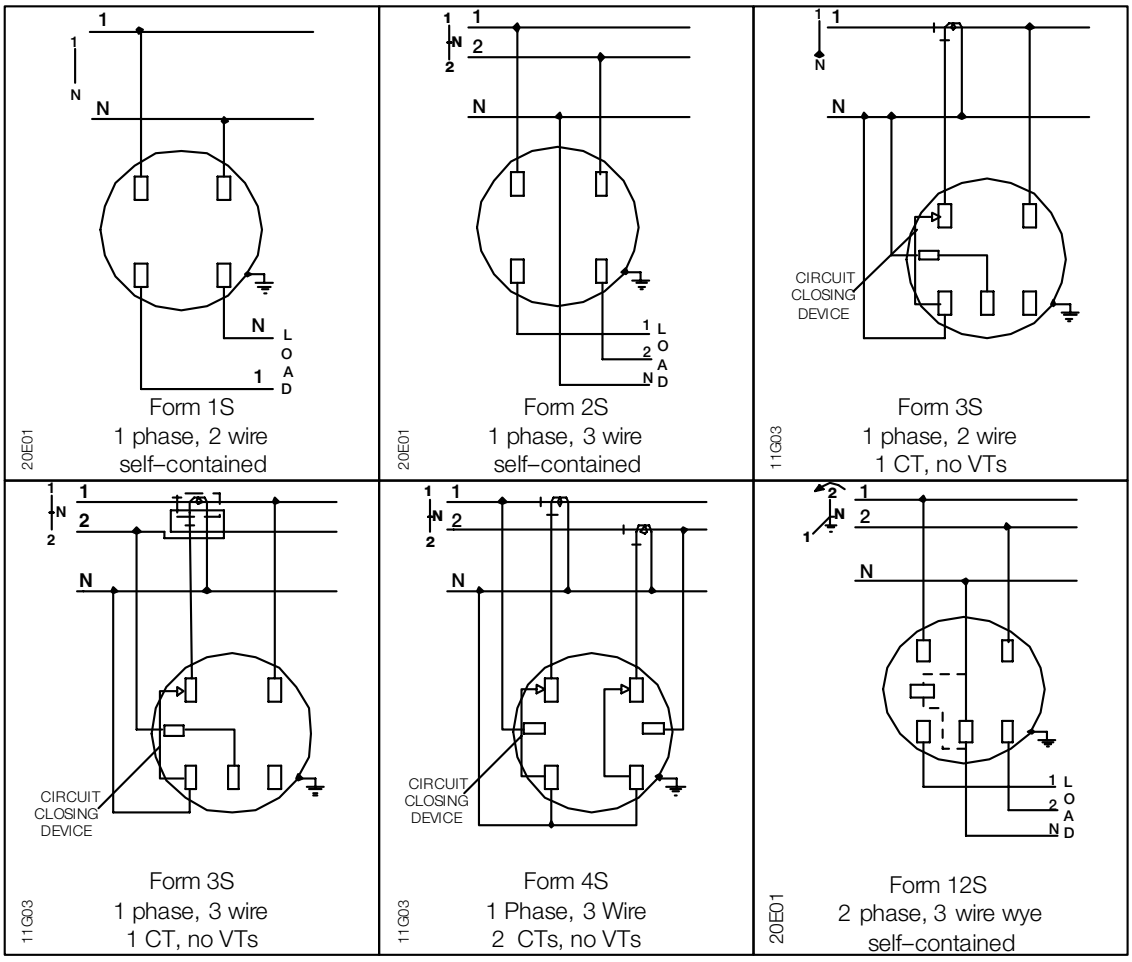
Form 12S



09F05

2-wire
Self contained

Installation Wiring Diagrams



E Technical Specifications

Absolute Maximums

Voltage	288 VAC (Forms 1S, 2S, 3S, 4S)	144 VAC (Form 12S)
Surge voltage withstand	*Test Performed*	*Results*
	ANSI C37.90.1 Oscillatory	2.5 kV, 2500 strikes
	Fast transient	5 kV, 2500 strikes
	ANSI 62.41	6 kV @ 1.2/50 µs, 10 strikes
	IEC 61000-4-4	4 kV, 2.5 kHz repetitive burst for 1 minute
	ANSI C12.16 dielectric	2.5 kV, 60 Hz for 1 minute
Current	Continuous at 100 % of the meter maximum current	
	Temporary (1 second) at 200 % of meter maximum current	

Operating Ranges

Voltage	*Nameplate nominal range*	*Operating range*
Form 1S and Form 12S	120 V	96 V to 144 V
Form 2S	240 V	192 V to 288 V
Form 3S and Form 4S	120 V to 240 V	96 V to 288 V
Current	0 to maximum amperes	
Frequency	Nominal 60 Hz ± 5 %	
Temperature range	-40 °C to +85 °C inside meter cover	
Humidity range	0 % to 100 % noncondensing	

Operating Characteristics

Power supply burden	Less than 4 W
Current burden	0.1 milliohms typical at +25 °C
Voltage burden	0.907 W at 120 V
	1.138 W at 240 V
Accuracy	The REX meter meets ANSI C12.20 0.5 % accuracy class.

General Performance Characteristics

Starting current	*Class 20*	*Class 200*	*Class 320*
Form 1S and Form 3S	10 mA	100 mA	160 mA
Form 2S and Form 4S	5 mA	50 mA	80 mA
Form 12S	N/A	50 mA	50 mA
Startup delay	Less than 2 seconds from power application to pulse accumulation		
Creep 0.000 A (no current)	No more than 1 pulse measured per quantity, conforming to ANSI C12.1 requirements.		
Primary time base	Relative time is maintained by a crystal; real time is provided via the 900 MHz network.		

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Preliminary

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