> Itron white paper

Itron Water AMI
100W Communication Module
Network Interval Message

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Introduction

The 100W is the latest ChoiceConnect™ water communication module, offering advanced capabilities such as full two-way communications to the meter and time-synchronized interval meter data.

Network Interval Message

The *Network Interval Message* (NIM) is the unique message transmitted by the 100W Datalogging ERT® module to support hourly data logging. It leverages Itron's experience with industry-leading interval data latency—learned over several years of Fixed Network development—yet maintains our superior 20-year battery life in a reliable and cost-effective design.

The network packet contains 32-bit ID and consumption data, 16 bits of tamper counters and flags, packet sequence numbers, and network configurable data bytes. In operation, it is nominally transmitted every five (5) minutes from the 100W Datalogging ERT module. Data redundancy is built in so that the message contains sufficient data for a Fixed Network to maintain interval data integrity even if only one packet in an 8-hour period is read. This reduces the need for 2-way communications in the system to fill in any missed intervals.

Field Number	Bits	Value (Hex)	Description
1	8	55	Preamble
2	16	16A3	Frame sync
3	8	1F	Protocol ID
4	16	27E2	Length/ Hamming code
5	8	0F	Message number
6	8	6B or 8B	Endpoint type 100W (w or w/o Leak Sensor)
7	32	Xxxxxxxx	Endpoint serial number
8	8	07 or 25	BCD Data Type (un-compressed or compressed)
9	24	Xxxxxx	Datalogging Multiplier/Rollover/Compensation
10	32	Xxxxxxxx	Current Consumption Reading
11	128 or 64	xx...xx	Eight hourly interval delta values (un-compressed
12	8	Xx	Sequence counter (0 - 191)
13	16	Xxxx	Seconds since midnight
14	1	X	Last Good Read Flag
15	1	X	Extended Tamper Flag
16	1	X	Last Interval Sum Flag
17	1	X	Right Size Complete Flag
18	1	X	Leak Detection Flag
19	1	X	Reverse Flow Flag
20	1	X	Pulser/Encoder Flag
21	1	X	Leak Sensor Ok Flag
22	3	Xxx	Metrology programming counter
20	3	Xxx	Non-metrology programming counter
21	16	Xxxx	Network configuration
22	32	Xxxxxxxx	Packet CRC (32-bit)

Standard Consumption Message

For comparison, Itron's *Standard Consumption Message* (SCM) is the message historically supported by all Itron water ERTs, such as the 40/50/60 and 80W devices used within AMR systems. Its fundamental purpose is to simply transmit the index read and provide some tamper event indicators. (Tampers can be different in different ERT models; 100W tampers are given below.)

Field Number	Bits	Value (Hex)	Description
1	20	F9530	Preamble
2	1	0	Preamble (extension)
3	2	Xx	ERT ID (upper 2 bits)
4	1	X	Spare bit (repeater)
5	2	B	ERT Type 11
6	1	X	Last Good Read Flag
7	1	X	Extended Tamper Flag
8	1	X	Leak Detection Flag
9	1	X	Reverse Flow Flag
10	24	Xxxxxx	Current Consumption Read
11	24	Xxxxxx	ERT ID (lower 24 bits)
12	16	Xxxx	Packet CRC (16 bits)

NIM Message Field Understanding

Most fields within the data messages are obvious by their description. However, further explanation is provided below to assist in understanding the consumption information and data logging processing fields.

Fields 1-9, 12 and 21-22

These fields are used for packet identification, routing, data formatting, network optimization, and message protection. They are the wrapper allowing us to get the data to the proper destination without error and with the proper formatting.

Fields 10 and 11

Field 10 contains the current consumption reading (index read) and field 11 contains the last eight hours (Current partial hour + 7 full hours) of interval deltas. This data can be in a compressed or uncompressed format. The endpoint automatically switches to the compressed format when possible to conserve battery life.

Field 13

This field contains the endpoint time, referenced to midnight on the current day. The reader will compare this to the actual UTC time and correct the EP time if necessary to maintain a time synchronized system.

Fields 14 through 20

These are the tamper and status fields provided by the 100W.

