

S4e MFMM Cellnet User Manual

Bulletin 051101

Revision A

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DOCUMENT HISTORY

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A	11/1/05	Initial Draft
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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 these instructions 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.
- Remove the meter from service prior to installing the antenna isolation kit and/or remote external antennas.
- Be aware that dangerous voltages exist at several points within the meter when this product is installed on a meter socket.
- Always disconnect power before meter disassembly, soldering, or replacing components.

The S4e meter is connected directly to line potential. Due to the possibility of the potential lines being reversed, points accessible with the cover off may be at line voltage.

LINE POTENTIAL IS PRESENT ON THE INCOMING CONNECTORS ON THE MEASUREMENT BOARD INCLUDING THE BATTERY CONNECTOR.

The connectors have full-length insulators crimped onto each connector, which are shielded by the housing. However, pulling the connector loose will expose the battery terminals, which may be at line potential. The option board is connected directly to the main board and may be at a high potential. A Mylar shield prevents touching the option board. Removing the Mylar shield exposes line voltage. The above warning label affixed to the meter frame identifies hazards in the meter.

Failure to follow all instructions may result in an unsafe product that could cause injury or death

CAUTION:

DO NOT OPERATE METER WITHOUT ANTENNA ATTACHED.
OPERATION WITHOUT ANTENNA MAY CAUSE PERMANENT DAMAGE
TO THE CELLNET MFMM MODULE.



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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.

Note:

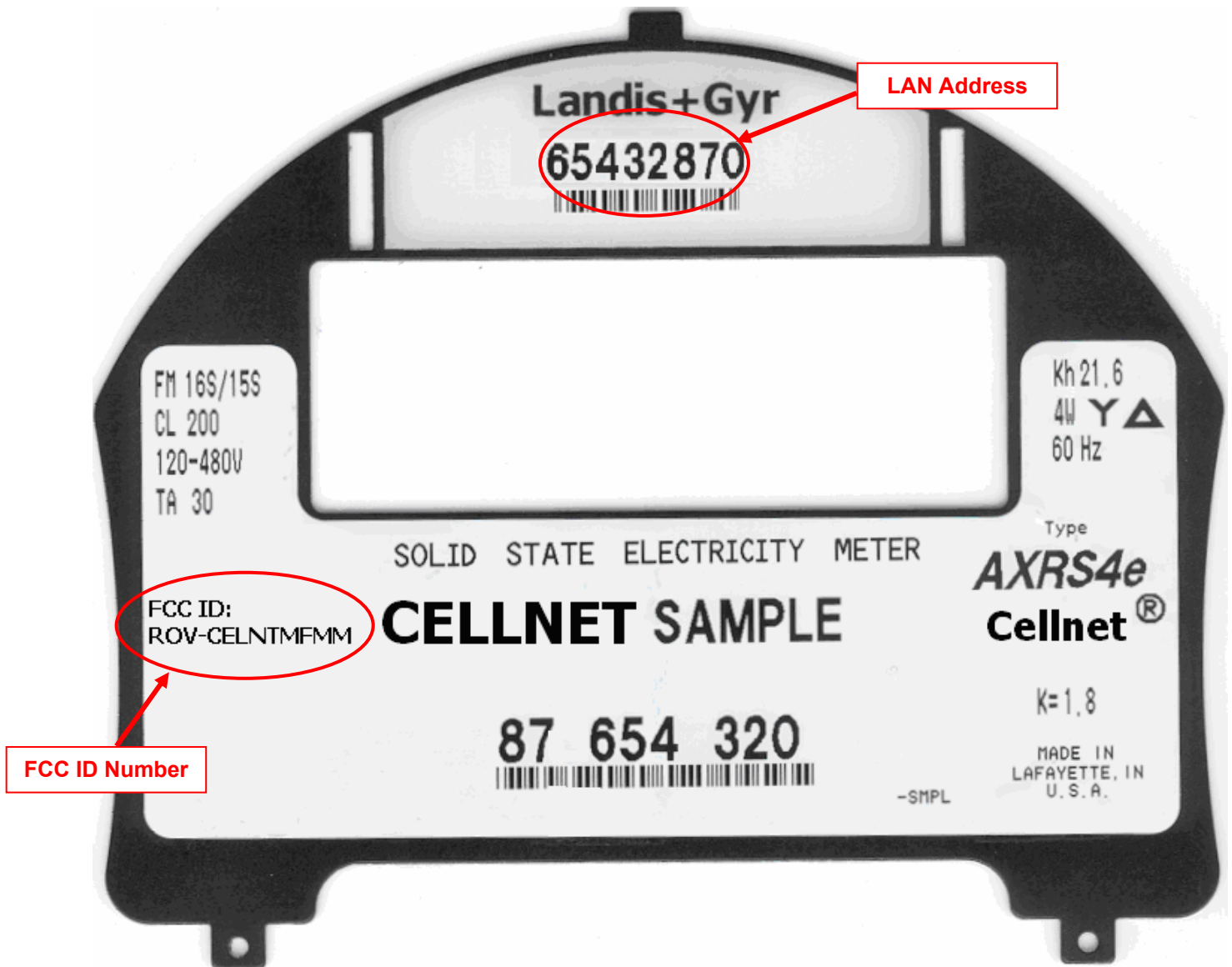
This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment uses and can radiate radio frequency 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.

