Landis+Gyr

FOCUS kWh Solid-State Meter

Technical Manual

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Document History

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Purpose

This technical manual contains the following information:

- Installation instructions, construction, characteristics and maintenance information
- Performance and technical data

Target Group

The contents of this technical manual are intended for technically qualified personnel of energy supply companies responsible for the system planning, installation, commissioning, operation, maintenance, decommissioning and disposal of the meters.

Conditions

This technical manual is for personnel who are qualified and have received instructions in basic electrical principles, including safety procedures for installation of energy meters.

Safety Warnings

The following safety precautions must be observed during all phases of operation, service, and repair of this device. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and the intended use of the metering instrument. Landis+Gyr, Inc. assumes no liability for the customer's failure to comply with these requirements.

Warning: Any work on, or near, energized meters, meter sockets, or other metering equipment can present a danger of electrical shock. All work on this product should be performed only by qualified electricians and metering specialists in accordance with local utility safety practices, utility requirements, and procedures outlined in Chapter 14 of The Handbook for Electricity Metering (9th Edition). The information contained within this manual is intended to be an aid to qualified metering personnel. It is not intended to replace the extensive training necessary to handle metering equipment in a safe manner.

Use care when servicing with the power on.

The ***FOCUS*** does not have an auto-ranging power supply. Care should be taken to ensure that meters are installed correctly, matching meter form and voltage with the installation.

FCC Information:

This device complies with part 15 of the FCC rules. 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.

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

Do not change the original antenna without pre-approval from the original meter manufacturer. This will violate the FCC regulations of using the radio.

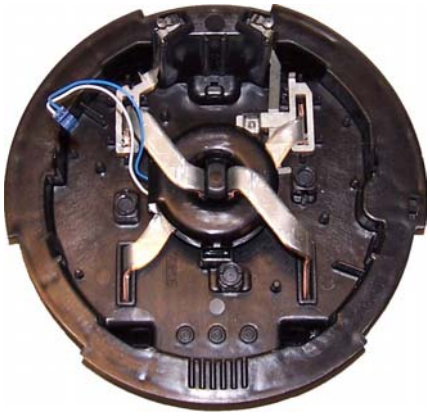
Note:

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 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:

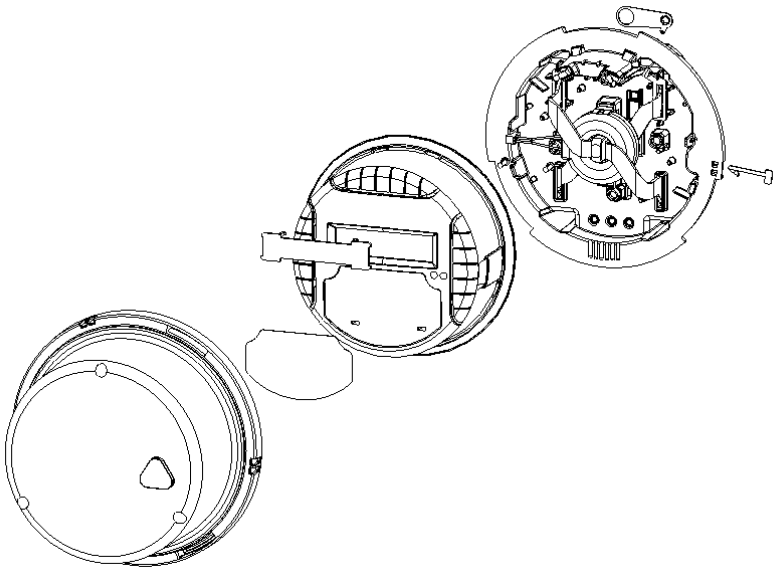
- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult Landis+Gyr or an authorized technician for help.

1. Introduction to the *FOCUS*

The ***FOCUS*** meter was designed to be a low-cost, solid-state, kWh-only meter as an alternative metering and AMR platform with attributes that make it more accurate and stable over time.



