



Intelis™ Gas Meter Technical Reference Guide

**Includes Intelis Gas Meter, Intelis 250 Gas Meter, and
Intelis 425 Gas Meter**

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New in this Document

Revision	Date	Description
REV 011	May 23, 2023	Updated document to support release of Intelis 250 and Intelis 425 Gas Meters. Note: Gen5 support for Intelis 250 Gas Meter and Intelis 425 Gas Meters will be added in an upcoming release.
REV 010	March 8, 2023	Updated content in High flow on page 46
REV 009	January 13, 2023	Added important note to Safety shutoff valve on page 45 .
REV 008	November 30, 2022	- Added data for UMU Modified meters in Elevated Pressure Meter Capacity on page 1. - Updated content in High flow on page 46
REV 007	August 16, 2022	- Added note to Operational parameters on page 28 - Added trademark to title to reflect new registration of "Intelis Gas Meter" - Minor formatting changes
REV 006	June 1, 2022	- Added Elevated Pressure Meter Capacity on page 1. - Added new information to Consumption data on page 39. - Updated High flow on page 46 with new formulas and values for entering aggregation windows.
REV 005	February 2022	- Added Low Flow Cut Off Setpoint specification to Specifications on page 11. - Added instructions and images for the magnet housing tool usage in Start up on page 50.
REV 004	February 2022	Updated Specifications on page 11 to indicate Intelis Gas Meter meets Measurement Canada.
REV 003	October 2021	- Added a row to describe Low Flow Cut Off Setpoint specification in Specifications on page 11 - Moved Important safety and compliance information on page 71 from front of document to end - Combined what was chapters 1 and 2 and renamed the chapter to "Introduction"
REV 002	December 2020	- Added information about the optional configurable display in - Replaced references to "standard mode" with "default mode" where appropriate in Programming the Intelis Gas Meter on page 1 and

Revision	Date	Description
REV 001	July 2020	■ Added information supporting Gen5 mode and devices to Intelis Gas Meter Data Collection on page 1, Transmission modes on page 42, and Specifications on page 11 ■ Added the following sections: – New in this Document page – Important safety and compliance information on page 71 – Models on page 11 – Components on page 24 – Automatic Shutoff Configuration – Installation on page 49 – Maintenance on page 70 – Table describing Events and triggered registers on page 58 ■ General updates to the following sections: – Introduction on page 8 – Internal Safety Shutoff Valve – Integrated RF communications on page 26 – Calibrating the Intelis Gas Meter on page 53 – Events and alarms logging on page 57 ■ Updated title page
REV 000	January 2020	Original publication date under part number 815-0119-00. This document was previously tracked under part number TDC-1805-005. Note: The content in this document used to be part of the <i>Intelis Gas Meter Installation Guide</i>, which has since been redacted and merged with the <i>Intelis Gas Meter Technical Reference Guide</i>.

1

Introduction

The Intelis™ Gas Meter line includes three variants:

- **Intelis Gas Meter:** The original variant of the Intelis Gas Meter and the term used to refer to all variants, unless explicitly stated otherwise.
- **Intelis 250 Gas Meter:** The variant that supersedes the original Intelis Gas Meter. Customers now have the option to purchase the updated meter with or without pressure sensing.
- **Intelis 425 Gas Meter:** The latest variant of the Intelis Gas Meter in a light commercial offering with pressure sensing standard in every meter.

The information in this document is generally applicable to all Intelis Gas Meter variants unless explicitly stated otherwise.

The Intelis Gas Meter is a solid state ultrasonic smart meter equipped with the following features:

- High flow alarm with optional automatic valve shutoff
- High temperature alarm with an optional automatic valve shutoff
- Built in temperature conversion
- Integrated RF communications module
- Air detection
- Reverse flow detection
- Pressure sensing

Note: Pressure sensing is not included in the Intelis Gas Meter, is optional for Intelis 250, and is always included on the Intelis 425 Gas Meter.



Figure 1 Intelis Gas Meter (left), and Intelis 425 Gas Meter (right)

The internal automatic safety shutoff valve can be configured to function similarly to an excess flow valve downstream of the meter. The meter delivers distributed intelligence to gas metering by providing the ability to self-monitor and close the valve during a high flow incident.

Intelis Gas Meters mount easily within existing meter footprints for replacement of existing gas meters. An integrated communications module can be shipped in mobile mode for Mobile AMR, or OpenWay® Riva™ or Gen™5 network mode for AMI.



Caution: Always follow your company's procedures for gas meter installation and operation.

Document scope

The *Intelis Gas Meter Technical Reference Guide* provides information about the Intelis Gas Meter for field dispatchers, utility personnel, and Itron internal users. This guide describes the meter's functionality including the measurement, communications, and safety shutoff valve.

Related documents

For more information about the Intelis Gas Meter and compatible system architecture documentation, see your product's documentation. The following table lists documentation that might be relevant to the setup of your meter. All Itron product documentation can be located and accessed through <https://products.itron.com>.

Note: Where the part number is not specifically listed below, refer to the documentation that matches your version of the indicated product.

- *Intelis™ Gas Meter Ordering Guide* (815-0335-00)
- *Intelis™ Gas Meter Proving and Setup Guide* (815-0154-00)
- *Intelis™ Gas Meter Specification Sheet* (101584SP)
- *Field Deployment Manager Mobile Application Guide*

- *Field Deployment Manager Tools Application Guide*
- *Field Deployment Manager Tools Configuration Guide*
- *Field Tools Online Help*
- *Field Tools and FDM Tools Architecture Overview (LDI-0138)*
- *Field Tools for North American Gas and Water ERTs and Meters Get Started Quick Reference (LDI-0124)*
- *Itron Security Manager (ISM) User Guide*
- *OpenWay® Collection Manager Device Interface Guide (for versions 5.1 and later)*
- *OpenWay® Operations Center Collection Manager Device Interface Guide (for versions 5.0 and earlier)*

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About Intelis Gas Meter

This chapter describes the following:

- [Models on page 11](#)
- [Specifications on page 11](#)
- [Components on page 24](#)

Models

The Intelis Gas Meter is available in the following types:

- Temperature compensated
- Non-temperature compensated

Specifications

This section lists the Intelis Gas Meter family product specifications, including:

- [Specifications on page 11](#)
- [Specifications on page 11](#)

[Table 1](#) lists the Intelis Gas Meter and Intelis 250 Gas Meter product specifications.

Table 1 Intelis Gas Meter and Intelis 250 Gas Meter specifications

Specification	Specification value
Meter capacity	■ Intelis Gas Meter: 250 CFH at ½ WC (water column) or 7.1 m3/h at 0.125 kPa ■ Intelis 250 Gas Meter: 300 CFH at ½ WC or 8.5 m3/h at 0.125 kPa (see Elevated pressure meter capacity on page 1 for more details)
Measurement principle	Ultrasonic time of flight
Accuracy (gas measurement)	Class 1 and ±0.5% at room temperature
Accuracy (pressure)	+/- 1% full scale from -25°C to +55°C (-13°F to +131°F) Note: Applicable only to Intelis 250 Gas Meters that are configured with pressure sensing.
Meter type	Temperature compensated (TC) or non-temperature compensated (NTC)
Hub center-to-center	6 inches (152.4 mm)

Table 1 Intelis Gas Meter and Intelis 250 Gas Meter specifications (continued)

Specification	Specification value
Hub size options	■ 10LT ■ 20LT ■ 30LT ■ 1A/Sprague standard ■ 1-1/4" NPT (1" Pittsburgh) ■ 1" BS746 ■ ISO G 1-1/4"
Meter MAOP	■ Intelis Gas Meter: 5 PSIG (35 kPa) ■ Intelis 250 Gas Meter: 10 PSIG (69 kPa)
Valve	Actuated swing valve, maximum 0.035 CFH (1 L/H) leakage rate
LCD displayed units	CCF (100 x cubic foot) or cubic meter
LCD resolution	Intelis Gas Meter: Five digits to the left of the decimal and three digits to the right of the decimal with the exception of Large Star Configurable Display. See variants listed below for Intelis 250 Gas Meter. Intelis 250 Gas Meter: Four or five digits to the left of the decimal, and three or four to the right of the decimal. For example: ■ 00000.001 CCF (0.1 CF) or 00000.001 m³ default ■ 00000.0001 ■ 0000.001 ■ 0000.0001
Case	Aluminum case with ASA 49 gray powder coat finish
Weight	Intelis Gas Meter: 4.5 lbs (2.04 kg) Intelis 250 Gas Meter: 4.35 lbs (1.97 kg)
Gas type	■ Natural gas Type H, E, L (per EN 437) ■ Reference gases G20, G21, G23, G25, G26, G27 ■ Hydrogen (up to 20% Hydrogen compatible, for Intelis 250 Gas Meter only. See Hydrogen on page 22 for more details).
Component materials	■ UMU (ultrasonic measuring unit): polybutylene terephthalate (PBT) and polycarbonate (PC) ■ Valve plastics: PBT ■ Inlet and outlet tubes: polyoxymethylene (POM)

Table 1 Intelis Gas Meter and Intelis 250 Gas Meter specifications (continued)

Specification	Specification value
Intrinsically safe	For use in Class I, Division 1, Group D hazardous locations. IECEX UL 18.0144X Ex ia IIA T1 Ga Temp Code T1 -40°C ≤ Ta ≤ +70°C IEC 60079-0:2011 Edition: 6.0; IEC 60079-11:2011 Edition: 6.0 UL 913 CAN/CSA-C22.2 No. 60079-0:15+Update No. 1 April 2018; CAN/CSA-C22.2 No. 60079-11:14
Regulatory	■ FCC: Part 15.247, Part 15.249 (programming) ■ FCC ID: – EWQINTELISG (Intelis Gas Meter) – EWQINTELISG2 (Intelis 250 Gas Meter) ■ Innovation, Science, and Economic Development Canada (ISED): RSS-247 and RSS-210 (programming) ■ IC ID: – 864D-INTELISG (Intelis Gas Meter) – 864D-INTELISG2 (Intelis 250 Gas Meter) ■ Measurement Canada: PS-G-06, approval AG-0642
Operational	All Intelis Gas Meters operate without the need for an FCC or ISED license. ■ Frequency: 902-928 MHz ISM band ■ Program frequency: 908-923.8 MHz
Australia	■ Radiocommunications Equipment (General) Rules 2021 ■ ACMA AS/NZS 4268 ■ Frequency: 915-928 MHz ISM band ■ Program frequency: 916-926.8 MHz
Operating temperature ratings	■ Measurement: -30° F (-34°C) to +131° F (55°C) ■ Valve: -13°F (-25°C) to +131°F (55°C) ■ RF: -40° F (-40° C) to +158° F (70°C) ■ LCD: -40°F (-40°C) to 185°F (85°C)^a When the firmware cannot read the correct values from the attached UMU or meter, the Intelis Gas Meter reports an "unknown" value.
Storage temperature ratings	-40°F (-40° C) to +158° F (70° C)
Battery information	4 Lithium manganese dioxide (LiMnO ₂) 'A' cell batteries, replaceable
Battery life	20 years for meter, RF, and valve using recommended operating parameters
Badging	Standard aluminum manufacturing and optional customer badge
Test pulse weight (volume per pulse)	0.10CF, 0.25CF, 0.50CF, 1.0CF, 10dm ³ , 50dm ³ , 3.0dm ³ (Intelis 250 Gas Meter only)

Table 1 Intelis Gas Meter and Intelis 250 Gas Meter specifications (continued)

Specification	Specification value
Test pulse width	10 ms - 1000 ms (1 second)
Minimum compatible collection software for Mobile AMR and Riva network	■ Intelis Gas Meter – FCS 4.3.1 – Itron Mobile 3.0 – FDM Tools 4.4.0 – Temetra/Temetra Mobile – ISM 3.6 (if using enhanced security) ■ Intelis 250 Gas Meter – FCS 4.5.3 – Itron Mobile 3.3 – FDM Tools 4.4.0 – Temetra/Temetra Mobile
Minimum compatible collection software for Gen5 network	■ Intelis Gas Meter – Gen™3, 4, or 5 constantly powered device (CPD) hardware running UtilOS® 5.0 – FCS 4.3.1 – Itron Mobile 3.0 – Temetra/Temetra Mobile – FDM Tools 4.4.0 – ISM 4.2 – UtilityIQ® 4.15 ■ Intelis 250 Gas Meter – FCS 4.6.1 – Itron Mobile 3.6 – FDM Tools 4.4.0 – Temetra/Temetra Mobile
Standards	Designed in compliance with ANSI B109.6 and applicable sections of ANSI B109.1. (Intelis Gas Meter only) Meets Measurement Canada PS-G-06, approval AG-0642.
Low Flow Cut Off Setpoint	0.176 CFH or 5 L/H

Table 2 lists the specifications for the Intelis 425 Gas Meter.