Warning:

The antennas used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. End-users and installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance.

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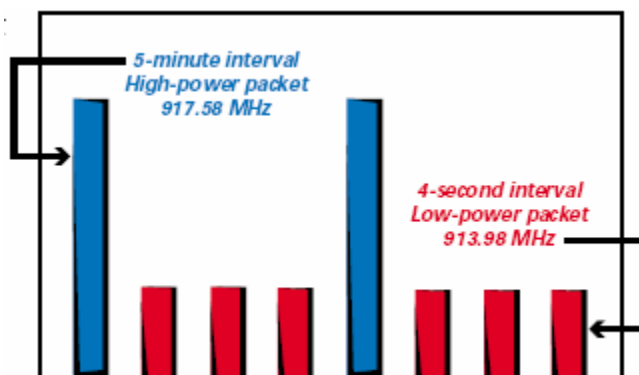
Introduction

The S4e Cellnet endpoint brings accuracy, reliability, and low-cost wireless communications to polyphase metering applications. Leveraging the Cellnet Solid-State Meter Module (MFMM), the S4e Cellnet endpoint transmits 5 minute interval data with 4x redundancy. Some highlights of the S4e Cellnet endpoint are:

- Reliable polyphase AMR
- Advanced metering capable (Demand, TOU, LP)
- Under-cover wireless communications
- Tamper detection
- Outage notification
- High reliability and accuracy
- Field proven
- Economical price

System Overview

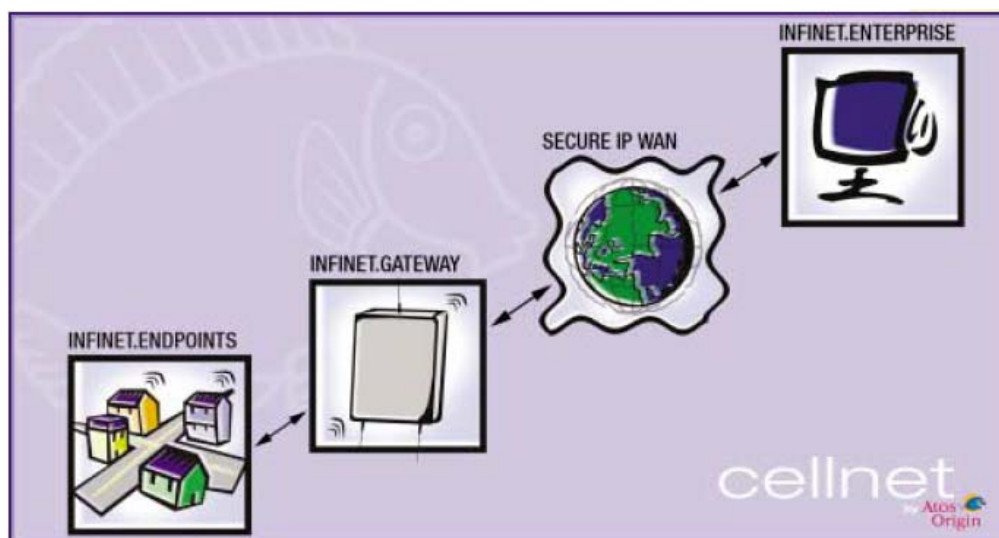
The Cellnet MFMM is a one-way radio frequency communication device that broadcasts using direct sequence spread spectrum technology over the unlicensed 902-928 MHz frequency band. The Cellnet MFMM also incorporates an interleave broadcasting technology. Every five minutes, it broadcasts a higher power signal that carries for about $\frac{3}{4}$ of a mile. Between these broadcasts, the MFMM also broadcasts every four seconds at a reduced power that carries for 1,200 feet.