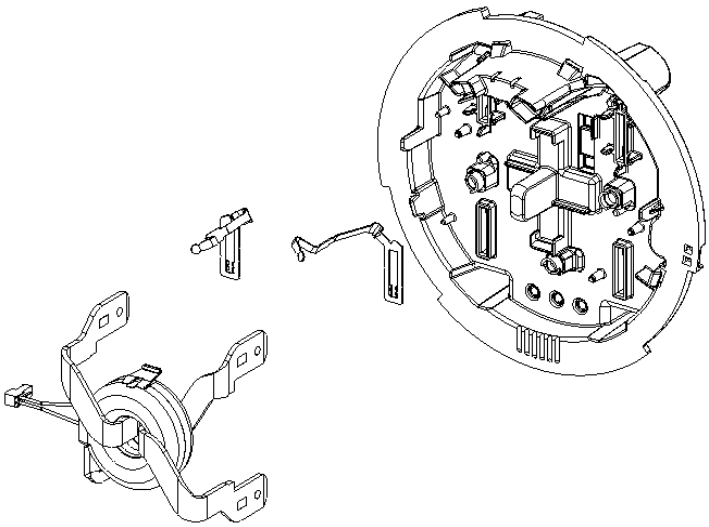
1.1. Meter Assembly



Meter Assembly Exploded View

The Focus meter is composed of three basic sub-assemblies: The baseplate assembly, the electronics housing assembly and the meter cover. The electronics housing assembly snaps onto the baseplate and creates a weatherproof seal when the cover is installed. The cover includes an emboss to align an optical probe for register configuration purposes.

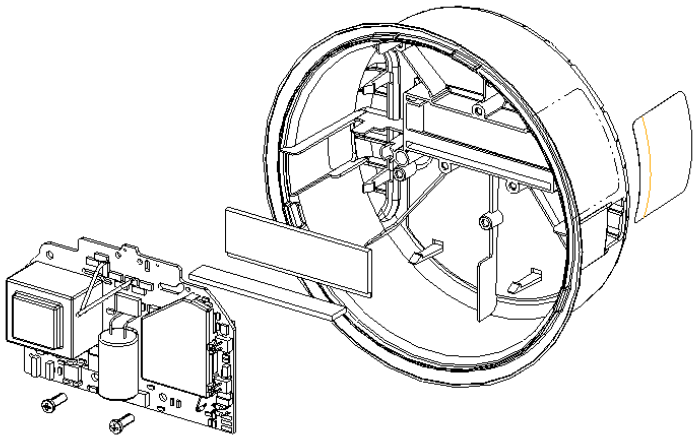
1.2. Baseplate Assembly



Baseplate Assembly Exploded View

The baseplate module is constructed of highly durable thermoplastics. Inside the baseplate is the current transformer and current carrying parts…

1.3. Electronic Housing Assembly



Electronics Housing Exploded View

The Electronics Housing contains the measurement board and any optional electronics assemblies such as option boards or communication devices. The Electronics Housing assembly snaps onto the baseplate and can be removed and reinstalled many times without damage to the meter.

2. The *FOCUS* Meter Family

The ***FOCUS*** provides more than just reliability and accurate billing data. The ***FOCUS*** is designed to be a building block for a complete metering system. Each ***FOCUS*** has built-in compatibility for a variety of AMR packages. Any of these can be factory installed or conveniently added to the meter in the field.

2.1. Register Types

The Focus kWh is an active energy "kWh-only" meter. It is capable of measuring and displaying kilowatt-hours delivered to and received from a load.

The energy accumulation register has capacity to display 999999 kWh for all meter forms without overflowing.

The meter supports four energy metric displays:

- +kWh (energy delivered to the load)
- -kWh (energy received from the load)
- NET kWh (the net energy consumed by the load)
- ADDED kWh (the total energy produced in the electrical service/load system)

Figure 1 – *KWH FOCUS*

3. Meter Assembly

3.1. Removal of the Electronics Housing from the Baseplate

To remove the Electronics Housing from the baseplate, set meter on a solid surface and place hands around the bottom of the gray housing where it meets with the baseplate. With thumbs in the 6 o'clock position, squeeze firmly with thumbs using considerable force, to flex the housing and release the bottom two fasteners located at the 4 o'clock and 8 o'clock positions. It may be necessary to alternate pressure by thumbs until both fasteners are released. Once these two fasteners are released, push gently toward the 12 o'clock position to release the top two fasteners. The housing can be lifted off and the blue and white power connector can be unplugged.

