



Submetering End-Device Developer Guide

Preface

Notice

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Document Conventions

The following notices are used throughout this document:

Note: Emphasizes points, provides supplementary information, or indicates minor problems in an expected outcome.

Caution: Indicates possible damage to equipment or loss of data, as well as potential problems in an expected outcome.

Warning: Indicates the possibility of minor injury to oneself or others.

Danger: Indicates the possibility of serious or fatal injury to oneself or others.

Revision History

Revision Level	Revision Description
B	Edited cover and made changes to paragraph styles; edit product overviews to current formats
C	Edited/added "Installation Instructions", "Compliance Requirements", and "Inovonics One-Way Binary RF Module Compliance Review Form".

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Chapter 1

Overview

1.1 Introduction

Inovonics submetering end-devices can be easily integrated into your EchoStream system using the following message information. EchoStream submetering end-devices include pulse meter transmitters, pulse meter transmitters with long-life battery, integrated water meters, and board-only integrator pulse meter transmitters.

EchoStream submetering end-devices are one-way devices, but like all EchoStream one-way devices, they can be integrated seamlessly into two-way EchoStream systems. The EchoStream submetering end-devices transmit meter and status information after ten pulses are received or after approximately sixty minutes since the last transmission, whichever comes first.

1.2 EN1501 Pulse Counting Transmitter

The Inovonics pulse counting transmitter is used to count the number of pulses generated from a pulse-output device, such as a utility meter. The EN1501 is for use in Australia, New Zealand, and North America.

1.2.1 Product Information

<http://www.inovonics.com/pulse-counting-transmitter.aspx>

1.3 EN1501-EXT Pulse Counting Transmitter for Integration

The Inovonics pulse counting transmitter for integration is a board-only transmitter with external header pins. It is designed for integration into a customer-designed meter or product. The EN1501-EXT is for use in Australia, New Zealand, and North America.

1.3.1 Product Information

<http://www.inovonics.com/pulse-counting-transmitter-for-integration.aspx>

1.3.2 EN1501-EXT Components

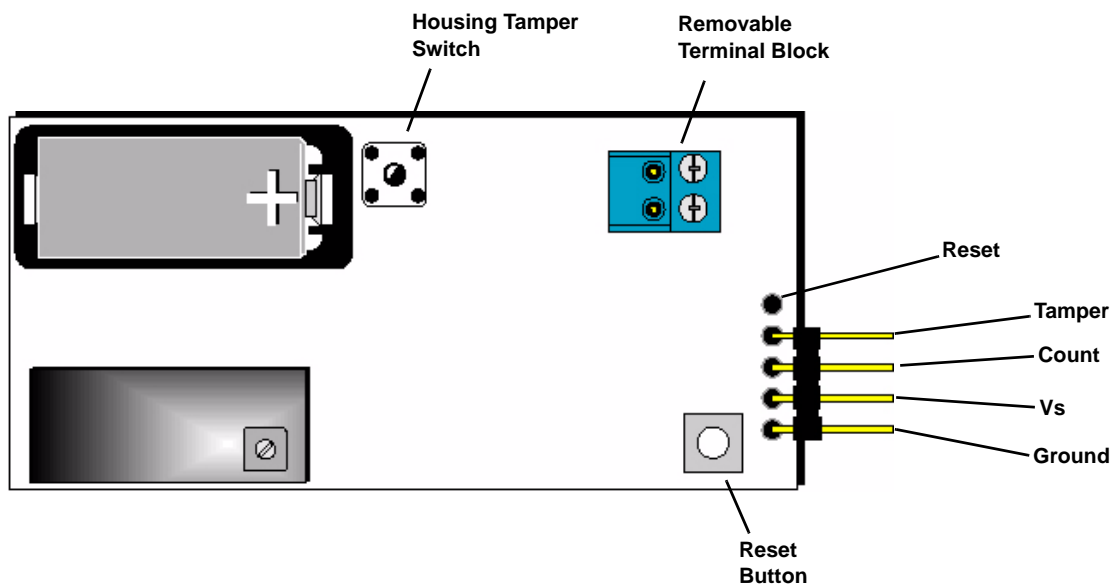


Figure 1-1 FA5201-EXT Pin Configuration

Housing tamper switch Sends an alert message when the housing is opened.

