

Gen5™

550G ERT® Module Technical Reference Guide

550G ERT® Module Technical Reference Guide

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Table of Contents

1	Document Scope	5
	Related Documents	5
2	The Gen™5 550G ERT Module	6
	Gen5 550G ERT Module Overview	6
3	Gen5 550G ERT Module Concepts and Technology	8
	Standard Gen5 550G ERT Module Configuration	9
	Gen5 550G ERT Module Firmware Functionality	9
	Gen5 550G ERT Module Transmission Modes	9
	Gen5 550G ERT Module Registration	10
	Gen5 550G ERT Module Data Collection	11
	Module Reading Cycles	11
	Gen5 550G ERT Module Transmit and Receive Cycle	11
	Gen5 550G ERT Module Network Security	11
	Gen5 550G ERT Module Manufacturing and Installation	12
	Gen5 550G ERT Module Secured Messaging	13
	Gen5 550G ERT Module Encoding	14
	Encoding Gen5 550G ERT Module Consumption Data	15
	Encoding Gen5 550G ERT Module Event Data	18
4	Transmit and Receive Operations	24
	Message Exchange	24
	Gen5 550G ERT Module Receive Operation	24
	Gen5 550G ERT Module Transmit Operation	24
	Gen5 550G ERT Module Beacon	25
	Gen5 550G ERT Module Gas Day Take	25
	Gen5 550G ERT Module Network Time Management	25
	Gen5 550G ERT Module Transmission Modes	26
	Gen5 550G ERT Module Transmission Characteristics	26
	Gen5 550G ERT Module Operating Modes	27
5	Gen5 550G ERT Module Programming and Reading	28
	Gen5 550G ERT Module Programming Parameters	28

Manufacturer System Parameters	28
Gen5 550G ERT Module Default Values	29
Gen5 550G ERT Module Utility System Parameters	29
Gen5 550G ERT Module Meter-specific Parameters	30
Utility ID	30
Security Lock Level	31
Programming Gen5 550G ERT Module	31
Gen5 550G ERT Module Programming Parameters	32
Programming Best Practices and Considerations	33

1

Document Scope

The Gen5 550G ERT Module Technical Reference Guide provides information about the Gen5 550G ERT Modules for field dispatchers, utility personnel, and Itron personnel and customers. This guide includes descriptions of the features and functionality of the Gen5 550G ERT Modules and focuses on the high-level network architecture, systems, operations, theory supporting IoT technology, and supporting software.

Related Documents

Document title	Document part number
<i>Gen™5 550G ERT Module Installation Guide, Direct Mount</i>	TDC-7073-XXX
<i>Gen™5 550G ERT Module Installation Guide, Remote Mount</i>	TDC-7078-XXX
<i>Customer setup to order secured Gen™5 Gas Modules</i>	TDC-XXXX-XXX
<i>First article review form</i>	TDC-1749-XXX
<i>Critical Operations Protector for AMI (COP for AMI)</i>	
<i>UtiliQ Advance Metering Manager (AMM)</i>	
<i>Util IQ Meter Program Configurator (MPC)</i>	
<i>Firmware Upgrader (FMU)</i>	
<i>Network Center (NC)</i>	
<i>Network Event Collector</i>	
<i>Gas and Telemetry Module Meter Compatibility List</i>	PUB-0117-002
<i>Gen™5 550G ERT Module Specification Sheet</i>	
<i>Field Deployment Manager Tools Application Guide</i>	TDC-1713-XXX
<i>Field Deployment Manager Tools Configuration Guide</i>	TDC-1711-XXX
<i>Field Deployment Manager Field Representative's Guide</i>	TDC-1714-XXX
<i>CustomerIQ X.X Administration Guide</i>	
<i>CustomerIQ X.X Integration Guide</i>	

2

The Gen™ 5 550G ERT Module

Itron Gen5 550G ERT Modules are radio-frequency (RF) gas modules that connect to the Gen5 Network as a leaf on a continuously powered device (CPD). The Gen5 550G ERT Module chooses one CPD as a gateway to the Gen5 network. The CPD communication with the Gen5 550G ERT Module is based on a Limited Listening Schedule (LLS). The CPD handles the Gen5 550G ERT Module's messages, forwarding and transmitting the module's messages. The Gen5 550G ERT Module can communicate in 100S System Mode to support a ready-to-secure installation when a third-party work order system is used. The utility configures the module to switch to the Gen5 Network Mode. The switch to Gen5 Network Mode can be configured to make the operation mode switch up to 30 days in the future.

Itron Gen5 550G ERT Modules can be read by the Gen5 Network, the new Itron Mobile Radio readers, or FC300 handheld readers.

Gen5 550G ERT Module Overview

The Gen5 550G ERT Module is an encoder, receiver, and transmitter.

- Encoder. Modules record consumption and alarm/event information and encodes that information.
- Receiver. Modules receive radio signals for module programming or initiating an ERT module reading.
- Transmitter. Modules transmit encoded information to a collection device or method.

Gen5 550G ERT Modules are designed with the following characteristics.

- RF device. The module is a radio frequency (RF) device that attaches to a gas meter to collect usage (consumption) data and event (tamper) alerts. The module encodes and transmits the data and alerts over the Gen5 Network.
 - The module records consumption by counting the number of times the index rotates.
 - The number of rotations indicates the amount of gas consumed.
- The Gen5 550G ERT Module is supported and managed by the UIQ headend. The UIQ headend supports the listed functionality.
 - Data collection
 - Remote configuration

- Firmware upgrades
- Reported events and alarms

The Gen5 550G ERT Module is compatible with Gen5 neighbor area networks. The module operates as a leaf node only and communicates on the network through a continuous power device (CPD). The Gen5 550G ERT Module is not directly IP addressable from the UIQ headend. The module's network communications mobile beacon occur every 60 seconds.

3

Gen5 550G ERT Module Concepts and Technology

This chapter provides a general overview of the Gen5 550G ERT Modules operational concepts and technology.



Important! The battery life listed in the sections contained in this technical reference guide are dependent on the device being deployed in a standard configuration.

Gen5 550G ERT Module configuration supports the following parameters:

- **Manufacturing configuration.** Manufacturing configuration are parameters programmed during the Gen5 550G ERT Module manufacturing process. During the build-to-order process, manufacturing supports
 - Field Deployment Manager (FDM) parameters programmed through a File Snapshot.
 - Remote application configuration programmed in manufacturing. Remote application configuration is completed using a file produced by the Itron Independent Configurator (IIC).
- **Local in-field configuration.** Local in-field configuration is completed using FDM Tools.
- **Remote configuration from the headend.** Remote programming is completed using IIC and MPC.
- **Third-party work order installation.** The third-party work order installation requires the following configuration during the manufacturing process:
 - Programmed with a Network ID (SSID)
 - Injected with the utility's desired security (from the utility's ISM)
 - Shipment from the factory in 100S System Mode in a ready-to-secure level.
 - Configuration to allow a ready-to-secure switch to Network Mode.

