Guideline: Data logger requirements for water meters for non-urban metering

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Version 1.00

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Queensland Government

Version History

Version	Date	Comments
1.00	20/08/2019	Developed to support the revised Queensland interim water meter standard for non-urban metering.

Approval

Position	Name	Date
Director, Divisional Support	Ian Gordon	20/08/2019

Summary

A data logger is a low power device designed to collect and temporarily store readings from a variety of outputs in remote or unattended locations. A logger has an inbuilt clock that timestamps the data entry to allow for data review at a later date.

Installing data loggers on water meters allows for the retrieval of more comprehensive water extraction information. Loggers are installed to:

- Minimize the time spent on meter reading
- Minimize the cost of meter reading
- Capture time and event data
- Monitor for water extraction compliance.

For the purposes of this guideline a data logger is either integrated to a water meter or linked to a water meter, and complies with the requirements of this guideline.

The water meter must comply with the Queensland interim water meter standard for non-urban metering (interim standard).

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1 Basic Requirements

1.1 Overview

In order to meet the interim standard, a water meter (AS4747) may have either an integral data logger or be physically connected to an external data logger.

In the case of a mechanical water meter output, a pulse signal will be transmitted to the data logger to indicate when each unit of known volume has passed through the meter (AS4747).

An electromagnetic meter shall output an electronic signal of either pulse per unit of water or a direct volume of water utilising MODBUS, SDI-12 or RS232 connection protocols (AS4747).

While it is not the intention of this guideline to specify hardware design, several features should be considered in the basic logger unit:

- Proven design, with the manufacturer able to demonstrate the performance achieved under field testing.
- Battery powered and be capable of operating unattended for long periods.
- Robust and shock resistant, capable of withstanding a variety of conditions encountered during installation, operation and maintenance.
- Environmental security to prevent failure of any internal components, connections and fittings.
- Ease of installation, maintenance and routine operational practices.
- Reliable, long life with minimal mechanical servicing required.
- Routine maintenance should be limited to battery replacement.

The data logger **must** be capable of connecting to a suitable data telemetry modem for the purposes of transmitting data to the Department of Natural Resources, Mines and Energy (the department), if required in the future. Existing connection types considered suitable include RS232, 4-20mA, RS485 and SDI-12.

1.2 Environmental

The data logger **must** operate reliably without deterioration in the following conditions:

- -10 degrees Celsius to 70 degrees Celsius at 95% non-condensing relative humidity.

The logger **must** be housed in an enclosure that provides protection to at least IP67 or IP68 (IEC 60529 (2004) Degrees of Protection Provided by Enclosures).

1.3 Power Supply

The logger unit **must** be able to be powered from a battery power source of sufficient capacity to operate for a minimum of 5 years. The logger unit product literature **must** articulate this performance.

All exposed cable **must** have cable shielding or be protected in conduit.

1.4 Documentation

Written instructions covering installation, commissioning and operational aspects of the logger unit **must** be provided to the department with the *water meter validation certificate*. These instructions will allow department officers to operate and download/extract from the logger if required.

Details of the operating software **must** be provided to the department with adequate comments to facilitate operation and download/extraction from the logger.

A system diagram for the connection of the components (e.g. meter, logger, battery, solar panel, etc.) **must** also be provided to the department with the *water meter validation certificate*.

2 System requirements

2.1 System memory

A fundamental requirement of the logger unit is for sufficient memory capacity. The logger unit **must** store a minimum of 5 years of events, time stamped to one second resolution.

In the scenario where the memory of the logger unit were to become full, it **must** continue to log the most recent events (memory wrap). The logger unit **must** be set up to erase the first/earliest records to facilitate the continuous logging of the most recent events.

It is imperative that recordings are secure and that every precaution is taken to maintain data retention in harsh operational environment if power is lost. The water usage/event record and logger set-up information **must** be stored in non-volatile memory.

2.2 System clock

The clock performance in terms of reliability and maintainable accuracy is important as the water usage record to assure viability of data. While precision accuracy is desirable, the clock **must** maintain an accuracy of better than 20 seconds per month with resolution to one second, across an operation temperature range from -10 degrees Celsius to +70 degrees Celsius.

The clock **must** be synchronized to Eastern Standard Time, being GMT +10 hours, at commissioning and when a personal computer (PC) or handheld smart device (device) is connected as part of maintenance or data download/extraction.

2.3 Water meter sensor interface

The logger unit **must** interface directly with the output of the water meter. The logger unit **must** provide the appropriate pulse or digital input channel to accept the output from the meter.

2.4 Watchdog

Should a disruption to power or communications occur the data logger **must** safely reboot and continue logging. This action is known as a ‘watchdog’ reset and **must not** affect previously recorded data and critical set-up parameters such as site identification and date and time.

2.5 Logger identification

Each data logger unit **must** have a unique alphanumeric identifier hard coded by the manufacturer and accessible as a read only system parameter via software. It is desirable that this identifier also uniquely identify the manufacturer.