Removable terminal block Allows connection to an external meter.

Reset input Connects a reset input to send a reset message when prompted by the user-specific end-device.

Tamper input Connects a tamper input to send a message when the user-specific end-device is tampered with.

Count Connects a count input to increment the meter count.

Power output .Allows for another device to share battery power.

Ground Connects to the ground.

1.3.3 EN1501-EXT Dimensions

The FA5201-EXT dimensions are as follows:

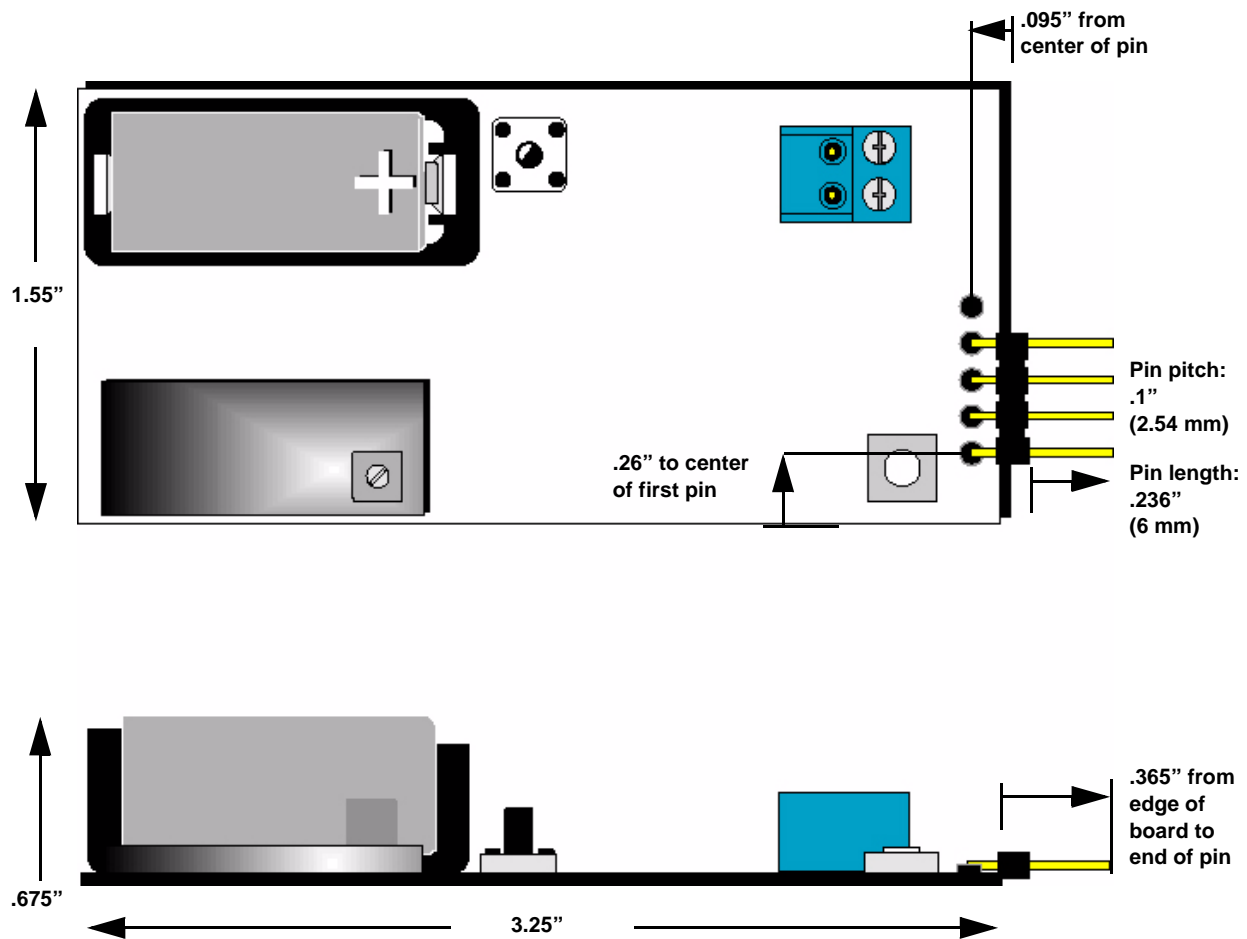


Figure 1-2 FA5201-EXT Pin Configuration

1.3.4 EN1501-EXT Requirements

1.3.4.1 Power

Power is supplied by the on-board 3v battery. The power pin allows for another device to use this power source, which can affect battery life.

The low battery flag is set when the measured voltage is less than 2.4 v.

1.3.4.2 External Tamper Requirements

The housing tamper switch and tamper pin have the same specification. Connecting the tamper pin to ground initiates the tamper condition. Once a transition (tamper connected/disconnected from ground) is detected, no further transitions can be processed for a debounce time of 250 ms.

1.3.4.3 Count Requirements

The removable terminal block and count pin have the same specification. On the terminal block, the outer terminal is the negative terminal if polarity is present from the connected meter.

The count is incremented by connecting the count to ground or receiving a contact closure from a pulse-output meter via a wired connection. In general the contact closure should meet the following characteristics:

- a minimum switch output pulse width of 10 ms or longer.
- a maximum rate of one pulse every four seconds (slower is better).
- a closed impedance smaller than 1k ohm.
- an open impedance greater than 5 Mega ohms.
- hardware latched input transitions from the external device.

Once a latched input is detected, no further transitions will be processed for a debounce time of 350 ms.

The count totalizer corresponds to the number of totalizer input pulses. The counts accumulate until the number 9,999,999 is reached. The totalizer will then go to zero on the next count.

1.4 EN1501-XL Pulse Counting Transmitter with Extended Life Battery