Table 2 Intelis 425 Gas Meter specifications

Specification	Specification value
Meter capacity	■ 610 CFH at ½ WC (water column)
Measurement principle	Ultrasonic time of flight
Accuracy (gas measurement)	Class 1 and ±0.5% at room temperature
Accuracy (pressure)	+/- 1% full scale from -25°C to +55°C (-13°F to +131°F)
Meter type	Temperature compensated (TC) or non-temperature compensated (NTC)

Table 2 Intelis 425 Gas Meter specifications (continued)

Specification	Specification value
Hub center-to-center	8-1/4 inches (209.55 mm) or 6 inches (152.4 mm)
Hub size options	■ For 8-1/4 inches hub center-to center variant: – 20LT – 30LT – 45LT – #4 Sprague ■ For 6 inches hub center to center variant: – 10LT – 20LT – 30LT – 1A/ Standard – 1-1/4" NPT (1" Pittsburgh) – 1" BS746
Meter MAOP	10 PSIG (69 kPa)
Valve	Actuated swing valve, maximum 0.035 CFH (1 L/H) leakage rate
LCD displayed units	CCF (100 x cubic foot) or cubic meter
LCD resolution	Four or five digits to the left of the decimal, three or four digits to the right. For example: ■ 00000.001 CCF (0.1 CF) or 00000.001 m³ default ■ 00000.0001 ■ 0000.001 ■ 0000.0001
Case	Aluminum case with ASA 49 gray powder coat finish
Weight	6.95 lbs (3.15 kg)
Gas type	■ Natural gas Type H, E, L (per EN 437) ■ Reference gases G20, G21, G23, G25, G26, G27 ■ Hydrogen (up to 20% Hydrogen compatible. See Hydrogen on page 22 for more information)
Component materials	■ UMU (ultrasonic measuring unit): polybutylene terephthalate (PBT) and polycarbonate (PC) ■ Valve plastics: PBT ■ Inlet and outlet tubes: polyoxymethylene (POM)

Table 2 Intelis 425 Gas Meter specifications (continued)

Specification	Specification value
Intrinsically safe	For use in Class I, Division 1, Group D hazardous locations. IECEX UL 18.0144X Ex ia IIA T1 Ga Temp Code T1 -40°C ≤ Ta ≤ +70°C IEC 60079-0:2011 Edition: 6.0; IEC 60079-11:2011 Edition: 6.0 UL 913 CAN/CSA-C22.2 No. 60079-0:15+Update No. 1 April 2018; CAN/CSA-C22.2 No. 60079-11:14
Regulatory	■ FCC: Part 15.247, Part 15.249 (programming) ■ FCC ID: EWQINTELISG2 ■ Innovation, Science, and Economic Development Canada (ISED): RSS-247 and RSS-210 (programming) ■ IC ID: 864D-INTELISG2 ■ Measurement Canada: PS-G-06, approval AG-0642
Operational	All Intelis Gas Meters operate without the need for an FCC or ISED license. ■ Frequency: 902-928 MHz ISM band ■ Program frequency: 908-923.8 MHz
Australia	■ Radiocommunications Equipment (General) Rules 2021 ■ ACMA AS/NZS 4268 ■ Frequency: 915-928 MHz ISM band ■ Program frequency: 916-926.8 MHz
Operating temperature ratings	■ Measurement: -30° F (-34°C) to +131° F (55°C) ■ Valve: -13° F (-25°C) to +131° F (55°C) ■ RF: -40° F (-40° C) to +158° F (70°C) ■ LCD: -40°F (-40°C) to 185°F (85°C)^a When the firmware cannot read the correct values from the attached UMU or meter, the Intelis Gas Meter reports an "unknown" value.
Storage temperature ratings	-40°F (-40° C) to +158° F (70° C)
Battery information	4 Lithium manganese dioxide (LiMnO ₂) 'A' cell batteries, replaceable
Battery life	20 years for meter, RF, and valve using recommended operating parameters
Badging	Standard aluminum manufacturing and optional customer badge
Test pulse weight (volume per pulse)	0.10CF, 0.25CF, 0.50CF, 1.0CF, 10dm ³ , 50dm ³ , 3.0dm ³
Test pulse width	10 ms - 1000 ms (1 second)

Table 2 Intelis 425 Gas Meter specifications (continued)

Specification	Specification value
Minimum compatible collection software for OpenWay Riva network	■ FCS 4.5.3 ■ Itron Mobile 3.3 ■ FDM Tools 4.4.4 ■ Field Tools 2.1 ■ ISM 3.6 (for network) and 4.6 (for mobile) ■ Temetra/Temetra Mobile
Minimum compatible collection software for Gen5 network	■ Gen™3, 4, or 5 constantly powered device (CPD) hardware running UtilOS® 5.6 ■ FCS 4.6.1 ■ Itron Mobile 3.6 ■ FDM Tools 4.4.0 ■ ISM 4.2 (for network) and 4.6 (for mobile) ■ Temetra/Temetra Mobile ■ UtilityIQ® 5.2
Standards	Designed in compliance with ANSI B109.2 and ANSI B109.6.
Low Flow Cut Off set point	0.176 CFH or 5 L/H

^a Electro-optical characteristic and optical performance is affected during high temperature operation (approximately 176°F/80°C to 185°F/85°C) and low temperature operation (approximately -22°F/-30°C to -40°F/-40°C). Performance recovers under normal temperature range.

Elevated pressure meter capacity

This test determines the capacity of the meters outside of the typical operation conditions of 7 inches WC (water column) metering pressure and 0.5 inches WC differential pressure and with various hubs.

Equipment:	Regulated air pressure source, Differential pressure slope gauge, Stopwatch
	Note: Meters were tested on air

The following sections describe data collected for the "UMU Original" and "UMU Modified." For more information about the differences between these UMUs, see *PIL-22-1480 - Modifications to the North America (NAM) Intelis™ 250 Gas Meter*, available on <https://products.itron.com>.

UMU original

Natural Gas Capacity (SCFH)					
10 LT Hubs	Inlet Pressure				
	7 IWC	14 IWC	1 PSI	2 PSI	5 PSI

Differential Pressure	0.5 IWC	242	247	250	266	317
	1 IWC	360	366	375	397	472
	1.5 IWC	446	455	463	491	583
	2 IWC	515	525	536	568	672

Natural Gas Capacity (SCFH)						
20 LT Hubs		Inlet Pressure				
		7 IWC	14 IWC	1 PSI	2 PSI	5 PSI
Differential Pressure	0.5 IWC	258	256	266	285	339
	1 IWC	380	387	398	422	502
	1.5 IWC	470	479	491	522	619
	2 IWC	544	549	565	602	708

Natural Gas Capacity (SCFH)						
30 LT Hubs		Inlet Pressure				
		7 IWC	14 IWC	1 PSI	2 PSI	5 PSI
Differential Pressure	0.5 IWC	255	259	269	285	337
	1 IWC	383	392	401	425	503
	1.5 IWC	477	484	492	521	622
	2 IWC	548	556	566	603	709

Natural Gas Capacity (SCFH)						
1A-Sprague Standard Hubs		Inlet Pressure				
		7 IWC	14 IWC	1 PSI	2 PSI	5 PSI
Differential Pressure	0.5 IWC	244	248	256	272	325
	1 IWC	369	375	386	409	484
	1.5 IWC	455	464	480	505	601
	2 IWC	525	536	551	584	690

Natural Gas Capacity (SCFH)						
1" Pittsburgh Hubs (1 1/4" NPT)		Inlet Pressure				
		7 IWC	14 IWC	1 PSI	2 PSI	5 PSI
Differential Pressure	0.5 IWC	244	252	254	273	325
	1 IWC	371	380	385	412	484
	1.5 IWC	461	470	477	510	596
	2 IWC	529	542	549	585	688

Natural Gas Capacity (SCFH)						
ISO G 1 1/4" Hubs		Inlet Pressure				
		7 IWC	14 IWC	1 PSI	2 PSI	5 PSI
Differential Pressure	0.5 IWC	244	247	255	269	323
	1 IWC	367	375	383	408	478
	1.5 IWC	454	463	474	505	594
	2 IWC	525	535	545	579	685

Note: If the safety shut-off valve is enabled, the capacity in the chart might not be achieved as the valve closes at 500 ACFH (actual cubic feet per hour). A utility threshold is also programmable which takes into account PCOMP and temperature as applicable.

UMU Modified

The following data pertains to the year 2022.

Natural Gas Capacity (SCFH)						
10 LT Hubs		Inlet Pressure				
		7 IWC	14 IWC	1 PSI	2 PSI	5 PSI
Differential Pressure	0.5 IWC	242	247	250	266	317
	1 IWC	360	366	375	397	472
	1.5 IWC	446	455	463	491	583
	2 IWC	515	525	536	568	672

Natural Gas Capacity (SCFH)						
20 LT Hubs		Inlet Pressure				
		7 IWC	14 IWC	1 PSI	2 PSI	5 PSI
Differential Pressure	0.5 IWC	309	312	324	326	347
	1 IWC	462	468	477	485	523
	1.5 IWC	578	583	596	605	664
	2 IWC	669	676	687	707	763

Natural Gas Capacity (SCFH)						
1A Sprague Hubs		Inlet Pressure				
		7 IWC	14 IWC	1 PSI	2 PSI	5 PSI
Differential Pressure	0.5 IWC	286	286	289	297	326
	1 IWC	423	424	432	443	492
	1.5 IWC	527	534	546	560	624
	2 IWC	613	616	632	650	717

Natural Gas Capacity (SCFH)						
30 LT Hubs		Inlet Pressure				
		7 IWC	14 IWC	1 PSI	2 PSI	5 PSI
Differential Pressure	0.5 IWC	311	315	321	328	369
	1 IWC	458	463	471	488	540
	1.5 IWC	572	579	588	608	656
	2 IWC	671	676	686	711	767

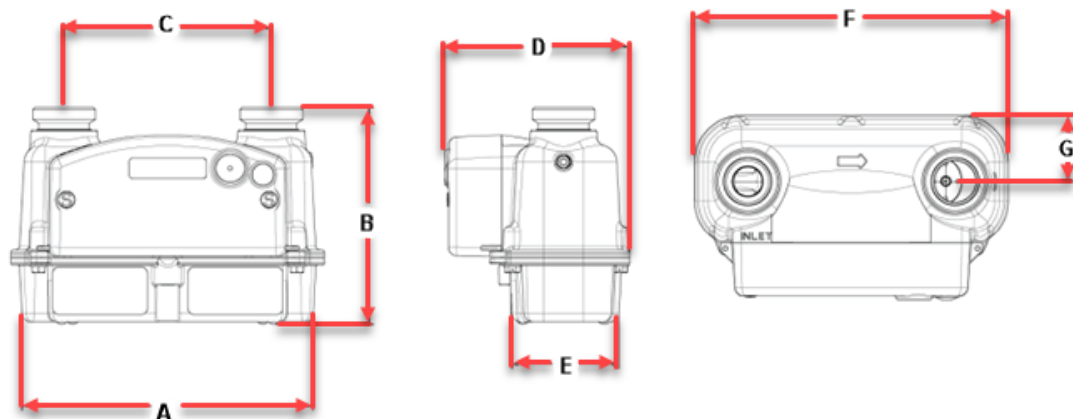
Natural Gas Capacity (SCFH)						
1" Pittsburgh Hubs (1 ¼" NPT)		Inlet Pressure				
		7 IWC	14 IWC	1 PSI	2 PSI	5 PSI
Differential Pressure	0.5 IWC	280	280	285	293	315
	1 IWC	408	412	419	432	467
	1.5 IWC	514	520	528	546	596
	2 IWC	594	603	622	634	687

Note: If the safety shut-off valve is enabled, the capacity in the chart might not be achieved as the valve will close at 500 ACFH (actual cubic feet per hour). A utility threshold is also programmable which takes into account PCOMP and temperature as applicable.

Dimensions

This section lists the Intelis Gas Meter variants' dimensions. Dimensions are listed in Imperial and Metric units.

Intelis Gas Meter/Intelis 250 Gas Meter



Note: This image depicts the Intelis Gas Meter (the Intelis 250 Gas Meter is not currently pictured).

Table 3 Intelis Gas Meter and Intelis 250 Gas Meter dimensions

A	B	C	D	E	F	G
8.4 inches	6.4 inches	6.0 inches	5.4 inches	3.1 inches	9.1 inches	1.9 inches
214.4 mm	161.9 mm	152.4 mm	138.3 mm	78.6 mm	230.6 mm	48.8 mm

Note: B dimension can vary with different hubs options. (20LT is shown).

Intelis 425 Gas Meter

This section describes the dimensions for both variations of the Intelis 425 Gas Meter.

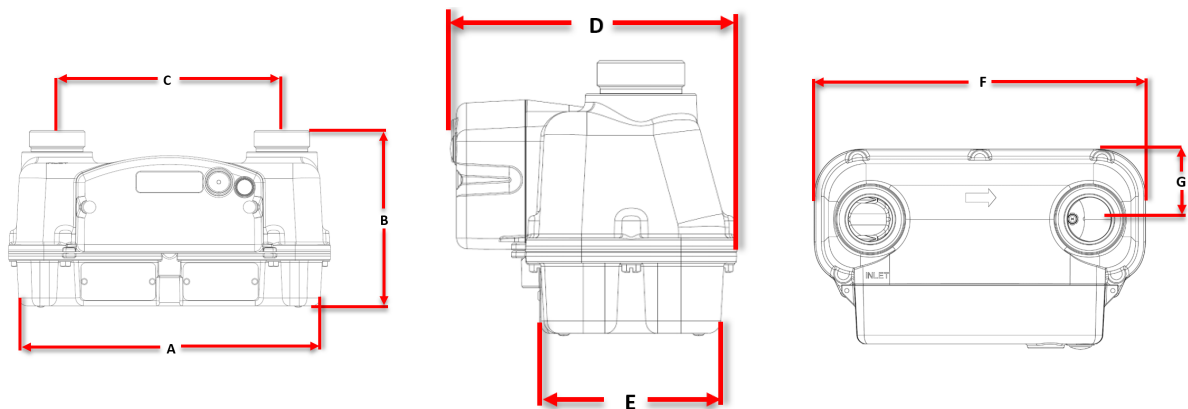


Table 4 Intelis 425 Gas Meter dimensions (8 inches hub)

A	B	C	D	E	F	G
11.07 inches	6.5 inches	8.25 inches	6.66 inches	4.19 inches	11.81 inches	2.24 inches
281.22 mm	165.13 mm	209.55 mm	169.61 mm	106.36 mm	299.97 mm	56.9 mm

Hydrogen

The Intelis 250 Gas Meter and Intelis 425 Gas Meters perform accurately when used with up to 20% Hydrogen gas. However, the pressure sensor's accuracy can be affected by worse case scenarios, which are described in [Table 5](#), [Table 6](#), and [Table 7](#)

Note: For any questions concerning Hydrogen gas and the Intelis 250 Gas Meter or Intelis 425 Gas Meter, contact your Itron representative.