Data can be collected in two ways. The first way employs a drive by solution known as Forerunner. With the Forerunner solution, information is collected using a receiver that is transported using an automobile. The receiver is capable of collecting both low power and high power signals, and is designed to be transported up to 30 MPH. If a customer base becomes dense enough, the Forerunner solution allows for the upgrade to a fixed network.

With a fixed network, the Cellnet MFMM transmits static data and meter data to the Infinet Gateway(s). The Gateway acts as a concentrator and retransmits information to the Infinet Take-Out point (TOP) point via a WAN, where it can be moved to a secure IP network.

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The Cellnet MFMM transmits static data (ID, type, address, etc) and meter data to the Infinet Gateway(s). The Gateway acts as a concentrator and retransmits information to the Infinet Take-Out point (TOP) point via a WAN, where it can be moved to a secure IP network.

This is similar to Landis + Gyr's Forerunner solution. With the Forerunner solution, information is transmitted from the meters much in the same way. However, information is collected using a receiver that is transported using an automobile. If a customer base becomes dense enough, the Forerunner solution allows for the upgrade to the fixed-point receivers.

S4e Meter Overview

All S4e meters include wide-dynamic voltage application capability, forms reduction, Service Scan automatic service recognition, and GyrBox installation diagnostics and monitoring. The S4e is available with several register types, providing the right functionality for any metering application. The S4e Cellnet MFMM can be ordered with the following register configurations, **however they can not be accessed using the Cellnet MFMM**:

AX	Active energy, Demand or TOU
AXR 32K	Active energy, with a 32K byte load profile recorder
AXR 128K	Active energy, with a 128K byte load profile recorder
RX	Active and reactive measurement, Demand or TOU
RXR 32K	Active and reactive measurement with 32K byte load profile recorder
RXR 128K	Active and reactive measurement with 128K byte load profile recorder

An optional input/output board provides up to 2, form C, solid-state relays and up to one external inputs for recording pulses from a remote source. The 4 relay option board is not available with the S4e Cellnet MFMM meter. One external input can also be used for real-time rate changes or self-read actuation. The board can be easily added in the field without the need for special tools or soldering.

For additional information on the S4e meter, consult the *S4/S4e Solid State Meter Instruction/Technical Manual*.

Cellnet Module Overview

The S4e meter is modular in its design. The Cellnet MFMM occupies the communications board slot in an S4e meter.

<Insert Cellnet MFMM Picture>

Configuration of the Cellnet Module

The S4e Cellnet MFMM meter is programmed using 1132Prog/1132Com. The Cellnet MFMM module is factory programmed with a unique LAN Address. It is programmed using RadioShop either serially or over the air.

Meter Setup

The Cellnet module relies on certain inputs from relay 4 for its operation. As a result, there are a few minimum programming requirements for the S4 (using 1132Prog). The load control relay activates the relay upon power up. This relay triggers the Cellnet MFMM module to power up. If the meter is not programmed as shown below, the Cellnet MFMM module will not power up. A special tool, Cellnet MFMM Radio Tool, was developed to query and reboot the Cellnet MFMM module.

Relays:

Set Relay 4 to Load Control ("LC"), "Used" in Normal Mode and Normal Off State to "Closed".

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Time-Of-Use Relay Values

TOU

AXS2/AXS4

DXMX/DXMS

RDS3/RXS3

RXS4

Record: 1 of 1

Goto:

Save

Relay Data Key Name: Sample RXR

Relay 1: (unused)

Relay 2: (unused)

Relay 3: (unused)

Relay 4: LC

Normal

Real Time

Test Mode

Normal Off State

Used

Not Used

Not Used

Closed

Meter Installation

Step 1. Installing S4e Cellnet MFMM Meter

If existing meter is present, follow company procedures for meter removal and installation. (Note: Meter removal and installation should only be performed by a properly trained technician.)

When the radio is reading information from the meter, the S4e will flash P/R on the display, as shown below.