3.2. Installation of the Electronics Housing onto the Baseplate

Before installing the Electronics Module onto the Baseplate, make sure that the Electronics Module and Baseplate are free of foreign debris and that any cables are properly routed to prevent interference with the meter's electrical connectors. Attach blue and white power connector. Line up the 4 slots in the gray electronics housing with the 4 mating snap-on protrusions located on the black baseplate. Once aligned, apply gentle force to snap the two assemblies together.

3.3. Sealing the Meter

The ***FOCUS*** meter comes standard with T-seal provision.

Whether to seal the meter or not is left to the user's discretion.

If sealing is desired, T-seals can be installed through the ***FOCUS*** cover and baseplate assembly.

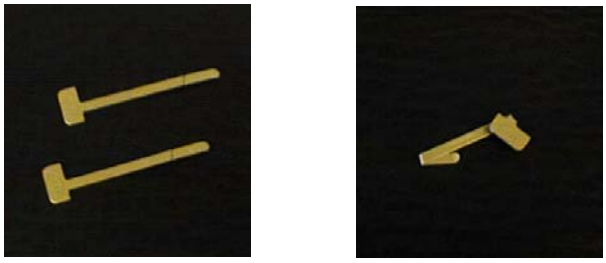


Figure 2 – Optional T-Seal

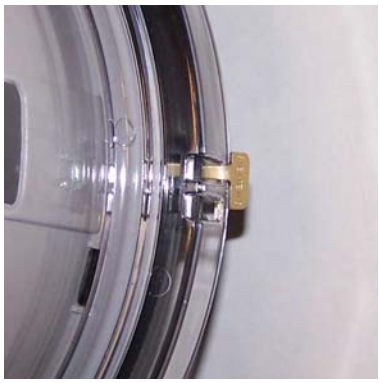


Figure 3 – T-Seal Installed

Each T-seal is installed by fully inserting it through the cover and through the baseplate assembly. Bend the T-seal tab to prevent extraction. Next, bend the T-seal over so that it resides within the baseplate assembly pocket. Finally, bend the top of the T-seal over so that it is flush against the cover.

4. Application Information

4.1. Available Meter Forms

The ***FOCUS*** is available in the following meter forms:

4.1.1. S-Base

- Transformer rated: Class 10 & 20: 3S, 4S
- Self-contained: class 100: 1S
- Self-contained: class 200: 2S, 12S and 25S (Network)
- Self-contained: class 320: 2SE

4.1.2. K-Base

- Self-contained: class 480: 2K

4.2. Meter Form Schematic Diagrams

Self-contained meter forms

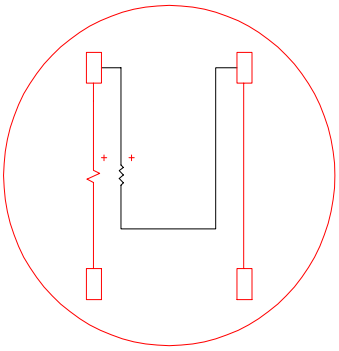


Figure 4 – Form 1S

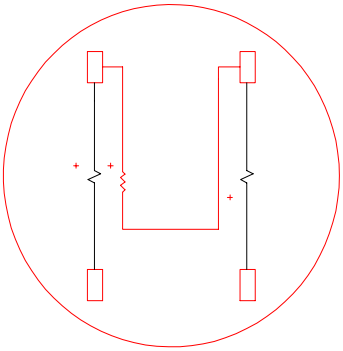


Figure 5 – Form 2S, 2SE

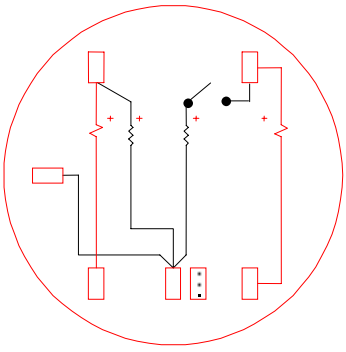


Figure 6 – Form 12S (Network)