Table 5 High pressure alarm or valve closure on meter with 7" set WC inlet pressure

7" inlet pressure	14" (0.5 PSI) Utility configurable high pressure setpoint	% difference	10 PSI Utility configurable high pressure setpoint	% difference
With 5% Hydrogen gas	1.3	153%	11.3	13%
With 10% Hydrogen gas	2.0	305%	12.5	25%
With 20% Hydrogen gas	3.5	609%	15.0	50%

Table 6 High pressure alarm or valve closure on meter with 2 PSIG inlet pressure

2 PSIG inlet pressure	4 PSI Utility configurable high pressure setpoint	% difference	10 PSI Utility configurable high pressure setpoint	% difference
With 5% Hydrogen gas	4.9	23%	11.3	13%
With 10% Hydrogen gas	5.9	47%	12.5	25%
With 20% Hydrogen gas	7.7	94%	15.0	50%

Table 7 High pressure alarm or valve closure on meter with 5 PSIG inlet pressure

5 PSIG inlet pressure	7.5 PSI Utility configurable high pressure setpoint	% difference	10 PSI Utility configurable high pressure setpoint	% difference
With 5% Hydrogen gas	8.6	15%	11.3	13%
With 10% Hydrogen gas	9.7	30%	12.5	25%
With 20% Hydrogen gas	11.9	59%	15.0	50%

Low pressure

Caution: To prevent inaccurate low pressure nuisance alarms, disable the low pressure alarm feature when using any amount of Hydrogen within your gas distribution system.

High pressure



Caution: The utility must decide what is best for their system when considering the high pressure alarm and valve shutoff because of the effects Hydrogen could have on the pressure sensor's accuracy. For example, on a 7" set with 10% Hydrogen, if your high pressure alarm and valve shutoff is set to close at 14" WC (water column), the valve would not close until pressure reached 2 PSI.

Tamper pressure

Although the valve shutoff is only activated on high pressure, the utility should be aware of the impact of Hydrogen on tamper pressure alarms. For example, on a 7" set with 10% Hydrogen, if your high pressure alarm and valve shutoff is set to close at 14" WC (water column) the alarm would not be triggered until pressure reached 2 PSI.

Components

The Intelis Gas Meter features the following components in a compact solid state meter:

- Intelis Gas Meter index
 - The index contains the integrated RF communications module, battery pack, and the liquid crystal display (LCD). The LCD provides a visual display of consumption, alarm messages, and status information. For information about LCD operation, see [Reading the Intelis Gas Meter LCD on page 59](#).
- An internal safety shutoff valve
- Ultrasonic measuring unit (UMU)
- Inlet and outlet tube
- Dust trap and filter (only on Intelis Gas Meter and Intelis 250 Gas Meter)
- Die cast aluminum case
- Steel hubs

Internal safety shutoff valve



Important! It is mandatory that a technician be on site at the meter to re-open the valve and ensure safe conditions before the flow of gas is resumed after a valve has been closed.

As a safety measure, all Intelis Gas Meters have an integrated actuated swing shutoff valve that can be programmed to automatically shutoff for a high flow or high temperature event. All Intelis 425 Gas Meters and Intelis 250 Gas Meters which have been manufactured with pressure sensing can be programmed to do the same for high pressure events. The valve is located in the outlet of the meter. An alarm is logged to notify the utility when the programmable threshold is reached and the valve closes, shutting off the gas flow. The valve can also be shut off through an RF command over the mobile network.

When one of these events is triggered, the disconnect is attempted even if the device temperature is out of range or the battery is low.

For more information about configuring the safety shut off valve, see [Safety shutoff valve on page 45](#).

High flow

When the valve is closed, the meter performs a volume check every 30 seconds and logs an alarm if more than 0.18 CF (5 L) is detected. The alarm is logged in the event log. In network mode, the alarm is transmitted to the meter data management system.



Caution: This valve is not designed to be a permanent shutoff. The maximum leak rate for the closed valve is 0.035 CFH (1 L/H). For more information about the safety shutoff valve, see [Safety shutoff valve on page 45](#).

Pressure sensing

The Intelis 250 Gas Meter with optional pressure and Intelis 425 Gas Meter uses periodic pressure readings to evaluate against high and low pressure thresholds values, and initiates events (such as automatic disconnect) based on the results of that evaluation. The meter frequently monitors for high pressure conditions and initiates high pressure shutoff within ten seconds of high pressure being detected.

Low pressure alarming can be useful to understand potential outage situations or areas of the distribution system where pressure is declining. Tamper pressure can be used as a warning of regulator health (for example, when the regulator goes into relief and is venting gas) or it can be used to determine if someone has increased the gas regulator pressure to potentially steal gas. All pressure set points are factory programmed at values defined by the utility. However, utilities are expected to configure based on the ranges outlined in [Table 8](#).

Table 8 Factory programmed valid ranges for high pressure threshold

Meter inlet pressure ²	Low pressure alarm	High pressure alarm and shutoff	Tamper pressure alarm ³
7" WC (0.25 PSI) ⁴	3.5" WC (0.13 PSI)	14" WC (0.5 PSI) to 10 PSI	14" WC (0.5 PSI) to 10 PSI
9" WC (0.33 PSI)	3.5" WC to 4.5" WC (0.13 to 0.16 PSI)	18" WC (0.65 PSI) to 10 PSI	18" WC (0.65 PSI) to 10 PSI

² The regulator set pressure or delivery pressure if there is no regulator.

³ The pressure that results in a pressure alarm.

⁴ If meter inlet pressure or delivery pressure is less than 7" WC, false alarms can occur. If the utility does not want false low pressure alarms, low pressure alarming should be disabled. High pressure alarm and shut off threshold, low pressure alarm threshold, and tamper pressure thresholds allow for any value within their respective range to be entered in PSI except for 7" WC inlet pressure, which is fixed at 3.5" WC for the low pressure alarm.

Table 8 Factory programmed valid ranges for high pressure threshold (continued)

Meter inlet pressure ²	Low pressure alarm	High pressure alarm and shutoff	Tamper pressure alarm ³
11" WC (0.4 PSI)	3.5" WC to 5.5" WC (0.13 to 0.2 PSI)	22" WC (0.79 PSI) to 10 PSI	22" WC (0.79 PSI) to 10 PSI
14" WC (0.5 PSI)	3.5" WC to 7" WC (0.13 to 0.25 PSI)	1 to 10 PSI	1 to 10 PSI
1 PSI	3.5" WC to 14" WC (0.13 to 0.5 PSI)	2 to 10 PSI	2 to 10 PSI
2 PSI	3.5" WC (0.13 PSI) to 1 PSI	4 to 10 PSI	4 to 10 PSI
5 PSI ⁴	3.5" WC (0.13 PSI) to 2.5 PSI	7.5 to 10 PSI	7.5 to 10 PSI

Automatic shutoff configuration

The Intelis Gas Meter can be configured for an automatic shut off for the following event types.

- **High flow.** Configuration for a high flow event enables an automatic shut off if the high flow threshold is reached or exceeded in a configurable window of time.

There are two thresholds for the high flow set point: the factory default threshold and the utility configurable threshold. The Intelis 250 Gas Meter factory default is 500 actual CFH. The Intelis 425 Gas Meter factory default is 850 actual CFH.

In the Intelis 250 Gas Meter and Intelis 425 Gas Meters, the factory threshold can be enabled or disabled. In the Intelis Meter, the factory threshold is always enabled if the utility configured valve is enabled.

- **High temperature.** Configuration for a high temperature event enables an automatic shut off if the high temperature threshold is reached or exceeded.
- **High pressure** (*Intelis 250 Gas Meter and Intelis 425 Gas Meters only*). Configuration for a high pressure event enables an automatic shut off if the high pressure threshold is reached or exceeded.

For more information about flow, temperature, and pressure event configuration, see the FDM documentation. For document information, see [Related documents on page 9](#).

Integrated RF communications

The integrated RF communications module is designed to operate in either mobile or network mode. When the Intelis Gas Meter is operating in mobile mode, it may be read

² The regulator set pressure or delivery pressure if there is no regulator.

³ The pressure that results in a pressure alarm.

⁴ If the meter inlet pressure or delivery pressure is above 5 PSI, high pressure alarm and valve shutoff should be disabled.

using an FC300SR, a Mobile Collector radio connected to a Windows laptop or tablet, or an Itron Mobile Radio connected to a smart phone, tablet or laptop. When the meter is operating in network mode, it is read by either the OpenWay Riva Network or Gen5 Network.

Note: The communication functionality is dependent on the module's firmware version.

The integrated RF communications device uses the following types of technology:

- **Encoder.** The device records consumption, tampers, events, and/or alarm information.
- **Receive.** The device receives radio signals for programming or to initiate a reading.
- **Transmit.** The device transmits the encoded information to the selected collection application or device.

RF communications devices are designed with the following characteristics.

- **RF device.** The integrated RF communications module is a radio frequency device integrated in the Intelis Gas Meter to collect consumption data and tamper or events/alarms. The device encodes and transmits the data and alerts to the configured collection method or device.
- The Intelis meter LCD displays the device's recorded gas consumption and status information.
- **Data logging.** The device logs interval consumption data.
 - **Mobile mode.** This functionality stores the preceding 40 days of hourly data.
 - **Gen5 network mode.** This functionality provides 5,952 buckets of configurable interval data down to five-minute resolution.
 - **OpenWay Riva network mode.** This functionality provides 3,840 buckets of configurable interval data down to one-minute resolution.



Caution: Performing a mode Switch (mobile mode to network mode) results in a loss of interval data.

- **Security.** Itron Security Manager (ISM) provides enhanced network security using authentication and encryption when the meter is read by Itron data collection methods and equipment.

3

Concepts and technology

This chapter provides a general overview of the Intelis Gas Meter operational concepts and technology, including:

- [Operational parameters on page 28](#)
- [Ultrasonic measurement technology on page 29](#)
- [Transmit and receive cycle on page 30](#)
- [Data collection on page 30](#)
- [Mobile reading cycle on page 32](#)
- [Security on page 36](#)
- [Consumption data on page 39](#)
- [Encoding status, event, and alarm data on page 40](#)
- [Pressure tamper detection on page 40](#)

Operational parameters

The operational parameters of the Intelis Gas Meter are programmable. Reprogramming the meter allows the utility to install the meter in a new location, extending the operational life of the meter if a meter is upgraded, exchanged, or removed. FDM programmable parameters include the following:

- Program audit mode
- Relative time ref
- SSID
- Auto wakeup enable

Note: If set to `true` in network mode, the meter looks for a network to join after 7 liters (if configured to metric units) or 0.2 cubic feet (if configured for imperial units) of consumption is measured in a single top-of-hour to top-of-hour period.

- Initial consumption
- Pressure compensation

Note: This parameter is a fixed factor value, i.e. PCOMP.

- Gas shutoff enabled
- High flow rate threshold

- High flow rate aggregation window
- High flow rate sampling frequency
- High pressure threshold (Intelis 250 Gas Meter and Intelis 425 Gas Meters only)
- Low pressure threshold (Intelis 250 Gas Meter and Intelis 425 Gas Meters only)
- Tamper pressure threshold (Intelis 250 Gas Meter and Intelis 425 Gas Meters only)
- High temperature threshold
- Automatic high flow shutoff
- Automatic high temperature shutoff
- Test mode maximum time
- Test mode pulse width
- Test mode pulse weight

Note: Most of the listed parameters are set at the server level and cannot be configured or set in the field.

Ultrasonic measurement technology

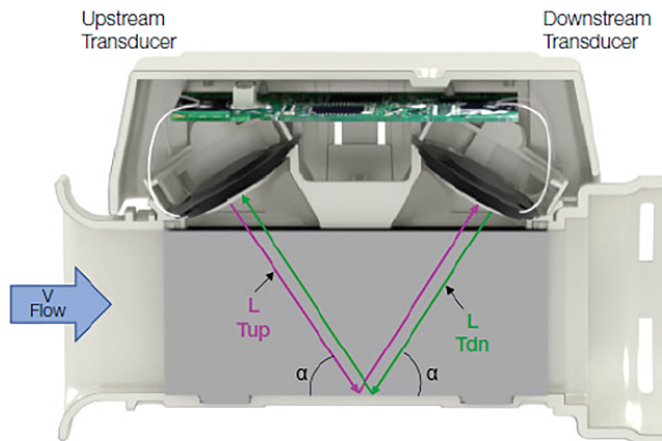
The Intelis Gas Meter is based on the ultrasonic measurement principle.