2.6 Set up

The logger unit **must** allow the Certified Meter Installer (CMI) to configure the various logger parameters such as Meter Serial No., Date, time, etc.

Should logger power be removed all set-up parameters **must** be retained and accessible upon restart.

Operation of the logger software will commence with the application of power and **must** continue while power requirements are met.

3 Operating requirements

The data logger **must** collect, record and store electronically in a single CSV file (per meter).

If more than one meter is connected to a data logger, the data logger **must** record logged data from separate meters as separate comma separated (CSV) text files.

3.1 Time based logging

The logger unit **must** log data from the water meter on an hourly interval and record the cumulative water use as a time stamp to one second resolution. Each event **must** be stored in secure, non-volatile memory in preparation for periodic data download/extraction.

3.2 Other logging requirements

Logger restart: event must be time stamped to one second resolution.

Battery voltage: must be recorded, at a daily (24 hourly) interval minimum.

3.3 Download

The data download/extraction process is to be accomplished via a PC or device. The PC or device functions as a network and data management tool providing data quality control procedures before eventual transfer to a central host where the data is permanently stored.

To ensure compatibility with the central host, the format of the data extracted from the logger **must** be in accordance with the 'data log file format guidelines' below.

The meter usage file will appear as a sequential record of usage event time stamps (see *data log file format guidelines* below).

4 Data log file format guidelines

These format guidelines have been taken from the NSW Department of Industry, *Data Acquisition Service Logged Data Format Guidelines – version 1*, and modified to suit this application.

Data loggers that comply with this specification **must** be configured to log data according to the following file format guidelines. If DNRME requires different file formats, sufficient time and documentation will be supplied to the logger manufacturers to implement file format changes in a reasonable timeframe.

4.1 File name

Data log files **must** be saved using a CSV text format. A new file **must** be saved per meter. The required file naming convention **must** be 'YYYYMMDD_HHmmss_MeterID_Version.csv', where:

- **YYYYMMDD** is the date expressed as ISO8601 tokens (20190311 in the example below).
- **HHmmss** is the time expressed as ISO8601 tokens (000000 in the example below).
- **MeterID** is the unique serial number of the water meter.
- **Version** is the *Data logger requirements for water meters for non-urban metering* (this document) version number. (The current version is V1 as in the example below).

The filename timestamp **must** match the first record in the data log file. An example of a data log file name is:

20190311_000000_A525_V1.csv

4.2 CSV text file format

The file contents **must** conform to the following format.

4.2.1 Header rows

Each file **must** contain three header rows:

- Row 1 contains a comma separated, variable set of attributes that should include:
    - Filename—filename of the enclosing document
- Row 2 contains the names of each logged parameter
- Row 3 contains the units of each logged parameter.

4.2.2 Data rows

Each record **must** be captured on a new line. Each record **must** contain no more than five fields: time, volume, event codes, event notes, and battery voltage. Fields **must** occur in the order listed, and the values of each field must conform to the Section 4.2.3.

4.2.3 Data fields

The following table summarises the required data fields, and provides a description of the data type.

Table 1.0 – Required data fields

Parameter	Description
time	The timestamp **must** conform to the format: YYYY-MM-DD HH:mm:ss. Note this is a 24-hour time format. All timestamps must be in the UTC+10 time zone.
volume	Cumulative water consumption **must** be reported in Kilolitres (kL) or Megalitres (ML) with meter scaling already applied. The cumulative water consumption should account for the reading of the meter at the time of installation of the data logger, where the data logger is installed on an existing meter.
‘reboot’	Data logger restart.
battery	Capacity of primary battery reported in Volts (V) or Percentage (%).

4.2.4 Sample

An example of a correctly formatted CSV file is shown below.

Correctly formatted CSV text file

filename=20190311_000000_A525_123235_V0.csv
time,volume,eventCode,eventNotes,battery
,ML,,,V

2019-03-11 12:15:01,012.12,,,12.0

2019-03-11 12:30:04,012.14,,,12.3

2019-03-11 12:38:24,012.15,1,reboot,12.4

2019-03-11 12:45:09,012.20,,,11.9

2019-03-11 13:00:03,012.21,,,12.6

Time-based and event-based logs are recorded in the same file. Not all parameters must be logged on every row. Where a parameter is not logged it **must** be represented by ‘,,’. This ensures the column order is maintained.

5 Security

The data logger is an element of the water meter and **must** be installed, set up and commissioned by the certified meter installer (CMI) who is undertaking the validation of the meter.

The data logger installation **must** have tamper evident seals to show evidence of unauthorized tampering i.e. if an authorized 3rd party tries to connect to the data logger set up parameters or event log records, a tamper evident seal will be broken.

As part of the validation of the meter, where a data logger is required the CMI **must** also ensure that the data logger and associated configuration meets the requirements of this specification.