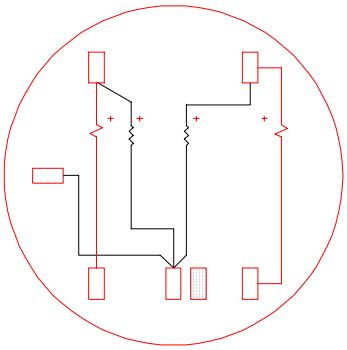


Figure 7 – Form 25S (Network)

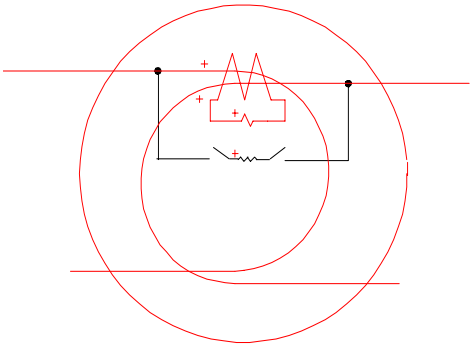


Figure 8 – Form 2K

Transformer Rated Meter Forms

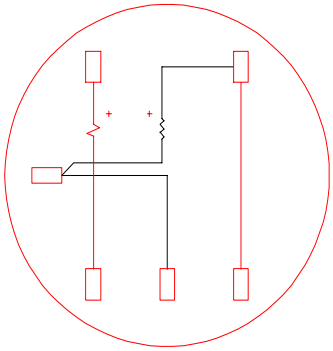


Figure 9 – Form 3S

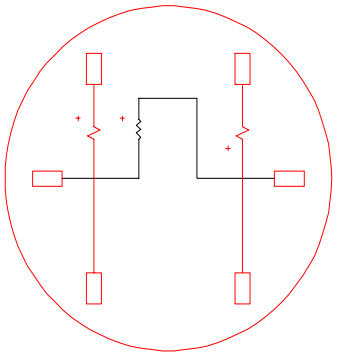


Figure 10 – Form 4S

The form 3S features a movable fifth terminal that can be located in the 3 o'clock or 6 o'clock centered locations. Forms 12S and 25S (Network) feature a movable fifth terminal that can be located in the 3 o'clock, 6 o'clock centered, or 6 o'clock offset locations.

4.3. Installation Procedures

1). Remove meter from the box, checking for any cables or connectors that may have been damaged.

2). Make sure that the meter type, form, and class match the installation.

3). Install meter in the appropriate socket.

4.3.1. Socket base

1). Compare wiring with diagrams of Section 3.2 to make sure the meter is wired properly.

2). Plug meter terminal blades into socket to make a connection with the terminal jaws.

4.3.2. K-Base

1). Compare the wiring with diagrams of Section 3.2 to made sure the meter is wired properly.

2). Install the meter on the studs in the K-mounting device.

3). Tighten down nuts securely to torque requirements listed inside the socket.

4). Check to make sure that the LCD operates and sequences through the display items which were programmed into the meter.