Ultrasonic measurement principle

The time-of-flight single-path measurement method used in Ultrasonic Meters is simple, yet highly effective. It utilizes two transducers, one upstream and one downstream of the gas flow. One transducer emits an ultrasonic signal, while the other senses it. The process is then reversed. The time difference between the ultrasonic signals traveling upstream is then measured, allowing for precise gas flow measurements.

The time difference for the ultrasonic pulses to travel upstream versus downstream and the length between the pulses is used to determine the velocity of the gas flow. The flow rate is calculated from the velocity and the cross-sectional area of the path. The ultrasonic pulse takes less time to travel in the direction of the gas flow and more time to travel against the flow of gas. During no flow conditions, the transit time for the pulses is the same.

Ultrasonic single path with two transducers



L = length of path between transducers

T_{up} = time from transducer upstream to downstream

$$T_{up} = \frac{L}{C + \cos \alpha \cdot V}$$

T_{dn} = time from transducer downstream to upstream

$$T_{dn} = \frac{L}{C - \cos \alpha \cdot V}$$

C = speed of sound

$$C = \frac{L}{2} \cdot \frac{T_{up} + T_{dn}}{T_{up} \cdot T_{dn}}$$

V = velocity

$$V = \frac{L}{2 \cdot (\cos \alpha)} \cdot \frac{T_{dn} - T_{up}}{T_{up} \cdot T_{dn}}$$

Volume = Velocity * cross sectional area of the measurement channel * time

Ultrasonic measurement benefits

The benefits of the Intelis Gas Meter's ultrasonic measurement technology include the following:

- **Compact size.** The primary benefit of the Intelis Gas Meter is the compact size.
- **Accuracy.** After the initial calibration, the ultrasonic Intelis Gas meter is less likely to drift and require re-calibration since there are no moving parts.
- **Stability.** The Intelis Gas Meter measurement device has no moving parts making lock-up due to contamination or freeze-up highly unlikely.
- **Self-diagnostics.** Due to the electronic design, the Intelis Gas meter is capable of some self-diagnostics.

Transmit and receive cycle

The meter's encoding, transmitting, and receiving data cycle supports a two-way messaging structure to transmit data in response to requests from data collection devices. For more information about the Intelis Gas Meter transmit and receive cycles, see [Transmit and receive operations on page 42](#).

Data collection

The Intelis Gas Meter operating in mobile mode is read by Itron handhelds and mobile readers. For more information about reading devices and software requirements, see or reference the Intelis product specification sheet. For documentation information, see [Related documents on page 9](#).

Mobile mode

The Intelis Gas Meter programmed for mobile mode can be read by Itron reading options.

[Table 9](#) lists compatible ChoiceConnect data collection devices. For Itron product software compatibility, see [Table 10](#).

Table 9 Gen5 and OpenWay Riva in mobile mode (All RF Features, All ChoiceConnect Security Levels)

Model	Compatible model part number	Radio firmware version
Mobile Collector 4 (MC4)	■ DCU-5320-001 ■ DCU-5320-201 ■ DCU-5320-301	1.4
Mobile Collector 3 (MC3)	■ DCU-5300-001DL, DCU-5300-001DLU ■ DCU-5300-011DLU ■ DCU-5310-001, DCU-5310-011, DCU-5310-012 ■ DCU-5310-011U	1.4
MC3Lite	■ DCU-5310-301, DCU-5310-302	1.4
MCLite	■ DCU-5000-002DL DCU-5310-201	033
FC300SR Note: As of 2021, the FC300 is no longer officially supported by Itron. FC300 customers are strongly encouraged to instead use Field Tools, which will include features and support that is not included with FC300 products.	■ FC3-xxx1-xxx ■ FC3-xxx4-xxx	033
IMR	■ IMR-0900-xxx ■ IMR-0902-xxx	2.5

Note the following:

- Intelis requires installation of Itron Security Manager (ISM). This is needed for both mobile and network mode. ISM provides additional security to prevent unintentional commands such as closing a valve. For mobile mode, Itron recommends Command Security.
- Field Tools can operate on a variety of smart phones, tablets, and laptops running Android®, Apple iOS™ and Windows®.
- Itron Mobile for FCS can operate on a variety of smart phones, tablets, and laptops running Android, Apple iOS and Windows 10, including products from Honeywell and Panasonic that are resold by Itron.

Compatibility

[Table 10](#) describes the software compatible with the products listed in [Table 9](#).

Table 10 Software compatible with the products listed in [Table 9](#) by Intelis variant

Intelis variant	All models of MC3, MC4, and IMR	FC300SR and MCLite
Intelis Gas Meter	■ OpenWay Riva — FCS 4.3.1 — Itron Mobile 3.0 ■ Gen 5 — FCS 4.3.1 — Itron Mobile 3.0	■ OpenWay Riva — FCS 4.3.1 ■ Gen5 — FCS 4.3.1
Intelis 250 Gas Meter	■ OpenWay Riva — FCS 4.5.3 — Itron Mobile 3.3 ■ Gen5 — FCS 4.6.1 — Itron Mobile 3.6	■ OpenWay Riva — FCS 4.5.3 ■ Gen5 — FCS 4.6.1
Intelis 425 Gas Meter	■ OpenWay Riva — FCS 4.5.3 — Itron Mobile 3.3 ■ Gen5 — FCS 4.6.1 — Itron Mobile 3.6	■ OpenWay Riva — FCS 4.5.3 ■ Gen5 — FCS 4.6.1

Mobile reading cycle

The Intelis Gas Meter converts consumption or status data to an RF signal providing an efficient solution to collect utility meter reads via a mobile system. The meter's data collection is accomplished using a compatible reading solution.

The solid state Intelis Gas Meter collects and electronically transmits the meter reading using radio frequencies. Data collection reads are obtained from meter populations in a short time. The meter reading cycle for daily and hourly data follows fundamental principles utilizing a two-way messaging format. Data is transmitted upon a request from the data collection reader. Along with the current reading SCM+ message, daily or hourly consumption, tamper information, and extended status data can be read in one of the listed requests. The following read requests are available in mobile mode.

- **Read one day of hourly interval data.** This request prompts the Intelis Gas Meter to return one day of hourly interval data ending at the specified hour offset. The hour offset is the number of hours back from the current hour.
- **Read 40 days of daily interval data.** This request prompts the Intelis Gas Meter to return 40 days of daily interval data measured at the specified hour offset. The hour offset is the number of hours back from the current hour.
- **Read 40 days of hourly interval data (960 intervals).** This request prompts the Intelis Gas Meter to return 40 days of hourly interval data for the hours specified. Due to the amount of data requested, the meter sends the data in multiple packets. This request method requires a multi-packet message (more than one response).

The Intelis Gas Meter maintains a 24-hour clock for hourly data. The system allows the user to set the time with most two-way downlink commands without affecting the system performance. Whenever the time is adjusted, a flag is set in the hourly consumption field to indicate a time adjustment event. The maximum time drift is less than $\pm$ five minutes per month when read monthly. If greater accuracy is required, update the Intelis Gas Meter at regular intervals.

OpenWay Riva network mode

The Intelis Gas Meter RF communications programmed for OpenWay Riva network mode uses IPv6 open standards-based protocol that can be read by the Itron Connected Grid Router (CGR) in a point-to-point star network. An Itron OpenWay Riva electric meter can read the meter in areas where the gas and electric systems overlap.

[Table 11](#) lists the compatible ChoiceConnect data collection devices when a mobile contingency read is necessary for a device operating in OpenWay Riva network mode. For Itron product software compatibility, see [Table 12](#).

Table 11 OpenWay Riva Intelis Gas Meter in OpenWay Riva network mode (Contingency Read)

Model	Compatible model part number	Radio firmware version	Software type and version
Mobile Collector 4 (MC4)	■ DCU-5320-001 ■ DCU-5320-201 ■ DCU-5320-301	1.4	FCS and Itron Mobile 4.3.1/2.5
Mobile Collector 3 (MC3)	■ DCU-5300-001DL, DCU-5300-001DLU ■ DCU-5300-011DLU ■ DCU-5310-001, DCU-5310-011, DCU-5310-012 ■ DCU-5310-011U	1.4	FCS and Itron Mobile 4.3.1/2.5
MC3Lite	■ DCU-5310-301, DCU-5310-302	1.4	FCS and Itron Mobile 4.3.1/2.5

Table 11 OpenWay Riva Intelis Gas Meter in OpenWay Riva network mode (Contingency Read) (continued)

Model	Compatible model part number	Radio firmware version	Software type and version
MCLite	■ DCU-5000-002DL DCU-5310-201	033	FCS Legacy 4.3.1
IMR	■ IMR-0900-xxx ■ IMR-0902-xxx	2.5	FCS and Itron Mobile 4.3.1/2.5FDM Tools 4.4.0

Compatibility

Table 12 describes the software compatible with the products listed in Table 11.

Table 12 Software compatible with the products listed in Table 11 by Intelis variant

Intelis variant	All models of MC3, MC4, and IMR	FC300SR and MCLite
Intelis Gas Meter	■ Temetra/Temetra Mobile ■ OpenWay Riva — FCS 4.3.1 — Itron Mobile 3.0	■ OpenWay Riva — FCS 4.3.1 ■ Gen5 — FCS 4.3.1
Intelis 250 Gas Meter	■ OpenWay Riva — FCS 4.5.3 — Itron Mobile 3.3	■ OpenWay Riva — FCS 4.5.3 ■ Gen5 — FCS 4.6.1
Intelis 425 Gas Meter	■ OpenWay Riva — FCS 4.5.3 — Itron Mobile 3.3	■ OpenWay Riva — FCS 4.5.3 ■ Gen5 — FCS 4.6.1

Gen5 network mode

The Intelis Gas Meter RF communications programmed for Gen5 network mode are compatible with Gen5 neighborhood area networks. The Gen5 head end software requests the Intelis' meter data on demand or on a predetermined schedule. The Intelis communication module operates as a leaf node and uploads its data to the head end through a secure trap through a constantly powered device (CPD).

Table 13 lists the compatible ChoiceConnect data collection devices when a mobile contingency read is necessary for a device operating in Gen5 network mode. For Itron product software compatibility, see **Table 14**.

Table 13 Gen5 Intelis Gas Meter in Gen5 network mode (Contingency Read)

Model	Compatible model part number	Radio firmware version	Software type and version
Mobile Collector 4 (MC4)	■ DCU-5320-001 ■ DCU-5320-201 ■ DCU-5320-301	1.4	FCS and Itron Mobile 4.3.1/2.5
Mobile Collector 3 (MC3)	■ DCU-5300-001DL, DCU-5300-001DLU ■ DCU-5300-011DLU ■ DCU-5310-001, DCU-5310-011, DCU-5310-012 ■ DCU-5310-011U	1.4	FCS and Itron Mobile 4.3.1/2.5
MC3Lite	■ DCU-5310-301, DCU-5310-302	1.4	FCS and Itron Mobile 4.3.1/2.5
MCLite	■ DCU-5000-002DL DCU-5310-201	033	FCS Legacy 4.3.1
FC300SR Note: As of 2021, the FC300 is no longer officially supported by Itron. FC300 customers are strongly encouraged to instead use Field Tools, which will include features and support that is not included with FC300 products.	■ FC3-xxx1-xxx ■ FC3-xxx4-xxx	033	FCS Legacy 4.3.1 FDM Tools 4.4.0
IMR	■ IMR-0900-xxx ■ IMR-0902-xxx	2.5	FCS and Itron Mobile 4.3.1/2.5 FDM Tools 4.4.0

Compatibility

Table 14 describes the software compatible with the products listed in **Table 13**.

Table 14 Software compatible with the products listed in Table 13 by Intelis variant

Intelis variant	All models of MC3, MC4, and IMR	FC300SR and MCLite
Intelis Gas Meter	■ Temetra/Temetra Mobile ■ Gen 5 — FCS 4.3.1 — Itron Mobile 3.0	■ Gen5 — FCS 4.3.1
Intelis 250 Gas Meter	■ Gen5 — FCS 4.6.1 — Itron Mobile 3.6	■ Gen5 — FCS 4.6.1
Intelis 425 Gas Meter	■ Gen5 — FCS 4.6.1 — Itron Mobile 3.6	■ Gen5 — FCS 4.6.1

Security

The Intelis Gas Meter operates securely using Itron Security Manager (ISM) for enhanced security to provide greater protection for bubble up and two-way messaging.



Important! Once the Intelis Gas Meter is programmed to a specific ISM, it cannot be changed. The enhanced encrypted communications helps prevent others from monitoring user information.

Security must be enabled to manually send valve commands and configure automatic disconnect functionality.

The Intelis Gas Meter has the following security levels, defined by ISM, available in Choice Connect mobile mode.

- **Ready to secure.** No enhanced security is enabled, although it is available. Certain functions—such as an RF command to open or close the valve—are not available when the security level is ready to secure. Ready to secure mode includes no application layer security. In a ready to secure state, meters contain only the Itron and utility factory keys, which allow the device to be programmed to command security or full security at a future date. After the meters are imported into the Itron Security Manager, they are ready for the ISM security officer to request a security level change to a different security level.
- **Command security.** In command security mode, all programming and action commands sent to the meter are encrypted and authenticated with a unique device key. Setting the Intelis Gas Meter to command security adds command, revocation, and recovery security keys.

