Manual of Petroleum Measurement Standards
Chapter 21
Electronic Flow Measurement (EFM)

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Introduction
MPMS Chapter 21

1. Chapter 21.1 – Electronic Gas Measurement (EGM)

2. Chapter 21.2 – Electronic Liquid Measurement (ELM)

3. What is their purpose or Intent

4. To who or what do they apply

5. How to use them

6. Some key areas for discussion
   • Auditability & Traceability
   • Security
Measurement Life before EFM

No concerns for the effects of Pressure and Temperature here!
Progress towards EFM

Meters with Totalisers

Chart Recorders

Flow Computers
What is the need for Chapter 21?

1. To protect all parties to a Custody Transfer transaction.

2. Developments in Information Technology (IT) have allowed the ability for greater amounts of data to be shared in real-time with an almost infinite number of people

3. Controlling, Restricting and Protecting access in today's information demanding society and workplace is a big issue
In many parts of the world, the Oil & gas industry is (heavily) regulated with government agencies imposing strict requirements for the measurement and reporting of hydrocarbon production.

Historically, the US is less regulated and relies on contractual obligations between two parties to achieve the similar objectives.

Contracts mean Lawyers.

Lawyers like to reference Standards.

API Ch 21.1 and 21.2 should be referenced as minimum standards between two parties to a Custody Transfer agreement for Reporting, Calibration...etc.
Chapter 21 Flow Measurement Using Electronic Metering Systems


Both sections broadly cover similar areas for their respective measurement phases of Gas and Liquid
Chapter 21, EFM - Scope

1. “Recommended,” “Minimum” procedures and techniques for flow measurement and recording using recognized Primary devices.

2. Considers Primary, Secondary and Tertiary elements or devices of a measurement system:-
   - Primary – The flow meter or element
   - Secondary – Pressure, Temperature, DP, Density transducers
   - Tertiary- Flow Computer or computation device
Chapter 21, EFM - Scope

4. Defines
   – component and composite algorithms
   – Sampling + calculation methodologies and averaging techniques
   – Sampling + calculation frequencies
   – Their application to an appropriate composite equations referenced back to other standards such as API MPMS Ch 14.3 (AGA3), AGA8....etc
   – Considers the needs when the calculations are carried out On-site and Off-site

5. Audit & Reporting Requirements

6. Equipment calibration & Verification

7. Security
What is EFM

Example from 21.1 Electronic Gas Measurement

EGM System

Volume and Energy Quantity Calculation Devices

Figure 1 – Graphical Representation of an Electronic Gas Measurement (EGM) System and Its Relationship to Other Devices
So who does Chapter 21 apply to?

1. Any one operating an Electronic Flow Measurement (EFM) system
   • Any party with an interest in the results of measurement; Buyer, Seller, Field Partner, Regulation Authority

2. EFM System designers and integrators

3. EFM Equipment manufacturers

4. I.T. infrastructures; Networks, data storage....etc
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Audit and Reporting Requirements

1. “Shall retain sufficient data and information for the purpose of verifying Daily and Hourly quantities”

2. “Data may be created on-site or off-site or both.

3. EFM Audit Trail and Reporting section defines the minimum requirements of a quantity transaction record, corrected records and supporting documentation.

4. Data must provide sufficient detail to apply reasonable adjustments when EFM; is not available, outside accuracy requirements or when parameters are incorrectly entered.
What is the data required for the audit trail?

1. Quantity Transaction Records
   - Daily and hourly records (Reports)
2. Algorithm Identification
3. Configuration Log
4. Alarm and Event log
5. Test Records
6. Corrected Transaction Records

Additionally, the length of time that records shall be retained for audit purposes is stated as a minimum of two (2) years.
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6. Equipment calibration & Verification

7. Security
Data Security – Access and Protection

1. Who has access to the data – Restricting access to authorized means.
2. Restricting access – By use of passwords and other means (Padlock!)
3. Logged Data integrity – All changes must be recorded.
4. Algorithm Protection – Protection from change at any level.
5. Original Data – No changes to original data.
6. Memory Protection – In the event of power loss.
7. Error Checking – Communicating data from one system to another
Algorithm Protection

In a world where users demand greater flexibility from their computing devices and your computing device manufacturer meets that demand with open software structures, how can you be assured your Algorithm in use is protected from changes or is the one you witnessed being tested at the factory?

1. How will you know if the original manufacturers algorithms have been changed, replaced, edited or altered in any way?

2. One single Version number and check sum is not enough.

3. Real, repeated algorithm testing/validation is required multiple times:-
   1. At Factory Acceptance Tests and Site Acceptance Tests
   2. In the operation phase of the systems lifetime
   3. By competent personnel
Conclusion

The need for the use of API MPMS Chapter 21 has never been greater.

• It offers protection when implemented correctly to all interested parties to a custody transfer transaction using Electronic Flow Measurement.

• Its scope must not just be used by the Measurement Professional but also by I.T. providers and management alike – Anyone in the measurement data transfer and storage trail.

• While like many written standards, modern technology and industry trends tests its limits and applicability, overall its general principals and practices hold true.
Questions

Thank You