5. Overview of Electronic Hardware

5.1.1. LCD Display

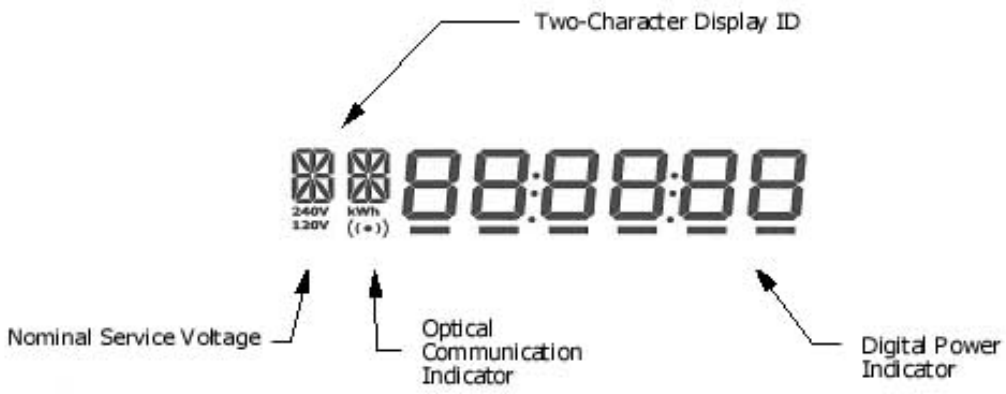


Figure 11 – Liquid Crystal Display

The ***kWh FOCUS*** display shows the digital power indicator, nominal service voltage, and kWh digits.

5.1.2. Display Scroll Sequence:

The display scroll sequence is programmable at the factory or by the user with *Focus Configuration Tool*. The scroll sequence can consist of up to 16 individual displays. The display choices are:

- +kWh
- -kWh
- NET kWh
- ADDED kWh
- Active DPI segment check
- Diagnostic Flags
- Line Voltage(s)

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

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

The active digital power indicator (DPI or "caterpillar") segment check illuminates all LCD billing digit segments without affecting the DPI segments. This permits a user to use the DPI for timing with a segment check in the scroll sequence.

A two character programmable alphanumeric label can be associated with each display except the active DPI segment check, which has all segments in the alphanumeric field, illuminated. This two-character field is used to identify the energy displayed.

5.1.3. Display Format

The display accommodates the following digit formats:

- 6x1
- 5x1
- 4x1
- 4x10 (Four digit display with the least significant digit representing 10kWh per increment)

The energy display format is programmable at the factory or by the user with *Focus Configuration Tool.* The chosen format is in effect for all displays in the scroll sequence. Display format does not affect the active DPI segment check, diagnostic flag word, or line voltage(s).

5.1.4. Digital Power Indicator

The Focus kWh has a digital power indicator similar to the Landis+Gyr traditional "caterpillar" and consists of six segments.

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

The DPI makes one revolution for each Kh of metered energy.

Each DPI segment on/off transition is observable when occurring at a maximum rate of one on/off transition each .45 second at –20°C and above.

5.1.5. Power Up Display Sequence

All Focus kWh display segments, including the DPI segments, illuminate after the meter is powered up regardless of the display sequence program. This segment check display persists for five seconds after the meter is powered, after which time the display begins its programmed scroll sequence.

5.2. Diagnostics

5.2.1. Diagnostic Error

The following table contains the diagnostic errors available for display in the diagnostic status word.

Diagnostic Errors
Unprogrammed
Configuration Error
Self Check A/D not ready UART transmit not ready
RAM Error Memory copy with invalid destination
Nonvolatile Memory Error Nonvolatile read error Nonvolatile write error
Measurement Error MMI overrun Bad checksum Voltage overrun

5.2.2. Diagnostic Error Mapping

The number of each diagnostic sub-error (Sub-error example: Measurement Error/MMI overrun) occurrences is accumulated and compared to a counter limit which, when met or exceeded, results in the error being displayed if it is not masked.

5.2.3. Diagnostics Error Display, Power Outage Counter, and User Access

All diagnostic errors are displayed by means of a single six-digit diagnostic status word. The user has the ability to mask each individual diagnostic error from being displayed (i.e. – a masked diagnostic error will always be displayed as 'false').

The user has the ability to read a power outage counter. The power outage counter resets following a billing data reset/preset command

6. Configuring the Meter

6.1. Configuration Port

The ability to configure the meter is provided through a secure meter configuration port. A cover mounted optical configuration port accommodates meter configuration by the user. The configuration port shall be used only in a meter shop ambient environment, requiring that it function in a room temperature environment under room ambient lighting conditions. The configuration port interface supports a read/write security function. The configuration port can be completely disabled such that meter communications cannot be enabled without breaking the meter security seal.

6.1.1 Initial Power-Up and Operation

KWH FOCUS meters are always shipped programmed in a configuration defined at the time an order is placed.