- **Full security.** In addition to the programming and action commands being secured with a unique key, all reading commands and responses from the meter are now encrypted with a shared reading key. This is the most secure ISM mode.

For more information about ISM, refer to *Itron Security Manager (ISM) User Guide*. See [Related documents on page 9](#).

Security fundamentals

Security is applied to the RF communications between the Itron data collection device and the Intelis Gas Meter. The Intelis Gas Meter and the data collection device use two fundamental security processes to ensure communications confidentiality and validity across the RF link.

- **Authentication.** Authentication is the process of confirming that an artifact is genuine or valid. Itron Security Manager (ISM) authentication is the process of verifying that the request is from a valid source and that the request is in its original form.
- **Encryption.** Encryption is the process of transforming information to make it unreadable to anyone who does not possess the required security key. There are two types of encryption: symmetric and asymmetric. Symmetric uses a shared key to decrypt/encrypt information. Asymmetric uses a private key to encrypt and a public key to decrypt. ISM uses both symmetric and asymmetric encryption in the Itron security solution.

The Intelis Gas Meter provides both authentication and encryption. Privacy is maintained on data collection messages from Intelis Gas Meter with enhanced security through encryption. Messages from the Intelis Gas Meter are authenticated by the data collection systems. Two-way commands from the data collection systems are authenticated by the Intelis Gas Meter to ensure that the source of the data is valid. Command messages are used to manage the Intelis Gas Meter security keys. New security keys can be injected or updated with Itron ISM key control.

Security key and certificate types

When the Intelis Gas Meter is operating in mobile mode, security keys are maintained for the device. Mobile mode device ISM security keys include the following:

- **Two reading keys.** Reading keys secure and decipher reading data including bubble-up messages and two-way data logging commands.
- **Two command/programming keys.** Command/programming keys secure commands that modify both the metrology and non-metrology state of the Intelis Gas Meter.
- **Two revocation keys.** Revocation keys perform key exchanges. The Intelis Gas Meter key exchanges support adding new keys, exchanging one key for another, or removing reading keys.

- **One recovery key.** The recovery key is a special revocation key. The recovery key is utility-generated and managed and does not participate in the active/standby rollover operations as the two other revocation keys do. The intent of this key is to allow the utility to set a key aside in a secure location for use in the event that the revocation keys are lost. When security is removed from a module, configuration tools include a delete all non-factory keys method that must be secured using the recovery key.
- **One utility factory key.** The utility factory key is injected during the manufacturing process into non-volatile memory and is used to manage security keys in the Intelis Gas Meter while the device is operating in an unsecured mode. When the Intelis Gas Meter is operating in the enhanced security mode (ISM), this key is non-functioning.
- **One Itron factory key.** The factory key is a permanent key that is injected in non-volatile memory during the manufacturing process. The sole purpose of this key is to allow Itron to change the utility factory key using an RF-based command. Changing the utility factory key is typically completed as a step in the return sales order process (RSO). Like the utility factory key, this key is non-functioning when the Intelis Gas Meter is operating in the enhanced security mode (ISM).

When the Intelis Gas Meter is operating in network mode, security is applied at the network and application layers.

The Intelis Gas Meter injected security credentials are dependent on utility ordering. The Network layer includes a set of certificates injected during the manufacturing process. These certificates include:

- **Birth certificate chain.** The birth certificate chain is used to authenticate the Intelis Gas Meter to the utility's network domain when joining the network.
- **AAA CA Certificate.** Used as a trust anchor when authenticating the utility's network domain during the join process.

At the application layer, the following sets of credentials are used:

- **OpenWay Enhanced Security Key set.** Used to secure application messages between OWOC-CM and the device. Also, used in part during communication sessions between FDM and the Intelis Gas Meter.
- **FND CA Certificate.** Used to authenticate messages sent from IoT FND to the Intelis Gas Meter.

The reading keys for all OpenWay Riva Network devices at a utility are shared by all Intelis Gas Meters in the utility's installation. For clarification, the reading key list for the Intelis Gas Meters is different than the reading key list used by the OpenWay Riva Network repeaters. All other key types are unique for each Intelis Gas Meter. The device ISM security keys include the following types:

- **Four command keys.** Command keys are shared keys that are used to digitally sign command messages sent to Intelis Gas Meters.
- **Two revocation keys.** Revocation keys are shared keys that are used to digitally sign commands to update public keys.
- **One recovery key.** The recovery key is unique for the device and is used to encrypt symmetric key materials during key updates.
- **Two system keys.** System keys are shared keys that are used to encrypt and authenticate multicast messages sent to the Intelis Gas Meter.
- **Two device keys.** Device keys are unique for the device. They are used to encrypt and authenticate unicast messages sent to the Intelis Gas Meter. Device keys are also used to encrypt and authenticate messages sent from the Intelis Gas Meter to OWOC.
- **Session keys.** Session keys are limited lifetime keys that are unique for each local access session. The session keys are not maintained by ISM.
- **One rollover nonce key.** The rollover nonce key is a unique key used during the rollover process that updates symmetric keys.
- **One firmware encryption key.** The firmware encryption key is a shared key used to encrypt device firmware images.
- **One firmware signing key.** The firmware signing key is a shared key used to digitally sign device firmware images.

Consumption data

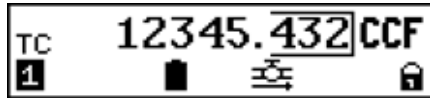
The primary operation of the Intelis Gas Meter is to measure the amount of gas flowing through the meter. The hourly count data (consumption) is stored in the meter. In mobile mode, the meter stores 40 days of hourly interval data and the data is overwritten every 960 intervals in a round-robin fashion (the first interval is the latest written interval, and the last interval is the one written 40 days ago). In contrast, in Riva network mode, the meter stores 3,840 intervals of data, programmable down to one minute intervals. In Gen5 network mode, the meter stores 5,952 intervals of data programmable down to 5-minute interval data.

The Ultrasonic Measuring Unit (UMU) requires battery power to update consumption. Every hour after initial power up, consumption in the UMU is written to EEPROM which is non-volatile memory in the Intelis index/radio. If the UMU loses battery power, such as if the index containing 4 batteries is removed from the meter, any flow that occurs while there is no power is not measured. Once power is restored, the UMU continues to add consumption from the last stored value in EEPROM.

Note: If power is removed from the Intelis Gas Meter prior to the Intelis Gas Meter being properly decommissioned, the UMU does not turn back on when power is restored, and there is no signal in the LCD display or the meter's log that indicates the UMU off status. Additionally, safety features that rely on the UMU data are disabled and the valve remains in its current state (open). Effectively, gas will continue to flow through the meter without any volume accumulation.

The consumption data information is displayed on the Intelis liquid crystal display (LCD). The following list describes the way the consumption data may be displayed.

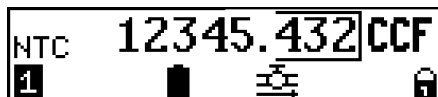
- Intelis Gas Meter LCD temperature compensated (TC) display with Imperial units.



- Intelis Gas Meter LCD temperature compensated (TC) display with Metric units.



- Intelis Gas Meter LCD non temperature compensated (NTC) display with Imperial units.



Encoding status, event, and alarm data

The Intelis Gas Meter encodes gas consumption, event, and alarm data. The meter also reports system status and provides event or alarm notifications, some of which are specific to potential tampering situations. The tamper or event counters increment at each event.

High pressure detection

For information about high pressure, see [Safety shutoff valve on page 45](#) and [High pressure on page 47](#).

Pressure tamper detection

The Intelis Gas Meter compares the pressure reading value taken at each pressure recording interval period (as described in [Pressure sensing on page 25](#)) to a user-configured pressure tamper threshold value. If the new pressure reading is equal to or greater than the pressure tamper threshold, a pressure tamper started event is added to the event log. A subsequent pressure reading that falls below the pressure tamper threshold results in a pressure tamper ended event added to the event log.

By default, the pressure tamper threshold is disabled to prevent false alarms. For information about configuring this threshold, see the *Field Deployment Manager (FDM) Mobile Application Guide*.

In mobile mode

A pressure reading that is greater than or equal to the pressure tamper threshold sets a tamper bit, which is processed and sent to Field Collection System (FCS). The bit clears after 40 days.

In network mode

By default, the pressure tamper start and end events are not enabled as alarms (they are default configured as events). Users can configure these events as alarms in OWCM.

4

Transmit and receive operations

This section describes the Intelis Gas Meter transmit and receive communications.

Transmission modes

The Intelis Gas Meter's integrated RF communication device supports and reports consumption and alarm or event information through a transmitted mobile mode message or network message beacon collected using an Itron collection method.

OpenWay Riva network mode retry algorithm

In OpenWay Riva network mode, the RF communications device alternates between searching for the Star Network and a Mesh Network. The default setting is for the device to search for a Star network first, and then to search for a Mesh Network. The RF communications device default of searching for a Star Network first can only be changed with custom programming at the time the device is ordered. Custom programming is completed at the time the device is manufactured. This default setting cannot be changed in the field with FDM.

The retry algorithm contains a back off sequence that is designed to conserve battery life while the device continues the attempts to join the network. This sequence is intentionally randomized to create the best opportunity for multiple devices to successfully join the network. A retry algorithm process can take two to four days to complete. A retry cycle is dependent on the device's randomized timing for the network joining attempts.

Communications operation specifications

The Intelis Gas Meter's mobile and network operating modes are summarized in the following tables.

Table 15 Mobile and networking operating modes

Operation mode	Transmission rate	Output power
High Power Mobile	60 seconds	+24 dBm (250 milliwatts)
Mobile/Handheld	15 seconds	+10 dBm (10 milliwatts)

Table 15 Mobile and networking operating modes (continued)

Operation mode	Transmission rate	Output power
(optional) Hard-to-Read Mobile/Handheld	30 seconds	+24 dBm (250 milliwatts)
OpenWay Riva Network and Gen5 Network	Dependent on utility configuration of OWCM and UtilityIQ interrogation schedule. Nominally, three times per day.	+27 dBm (500 milliwatts)

The Intelis Gas Meter's optimum battery life is dependent on the meter operating in a standard configuration. For standard configuration settings, see [Battery life on page 54](#).

Extended FAN connectivity (EFC)

Extended fan connectivity allows the communications module to communicate through a parent battery powered device (such as another Intelis Gas Meter) which in turn can communicate to a parent mains powered device. Extended fan connectivity is not reliant on the head end or FDM for setup. The default configuration for EFC is enabled. EFC is a programmable parameter.

Note: EFC does not pertain to mobile mode and will be available in the future releases of Gen5 mode.

Mobile mode message exchange

The Intelis Gas Meter operating in mobile mode bubbles up (transmits) SCM+ messages on fifty discrete channels. After the device transmits on each of these channels, the module listens for commands from an Itron programming device or collection method on the same channel.

Mobile mode transmit operations

When the Intelis Gas Meter is moved out of factory mode and into mobile mode, it begins to bubble-up messages. The message includes the following data types:

- Module ID
- Meter reading value
- Tamper or event value
- Valve state

Transmission characteristics

In mobile mode, the Intelis Gas Meter transmits messages in a bubble-up fashion. The RF communications device transmits an SCM+ message an average of every 15 seconds when programmed in the default handheld/mobile mode. Each transmission occurs on 1 of

50 channels the device picks pseudo-randomly. If there are many Intelis Gas Meters in a close proximity, it is possible that two devices will transmit at the same time. Even though two Intelis Gas Meters may transmit at the same time, it is highly unlikely they will transmit on the same channel. To eliminate the likelihood of transmissions repeatedly occurring at the same time, the transmission time is varied randomly by ± 2 seconds. The Intelis Gas Meter bubbles-up every 15 to 60 seconds depending on its mobile mode configuration.

This frequency (channel) hopping and time dithering combined with the bubble-up rate and the likelihood of being in range to receive multiple messages provide for reliable communication between the Intelis Gas Meter and the data collection reader or method.

The Intelis Gas Meter must receive a specific request from the reader to transmit daily or hourly interval data. When the Intelis Gas Meter sends interval data, the device must send the current consumption so the interval is related to the consumption value to determine the actual consumption at the prior interval. The meter does not send raw count data because consumption is a combination of raw counts and initial consumption.

The total consumption sent in an interval packet is the same as the SCM+ (processed for pressure compensation and initial consumption) but the reading is not adjusted for rollover. Intervals are sent as the raw count value; compensation and rollover are not included.

To calculate the value at a prior interval, the reader can sum the subsequent interval values and then apply the compensation to get a consumption with the remainders adjusted for rollover. This approach eliminates complex or time-consuming math in the Intelis Gas Meter and transfers it to the reader, where more powerful resources can process the data.

Mobile mode receive operations

The Intelis Gas Meter receives commands in the Industrial Scientific Medical (ISM) band in the range of 902-928 MHz with programming commands received in the range of 908-923.8 MHz. While Intelis Gas Meters are in factory mode, the receiver turns on every 60 seconds to listen for a Program Endpoint or Check Endpoint command at 908 MHz. The meter receiver is tuned to the transmission channel for a duration of approximately 2 ms and can receive commands during this time.

