Application Note - Demand Response Event Data

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Introduction

This document describes how demand response event data (which is produced by the high speed data module on EpiSensor's ZDR product line) is handled by the EpiSensor Gateway.

The event data is a high resolution snapshot of the power, frequency and relay state taken before and after a frequency / dispatch event.

Because of the resolution and quantity of data produced, this data will be handled differently in some ways by the EpiSensor Gateway.

This document applies to applied to Gateway Software Version V04.01.00.01 and onwards. For more detailed information on the ZDR and the high speed data module, refer to the ZDR user guide.

Related Documents

Related installation and configuration documents are listed in the following table:

Document	Reference No.
EpiSensor NGR-30-3 Datasheet	EPI-102-00
EpiSensor NGR-30-5 Datasheet	EPI-077-00
Gateway API User Guide	ESE-009-08
EpiSensor ZDR User Guide	EPI-078-00

Event Data Message Format

Event data will arrive at the Gateway from the ZAP (Zigbee Access Point) in the form of a "DREV" message. The DREV message will contain one or more event data points. For each DREV message that arrives at the Gateway, an acknowledgement "DRAK" message will be sent by the Gateway to the ZAP. The Node will retry the DREV message if a DRAK is not received within the expected timeframe.

The DREV message takes the following format (with the fields delimited by | as per other messages) :

DREV<shortAddress>		The Mnemonic and the short address of the ZDR node
Long Address		The Long Address of the ZDR node
Timestamp		Timestamp with same format as DATB
Sequence Number		Sequence Number with same format as DATB
Element Count		Number of elements within this DREV message. Each element will contain three sensor event data values for a particular millisecond value. Event Data Points for Sensor 342 Line Frequency and Sensor 359 Switch state are always included in each element presented here. Because these values are expected, the sensor ID and data type are not presented in here. The maximum element count will be 5.
Element i (i will range from 1 to Element Count number)	Millisecond i	The millisecond within the timestamp the following 3 data points were recorded for. This value will be represented as a decimal in the range 0 to 999. This millisecond value is to be combined with the timestamp field above.
	Frequency i	Frequency Line Event Data Value encoded as per data values for sensor ID 342. (This will be an unsigned hex value)
	Switch State i	Switch State Data Value encoded as per data values for sensor ID 359. (This will have value 0 or 1)
	Sensor ID i	The sensor ID of the sensor to which the third data value in this element related to. (Initially will always be 335)
	Sensor Type i	The data type (encoding) of the third data value in this element.
	Sensor Value i	The actual data value of Sensor ID_0 encoding according to Sensor Type_0.

In response to the DREV message, the Gateway will return a DRAK message in the following format:

DRAK<shortAddress>		The Mnemonic and the short address of the ZDR-10 node
Sequence Number		Sequence Number as per the corresponding DREV message.

Handling of Event Data in the EpiSensor Gateway

After parsing by the MESSAGE_PROCESS module, Sensor Event Data is queued internally in the same queue and normal Sensor Data. The DRAK message will be sent once the data has been queued. The DATA-SERVER module in the Gateway is responsible for de-queuing the Sensor Data and Sensor Event Data and exporting it as configured by the user. All data points in the data queue are dequeued and handled one at a time by the DATA_SERVER.

Event Data is handled in a slightly different way to normal sensor Data as follows :

- The data timestamp is composed of the data timestamp field with the millisecond field added in. The DATA-SERVER will perform this computation at the time of removing the data point from the data queue and preparing it for the selected export format.
- The actual exported timestamp format will be influenced by the type of data. Event Data will always have millisecond resolution. Non-event data will always have a resolution of seconds. Some examples are shown below for common timestamp formats:
    - Unix Timestamp With Milliseconds
        - 1537531961123
    - Unix Timestamp Without Milliseconds
        - 1537531961
    - ISO Timestamp With With Milliseconds
        - 2018-09-21T11:49:35.123
    - ISO Timestamp Without Milliseconds
        - 2018-09-21T11:49:35
- The Extended CSV and Multi Column CSV formats do not support millisecond timestamp resolutions and therefore do not support Event Data export.
- Event Data will not be saved in the Gateway's internal store of last data points (Defaults to last 96 data points for normal Sensor Data).
- Event Data will not be recorded as the last data point for any node or sensor. As a result, event data will not be displayed on the Nodes → Settings page as the last data point for a node or the sensors of that node.
- Event Data will not be shown on the data graph on the Data → Graph View page.
- Event Data will not be accessible via the API.
- The Last Event Data Point (if any) for a sensor will be shown on the Sensor Settings page for each sensor. The data value and timestamp will be shown.
- As with all sensor data, the data will only be exported if export is enabled for that sensor.