Step 2. Verifying the S4e Cellnet MFMM Communicates Over the Network

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Trouble shooting Guide

Symptom	Possible Causes
S4e Meter LCD Display Blank	Check voltage to meter
Cellnet MFMM Not Communicating	Check Module to Meter Connection Check relay 4 settings

Use of External Antennas

S4e Cellnet MFMM equipped meters are manufactured with an internal antenna. However, some meter locations have less than optimal RF reception. Many meter services are ungrounded. Examples of these types of services include single-phase form 2S, as well as floating 3-wire delta services, 12S and 45S/5S. To improve the reliability and safety of these floating services, Landis+Gyr has developed an interface for remotely mounted antennas that allows RF reception under these service conditions. The High Voltage antenna coupling system protects Cellnet MFMM components from transients reaching up to 7,000 volts. The Landis+Gyr External Antenna Isolation Solution needs to be installed in the S4e meter in accordance with Landis+Gyr Specifications. Contact the factory for more information regarding ordering and installing approved external antenna solutions. See the diagram on the next page. THIS IS FROM THE UTILINET MANUAL. I AM UNSURE ON HOW THE CELLNET'S ANTENNAS DIFFER.

Technical Features of the S4e Cellnet Meter

S4e Specifications

Applicable Standards

ANSI C12.1-2001	for electricity metering
ANSI C12.10-1987	for watt-hour meters
ANSI C12.20-1998	for solid-state electricity meters
CAN3-C17-M84	Canadian Specs for approval of electrical meters
CAN3-Z234.4-79	Canadian Specs for all-numeric dates and times

Application Information

Frequency	50 or 60 Hz +/- 5%
Nominal Voltage	120-480 VAC ranging
Operating Voltage	80-115% of nominal
Operating Temperature	-40 to +85 C under cover
Humidity	Meter Less than or equal to 95% relative humidity, non-condensing

Rated Accuracy at Unity Power Factor

Transformer-Rated/	
Self Contained Meters	+/- 0.2%
K-Base Meters	+/- 0.5%
Over voltage Withstand	
Temporary (.5 sec)	150% rated voltage
Continuous (5 hours)	120% rated voltage
Starting Load:	
Class 20	0.005 amps
Class 200	0.050 amps
Class 320	0.050 amps

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Meter compatibility

	FORM	CLASS	VOLTAGE
Transformer -Rated: S-Base	9S/8S	20	120 to 480 ranging
	29S	20	120 to 480 ranging
	36S	20	120 to 480 ranging
	45S	20	120 to 480 ranging
	56S	20	120 to 480 ranging
Transformer-Rated: (A-Base)	10A/8A	20	120 to 480 ranging
	36A	20	120 to 480 ranging
	45A	20	120 to 480 ranging
Self-Contained (S-Base)	12S	200	120 to 480 ranging
	16S/15S	200	120 to 480 ranging
	25S	200	120 to 480 ranging
	12SE	320	120 to 480 ranging
	16SE/15SE	320	120 to 480 ranging
Self-Contained: (K-Base)	12K	480	120 to 480 ranging
	16K/15K	480	120 to 480 ranging
	27K	480	120 to 480 ranging
Self-Contained: (A-Base)	16A/15A	120	120 to 480 ranging
Residential Meters:	2S	200	120 to 480 ranging
	2SE	320	120 to 480 ranging
	3S	20	120 or 240

Cellnet Multi-Function Meter Module (MFMM) on the S4e Meter

Applicable Standards:

FCC Parts 15.109, 15.107, 15.205

ANSI/IEEE C62.41-1991

ANSI C12.1-1995, Sections 4.7.2, 4.7.2.5, 4.7.3.2, 4.7.3.1, 4.7.3.14, 4.7.3.8, 4.7.3.3, 4.7.3.4

ANSI C37.90.1-1989

ANSI B109.1-1992

ASTM B117-85

ASTM D999-86

CFR 47 Parts 15, Class B and Class C

IEC 61000-4-2 (Level 4)

IEC 801-4

IPC-A601B, Class 2

NSTA-1A and Mil-STD-810D

Power requirement:

20 mA max steady-state, 200 mA max during transmission at 85°C

Transmitter Power:

Typical ERP (Equivalent Radiated Power) from 19 dBm to 23 dBm depending on model type

Operating environment

Temperature: -40° to +85°C (electric and gas), -30° to +65°C (water)

Humidity: 5% to 95% non-condensing (electric and gas), 0% to 95% condensing (water)

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Radio Transmitter Specifications:

Transmit Frequency:	902-928 MHz (Spread spectrum, direct sequence)
Transmit Power:	High-Power fixed network transmission
Transmission Redundancy:	9x or more