In two-way communication mode, the meter responds to a specific command from the reading device. The reading device transmits a command during the time the Intelis Gas Meter has its receiver active. The meter must conserve power so its receive time is set to a minimum—just long enough to detect a message command. If no other command operation is required, the reading device will not send any additional message. If the Intelis Gas Meter fails to detect a command message, it reverts to listening for a command.

5

Safety shutoff valve

The Intelis Gas Meter safety shutoff valve is comprised of two components: the main valve, which is an actuated swing valve, and a bleed valve. The bleed valve assists when opening the main valve. A maximum pressure differential of approximately 1PSI is required to open the main valve.

The following list describes icons referenced in this section.

- **Armed state:**  
- **Open valve:** 
- **Closed valve:** 

To open a closed valve, send an Arm to Connect command using FDM Tools, Itron Mobile, or Temetra Mobile. When the meter is in mobile mode, the Arm for Connect command arms the meter without opening the valve. The LCD displays the icons to represent the armed state. The technician should ensure there is no flow downstream of the meter. When the technician presses the meter button (for approximately 2 seconds) and releases it to complete the valve opening process, the following occurs:

- The valve icon alternates between open and closed.
- The motor drives the valve to open.
- A stabilization time occurs.
- A flow test is performed for a specified amount of time:
 - If the accumulated volume during the flow test is less than a threshold volume, the motor is driven for additional time and the valve icon displays as open.
 - If the volume is greater than a threshold volume, this could mean there is a system leak or other demand downstream of the meter, or it could mean that there hasn't been enough time to allow the pressure differential to get below approximately 1 PSI. In any case, the motor drives the valve to close (as a fail-safe). The technician should check for leaks or demand and ensure safe conditions before trying to open the valve again. The arm icon is displayed on the LCD and the technician can re-try to open the valve by pressing the button on the meter. If the volume is greater than the threshold volume on the third attempt, then the valve returns to closed and a new connect command is required to re-arm (open) the valve.



Important! An armed meter in test mode does not open the valve on button press. You must first take the meter out of test mode to open the valve. For more information about test mode, see [Calibrating the Intelis Gas Meter on page 53](#).

High flow

The high flow feature, which automatically shuts the valve when a utility-configured threshold is reached, can be enabled or disabled according to the preference of the utility. The high flow threshold flow, sampling frequency, and aggregation window are programmable parameters. It is important for the utility to understand the capacity and flow rates at the time of meter installation.



Important! Piping configuration can impact the high flow rate setting.



Warning! If enabled, the automatic valve shutoff for utility-defined high flow operates only when the meter is either in:

- network mode
- mobile mode in either command secure or full security state

If enabled, the automatic valve shutoff for factory default high flow operates when the meter is either in:

- network mode
- mobile mode in either ready to secure, command secure, or full security state

For typical residential meter installations, Itron recommends setting the high flow rate at 500 CFH (14.2 m³/h) or less, a 5-minute sampling frequency, and a 15-minute aggregation window. For example, when using a 15-minute aggregation window, the desired high flow threshold hourly flow rate should be divided by 4, which enters it as a flow rate over the 15-minute aggregation window.

To close the valve for high threshold at 480 CFH (13.6 m³/h) with a 15-minute aggregation window, enter **120** (CF) for imperial² or **340** for metric³. Setting the high flow threshold to **0** (imperial or metric) disables the high flow shut off. In this situation, the valve does not shut off if the high flow shutoff feature is enabled.

Note: The values in FDM are unit-less and the user must know what the meter units are at the time of creating the FDM file snapshot.

The recommended high flow configuration does not reduce the battery life. A high flow event triggers the safety shutoff valve to close if the flow rate reaches or exceeds the configured threshold over the aggregation window. This utility-configurable high flow threshold only triggers the shutoff of the valve if the meter is operating in network mode or

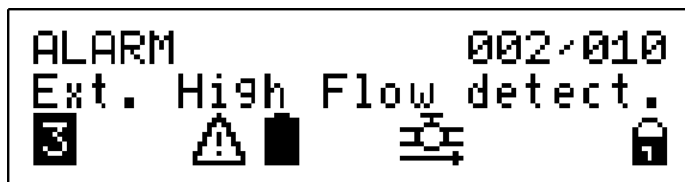
² 480/4 = 120

³ (13.6/4)*100

in mobile mode in command secure or full security state. If the meter is in ready to secure mobile mode and high flow shutoff is enabled, the factory shutoff (described below) still functions.

Setting the high flow threshold to zero (0) disables the high flow detection (so the event is never logged), which causes the automatic disconnect (if enabled) to never occur.

When the shutoff valve is enabled for high flow, the Intelis Gas Meter is enabled with a factory safety shutoff parameter. The safety shutoff is set at 500 CFH (14.2 m³/h) over 15 seconds. If this value is reached, the valve automatically closes. The LCD displays an alarm (as shown below) and the meter logs the event/alarm. In OpenWay Riva network mode, the event/alarm is sent to the meter data management system.



Note: PCOMP is factored into the utility-configurable high flow threshold value. PCOMP is not factored into the secondary factory preset value of 500 CFH (14.2 m³/h).

High temperature

The high temperature feature to automatically close the valve can be enabled or disabled as the utility chooses. The high temperature threshold is a programmable parameter (from 32°F/0°C to 212°F/100°C).



Caution: The valve contains plastic and rubber components and will not remain tightly closed at extreme temperatures. Higher leakage can occur at extreme temperatures. The temperature sensor used to determine the high temperature threshold is located in the index housing.

Setting the temperature threshold to 0°C/32°F disables the high temperature detection. In this situation, if the high temperature shutoff is enabled, the valve does not shut off. The high temperature alarm has a start and end log for reference.

High pressure

The high pressure feature, which automatically shuts the valve when a utility-configured threshold is reached, can be enabled or disabled according to the preference of the utility (by default, it is disabled). The high pressure threshold is a programmable parameter. It is important for the utility to understand pressure capacity at the time of meter installation.



Important! Piping configuration can impact the high pressure setting.



Warning! If enabled, the automatic valve shutoff for utility-defined high pressure operates only when the meter is either in:

- network mode
- mobile mode in either command secure or full security state

If enabled, the automatic valve shutoff for factory default high pressure operates when the meter is either in:

- network mode
- mobile mode in either ready to secure, command secure, or full security state

Setting the high pressure threshold to **99999** disables the high pressure shut off. In this situation, the valve does not shut off if the high pressure shutoff feature is enabled.

Note: The values in FDM are unit-less and the user must know what the meter units are at the time of creating the FDM file snapshot.

The recommended high pressure configuration does not reduce the battery life. A high pressure event triggers the safety shutoff valve to close if the pressure reaches or exceeds the configured threshold. This utility-configurable high pressure threshold only triggers the shutoff of the valve if the meter is operating in network mode or in mobile mode in command secure or full security state. If the meter is in ready to secure mobile mode and high pressure shutoff is enabled, the factory shutoff (described below) still functions.

The LCD displays an alarm (as shown below) and the meter logs the event/alarm. In network mode, the event/alarm is sent to the meter data management system.



6 Installation

This section provides the Intelis Gas Meter installation information.



Warning! This product, as of the date of its manufacture, is designed and tested to conform to all governmental or industry safety standards then existing as they may apply to the manufacturer. The purchaser and user of this product are warned that compliance with all country, state, and local codes required in order to avoid the hazards of leaking gas resulting from improper installation, start-up, or use of this product, and further, that all fire control, building codes, or other safety regulations established under public laws which regulate or govern the application, installation, operation, or general use of this product, should be complied with. In order to ensure the safe and proper operation of this product, the manufacturer recommends that a qualified technician install this product.

The Intelis Gas Meter must be installed with the inlet to the left, the outlet to the right, the meter in a horizontal position and with the LCD facing out. INLET and a flow arrow are marked on the Intelis Gas Meter casing.



These instructions assume the gas is turned off, the previous gas meter is removed (when the Intelis Gas Meter is replacing an existing installation), piping tests are completed, and all safety requirements are met.

Prior to start up

Note: The Intelis Gas Meter is shipped from the factory with the safety shutoff valve in the open position. Verify the valve is open prior to installing the meter. Confirm the open valve icon is displayed on the LCD display and that the valve closed icon is not displaying.



Perform a visual check of the inside of the meter outlet to also verify the safety shutoff valve is open.



Before the Intelis Gas Meter start-up:

- Read the meter badge data regarding maximum allowable operating pressure (MAOP) and capacity flow rate to be sure the meter meets the installation requirements.
- Sight across both swivel flanges or test with a suitable level to determine that the flanges are nominally in the same plane and will not cause excessive strain on the meter or piping when the connection nuts are tightened.

Start up

1. Blow out the service lines before the meter is installed to ensure no dirt, debris, or liquids of any kind are carried into the meter when the gas is flowing in the line.
2. Place a new connection nut washer (gasket) on each connection nut or meter hub.
3. Support the meter so that both hubs are against the connection washers and run the connection nuts down hand tight.
4. In an alternating fashion, tighten the nuts to the appropriate torque for the connection size.
5. Check the meter's downstream system to ensure that all connections are leak free or that the downstream valve, if one is present, is closed.
6. Open the upstream and downstream valves very slowly to prevent any pressure surges into or out of the meter.



Caution: Avoid high differential pressure across the meter. Abnormal differential pressures can damage internal meter components.

7. Alternate cracking open the upstream and downstream valves for a few seconds and then slowly-over a period of 10 seconds.

For ¼ PSIG systems, turn the valve to the ¼ open position and then to the full open position.

8. After the meter is pressurized, apply a soap solution or other leak detecting liquid to the connections to check for leaks.
9. Test the meter to verify the meter is registering the gas flow.
 - a. Press the button to activate the LCD.
 - b. Observe the LCD display and look for usage to increase.

Note: If the LCD does not display any expected consumption, investigate the installation. If necessary, change out the meter.

10. Perform a leak test (shadow or lock-in test) following company or utility procedures.

Some utilities may choose to use the magnet housing tool (part number CFG-7100-800) to put the Intelis Gas Meter into Menu 6 for visibility of flow rate and consumption with 4 digits to the right of the decimal. If you are not using the magnet housing tool for this purpose, skip to step 11. Otherwise:

- a. Locate the engraved word **UP** and the arrow at the top of the housing.

11. After the Intelis Gas Meter installation testing is complete, purge all air from the gas line including the piping section.



Warning! Never allow gas to discharge into a confined space or area where there are ignition sources unless precautions are in place to eliminate potential hazardous conditions.

Note: It is possible to get air detection alarms during Intelis Gas Meter installation due to installation setups, gas pressure, flow rates, pipe length, and general installation practices. Air detection and low pressure alarms during installation should be ignored.

Removing or installing the pipe plug

This section provides the steps to remove or re-install the pipe plug, for cases where the meter has a pipe plug and its removal is desired.

Removing

Using a 3/16" hand-driven Allen wrench, remove the pipe plug.

Installing

1. Clean any debris from the pipe plug and inspect it for any damage or deformation. Replace the pipe plug if any defects or wear are found.
2. Apply new sealant to the leading 3 to 4 threads of the pipe plug.

Note: Itron recommends RectorSeal #5 sealant.

3. Using a 3/16" hand-driven Allen wrench, begin tightening the pipe plug into the threads, using care not to cross-thread or remove the sealant during the process.
4. Tighten the pipe plug. Do not exceed 50 inch-pounds torque (5.6 Newton Meters).
5. Leak test following your utility's leak test procedure.

7

Calibrating the Intelis Gas Meter

FDM allows users to re-calibrate the Intelis Gas Meter accuracy. The Intelis Gas Meter test mode and a prover station are used to confirm the accuracy of the meter and FDM is used to recalibrate the meter if necessary.

The Intelis Gas Meter cannot be programmed (configured) or calibrated while the meter is in test mode. You must exit test mode to program or configure the meter. Attempting to program or configure parameters while the meter is in test mode will result in a temporary error in FDM. If the valve icon is blinking, the meter is unable to go into test mode. Wait a few minutes and try again.

Some meter configuration is required for the meter to communicate with the prover type. Configuration is completed using the FDM configuration (snapshot) file or using the handheld programmer and FDM Tools.

Note: The option to configure the meter with a handheld programmer and FDM Tools is available only for certain properties.

Intelis Gas Meters are calibrated at the factory prior to shipment. Recalibrating the Intelis Gas Meter requires FDM and the results of the accuracy test. For proving and calibrating instructions, see the *Intelis Proving and Setup Guide*. For more information about calibrating the Intelis Gas Meter using FDM, see the *FDM Mobile Application Guide*. For more documentation information, see [Related documents on page 9](#).

8

Programming

When the Intelis Gas Meter ships from the factory, either all programmable parameters are set from the utility-provided configuration parameters or default settings are used.

Identification numbers

The Intelis Gas Meter is programmed and identified through the following serial number types:

- **Electronic serial number (ESN).** Also known as the Endpoint ID, the ESN can be read from the Intelis Gas Meter by Field Deployment Manager (FDM) Tools and is shown on the appropriate programming screens. This number is located on the top of the index.
- **Customer Serial Number.** The customer serial number is not read by FDM Tools but can be included in the utility's custom FDM work order for inclusion in the meter data import (MDI) FDM work order file.
- **Meter Serial Number.** The meter serial number is not read by FDM Tools but can be included in the utility's custom FDM work order for inclusion in the MDI FDM work order file.