Special Handling for MQTT Export Format

Typically for non-event Sensor Data, the data is published per timestamp. In other words, the Gateway publishes all data with a particular timestamp together as shown in the following example:

```
{
"Gateway":"000D6F00010B768E",
"Timestamp":1537532100,
"Values":{
      "000D6F00030516C4":{
            "380":"-1.46",
            "381":"24.3"
            }
      }
}
```


However for Event Data there will be a higher timestamp resolution, resulting is many more data points being produced. For this reason a new configuration option was introduced on the Settings → Data Export page to allow the user to deselect “Publish for Timestamp” for MQTT. This is highly recommended for systems expecting Event Data to be exported.

Also note the presence of the additional “milliseconds” element per timestamp element. This will be present and set to boolean value true when the timestamp is of milliseconds resolution. It will not be present when the timestamp is of seconds resolution. It is possible to have a mix of milliseconds and second timestamps in one publish.

An example for the format of a publish message with more than one timestamp is shown here:


```
{
 "Gateway":"000D6F00010B768E",
 "data":
 [
   {"timestamp":1532092920000, “milliseconds”: true, "values":{"000D6F00030516C4":{"380":"213.11"}}},
   {"timestamp":1532092980000, “milliseconds”: true, "values":{"000D6F00030516C4":{"380":"213.11"}}},
   {"timestamp":1532093040000, “milliseconds”: true, "values":{"000D6F00030516C4":{"380":"213.11","381":"79.08"}}},
   {"timestamp":1532093054000, “milliseconds”: true, "values":{"000D6F00030516C4":{"381":"79.14"}}},
   {"timestamp":1532093100000, “milliseconds”: true, "values":{"000D6F00030516C4":{"380":"213.15"}}},
   {"timestamp":1532093160000, “milliseconds”: true, "values":{"000D6F00030516C4":{"380":"213.13","381":"79.21"}}},
   {"timestamp":1532093220000, “milliseconds”: true, “values":{"000D6F00030516C4":{"380":"213.2"}}},
   {"timestamp":1532093280000, “milliseconds”: true, "values":{"000D6F00030516C4":{"380":"213.17","381":"79.12"}}},
   {"timestamp":1532093290, "values":{"000D6F00030516C4":{"380":"214.17"}}}
 ]
}
```

Live Stream Export

Live Stream Export is an efficient way of getting both the Sensor Data and Event Sensor Data out of the Gateway and on to the export target. However, large volumes of event data are expected at the Gateway when an event occurs.

Note	
	At a node level, there will be a burst of event data for a 30 second window. This will result in 4500 data points to be processed at the gateway for export. This will come about as a result of 300 separate DREV messages, each containing 5 elements. Each element will contain 3 data points. It will take longer than 30 seconds for the 4500 data points to arrive at the gateway from the node. In other words, event data will still be arriving at the gateway after the event has passed.

If Live Stream export is selected, but the latency on the export transport mechanism is high, data will backlog at the Gateway and in worse-case scenarios at the node. A periodic, non Live Stream export schedule could be more efficient in this case.

Glossary

Definitions for terms and abbreviations used in this document are listed in the following table:

Term	Description
ZAP	ZigBee Access Point, which refers to the ZigBee radio processor and software on the Gateway
DREV	An acronym for **D**emand **R**esponse **EV**ent message produced by the EpiSensor ZDR
DRAK	An acronym for **D**emand **R**esponse **A**c**K**nowledgement produced by the EpiSensor ZDR