The Inovonics pulse counting transmitter with extended life battery is used to count the number of pulses generated from a pulse-output device, such as a utility meter, and includes an extended life battery. The EN1501-XL is for use in Australia, New Zealand, and North America.

1.4.1 Product Information

<http://www.inovonics.com/pulse-counting-transmitter-with-extended-life-battery.aspx>

1.5 EN1550 MetraMeter

The Inovonics MetraMeter is an integrated meter and pulse counting transmitter. The water meter is the utility industry proven T-10 meter from Neptune Technology Group. The RF transmitter is protected inside the easy-to-read register, eliminating resident tampering. The EN1550 is for use in Australia, New Zealand, and North America.

1.5.1 Product Information

<http://www.inovonics.com/metrameter.aspx>

Chapter 2

EN1501-EXT Pulse Counting Transmitter for Integration Installation Instructions

2.1 Connecting the EN1501-EXT Pulse Counting Transmitter

The EN1501-EXT is designed to be easily interfaced with your meter or product, however integration must conform to the following:

- A.** The EN1501-EXT must only be connected at the four pin header.
- B.** All cables and wires must be routed away from the component side of the EN1501-EXT.
- C.** The on-board antenna must not be tampered with; no connection to an alternate antenna is provided.
- D.** The meter or product must not include an integrated secondary colocated radio module.
- E.** The EN1501-EXT on-board antenna should be placed so that it is facing away, or otherwise isolated from, your device's ground plane.
- F.** Components that are sensitive to RF transmission, such as high gain circuits, should be isolated from the on-board antenna to prevent interference.
- G.** EN1501-EXTs should not be mounted on metal surfaces or inside metal enclosures. They should also not be mounted where sheet metal ductwork, wire mesh screens, etc. might block transmissions.

Chapter 3

EN1501-EXT Pulse Counting Transmitter for Integration Compliance Requirements

3.1 FCC Requirements for the EN1501-EXT

The EN1501-EXT has received a Limited Modular Grant, requiring Inovonics to retain control of the final installation to ensure compliance to FCC/IC regulations. The integrator is responsible to test the final installation to verify compliance to FCC/IC regulation for unintentional emissions.