6.1.2 Billing Data Reset/Preset

The contents of the –kWh and +kWh accumulation registers are user programmable through an optical configuration port. In its simplest form, this feature allow s the user to reset the contents of the +kWh and –kWh accumulation registers. This feature also enables the user to clear any accumulated energy following meter verification testing.

The user also has the ability to enter initial energy values into the +kWh and –kWh accumulation registers. This feature allows a user to pre-load energy values into a replacement meter before it goes into service.

The user can perform this function in a meter shop

6.1.3 Display Multiplier

The user has the ability to program a display multiplier. kWh values contained in the energy registers are multiplied by the display multiplier prior to being displayed in the LCD. The display multiplier does not affect the contents of the energy registers.

The display multiplier multiplies the displayed energy value(s) by N for $1 \leq N \leq 240$. N is an integer value.

7. Meter Calibration

7.1. Calibration LED

The Focus kWh has an infrared light emitting diode (LED) that emits energy pulses. The meter demonstrates registration accuracy in accordance with the accuracy requirements of Section 2.4.3 when tested via the calibration LED.

The calibration LED is deactivated 24 hours after the meter powers up. The calibration LED can be reactivated without power cycling the meter. Once reactivated, the calibration LED remains active for 24 hours.

The calibration LED is accessible from the front of the meter cover. The user can fix an LED pickup device to the front of the meter.

The calibration LED produces stable pulses in no more than five seconds following meter power up.

The calibration LED produces pulses in response to energy whether it is delivered to the load or received from the load.

Registration verification testing requires no more than 30 seconds at full load.

The calibration LED is visible in meter shop lighting and room temperature conditions.

7.1.1. Factory Calibration

The meter is calibrated at the factory as part of the manufacturing process. Calibration constants are stored in nonvolatile memory. These constants are not alterable once programmed except through another calibration cycle at the factory. Sufficient security features are provided to prevent the user from altering the calibration constants stored within the meter.

7.1.2. Customer Calibration Adjustment

Focus kWh calibration is adjustable by the user. Individual element FL calibration biases up to 1.00% in increments of 0.05% are provided by means of a calibration utility and the configuration port.

The factory calibration FL series (and individual element, when applicable) calibration value can not be altered by user calibration adjustment. Any individual element FL user calibration biases is stored in separate nonvolatile memory locations accessible through the configuration port. The user calibration biases are scaled to represent percent registration biases from the factory calibration registration values.

7.2. Data Retention

All billing data is stored in nonvolatile memory. Billing data is retained during loss of power to the meter.

8. Pulse Outputs

8.1. Pulse Initiator Output

The Focus kWh offers one optional solid-state KYZ output. The solid-state pulse initiator output emits pulses in accordance with +kWh, -kWh, and added kWh as configured by the user. The pulse output scaling factor is programmable by the user and follows the same convention as the AX Altimus Ke scale factor with the exception that Ke values shall be selectable in increments of meter Kh/12. All energy measured by the meter is accounted for in the KYZ pulses emitted by the meter for all valid Ke values. The can modify the Ke scaling factor in a meter shop.

The unterminated KYZ output cable passes through a hole in the 6 o'clock position in the meter base.

The pulse initiator output responds in accordance with energy delivered to the load. No pulses are emitted when energy is received from the load.

The pulse initiator option is user installable in a meter shop environment.

8.2. Communications

Focus kWh provides two scalable TTL-level pulse outputs for interfacing with pulse accumulating AMR modules. Each output is user configurable to function in one of two operating modes.

Mode 1:Quadrature Pulse

AMR pulse output #1 responds to energy accumulation in the +kWh register. AMR pulse output #2 responds to energy accumulation in the –kWh register. The relative timing of the two pulses satisfies the requirements of a disk pickup application with the ability to determine the direction of disk rotation. The energy represented by each pulse is scaled by the meter's Ke value.

Mode 2: Differential +kWh Pulse

AMR pulse outputs #1 & #2 respond to energy accumulation in the +kWh register. The output #2 pulse polarity is opposite of the output #1 pulse polarity (consistent with form C outputs). The energy represented by each pulse is scaled by the meter's Ke value.