Programming parameters

The Intelis Gas Meter has the following general programming parameters:

- **Manufacturer system parameters.** Manufacturer parameters are set by Itron and cannot be changed by the utility.
- **Utility-specific parameters.** Utility system parameters are common to a family of meters for a specific utility.
- **Meter-specific parameters.** Intelis-specific parameters.

Battery life

The Intelis Gas Meter communications are capable of configurations that reduce battery life.



Important! The Intelis Gas Meter battery life listed in the section contained in this technical reference guide is dependent on configuration parameters.

Standard battery life is based on the following configuration when the meter is operating in mobile mode:

- Activation of user interface (LCD): once per month
- Local access tool communication: once per year
- Mobile reading: once per month (40 days of interval data)
- Valve cycles (a close and an open is one cycle): one per year
- Proving cycles (one cycle is proving, calibration, and a second proving): 5 times over the life of the product
- Meter programmed to Command Secure (Meter Programmed to Command Secure or Full Secure)
- High Flow Sampling Frequency programmed to 300 seconds (5 minutes)
- High Flow Aggregation Window programmed to 900 seconds (15 minutes)

Standard battery life is based on the following configuration when the meter is operating in network mode:

- Hourly interval data
- 3 interrogations per day
- 5 firmware downloads over the life of the meter
- Network management and security overhead set to default timing
- RF network at capacity (2,000 devices maximum per cell)
- Average of one two-way command/response per week
- Valve cycles (a close and an open is one cycle): one per year
- Proving cycles (one cycle is proving, calibration, and a second proving): 5 times over the life of the product
- High Flow Sampling Frequency programmed to 300 seconds (5 minutes)
- High Flow Aggregation Window programmed to 900 seconds (15 minutes)

Programming the Intelis Gas Meter



Important! The Intelis Gas Meter must be programmed before use.

An Itron programming device is used to program the Intelis Gas Meter. Programming requires technology with an Industrial-Scientific-Medical (ISM) band transmitter. Itron programming devices (or methods) use Field Deployment Manager (FDM) Tools or Field Tools software. See [Specifications on page 11](#) for the correct firmware version (for more information, see [Related documents on page 9](#)).

Programming the Intelis Gas Meter requires an understanding of the Intelis Gas Meter and your system.

Understanding the Intelis Gas Meter display

The Intelis Gas Meter has five digits to the left of the decimal point and three to the right of decimal point as its default. See [Reading the Intelis Gas Meter LCD on page 59](#) for other possible options for configuring the display.

Interpreting the meter reading

Some systems modify the consumption reading with the collection software. Other times, the billing system is used to make modifications. If modifications are made in both systems, issues may cause consumption reading errors.

9

Events and alarms logging

The Intelis Gas Meter is capable of logging events. When the meter is programmed to network mode, events are logged with a start time (some also have an end time). When the meter is programmed to mobile mode, it is not possible to retrieve events or alarms.

This chapter provides information on the Intelis Gas Meter events and configurable alarms, including:

- [Registers on page 57](#)
- [Reading the Intelis Gas Meter LCD on page 59](#)
- [LCD display icons on page 62](#)
- [Cross checking events with FDM on page 68](#)
- [Performing an LCD test on page 68](#)

Registers

The Intelis meter has the following registers:

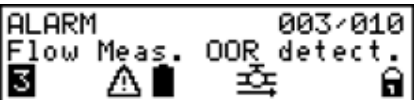
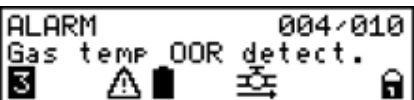
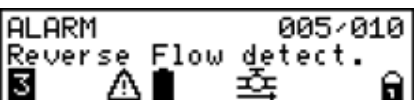
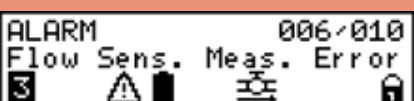
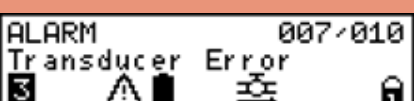
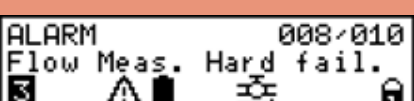
- Non-temperature corrected (NTC) volume
- Temperature corrected (TC) volume
- Volume under alarm

Either the NTC or TC can be programmed to be the primary displayed index. [Table 16](#) illustrates under what conditions each register increments.



Tip: The colors in the [Table 16](#) are intended to provide easy reference to which conditions trigger an increment. Green cells indicate yes, yellow cells indicate no, blue cells indicate yes or no depending on the situation, and red indicates an error that is fatal, regardless of whether the meter increments or not.

Table 16 Events and triggered registers

Associated Itron event log event(s)	NTC index	TC Index	Volume Under Alarm index	LCD Index displayed message
NA (Normal Operation)	Yes	Yes	No	 Note: Normal operating Index shown could be CCF/M3 or TC/NTC
523/524: Flow Measurement Outside Physical Range	Yes	No	Yes ¹	
526/527: Gas Temperature Outside Sensor Range	Yes	No	Yes ²	
9/10: Reverse Flow Detected	No	No	No	
528: Flow Sensor Measurement Error ³ This is a fatal error.	Yes ⁴ /No ⁴	No	Yes ⁵ /No ⁵	
529: Transducer Error ³ This is a fatal error.	No	No	No	
522: Flow Sensor Hard Failure ³ This is a fatal error.	No	No	No	

¹ Uses gas temperature for temperature correction.

² Uses fallback temperature which is 15.6°C (60°F) by default for temperature correction.

³ For error codes highlighted in red, meter should be replaced.

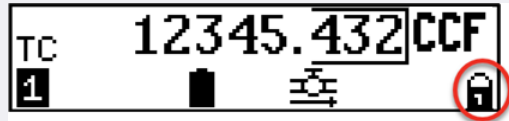
⁴ Meter could have a measurement related error or a temperature sensor error. If the error is measurement related, the NTC index will not increment. If the error is temperature sensor, the NTC index will increment.

⁵ Meter could have a measurement related error or a temperature sensor error. If the error is measurement related, the alarm index will not increment. If the error is temperature sensor, the alarm index will increment using 15.6C/60F for temperature correction.

Reading the Intelis Gas Meter LCD

This section describes the Intelis Gas Meter LCD menus that are displayed in a pre-defined order (1-8).

Note: The Intelis Gas Meter ships in a sealed (locked) state.



There are [Additional LCD screen displays on page 64](#) that display in response to an overflow or test condition. These menu pages, which are not part of the normal sequence, provide overflow condition information and an interface to perform an LCD test. For information on initiating an LCD test, see [Performing an LCD test on page 68](#).

The LCD normal mode is off. A button press activates the LCD. In Intelis Gas Meters, each menu page is active for six seconds before the LCD advances to the next menu page (you can also advance by pressing the button). Intelis 250 Gas Meter and Intelis 425 Gas Meters require a button press to advance the LCD screen to the next menu page (the menu stays on for 30 seconds before turning off due to inactivity). If the LCD turns off due to inactivity, it starts on Menu 1 the next time the button is pressed. When the last menu page is reached, the process loops to the first menu page until the configured timeout is reached.

The standard LCD index configuration on the Intelis Gas Meter menu 1 is 5 digits to the left of the decimal and 3 digits to the right of the decimal. Depending on your firmware and meter type, you can configure this display. For meters running on firmware version FMW-7310-001 (GSR 5.1 SP1) and for Intelis 250 Gas Meter and Intelis 425 Gas Meters, the FDM File Snapshot allows for the selection of either 4 or 5 digits to the left of the decimal and 3 or 4 digits to the right of the decimal. For Intelis 250 Gas Meter and Intelis 425 Gas Meters, all customers can choose how to configure the LCD index: 4 or 5 digits to the left of the decimal, and 3 or 4 digits to the right of the decimal.



Important! To prevent the meter from rolling over before reaching 90 days of maximum capacity, Canadian customers using the Intelis 250 Gas Meter with metric must configure their index to include five digits to the left of the decimal.

See [LCD menus and display on page 60](#) for more information.

[Figure 2](#) highlights 4 digits to the left and 3 digits to the right of the decimal.



Figure 2 Intelis Gas Meter configurable display

Table 17 describes the typical menus and LCD displays.

Table 17 LCD menus and display

LCD menu	LCD display	Description
1.	■ TC meter display in Imperial units. TC 1 12345.432 CCF ■ NTC meter display in Imperial units. NTC 1 12345.432 CCF ■ TC meter display in Metric units. TC 1 12345.432 m³ Note: All menu displays can be configured for Imperial or Metric units. The remaining displays are shown in Imper.	The primary index (Menu 1) is either a TC or NTC measurement based on the meter configuration. The default LCD displays with 5 digits to the left of the decimal and 3 to the right of the decimal (in cubic feet x 100 [Imperial] or m3 [Metric] dependent on utility configuration). The primary index (Menu 1) is either TC or NTC measurement based on the meter configuration. An optional configurable display is available for firmware version FMW-7310-001 (GSR 5.1 SP1). When this version is used, the FDM File Snapshot allows for 4 or 5 digits to the left of the decimal and 3 or 4 digits to the right of the decimal to be selected.
2.	AL 2 04567.891 CCF	Displays current index volume measured under an alarm condition.

Table 17 LCD menus and display (continued)

LCD menu	LCD display	Description
3.		Displays active alarms. Note: In the illustration, 001 indicates the number of the current displayed alarm while 003 indicates the total number of alarms. Before the display moves to the next menu page, all active alarms are displayed. If there are no alarms, <i>NO ALARM</i> displays. For more information about the Intelis Gas Meter display events and alarms, see Encoding status, event, and alarm data on page 40. 
4.		Local date and time The local date is formatted as configured. The date and time are adjusted by the local time zone and DST configuration.
5.		Current gas temperature and conversion factor This is the gas temperature from the temperature sensor in the UMU. When the Intelis 250 Gas Meter and Intelis 425 Gas Meters cannot retrieve the current gas temperature or the primary index configuration from the UMU, the value of those variables change to -32768 and 2 respectively, to indicate "unknown." These enumerations are the default value.
6.		Test mode Flow rate and volume.
7.		Pressure compensation

Table 17 LCD menus and display (continued)

LCD menu	LCD display	Description
8.	■ R LNF: Register Legal Non-Fixed Firmware; R LF: Register Legal Fixed Firmware  ■ E LNF: Encoder Legal Non-Fixed Firmware; E NL: Encoder Non-Legal Firmware  ■ E LF: Encoder Legal Fixed Firmware; UMU: Ultrasonic Measurement Unit CRC 	Firmware versions The display cycles through three screens to display the six Intelis Gas Meter firmware versions. The firmware version types are displayed on the three LCD display menus.
9.	Image forthcoming.	Device configuration This screen displays the device's configured parameters. When the programmed mode is in the process of being changed, the display shows the current mode. ■ In mobile mode: bubble up rate, programmed RF output power. ■ In network mode: network (for example, OpenWay Riva), network type (for example, mesh), and network ID (for OpenWay Riva meters) or SSID (for Gen5 meters).

LCD display icons

Table 18 describes the menu icons that may be displayed on the LCD screen of the Intelis Gas Meter. Each icon provides a visual indication of status information.

Table 18 Menu icons

Display icon	Icon definition
Meter status icons	
	Battery level  Battery is greater than or equal to 80%  Battery is greater than 40% and less than 80%  Battery is greater 10% and less than 40%  Battery is less than 10% Note: Battery life is checked every 12 hours and the icon is updated accordingly. The battery icon flashes when the battery reaches 5% remaining power.
	The meter has an active alarm.
	The meter is in factory ship mode. Note: The truck icon clears when the Intelis Gas Meter is moved to an operational mode.
	Closed padlock icon. The meter is sealed. The lock icon clears when the meter is unsealed.
Safety shutoff valve status icons	
	The safety shutoff valve is open.

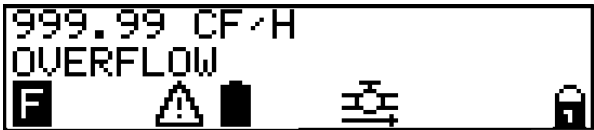
Table 18 Menu icons (continued)

Display icon	Icon definition
	The safety shutoff valve is closed.
	Safety shutoff valve is in armed state. The safety shutoff valve opening is actuated by pressing the button for 2 seconds and releasing it. Important: If the Intelis Gas Meter LCD button is pressed too long, the LCD Test screen appears. If this happens, wait for the Test screen to exit and press the button again.  A technician should ensure the installation premise is safe by ensuring there is no flow downstream of the meter prior to opening the valve. Prior to pressing the button to open the valve, the technician must check the LCD to verify there are no alarms. If any alarms are present, investigate and remediate them prior to opening the valve.

Additional LCD screen displays

The LCD displays two additional screens in an overflow or test event.

- **Overflow.** This screen displays if the meter reaches an overflow condition.



- **Display test.** This screen displays after a long button press of 4.8 seconds. The test provides a visual confirmation that the LCD is functioning correctly.



- **Fatal.** This indicates an unrecoverable error and applies to the following alarms: Flow Meas. Hard fail., Flow Sens. Meas. Error, and/or Transducer Error. Remove the meter and return it to Itron for evaluation. This alarm has a start log.



LCD display alarms

The Intelis Gas Meter reports the following alarms on the LCD regardless of the programming mode. When the meter is programmed to network mode, events are logged with a start time (see the following table for alarms that also have an end time). Users may cross check alarms over the network or with a device loaded with FDM Tools. For more information, see [Cross checking events with FDM on page 68](#).



Important! When the meter is programmed to mobile mode, it is not possible to retrieve any of the listed events or alarms. Active alarms can be seen on the LCD, as described in the following LCD alarm information.



Warning! The automatic high flow valve closure will not operate if the meter is in an unrecoverable error state. This includes: Flow Meas. Hard fail., Flow Sens. Meas. Error, and/or Transducer Error. When the meter experiences one of these errors, the word **FATAL** appears on the screen and indicates the meter should be replaced.

Intelis Gas Meter alarms

Table 19 describes the alarms supported by Intelis Gas Meters.

Table 19 Alarm displays and description

LCD alarm	Description
	Reverse Flow detect. The meter is currently detecting reverse flow; gas flowing from outlet to inlet. The reverse flow event is an alarm for utilities that alerts them of possible tampering. If a reverse flow is detected, the meter may be installed backwards. The Reverse Flow detect. alarm is cleared once normal flow and a small buffer of 0.71 CF (0.02 m3 or 20L) is reached. This alarm has a start and end log.
	Ext. High Flow detect. The meter detected flow that exceeded the utility-configurable high flow threshold. This alarm has a start and end log.

Table 19 Alarm displays and description (continued)

LCD alarm	Description
	High Temp. detect. The meter detected that the temperature exceeded the utility-configurable high temperature threshold. Note: Setting the temperature threshold to 0°C (32°F) will disable the high temp detection. In this situation, if high temperature shutoff is enabled, the valve won't shutoff. This alarm has a start and end log.
	Air in Pipe detect. The meter detected air in the meter. The air in pipe alarm is set to 'ready to detect' state after measuring more than 1.4 CFH (0.04 m3/h or 40 L/H). The minimum flow rate was chosen to reduce nuisance air in pipe alarms upon initial installation. The speed of sound of the gas being measured is periodically compared to the speed of sound of air to determine if an air in pipe alarm/event is triggered. This alarm notifies the utility of possible tampering of meter removal. It is expected to have very minimal flow rates (less than 1.4 CFH) of air during this event. Flow rates higher than 1.4 CFH (0.04m3/h) are assumed to be natural gas. For example, if a utility is testing with air at 250 CFH, the alarm does not display and is not active higher than 1.4 CFH. This alarm has a start and end log. Intelis is rated as Class 1 (+/-1% accuracy) for Natural Gas Type H, E, L for reference gases G20, G21, G23, G25, G26 and G27 which includes gas compositions with up to 13% propane. It should be noted that during propane peak shaving, for example, higher concentrations in propane or nitrogen can occur which are outside these reference gases. This can result in the speed of sound for the gas composition being closer to that of the speed of sound of air, which could result in a false indication of air detection. For this reason, air detect alarms/events should be compared to incidences of propane peak shaving along with typical homeowner gas usage and reverse flow detection before considering further action for suspect tampering.

Table 19 Alarm displays and description (continued)

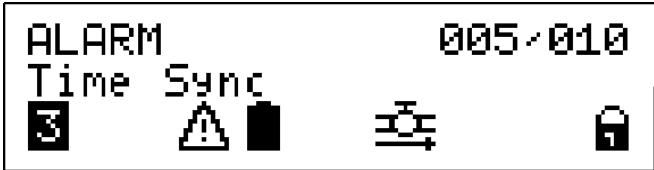
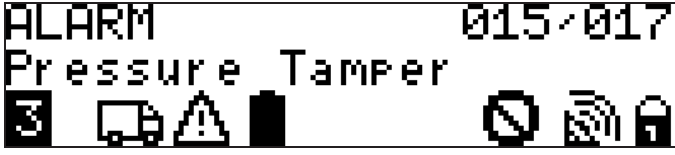
LCD alarm	Description
	Time Sync The meter detected that its time significantly differs (5 minutes or greater) from the network time. This alarm only applies to network mode. This alarm should prompt the utility to look at the network read rates for the meter to see if there is a general network connectivity issue that is occurring with that meter. If the time is getting out of sync repeatedly, then it is likely the meter is having trouble staying connected to the network, perhaps due to a network coverage issue. This alarm has a start and end log.
	Flow Meas. Hard fail. The meter detected that the flow measurement sensor failed. This condition is an unrecoverable error. Remove the meter and return it to Itron for evaluation. This alarm has a start log.
	Flow Meas.OOR detect. The meter detected flow that is outside the physical range of 500 CFH (14.2 m3/h) of the measurement sensor. This alarm has a start and end log.
	Gas temp OOR detect. The meter detected that the maximum (133° F/56° C) or minimum (-31° F/-35° C) temperature range was exceeded. This is a recoverable error. This alarm has a start and end log.
	Flow Sens. Meas. Error The meter detected that a flow sensor measurement error occurred. This is an unrecoverable error. Remove the meter and return it to Itron for evaluation. This alarm has a start log.
	Transducer Error The meter detected that its ultrasonic transducers experienced an error. This is an unrecoverable error. Remove the meter and return it to Itron for evaluation. This alarm has a start log.

Table 19 Alarm displays and description (continued)

LCD alarm	Description
	(Intelis 250 Gas Meter and Intelis 425 Gas Meters only) High Pressure Detect. The device has detected that the gauge gas pressure has exceeded the high pressure threshold. This alarm has a start and end log.
	(Intelis 250 Gas Meter and Intelis 425 Gas Meters only) Low Pressure Detect. Device detects the gauge gas pressure has fallen below the low pressure threshold. <i>This alarm has a start and end log.</i>
	(Intelis 250 Gas Meter and Intelis 425 Gas Meters only) Pressure Tamper Detect. The device detects that the gauge gas pressure has exceeded the pressure tamper threshold. This alarm has a start and end log.

Cross checking events with FDM

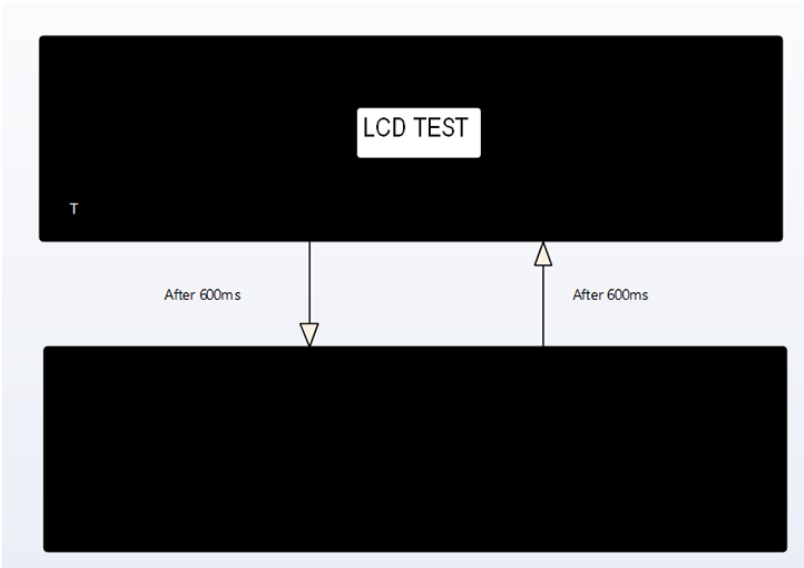
Cross checking Events with FDM can only be done if the meter is in network mode. See the *Field Deployment Manager Field Representative's Guide* (for version 4.1.1 or later) for information about cross checking the Intelis Gas Meter Events with FDM.

Performing an LCD test

The Intelis Gas Meter LCD Test is used to confirm the LCD display is functioning properly and that there are no non-displaying pixels that could lead to misinterpretation of a value.

To perform an LCD test, hold down the meter button longer than 4.8 seconds (long press). After the long press, the display turns black for 600ms (0.6 seconds).

After 600ms (0.6 seconds), the screen displays LCD TEST again.



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Maintenance

The Intelis Gas Meter is designed to be maintenance free, but customers have the option of replacing the batteries that power the radio, meter and valve. If the LCD is damaged or requires replacement, see the *Intrinsic Safety Control Drawing for Index Module Replacement of Itron Model Intelis Gas Meter* instructions. If the batteries need to be replaced, see the *Replacing Batteries in the Intelis Gas Meter* instructions. Refer to [Related documents on page 9](#) for more information.

Note: If power is removed from the Intelis Gas Meter prior to the Intelis Gas Meter being properly decommissioned, the UMU does not turn back on when power is restored, and there is no signal in the LCD display or the meter's log that indicates the UMU off status. Additionally, safety features that rely on the UMU data are disabled and the valve remains in its current state (open). Effectively, gas will continue to flow through the meter without any volume accumulation.

A

Important safety and compliance information

This section provides important information for your safety and product compliance.

USA, FCC Part 15 spectrum compliance

This device complies with Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference that may cause undesirable operation.

This device must be installed to provide a separation distance of at least 20 centimeters (7.9 inches) from all persons to be compliant with regulatory RF exposure.

USA, FCC Class B-Part 15

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 or TV technician for help.

Modifications and Repairs

To ensure system performance, this device and antenna shall not be changed or modified without the express approval of Itron. Per FCC rules, unapproved modifications or

operation beyond or in conflict with these instructions for use could void the user's authority to operate the equipment.

Canada, ISED spectrum compliance

Compliance Statement Canada	Déclaration de Conformité
This device complies with Innovation, Science and Economic Development Canada (ISED) license-exempt RSS standard (s). Operation is subject to the following two conditions: (1) this device may not cause interference, (2) this device must accept any interference, including interference that may cause undesired operation of the device. Under Innovation, Science and Economic Development Canada (ISED) regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.	Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement. Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

RF exposure (FCC/ISED)

This equipment complies with radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Cet équipement est conforme aux limites d'exposition aux radiations dans un environnement non contrôlé. Cet équipement doit être installé et utilisé à distance minimum de 20 cm entre le radiateur et votre corps. Cet émetteur ne doit pas être co-localisées ou opérant en conjonction avec tout autre antenne ou transmetteur.

Australia, ACMA spectrum compliance

When this device is sold and shipped to Australia, it is configured and labeled accordingly to be compliant with ACMA Standards for the Radio, EMC and RF Exposure. This includes Radiocommunications Equipment (General) Rules 2021 and AS/NZS 4268.

Electromagnetic compatibility



Warning! Use only approved accessories with this equipment. All cables must be high quality, shielded, and correctly terminated. Unapproved modifications or operation beyond or in conflict with these use instructions may void the authority's authorization to operate the equipment.

Intrinsic safety



Warning! Substitution of components may impair intrinsic safety.

Lithium battery



Warning! Follow these procedures to avoid injury to yourself or others.

- The lithium battery may cause a fire or chemical burn if it is not disposed of properly.
- Do not recharge, disassemble, heat above 212°Fahrenheit (100°C Celsius), crush, expose to water, or incinerate the lithium battery. Fire, explosion, and severe burn hazard.
- The battery used in this device may present a risk of fire or chemical burn if mistreated.
- Keep the lithium battery away from children.

Transportation classification

The Federal Aviation Administration prohibits operating transmitters and receivers on all commercial aircraft. When powered and not in factory ship mode, the Itron device is considered an operating transmitter and receiver and cannot be shipped by air. All product returns must be shipped by ground transportation.

Electrostatic discharge



Warning! Internal circuit components can be sensitive to electrostatic discharge. Before installation, discharge electrostatic buildup by touching a metal pipe or other earth-grounded metal object prior to touching the meter body, register housing, or Itron device.

Electrostatic ignition hazard



Warning! Verify the area is not hazardous when installing, servicing, cleaning, or touching the Itron device.

Device cleaning



Warning! Clean only with a damp cloth.

Do not drop



Warning! While Itron meters are designed to withstand a drop, dropping the meter may damage the device, impact the meter accuracy, and void the warranty.

Product standards

These instructions are not intended to replace any utility or company-established meter installation procedures. These instructions are provided for additional information. The meter installation must comply with all country, state, and local building and safety regulations as well as federal regulations including Section 192.353 of Title 49 of the Code of Federal Regulations. Two pertinent paragraphs of the code are:

- Each meter and service regulator, whether inside or outside of a building must be in a readily accessible location and be protected from corrosion and other damage.
- Each meter installed within a building must be located in a ventilated place and not less than 3 feet from any source of ignition or any source of heat which might damage the meter.

The Intelis Gas Meter is rated for the following operating and storage temperature ranges. Use of the meter outside of the listed temperature ranges is not recommended.

- Operating ranges:
 - **Measurement:** -30° F (-34° C) to +131° F (55° C)
 - **Valve:** -13° F (-25° C) to +131° F (55° C)
 - **RF:** -40° F (-40° C) to +158° F (70° C)
- Storage range:
 - -40° F (-40° C) to +158° F (70° C)
- Direct inquiries as to the selection and application of gas meters to your local Itron sales representative or Itron Support.
- Itron does not endorse or warrant the completeness or accuracy of any third-party meter installation procedures or practices, unless otherwise provided in writing by Itron.
 - Follow your company's standard operating procedures regarding the use of personal protection equipment (PPE).
 - Adhere to guidelines issued by your company in addition to those given in this document when installing or repairing meters.