Prior to marketing the product, the integrator must complete and submit to Inovonics a compliance review form and documentation, and, if requested, a functional product sample for approval. If this is not possible, the integrator must perform the testing themselves and submit proof to Inovonics of compliance to Part 15 of the FCC Rules and Industry Canada ICES-003.

At the end of this guide is an Inovonics compliance review form to be filled out by the integrator.

The integrator is also responsible for properly labeling the product containing the EN1501-EXT. Labels must be placed on the outside of the product, and must include a statement indicating that the product contains the EN1501-EXT, along with the FCC and IC number.

Example 1 “Contains EN1501-EXT Pulse Counting Transmitter
FCC ID: HCQ3B6OTPMTX; IC ID: 2309A - OTPMTX

Example 2 “Contains FCC ID: HCQ3B6OTPMTX; IC ID: 2309A - OTPMTX

3.1.1 Television and Radio Interference

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are

designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

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

Chapter 4

Registration

4.1 Registration Overview

Every device is programmed with a four-byte unique identification (UID) number. The UID is sent with every message, indicating the device which transmitted it. The UID is made up of a one-byte market identification (MID) number and a three-byte serial number. The bar code label on each printed circuit board includes the eight digit serial number. For example the bar code label “00991240-2028B-1” begins with the eight-digit serial number: 00991240. Converting this number to hexadecimal yields: 0F 20 08. Preceding this serial number with the MID (A0), the MID for submetering devices, for example) gives the UID: A0 0F 20 08, and will appear in every RF message sent by the device.

The purpose of registration is to associate the unique ID in the wireless device with specific application functionality, such a descriptive name, the location and point supervision. It is recommended that all wireless transmitters, transceivers and repeaters be registered. To ensure wireless devices are registered only when intended, the application controller should have a specific registration mode.

4.2 Registration Procedure from the End User’s Perspective

1. The application controller is placed in registration mode, ready to associate the device’s UID with application functionality.
2. The application controller prompts the end user to enter application specific information and send a registration message from the device.

3. The application controller receives the registration message, associates the device's UID with appropriate application information, and lets the end user know registration was successful.

4.3 Registration Procedure from the Developer's Perspective

The developer must provide

1. A means of initiating an inbound registration message from the device to the network coordinator.

While in registration mode, the application controller should indicate when it is ready for the user to trigger a registration message from the device. A registration message is simply a reset message sent from the device. A reset message will be sent when the **Reset** button is pressed on the device to be registered.

2. A means of processing the message as it is passed from the RF gateway to the application controller.

The registration message transmitted in the previous step will be received by the RF gateway and delivered serially to the application controller. The application controller must validate this message, extract the device's UID, and store it in the application database. Thereafter, the UID will be used to associate the wireless point with program functionality.

3. A means of letting the user know the registration message has been received by the application controller.

At a minimum, the application controller should provide some indication that the registration was successful. Preferably, the UID of the registered device should be displayed. At this time the application controller may begin the setup process for the next point or may begin normal operation. This action is application specific.

4.4 Device Reset, Application Controller Not in Registration Mode

There are cases where the device will send a reset message when the application controller is not in registration mode. When the battery is changed on an EchoStream device, for instance, it must be reactivated by the user pressing the reset button. A device may also transmit a reset message upon

recovery from an electrostatic discharge event. The identical type of reset message transmitted during the registration process is transmitted by the device during these instances, however the application controller must process these messages differently.

If the application controller is not in registration mode and a reset message from a previously registered device is received, the application controller should record this message in its event log as a device reset. Other status bits that may be active in the message from the device should be processed in an identical manner as when processed when the reset bit is not active.

4.5 Removing a Registered Device from the System

To remove a registered wireless device from the system, the application controller is placed in registration mode. The user then selects the point to be deleted.

When the user selects delete for that point, the application controller will adjust the database to remove all information, or replace the unique ID associated with that point with a unique ID of zero and set a flag to indicate that the point no longer has a device assigned to it. If a particular device has been registered to more than one point and the user wants to completely remove that device from the system, then the user must delete that device from each point to which it is registered.