Last Good Read Flag	Indication that the Consumption Reading is not from the current
Extended Tamper Flag	Indication of a tamper event not specifically called out
Last Interval Sum Flag	Indicates the last delta interval is a sum of previous intervals.
Right Size Complete Flag	Indicates the right sizing operation has completed
Leak Detection Flag	Indicates a possible lead on the metered side of the service.
Reverse Flow Flag	Indicates the presence of a reverse flow condition
Pulser/Encoder Flag	Indicates if the attached register is a Pulser or Encoder type
Leak Sensor Ok Flag	Indicates if an attached leak sensor (Distribution side) is
Metrology programming counter	Indicates if the metrology parameters in the ERT have been
Non-metrology programming counter	Indicates if the operational parameters in the ERT have been

Consumption Calculation

When using a Pulser type register, the actual registered consumption of the meter can differ from the raw switch counts. This difference is due to:

- **Initial Consumption**
  Not all meters start at zero, but consumption counts start when the endpoint is installed on the meter. The endpoint can be programmed with an initial consumption value to compensate for this fact.
- **Count Rate Multiplier & Compensation**
  Each meter shaft rotation can represent multiple or fractional units of Water. This variation depends on the size and programming of the of the meter register. This is accounted for by the count rate multiplier and compensation parameters.

  The Count Rate Multiplier has valid values of 1, 2, 5, 10, 20, 25, 40, 50, 100, 500 and 1000, while the compensation value is represented as *X over 10,000*, where *X* can be between 1 and 131072. The compensation value is multiplied by the count rate to determine the count increment.

  For example:

  Compensation comp = 10,000

  Count rate Multiplier = 10

  10,000/10,000*10 = 10.

Therefore, the consumption will increment 10 units for every switch closure.

- **Rollover.**
  The meter has a limited number of dials. Meter registers rollover to zero based on this dial number. Since the message from the endpoint should match the reading of the dials, the consumption must be adjusted for rollover.

  The allowed values for rollover are:

  10,000

  100,000

  1,000,000

  10,000,000

  100,000,000 (Not allowed for SCM)

  100,000,000 (Not allowed for SCM)

  100,000,000 (Not allowed for SCM)

  100,000,000 (Not allowed for SCM)

  NOTE: This parameter may not be set for the absolute encoder model. It is internally set based on the number of digits received from the last good read.

The formula for adjusted consumption is given by:

Consumption = (((Raw counts) x (Rate Multiplier) x (Compensation/10,000)) + Initial Consumption) x Modulo (Rollover)

Where:

Raw Counts = the number of shaft rotations

Count Rate Multiplier = Multiplier as described above

Compensation/10,000 = Value as described above

Initial Consumption = the meter dial reading when the meter is installed

Modulo (Rollover) is the modulo operator returning the remainder after the rollover value is divided into the consumption. This forces the consumption to roll over at one less digit than the roll over number (example 9,999 for a 10,000 roll over). Rollover can be 10,000, 100,000, 1,000,000 or 10,000,000 for SCM and up to 1,000,000,000 (9 digit) for a NIM

The endpoint applies this formula when sending index read values.

When sending interval data, the endpoint must also send current consumption. The intervals can be related to this value to determine the actual consumption at some prior interval.

The consumption sent in an interval data packet is the same as the SCM (processed for compensation, rate multiplier, and initial consumption) but not adjusted for rollover. Intervals are sent as the raw count value and the multiplier inclusive of compensation and rollover is sent along.

To calculate the value at a prior interval, the reader takes the subsequent interval values, sum them up, and apply the rate multiplier and compensation to get a consumption offset. This can be subtracted from the consumption sent and the remainder adjusted for rollover.

This approach eliminates complex or time-consuming math in the endpoint and transfers it to the reader where more powerful resources can process the data. It also allows the reader to easily process rollover and extract the total counts seen by a meter.

Summary

The messaging approach Itron uses to deliver Water AMI interval data performance is built on over 20 years of AMR and AMI experience along with multiple years of experience providing interval data information for Fixed Networks. Itron is confident our Network Interval Data message meet utilities needs for years to come while providing our hallmark 20 year battery life. .

About Itron

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Publication 101123WP-01
03/11