Gen5 550G ERT Modules may be shipped from the factory in a ready-to-secure 100S Mobile Mode or a fully-secured Network Mode.

Note: Shipping modules in a ready-to-secure Network Mode is not allowed.

Standard Gen5 550G ERT Module Configuration

The Gen5 550G ERT Module is capable of configuration that reduces battery life. Standard battery life is based on the following configuration:

- Standard reading profile (3 times a day, 8 hours of 1 hour interval data)
- Two-way on demand command once per week
- 98% read rate
- FWDL (5 FWDL customer downloads)
- RF at capacity (20 Gen5 550G ERT Modules for each CPD)
- Minimal operations after installation

Gen5 550G ERT Module Firmware Functionality

This section lists the Gen5 550G ERT Module firmware information and lists functionality by version.

Firmware part number	Global software release (GSR) version	FDM <i>Check Endpoint</i> firmware version	Over-the-air firmware part number	Firmware functionality
FMW-	4.2	1.X.X.X		<ul style="list-style-type: none"> ▪ 5,952 buckets of configurable interval data ▪ Interval options are 5, 15, 30 and 60-minute intervals ▪ Mobile Mode to support ready-to-secure installations (3 week functionality) ▪ Firmware download ▪ High flow alarm ▪ Gas day take ▪ Local auditing

Gen5 550G ERT Module Transmission Modes

Gen5 550G ERT Modules report their consumption and status information through a transmitted message collected over the Gen5 Network.

Gen5 Network Mode. Normal Gen5 550G ERT Module operating mode. In Network Mode, the Gen5 Gas Module will attempt to connect and register with the Gen5 network when the module is not in Factory Ship Mode.

Mobile Mode. Mobile Mode is provided to support installation by third-party work order systems. An Itron API integrates with the third-party work order systems to allow programming of site-specific installation parameters. Installation requires the Gen5 550G ERT Module to be configured to switch to Network Mode.

Note: Configuration of the Gen5 550G ERT Module switch to Network Mode can be immediate or up to 30 days in the future based on the third-party installation parameters. This allows the Gen5 550G ERT Module to be audited by the third-party work order system.

To support any third-party work orders, the following parameters are required:

- the Gen5 550G ERT Module must be manufactured following build to order (BTO) requirements, ship from manufacturing in ready-to-secure Mobile Mode, and have the utility security material injected and set to allow a ready-to-secure switch to Network Mode.
- third-party work orders must use the Itron API to program the site-specific parameters.

Note: Only parameters available in Mobile Mode are available for programming (index reading, PCOMP, multiplier, and Utility ID). Installers must perform a Check ERT following programming to verify configuration.

- Additional parameters must be programmed through the BTO process.
- After the installation, the third-party work order must program the ERT module to switch to Network Mode.
- The customer is responsible for the installation file imported into AMM.

Note: During the Mobile Mode operation (delay), the ERT module is ready-to-secure and open to risk. Completion of a switch from Mobile Mode to Network Mode clears the interval data and reading history. The Gen5 550G ERT Module is not intended to operate in Mobile Mode for an extended period of time.

Gen5 550G ERT Module Registration

The Gen5 550G ERT Module requires Field Deployment Manager (FDM) to query or display registration on the network, view the module's network status, and capture the module's first data information. AMM displays the Gen5 550G ERT Module's current network state which may be:

- New
- Installed
- Discovered
- Initializing

- Initialized
- Active

The NC displays the Gen5 550G ERT Module's CPD parent and the last time a read or registration was received from the Gen5 550G ERT Module. Discovery and registration typically takes from 30 minutes to four hours. Itron recommends allowing up to two days before investigating a possible issue.

Gen5 550G ERT Module Data Collection

Gen5 550G ERT Modules are read over the Gen5 network using a pull request and push data notification or trap. The same process is used for recurring and on-demand reads. The Gen5 550G ERT Module retrieves the following data:

- Configuration tag
- Daily register read
- Interval data
- Event log
- Current index (on-demand reads only)

When the Gen5 550G ERT Module is programmed to Gen5 Network Mode, the Gen5 550G ERT Module is read by the CPD. The module read data requires a secure trap environment. If a secure trap is not available, the CPD will not send the data. If unsecured data is received by AMM, the data is discarded.

Module Reading Cycles

Itron Gen5 550G ERT Modules convert consumption or status data to an RF signal to provide an efficient solution for collecting utility meter reading or status data without having a field technician physically inspect each individual installation location. Gen5 550G ERT Modules are IPv6 open standards based to be read over the network.

Gen5 550G ERT Module Transmit and Receive Cycle

The Gen5 550G ERT Module's cycle of encoding, transmitting, and receiving support a two-way messaging structure to transmit data in response to requests from the head end over the Gen5 network.

Gen5 550G ERT Module Network Security

The Gen5 550G ERT Module network communications are protected by the Gen5 network security. Network security is applied at the network and application layers. The CPD supports:

- The existing GenX application security
- GenX application security
- Added support for
 - Secure Traps between CPD and BOS
 - LLS security based on BC/DL certificate chains

The Gen5 Gas ERT Module supports 3 security models, dependent on the operating mode:

- 100S System Mode: Choice Connect Security. Choice Connect Security is used in 100S System Mode (locally and in mobile system).
 - Ready to Secure. ISM not required
 - Command or Full Secure. ISM required
- Network System Mode (locally): OW Riva Security. For Signed Authorization, Itron Security Manager is required.
- Network System Mode (remotely): LLS Security based on GenX Network Security
 - Birth Certificate/Manufacturing/INS Root
 - Drivers License/Operator/DLCA certificate chains using DLCA and First Capture
 - LLS Security is session key based (time expiring)

Gen5 550G ERT Module Manufacturing and Installation

The Gen5 550G ERT Module security features are determined by the device's operation mode. In Mobile Mode, the security features of the Gen5 550G ERT Modules are determined by the presence or absence of one or more key types. In the Gen5 network, the Gen5 550G ERT Module security begins in manufacturing where two unique factory keys (utility factory key and Itron factory key) are injected into each module. The utility factory key and Itron factory key are created and managed by the Gen5 Network. The network maintains the association between the module ID and its unique factory keys. With just the factory keys in place, the module operates in the basic security mode. As part of a Gen5 550G ERT Module shipment or upon subsequent customer requests, an enhanced security Itron key transfer file (SKTF) is provided to the utility. This file contains the Gen5 550G ERT Module ID/utility factory key pairings. After the utility receives the file, the utility customer imports the file into their network server and then the Gen5 550G ERT Modules with enhanced security activated are installed.

Field Deployment Manager (FDM) Tools is used to install and set the module security state. A module is moved from a basic security state to an enhanced security state by injecting keys. The state change is requested from the Gen5 network by the appropriate utility personnel or assigned during key import based on the network configuration. After the request is made, the network security application generates the appropriate keys based on the desired security level and creates key exchange commands secured by the utility factory key of the module. The key

exchange commands can be retrieved by the FDM Application Server when the installation work order for the module is created. The FDM Mobile Application performs the installation workflow and sends the key exchange commands to the module. After the module successfully receives and processes the key exchange commands, the module is in enhanced security mode. FDM returns the completed work orders and notifies the network of the completed key exchange commands. The network server updates the state of the newly generated keys from pending to active and operation with enhanced security begins.

Gen5 550G ERT Modules that will be operating in Gen5 Network Mode can be built to stock or to order. Gen5 Network security configuration parameters are determined by the manufacturing type. The Injected Keys Configurations table provides the configurations possible for the Gen5 500G security.

Build to Stock. Gen5 550G ERT Module that are build to stock are manufactured with default security parameters.

Note: Customer who will initially operate their Gen5 550G ERT Modules in Mobile Mode but intend to switch to Gen5 Network Mode may have the default IoT keys injected at the time the devices are manufactured.

Build to Order. Build to order Gen5 550G ERT Modules are manufactured with the customer's prescribed configurations and have their customer-supplied NMS, AAA Server CA, and device birth certificates injected during manufacturing. Build to order modules eliminate the need to inject a large portion of the required key set during module installation or a Mobile Mode to Gen5 Network Mode switch.

Gen5 550G ERT Module Secured Messaging

The Gen5 550G ERT Module follows the Gen5 Network security that includes a complete system knowledge of the content and purpose of each message. Security-related decisions (such as which key type—reading or command—to use when securing a message) are based on the function of the command. After a Gen5 550G ERT Module is installed and the appropriate keys are injected, the module begins secure operations. The listed reading and programming operations are secured.

In Gen5 Network Mode, security is required. In Mobile Mode, enhanced security operation is optional.

- **Bubble-Up Data Collection.** The Gen5 550G ERT Module enhanced security in bubble-up messages utilizes the reading key. A field in the message is used to identify the particular reading key. The point where the message security is removed by the collection system differs for modules operating in either Gen5 Network Mode or Mobile Mode systems.
 - For modules operating in Mobile Mode, the reading keys for the modules are downloaded to the module reading application.

Note: While the intent is for the utility to use a common reading key, through the key update processes, it is likely that some modules within the utility may have a different reading key than others. For this reason, the module reading application obtains up to 16 of the most recent reading keys issued to modules and downloads that list to the data collection application. The radio uses the key identifier in the bubble-up message to determine which reading key to use to decipher the secure message. This allows the module reading applications to process the secure message following Itron existing reading methods.

- Two Way Operations. Programming commands issued to a module are secured by the Gen5 network security application utilizing a command key that resides in the target module. The use of the active command key is recommended. The command operations are similar throughout the Gen5 Network solution.

When a two-way command is requested at the application server—either through a user request or through an internal job—the application server creates a command, formats the command packet, inserts a unique tracking ID, and sends the command to network to be secured using the module's command key.

The application server forwards the secure command message to the appropriate data collection application which sends it to the Gen5 550G ERT Module. The module validates the command message, executes the command, and logs the command instance, identifying it by the command tracking ID. The module then formulates a secure response using the active reading key and transmits the response to the collection application. The application receives the response. Security is deciphered dependent on the application type.

Modules operating in Mobile mode can generate commands at the application level and secure commands using the reading key. The collection method inspects the bubble-up message from the target Gen5 550G ERT Module to identify the module's reading key. The reading key allows the collection method to secure a pending read command using the identified key. The collection method can also inject the current time into the reading command prior to securing the message to force the module to update its time, thus ensuring the ad-hoc reading operation of the collection device is maintained even in a secure environment.

Gen5 550G ERT Module Encoding

The Gen5 550G ERT Module encodes the following types of information.

Note: Encoded information is dependent on the module operating mode.

- Gen5 Network Mode
 - Configurable interval data reports consumption, status, extended status, and event and alarm notifications.

Note: Interval data configuration is dependent on the Gen5 firmware version. For more information about your module's firmware functionality, see [r1952019.htm#r1952019](#).

- Mobile Mode
 - Data reports consumption, status, extended status, and tamper status and information.

Encoding Gen5 550G ERT Module Consumption Data

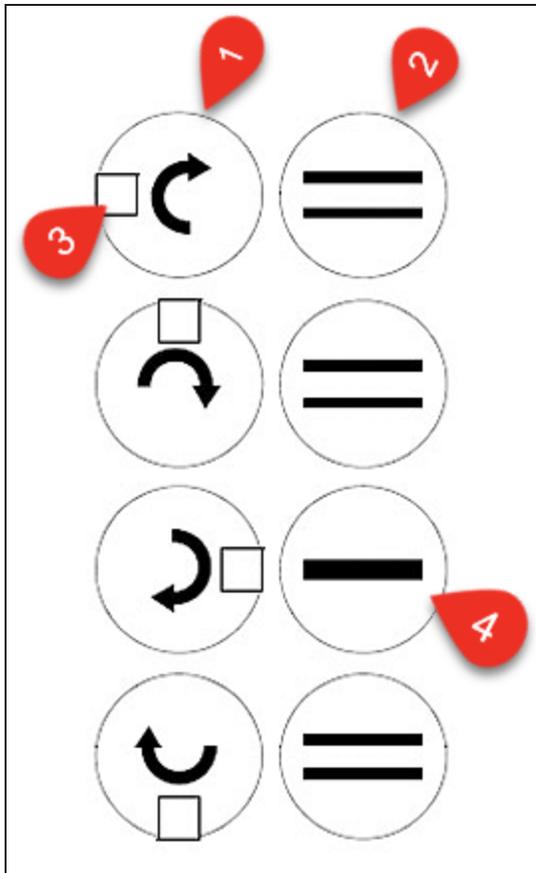


Tip: Consumption data count parameters include count rate, rollover, and pressure compensation (PCOMP).

The primary operation a 550G ERT Module performs is recording the amount of gas flowing through a pipe to a place of use. Using a typical residential, diaphragm gas meter as an example: as gas flows within the meter, it moves a measuring device that rotates a drive shaft. The drive shaft connects to the meter index, which displays the amount of flow. A gas meter that employs a direct-mount module has a shaft with a magnet attached. The shaft mechanically engages with the meter drive. As the meter drive rotates, so does the shaft and magnet. A reed switch, close to the shaft containing the magnet, is used to count revolutions generated by the meter's drive dog. As the magnet rotates near the reed switch contained in the sensing device, the reed switch closes. When the reed switch closes, a pulse is sent to the module.

In 100S Mobile mode, the hourly interval count data is stored in a data array in flash memory within the module. The data is overwritten every 960 intervals (40 days) in a round-robin fashion. By definition, the first interval is the latest written interval and the last interval is the one written 40 days ago.

In Gen5 Network Mode, the interval data is configurable dependent on the module's firmware version. For more information about the module's firmware functionality, see [Gen5 550G ERT Module Firmware Functionality on page 9](#). The module actually counts the number of times that the module detects a signal, known as a pulse. The method used to provide the pulse is known as the pulse initiator. The process is shown in the following illustration and the process is defined in the legend table.



Designator	Description
1	The module shaft turns with the gas flow.
2	The reed switch inside of the Gen5 550G ERT Module detects the movement.
3	The magnet initiates the pulse indication.
4	The process records a pulse.

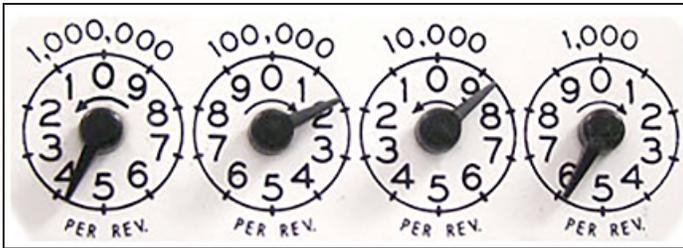
Gen5 550G ERT Module Consumption Counting and Meter Index Dials

Utility meters vary in the number of mechanical dials they have: 4, 5, or 6 dials. This section describes how the 550G ERT Module reading corresponds to a gas meter's mechanical dial reading for 4, 5, and 6 dials.

The correspondence depends on the number of the meter's mechanical dials. The fewer the number of dials, the more right-most (or least significant) module reading digits are available to represent fractions of a usage billing unit. This fraction corresponds to the partial rotations of the meter's mechanical dial from one digit to the next.

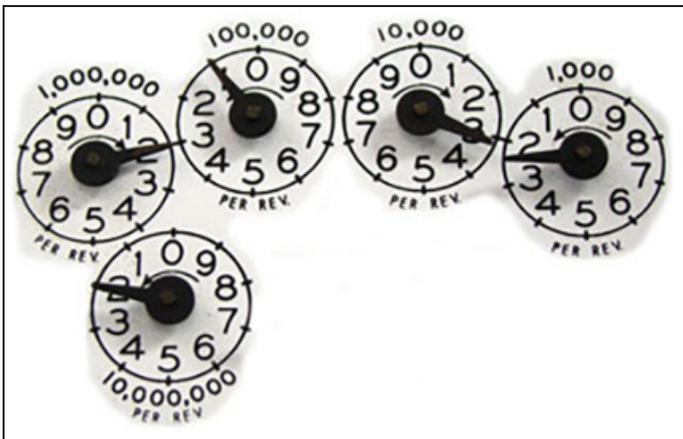
Note: The Gen5 550G ERT Module reading is programmed to roll over with the reading of the meter’s mechanical dials.

4 dial meter index



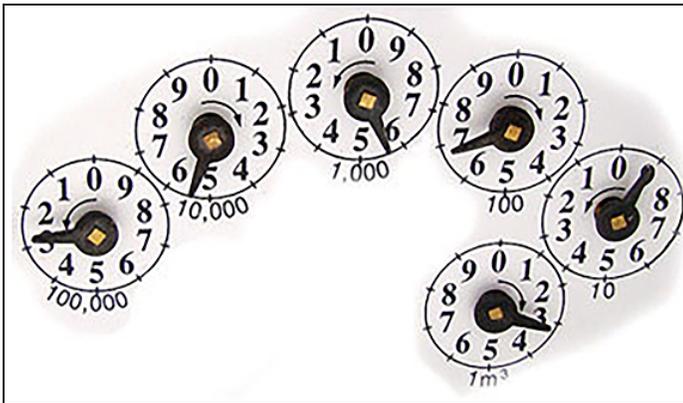
Reading type	Billing reading	Fractional billing units truncated by the meter reading software for customer billing
Meter index	4185	
Gen5 550G ERT Module	4185.42	.42

5 dial meter index



Reading type	Billing reading	Fractional billing units truncated by the meter reading software for customer billing
Meter index	22132	
Gen5 Gas ERT Module	22132.22	.22

6 dial meter index



Reading type	Billing reading	Fractional billing units truncated by the meter reading software for customer billing
Meter index	255693	
Gen5 Gas ERT Module	255693.6	.6

Encoding Gen5 550G ERT Module Event Data

The primary encoding function of an 550G ERT Module is to count the consumption of a utility product (typically gas, water, or electricity). Itron Gen5 550G ERT Modules also report their status in the system and detect when someone tampers with the gas meter or module (tamper events in Mobile Mode or events that are active in Gen5 Network Mode). Tamper or event and alarm values, interpretations, status information, and tamper or event reporting may differ among various module types.



Important! Tamperers are available when the Gen5 550G ERT Module is operating in Mobile Mode. Events are available when the Gen5 550G ERT Module is operating in Gen5 Network Mode. The available events are dependent on the module's firmware version.

The tamper or event sensors detect when a meter event occurs. The sensors then signal the tamper or event counters to increment. AMM translates the events to system event codes. See *AMM 4.14 (or higher) Events* for more information about event codes. Gen5 550G ERT Module events are configurable in the listed ways.

- An event can be enabled or disabled.
 - If the event is disabled, it will not be detected or reported.
 - If the event is enabled, the event is logged in an event log and retrieved in the event log during a read. If an event is enabled and configured as an Alarm, the event is immediately sent to the BOS as a trap.
- Event configuration is set up in IIC and can be programmed during manufacturing, locally with FDM, or remotely using MPC.
- All supported events are enabled by default.
- Legally relevant events cannot be disabled.
- Some events include Events Details or additional information included in the event log.



Tip: The module tamper or event counters increment at each event.

Gen5 Gas ERT Module Events List

The Gen5 Gas ERT Module events list includes the following types of events:

- Events that are not managed by the head-end system
- Events mapped to 100S tampers
- Gen5 550G ERT Module series events managed by the head-end system
- Events related to configuration and actions
- Events related to legally relevant functionality

Events Not Managed by HES, Mapped to 100S Tampers

Table 3-1: Events not managed by HES, mapped to 100S tampers

Event code	Event name	Event description
2	Register Error	No Communication with Register, logged if the retry logic exceeds the maximum number of retries. The Gen5 550G ERT Module will not attempt to retrieve a good read.
4	Tilt Detected	Tilt detector activated due to physical tampering.
5	Magnetic field detected Cut cable detected	The Gen5 Direct Mount 550G ERT Module detected an external magnetic field (direct mount module only). The Gen5 Remote Mount 550G ERT Module detected a cut cable (remote mount module only).
6	Low Battery	The Gen5 550G ERT Module has a low battery warning. 10% battery life remaining.

Table 3-1: Events not managed by HES, mapped to 100S tampers (continued)

Event code	Event name	Event description
16	Tilt Debounce Parameter change	The Tilt Debounce parameter changed. A parameter not related to the meter reading was programmed.
20	High Flow detected	The Gen5 550G ERT Module detected consumption that exceeded the high flow threshold.
21	High Flow end	The Gen5 550G ERT Module detected consumption that dropped below the high flow threshold after it was in a High Flow state.
28	Encoder Micro Reset	The Gen5550G ERT Module detected the encoder Micro reset unexpectedly.

Events Related to Configuration and Actions

Table 3-1: Events related to configuration and actions

Event code	Event name	Event description
3000	Device Reconfigured	The HES configuration changed in the Gen5 550G ERT Module.
3001	Event Log Cleared	The event log was reset.
3003	Configuration Downloaded	A new HES configuration was downloaded.
3004	System Reboot	Watchdog error, reboot.
3005	System Restart	A restart was planned for the Gen5 550G ERT Module.
3006	Improper Installation Detected	The Gen5 550G ERT Module can not adopt the configuration information.
3015	Authentication Failed	An application level security authentication failure occurred.
3016	Access Control Failed	An application level security Access Control failure occurred.
3017	Key Rollover	A Key Rollover command was received by the Gen5 550G ERT Module.
3018	Key Signing	An application level security certificate failure occurred.
3019	Takeover Package Accepted	A Takeover Package was presented to and accepted by the Gen5 550G ERT Module.
3020	Takeover Package Rejected	A Takeover Package was presented but rejected by the Gen5 550G ERT Module.
3021	Replay Attack Detected	An application level security replay failure occurred.

Table 3-1: Events related to configuration and actions (continued)

Event code	Event name	Event description
3022	RMA Signed Authorization Received	A Signed Authorization was issued to "Itron RMA". The authorization was received.

Events Related to Legally Relevant Functionality

Table 3-1: Events related to legally relevant functionality

Event code	Event name	Event description
10000	PCOMP Changed	The metrology PCOMP parameter changed.
10001	Count Rate Changed	The metrology Count Rate parameter changed.
10003	Count Sample Debounce Changed	The Metrology Count Sample Configuration-debounce parameters changed.
10006	Initial Index	The metrology Initial Index parameter changed.
10007	Image transfer initiated (enabled)	An Image transfer was initiated for the Gen5 550G ERT Module.
10008	Image transfer canceled (disabled)	An Image transfer was canceled (disabled).
10009	Image transfer cancel failed	An Image transfer cancel failed.
10010	Image verification initiated	An Image verification was initiated.
10011	Image verification successful	The Image verification was successful.
10012	Image verification failed	The Image verification failed.
10013	Image activation initiated	An Image activation was initiated.
10014	Image activation successful	The Image activation was successful.
10015	Image activation failed	The Image activation failed.
10019	Load Profile Interval Changed	A change was made to the CompressedLoadProfile object capture period.

Events Managed by the Head-End System

Table 3-1: Events managed by the head-end system

Event code	Event name	Event description
500	Critical error (internal)	The Gen5 550G ERT Module detected a critical error.
506	Entering Network Mode	The Gen5 550G ERT Module changed to Network Mode.
507	Set Battery Params	The Gen5 550G ERT Module detected a change in the BatteryUseParameters.
508	Set Meter Right Sizing Params	The meter right sizing parameters were changed.
509	Key Update	The Gen5 550G ERT Module security key was updated.
511	Load Profile Cleared	The Gen5 550G ERT Module Load Profile object was cleared.
512	Manual Time Sync	The Gen5 550G ERT Module time was manually changed.
514	Legally Relevant Event Log nearly full	The Legally Relevant Event is at 90% of total capacity.
515	Time Sync-over threshold detected	The module time change is greater than the warning level threshold.
516	Time Sync-over threshold end	The module Time Sync-over threshold is back below the configured threshold.
517	Entering 100S Mode	The Gen5 550G ERT Module changed to 100S Mode from Gen5 Network Mode.

Gen5 550G ERT Module Tamper or Event Detection

Magnetic tamper (or event) detection occurs through a reed switch close to the count switch. If a magnet is placed close to the module for theft purposes, the count switch may stay closed as the shaft rotates. Placing this magnet close to the module will also close the tamper (event or alarm) reed switch, which will increment the magnetic tamper (event or alarm) counter and indicate an event.

Tamper Counters

Tamper counter handling is dependent on the Gen5 550G ERT Module communication mode.

- Mobile Mode.** The tamper counters track each tamper event. The two-tamper counter least significant bits (LSB) are reported in the standard consumption message (SCM/SCM+) and can be detected when a Check Endpoint is performed using Field Deployment Manager (FDM) software. The end user sees values ranging from 0 to 3 when they perform a Check Endpoint. To read the tamper counters, perform a Read Tamper operation using FDM.

Reference the appropriate specification sheet or programming guide to verify the software version for your module.

Note: Opening and closing the sensor switch increments the tamper counter. A single tamper event may increment the tamper counter by two.

■ **Gen5 Network Mode.**

- **Events.** Events captured within the Gen5 550G ERT Module during the course of normal daily monitoring must be configured before they can be logged. Configured events support event notification and troubleshooting. Configuration of events using the `ConfiguredEventCodes` object alerts the Gen5 module of the need to store events in logs. These logs are available for data collection using the standard interrogation process. To read the event counters, perform a Read Tamper operation. By default, all events should be configured for delivery. Additionally, events can be configured as priority alarms, enabling asynchronous delivery on detection to the Collection Manager. The logs in the Gen5 module use a profile generic class structure allowing for selective access.
- **Alarms.** Alarms are configured such that the alarm event is delivered to the head-end immediately requiring configuration to perform the asynchronous delivery of captured alarms.

Battery Low Warning Extended Status Notification. The Gen5 550G ERT Module includes a battery life estimator. The estimator is based on the number of bubble-up data packets sent at the various power levels and the age (self-discharge) of the module. The battery low warning allows the utility to easily identify which modules are nearing the end of life in a mixed population. This advanced warning gives the utility the opportunity to schedule module replacement. The battery low warning is a single bit flag set when the battery has less than 10% remaining capacity, typically 2-years life remaining. Battery life is evaluated daily, at midnight.

4

Transmit and Receive Operations

This section describes the Gen5 550G ERT Module transmit and receive communications. The communications features described in this chapter may be dependent on the firmware version. To verify the firmware version of your Gen5 550G ERT Module, reference the Gen5 550G ERT Module product specification sheet.

Message Exchange

The Gen5 550G ERT Module transmits messages on fifty discrete channels. After transmitting over the Gen5 network, the module listens for commands from the network. The Gen5 550G ERT Module is configured for two different modes. The bubble-up rate and output power are unique for each operation mode. Users may utilize two-way messaging commands to assist in network management.

Note: The Gen5 550G ERT Module supports interval data messaging. Reference the product specification sheet and support documentation for proper use and application.

Gen5 550G ERT Module Receive Operation

The Gen5 550G ERT Module receives commands in the Industrial-Scientific-Medical (ISM) band in the range of 903—926.85 MHz. When Gen5 550G ERT Modules are manufactured, they are left in Factory Mode with the transmitter off. While modules are in Factory Mode, the receiver turns on every 60 seconds to listen for a Program Endpoint or Check Endpoint command at 908 MHz. About a second after each transmission, the module turns on its receiver, tuned to the transmission channel, for a duration of approximately 2 ms.

The Gen5 550G ERT Module can receive commands at that time. In a two-way communication mode, the module responds to a specific command from the reading method. The reading method transmits a command during the time the module has its receiver on. The module must conserve power so its receive time is set to a minimum. The module leaves its receiver on just long enough to detect a message command. When a message is heard from a programmer, a two-minute timer is set. If no other command operation from the module is required, the reader will not send any additional messages. When the module fails to detect a command message, it reverts to listening for a command.

Gen5 550G ERT Module Transmit Operation

When the Gen5 550G ERT Module is taken out of Factory Ship mode, it starts bubbling-up beacons. The beacon enables larger data fields with event and alarm status information in the

expanded beacon that allows Itron modules to communicate data such as a battery status indicator.

Gen5 550G ERT Module Beacon

The Gen5 550G ERT Module beacon includes the information that the module transmits to a data collection device or head-end system. The message contains the following data:

- Module ID
- Module type
- Meter reading value
- Even and alarm values
- Valve state

Gen5 550G ERT Module Gas Day Take

Gas Day Take (GDT) data is a critical to many natural gas utility companies, allowing them to manage deregulated gas purchases. While the daily GDT read can be used for varying operations within the gas utility, the primary time constrained business operation is the daily balancing of deregulated (transport) customers. This function requires that GDT data be captured from a portion of the utility's customers (typically a maximum of 10%) at 9:00 Central Clock Time (CCT) and that all of the collected GDT be prepared for presentation to deregulated marketers and customers by 11:00 AM CCT to support the gas utility's deregulated tariff. If a deregulated marketer or customer under or over burns what they nominated for a given day, a daily penalty may be associated with the imbalance. Further, customers need the previous day's GDT data so they can adjust their nomination for the next day to avoid a penalty.

Note: The default setting for GDT is off. To receive GDT messages at a specified time, you must enable the GDT function.

Gen5 550G ERT Module Network Time Management

Gen5 550G ERT Modules use application time to timestamp collected data. The Gen5 550G ERT Module receives a periodic network and absolute time broadcast from the Gen5 Network. Network time is used by the MAC layer to achieve network synchronization and facilitate consistent broadcast reception.

Note: Network time is available only after the module has registered with the Gen5 Network.

Timestamps on data collection that occurs prior to network registration is not dependable. The initial time is set in the Gen5 550G ERT Module at that time of installation.



Caution: If the Gen5 550G ERT Module was installed using zero touch deployment (ZTD), the time drift between manufacture and deployment may be significant until the device self-adjusts based on the time received from the network.

Gen5 550G ERT Module Transmission Modes

The Gen5 550G ERT Module supports Network and Mobile transmission modes. For more information about Gen5 550G ERT Module transmission modes, see [Gen5 550G ERT Module Transmission Modes on page 9](#).

Gen5 550G ERT Module Transmission Characteristics

The Gen5 550G ERT Module transmits messages in a bubble-up fashion.

Mobile Mode. In Mobile mode, the module transmits (bubbles-up) an SCM+ message an average of every 15 seconds. Each time it transmits, it will do so on 1 of 50 channels the module picks pseudo-randomly. If there are several modules in close proximity, it's likely that two modules will transmit at the same time. Even though two modules may transmit at the same time, it's most likely that they will not transmit on the same channel. To eliminate the likelihood of transmissions ending up on top of each other repeatedly, the transmit time is varied randomly by +2 seconds. In Mobile Mode, the module will bubble-up every 13 to 17 seconds.

The 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 very reliable communication between the Gen5 550G ERT Module and the data collection method.

To transmit daily or hourly interval data, the module must receive a specific request from the reader. When it sends interval data, the module must send the current consumption so the interval is related to the consumption value to determine the actual consumption at the prior interval. The module cannot send raw count data because consumption is a combination of raw counts and initial consumption. The module does not have the processing power to recalculate raw counts from an initial offset.

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

To calculate the value at a prior interval, the reader can sum the subsequent interval values and then apply the rate multiplier and compensation to get a consumption offset. The consumption offset can be subtracted from the total sent consumption with the remainders adjusted for rollover. This approach eliminates complex or time-consuming math in the module and transfers it to the reader, where more powerful resources can process the data.

Gen5 Network Mode. In Gen5 Network Mode, the module emits a beacon following the configured transmission schedule. The default behavior is for the head-end to send an interrogation request every 8 hours. After the module receives the request, it prepares the requested data and transmits it in the configured time period.

Gen5 550G ERT Module Operating Modes

Normal operation mode for the Gen5 550G ERT Module supports Gen5 Network communication and Mobile Mode for installation and specific utility configuration for up to 30 days. Transmission for normal operation mode is summarized in the following table.

Operation Mode	Transmission Rate	Output Power	Battery Life
Gen5 Network		+27 dBm (500 milliwatts)	20 years
Mobile	15 seconds	+10 dBm (10 milliwatts)	20 years

Note: Optimum battery life is dependent on the Gen5 550G ERT Module operating in a standard configuration. For more information about the Gen5 550G ERT Module standard configuration, see [Standard Gen5 550G ERT Module Configuration on page 9](#).

- **Normal Mode.** The Gen5 550G ERT Module is in bubble-up mode, emitting a beacon (Network Mode) or an SCM+ (Mobile Mode) at configured intervals.
- **Factory Ship Mode.** When the Gen5 550G ERT Module is manufactured, it is set to Factory Ship Mode. In Factory Ship Mode, the module does not transmit messages. In Factory Ship Mode, the module turns on its receiver every 4 seconds set for the 908 MHz programming channel. It remains quiet until it receives a command message.
- **Audit Mode.** When the module is programmed, it enters Audit Mode for up to 30 days. While the module is in Audit Mode, the module bubbles up messages every 4 seconds between its normal mode bubble-ups of +10 dBm every 15 seconds for Mobile Mode. The module turns on its receiver after each Audit Mode transmission. The module exits Audit mode after an inactivity timeout expires (Mobile Mode) or after the Signed Authorization session ends.

5

Gen5 550G ERT Module Programming and Reading

When a Gen5 550G ERT Module ships from the factory as a build to stock device, all programmable parameters are set to their manufacturing default values. At the time the modules are installed and/or as a build to order device, the module must be programmed for use with the utility equipment and collection methods. A configuration file defines the module's programming parameters.

Gen5 550G ERT Module Programming Parameters

The system will support following types of programming for the Gen5 550G ERT Module:

- Manufacturing configuration. Manufacturing configuration refers to configuration programmed as part of manufacturing.
- Local in field configuration
- Remote configuration over the head-end system

The ERT module has three 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 modules for a specific utility.
- **Meter-specific parameters.** Meter-specific parameters vary by the meter type connected to the module. Initial programming may place the Gen5 550G ERT Module in Gen5 Network Mode or Mobile Mode.

Manufacturer System Parameters

The manufacturer system parameters contain the information required for basic device operation. The tamper or event debounce parameter specifies the amount of time for the mechanical contact on the tilt switch to settle before a signal from the switch is considered valid by the Gen5 550G ERT Module. This configurable parameter is used to adjust the sensitivity of the meter removal tamper or event indicator.

Gen5 550G ERT Module Default Values

This section lists the default values for a Gen5 550G ERT Module not yet programmed. If a Check Endpoint was performed prior to programming, these values would be read and returned. These are the default values set in the module at the time of manufacture.

Parameter	Value
Count rate	1
Rollover	2
Bubble-up	OMR (15 seconds)
PCOMP	None (1.000)
Utility ID	0
Lock level	No lock (lock level 1)
RF output power	OMR (+10 dBm)
Network Mode	Star, Mesh
SSID	42834

Note: If the Gen5 550G ERT Module is programmed with a configuration other than the values shown above, such as a utility ID, and the above values appear after a Check Endpoint is performed, the ERT module was not successfully programmed.

Gen5 550G ERT Module Utility System Parameters

The Gen5 550G ERT Module's utility system parameters contain information required for the utility's system operation. Generally, all modules within a defined group are programmed with the same utility system's parameters. The utility system parameters for the Gen5 550G ERT Module include:

- Utility ID
- Security lock level (no lock, hard lock)

Itron sets the utility system parameters for use by a specific utility. They are designed to provide proper communication and module security for all the utility's Gen5 550G ERT Modules.

When a Gen5 550G ERT Module is programmed, the new parameters take effect immediately.

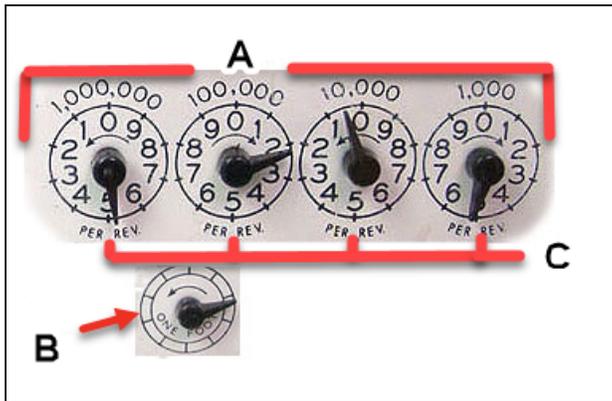
Note: When the Gen5 550G ERT Module is programmed, the utility ID and security lock level are set, which defines how subsequent reprogramming is performed. When the Gen5 550G ERT Module is programmed and set for Hard Lock security level, the module cannot be unlocked.

Gen5 550G ERT Module Meter-specific Parameters

A Gen5 550G ERT Module's meter-specific parameters contain information required for the module to operate properly with a certain meter type or model. Meter-specific parameters are different for all meters. The following parameters are common to most meters.

- Initial reading
- Count rate/pulse factor
- Rollover (number of dials)

The listed parameters correspond to the following features on a typical mechanical meter dial.



	Parameter	Description
A	Initial reading	Specifies the module's meter reading during installation. This is the number from which a module begins counting consumption.
B	Count rate and pulse factor	Specifies the gas flow amount required to deliver a pulse to the module.
C	Rollover	Specifies the number of the meter's mechanical dials that indicate the meter reading. This parameter synchronizes the module reading with the mechanical register reading.

A list of meter configurations is available when you program the module with Field Deployment Manager (FDM). In the case of the above example, the user would select 4-dial, 1 cu ft. and would not be required to enter a count rate or rollover value. These values are predetermined when the configuration is selected. Also, considering the example above, the user would enter 5205 for the initial reading.

Utility ID

Note: The Utility ID is used during Mobile Mode operation only.

The utility ID parameter specifies the unique, utility-specific security code that prevents an unauthorized individual from communicating with the module. Itron assigns the utility ID, which ranges from 0 through 255. The Utility ID is contained in the Meter Configuration File loaded into the Field Deployment Manager (FDM) application. Without the correct utility ID, a data collection method can read the beacon (Network Mode) or SCM+ (Mobile Mode), but it cannot alter the parameters or display the module's encoded data. With the correct utility ID, an operator can perform the following functions.

- Program the module
- Read the module's programmed parameters
- Read the tamper value.

Security Lock Level

The security lock level parameter controls module reprogramming.

Note: Itron recommends No lock whenever possible for greater flexibility.

The Gen5 550G ERT Module uses the following security lock levels.

- No lock. A module programmed with this lock level can be reprogrammed with a compatible programming method and the correct utility ID.
- Soft lock. The soft lock security level provides the same functions as no lock: however, the Unlock Endpoint functions must be successful before the module can be reprogrammed.
- Hard lock. If a module is programmed with this lock level, billing parameters such as consumption, number of dials, drive rate, or pressure compensation (PCOMP) cannot be reprogrammed. The Gen5 550G ERT Module may be programmed for Mobile Mode for a limited time to enable third-party device programming. After 30 days, the Gen5 550G ERT Module must be switched to Gen5 Network Mode.



Important! Measurement Canada requires a Canadian utility to use a locked security level for gas meter modules.