Chapter 5

Message Information

5.1 Submetering Message Information

Submetering end devices transmit meter and status information after ten pulses are received or after approximately sixty minutes since the last transmission, whichever comes first. Messages from security end-devices to the gateway adhere to the format defined following.

Note: The format of EchoStream messages will vary depending on the message type. Always check the message class byte before attempting to determine the contents of a message.

5.1.1 Default Message

Note: A number in parentheses following a data signifier represents the number of bytes the item contains. For example, unique ID (4) is a 4-byte field.

[0x72] - Header for inbound complete message.
[LEN] - Message length, excluding checksum.
[UID (4) originator] - Unique ID of device originating message.
[UID (4) first hop] - Unique ID of the device which received original message, as well as the signal level and margin. If the UID begins with 00, then the RF gateway is the first hop; if the UID begins with 01, then the repeater is the first hop.
[Trace count (1)] - Number of trace unique IDs that follow. The default is zero, indicating no trace data.

FUTURE: [Trace UID1 (4)]...[Trace UIDn (4)] - Unique ID of each device that repeats this message.

[Hop count (1)] - The number of times this message was relayed by a device.

[0x3E] - Message class byte for submetering data.

[PTI] - Product type identifier.

Note: See “Submetering End Device Product Type Identifiers” on page 16 for product type identifier information.

[STAT1] - Application flags.

Bit 7 - Delta totalizer.

Bit 6 - Rapid transmission mode.

Bit 5 - Reserved.

Bit 4 - Reserved.

Bit 3 - Reserved.

Bit 2 - Reserved.

Bit 1 - Reserved.

Bit 0 - Reserved.

[STAT0] - Primary Status Flags.

Bit 7 - Reserved.

Bit 6 - Low battery.

Bit 5 - Case tamper.

Bit 4 - Set when there has been no change in status since the last transmission.

Bit 3 - Reset.

Bit 2 - Set when the transmitter is entering sleep mode.

Bit 1 - Reserved.

Bit 0 - Reserved.

[Level] - Signal level of message as measured by the first hop device.

[Margin] - Signal margin of message as measured by the first hop device.

[CKSUM] - Checksum.

5.2 Submetering End Device Product Type Identifiers

5.2.1 Product Naming Conventions

- “ES” indicates EchoStream products with selectable 868 or 900 MHz operation.
- “EN” indicates EchoStream products that operate at 900 MHz only.
- “EE” indicates EchoStream products that operate at 868 MHz only.
- “E*” represents products available in both EE and EN versions.

5.2.2 Submetering End Device Identifier Table

Product	Description	Market ID	Product Type	End-Device Type
EN1501	Pulse Meter Transmitter	0xA0	0x01	One-Way
EN1501-XL	Pulse Meter Transmitter with Long-Life Battery	0xA0	0x09	One-Way
EN1501-EXT	Integrator Pulse Meter Transmitter	0xA0	0x19	One-Way
EN1550	Integrated Water Meter	0xA0	0x11	One-Way

EN1501-EXT Pulse Counting Transmitter for Integration Compliance Review Form

Please provide the following information for review of final installation to ensure compliance with FCC/IC regulations:

Required materials from integrator

The following must also be attached for review with this form:

- A description of the final installation, with attached photographs, as necessary
- The unintentional radiator test report indicating compliance

Integrator information

First name:	Last name:
Phone number:	Email address:
Address:	
Declaration of conformity to Inovonics' installation instructions:	
Submitted materials:	
Authorized signature:	Submission date:

Inovonics contact information

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Toll-Free: 800.782.2709
Fax: 303.939.8977
productmanagers@inovonics.com

Required materials from Inovonics

- The record of product sample review and test, as necessary

Inovonics approval

First name:	Last name:
Phone number:	Email address:
Approval status (pass, fail, samples required, compliance testing required, compliance test report required):	
Approval comments:	
Submitted materials:	
Returned materials:	
Authorized signature:	Approval date: