iQPulse Consumption Management System Events and Alarms

Overview:
The **iQPulse** system alerts are generated at two levels:

- Device triggered events
- Portal generated events

For each of these levels, there are two types of events:

- Consumption related events
- Status events

1. Device Consumption Events

The **iQPulse** cellular endpoint (device) can interface with either pulse, or encoded meters. Pulse meters are monitored continuously, so that the endpoint captures every pulse generated by the meter. This approach ensures that, for a pulse meter, the endpoint reading is always up to date. Each pulse represents a certain volume (for example, one pulse per gallon, or one pulse for every ten gallons for larger meters). In contrast, a meter with an absolute encoder register does not need continuous monitoring. The encoder provides the actual meter reading by detecting the current positions of the odometer-type wheels. The endpoint reads the encoder only once an hour. In between the hourly reads, the endpoint connected to an encoded register, does not collect updated readings. Consequently, endpoints connected to encoders can detect events only when the meter is read. Thus, real-time flow events are detected only on hourly intervals.

Suspected Leak Alert – A slow leak is a leak that is characterized by a continuous flow over a long period of time, such as a running toilet, for example. The **iQPulse** system provides an alert for suspected leak by monitoring the meter reading once an hour. If a leak is detected, the suspected leak alert is generated only if the reading **advances every hour** for a set period such as number of hours. The **event is set** after 24 consecutive hours of continuous consumption of at least one measurement unit every hour. A measurement unit depends on the meter AMR output. Some meters have an AMR resolution of 1 gallon, while other meters have an AMR resolution of 10 Cubic Feet. The suspected leak alert is transmitted together with the next meter reads (typically once a day). Once the endpoint has not detected a meter progress for at least one hour, the **event is cleared**. For example, a pulse meter with a pulse resolution of 1 gallon, the suspected leak event is set after 24 hours of consumption of at least 1 gallon which is consumed every hour. The same logic applies for encoded meters. The suspected leak alert will be available on the **iQPulse** portal within a 24-hour period after the event is set.

High Consumption Alert – A high consumption alert is generated once a predefined consumption threshold has been exceeded within a one-hour time interval. The value of the threshold varies depending on the size of the meter. Once

a high consumption event is set, the **iQPulse** endpoint attempts to send the alert immediately. The high consumption alert is the only alert which triggers an immediate action. Once the event is set the **iQPulse** endpoint connects to the server and notifies of the event. The **event is cleared** once the consumption between two hourly reads is lower than the predefined threshold.

Reverse Flow Alert – The reverse flow alert is available only for encoder meters. A reverse flow even is set if the last meter reading (current reading) is lower than the value of the previous meter reading (captured one hour earlier). The reverse flow event is cleared once the last reading (current reading) of the meter is equal to, or higher than the value of the previous meter reading (captured one hour earlier).

2. Device Status Events

The **iQPulse** cellular endpoint provides status information as detailed below:

Encoder Communications Error – The **iQPulse** endpoint provides an encoder communications alert if the endpoint is not successful in collecting the meter reading data (interface error). Such an event can be due to one of the following problems:

(a) Disconnected cable between the endpoint and the register (at least one wire is disconnected)

(b) Wrong wiring between the endpoint and the encoded register (the encoder wiring is polarity sensitive)

(c) Malfunction in the encoded register that prevents the meter reading to be polled

(d) Corrupted message from the encoded register

(e) Connection to an encoded register that is not compatible with the endpoint

(f) The endpoint was setup with a wrong type of meter

The encoder communication error is cleared once valid data is received by the endpoint. This type of event can occur only with an encoded output register. For pulse meters, this event is not applicable.

Low Battery Alert – The **iQPulse** endpoint provides a low battery alert when the battery voltage permanently drops below a predefined threshold. The endpoint measures the voltage every six hours. The low battery **event is set** If the measured voltage drops below 3.5 Volts and remains at this level for 28 subsequent readings.

3. Portal Generated Alerts

Consumption Events - The **iQPulse** portal can be configured to identify various events and provide alerts. The definition of the events is flexible, so that for each event the user can specify several parameters that provide the capability to adjust the event's criteria. Once these parameters are defined, for every event that is triggered, the event is recorded in the event log. Furthermore, for each type of event, the user can define additional alerts that can be generated by the software, including:

- Email to a predefined mailing list
- Text message to a specified list of individuals

The user can define two levels of consumption alerts (for example, high consumption and extremely high consumption). The ability to set multiple threshold levels provides the means to handle events based on their level of severity. Consumption events are defined so that the **iQPulse** portal generates an alert when a consumer's daily consumption significantly exceeds the average daily consumption during a reference period. The threshold for consumption events is configurable so that the event sensitivity is adjustable (defined as a percentage above the reference consumption value). For example, the default high consumption event is defined to trigger an alert if the daily consumption for the previous day is at least 200% higher than the average daily consumption from the previous 30 days, as long as the consumption is more than one 100 cu. feet. Each of the following values are configurable parameters:

(a) Number of days back from current day (for example, yesterday's total consumption)

(b) Comparison period - the reference period (for example, previous 30 days)

(c) Threshold percentage – the value in percent for which an alert is triggered (for example, previous 200%)

(d) Daily consumption lower threshold (for example, is at greater than 100 cu. Feet)

The alert threshold can be adjusted within the **iQPulse** portal under **Admin** – **Logical Tests** – **High Consumption and/or Very High Consumption**.

Non-Advancing Meters- An additional consumption event can be defined for detection of **non-advancing meters**. The system can screen for non-advancing meters based on lack of updated consumption. The non-advancing events do not include meters that did not advance due to lack of communications. The non-advancing alert is triggered when readings are recorded in the system, however, the meter reading has not changed for a predefined number of consecutive days. For example, the default non-advancing alert is set to trigger for meters that have showed no consumption for seven days in a row. The alert threshold can be adjusted within the **iQPulse** portal under **Admin** – **Logical Tests** – **Non Advancing**.

Status Events -The **iQPulse** portal can identify additional events that relate to the system performance such as the **no reception alert**. This alert is triggered when an **iQPulse** endpoint has not communicated with the **iQPulse** portal for a consecutive number of hours or days. For example, the default for a no reception alert is when no data has been received from a specific device for more than 72 hours/3 days. The alert threshold can be adjusted within the **iQPulse** portal under **Admin** – **Logical Tests** – **No Reception**.

Additional Configuration Options- As with the consumption related alerts, every no reception event is recorded in the alerts log and additional alerts can be defined for emails, and/or text messages. Emails and text message notifications for each alert can be set up in the **Admin** – **Contact People**.