Programming Gen5 550G ERT Module

Programming Gen5 550G ERT Module requires an understanding of:

- Your meter's drive rate and the number of dials
 - The drive rate and number of dials is important for programming the module to count correctly and roll over to zero at the correct time. For example, a four-dial, 2 cubic-foot meter

configuration will count two cubic-feet for each rotation and roll over to zero after 9999.99 where the ones place is equivalent to 100 cubic-feet.

- How your system interprets 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.

It is important to understand your system before the modules are programmed.

Program the Gen5 550G ERT Module in Gen5 Network Mode using a compatible programming method loaded with Field Deployment Manager (FDM) Tools. To enable enhanced security and for more complete programming information, see the Field Deployment Manager Tools Configuration Guide (for documentation information, see [r1945844.htm#r1945844](#)).



Important! Modules ordered pre-programmed with security injected and specified as Zero Touch Deployment require that the installer rotates the wriggler five (5) times to activate the module to join the network if installing in a location with little or no gas flow.

Gen5 550G ERT Module Programming Parameters

The system will support following types of programming for the Gen5 550G ERT Module:

- Manufacturing configuration. Manufacturing configuration refers to configuration programmed as part of manufacturing.
- Local in field configuration
- Remote configuration over the head-end system

The ERT module has three 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 modules for a specific utility.
- **Meter-specific parameters.** Meter-specific parameters vary by the meter type connected to the module. Initial programming may place the Gen5 550G ERT Module in Gen5 Network Mode or Mobile Mode.

Gen5 550G ERT Module Time to Program in the Initial Mobile Mode

In Mobile Mode normal operation, the module bubbles up an SCM+ message every 15 or 60 seconds. The handheld programmer will not have an opportunity to send a command (program) to the module until it receives the SCM+ message. It could take 60 seconds before the handheld computer receives the message and has an opportunity to transmit back. On average, the

handheld programmer receives the module's message within half the bubble-up rate time (for example, 7.5 seconds for Mobile Mode). The programming process completes a few seconds after the handheld programmer successfully receives the module's message.

In Factory Mode normal operation, the initial programming takes approximately 15 seconds (if success is achieved on the first attempt). The handheld programmer reads the module's Gen5 Mobile Mode and listens for an SCM+ message for 65 seconds before timing out. A failed programming attempt takes approximately 1 minute 25 seconds.

Programming Best Practices and Considerations

For initial module in-field programming, Itron recommends holding the handheld programmer within 6 feet of the target module. If you are re-programming or performing a Check Endpoint for a module installed in the field longer than 30 days (out of Audit Mode), hold the handheld programmer approximately six feet away from the module to accommodate power levels.

Note: Hold the handheld programmer approximately six feet from the module and as upright as possible when checking or re-programming the module.

Gen5 550G ERT Module Time to Program in the Initial Mobile Mode

In Mobile Mode normal operation, the module bubbles up an SCM+ message every 15 or 60 seconds. The handheld programmer will not have an opportunity to send a command (program) to the module until it receives the SCM+ message. It could take 60 seconds before the handheld computer receives the message and has an opportunity to transmit back. On average, the handheld programmer receives the module's message within half the bubble-up rate time (for example, 7.5 seconds for Mobile Mode). The programming process completes a few seconds after the handheld programmer successfully receives the module's message.

In Factory Mode normal operation, the initial programming takes approximately 15 seconds (if success is achieved on the first attempt). The handheld programmer reads the module's Gen5 Mobile Mode and listens for an SCM+ message for 65 seconds before timing out. A failed programming attempt takes approximately 1 minute 25 seconds.

Gen5 550G ERT Modules and FDM Variables

This section defines and clarifies possible system FDM variables you may encounter in programming Gen5 550G ERT Modules. The following tables illustrate various FDM programming configurations and the ERT module's response to each setting.

	1,000,000,000,000 CF	100,000,000,000 CF	10,000,000,000 CF	1,000,000,000 CF	100,000,000 CF	10,000,000 CF	1,000,000 CF	100 CF	10 CF	1 CF
3 Dial, 1 cubic foot										1
3 Dial, 2 cubic feet										2
4 Dial, 1 cubic foot										1
4 Dial, 2 cubic feet										2
4 Dial, 5 cubic feet										5
4 Dial, 10 cubic feet									1	
5 Dial, 1 cubic foot										1
5 Dial, 2 cubic feet										2
5 Dial, 5 cubic feet										5
5 Dial, 10 cubic feet									1	
5 Dial, 20 cubic feet									2	
5 Dial, 25 cubic feet									2	5
5 Dial, 40 cubic feet									4	
5 Dial, 50 cubic feet									5	
5 Dial, 100 cubic feet								1		
5 Dial, 500 cubic feet								5		
5 Dial, 1000 cubic feet							1			
6 Dial, 5 cubic feet										5
6 Dial, 10 cubic feet									1	
6 Dial, 20 cubic feet									2	
6 Dial, 50 cubic feet (CCF)									5	
6 Dial, 50 cubic feet (MCF)									5	
6 Dial, 100 cubic feet (CCF)								1		
6 Dial, 100 cubic feet (MCF)								1		
6 Dial, 500 cubic feet (CCF)								5		
6 Dial, 500 cubic feet (MCF)								5		
6 Dial, 1000 cubic feet (CCF)							1			
6 Dial, 1000 cubic feet (MCF)							1			
6 Dial, 10000 cubic feet							1			
7 Dial, 100 cubic feet (CCF)								1		
7 Dial, 100 cubic feet (MCF)								1		
7 Dial, 1000 cubic feet (CCF)							1			
7 Dial, 1000 cubic feet (MCF)							1			

Numbers represent the place and value that will increment per count/pulse
Entered in initial index read
Entered in initial index read but will not increment
Not entered in initial index read but passed on in reading
Not entered in initial index read and will not increment; will always read 0
Internal, incrementing digits not visible or transmitted
Not in SCM or SCM Plus but read out in NIM. Rolls over after 32 bits
4,294,967,295

	1,000,000,000,000 CF	100,000,000,000 CF	10,000,000,000 CF	1,000,000,000 CF	100,000,000 CF	10,000,000 CF	1,000,000 CF	100 CF	10 CF
6 Dial, 1000 cubic feet (CCF)							1		

Programming example: Endpoint programmed for 6 dial, 1000 cubic feet CCF.

1. Enter the initial index read. For this example, the initial read is 123456 where 6 = 600 cubic feet. After the initial programming, an endpoint read will result in a reading of 1234560 where the least significant digit is in 10's of cubic feet. Since counting is with a drive rate of 1000 cubic feet and the reading is transmitted in 10's of cubic feet, the last two digits of the reading will not change.
2. Program the endpoint to 123456.
3. Read the endpoint. The result should be 1234560 with the zero added to put the reading in 10's of cubic feet.
4. Add one count. The result should be 1234660. Notice that the last two digits of 60 do not change.