Optimizing Data Validation For Usability

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Gas Measurement + Data Validation

(Second in a series)

The October data validation article covered a number of Data Validation rules as verification actions on all aspects of your gas measurement system's capacity and data repository. Those validation criteria rules were classified as follows:

- User logins are validated to ensure total security.
- Meter configurations are validated against physical constraints to ensure these limitations are not violated.
- Data collected from external sources in the field and introduced to the gas measurement system are validated, audited, reported and fully integrated into your measurement system.

The benefits of data validation processes included:

- Reducing errors and inconsistencies within the gas measurement system;
- Managing exception data only;
- Elimination of duplication of business process;
- Provide accurate and reliable historical flow data to external business processes (e.g., gas estimating within Gas Control, data to Gas Accounting); and
- Provide flexibility for future growth.

In this article, we will cover the reasons that data validation is not used more frequently in gas measurement systems, configuration of validation rules, the issues with maintaining validation rules, and how a good measurement system can be made more "user-friendly" in regards to validation.

Configuring Data Validation

Before data validation was integrated into gas measurement systems, field engineers and measurement analysts reviewed hundreds of paper records to determine violations or anomalies in the data. The overall compilation process was so time intensive and difficult to perform, validation processing rarely took place in most gas measurement offices.

With the integration of a validation process into measurement systems, data validation could be performed much easier, but still required a significant effort. Older measurement systems attempted to deal with the issue of configuring individual meters by providing "system limits," whereby a set of validations was applied to all meters within the same classification. This process resulted in strict limitations and provided very little flexibility to the users. If a natural gas company determined that setting individual limits for each meter was important, the task of configuring limits for thousands of meters became a Herculean effort. Therefore, only the meters with high volume flows or repetitive problems had limits that were consistently updated.

The continued deregulation of the natural gas industry significantly changed the requirements of measurement organizations. Processing volume data by the end of the month is no longer acceptable. Daily reporting and balancing have become the standard, with intra-day requirements becoming more common. The gas measurement system now serves as a corporate data warehouse that not only can receive near real-time measurement data, but can validate and disseminate it rapidly.

This increased demand for real-time volume data has led to the use of electronic flow computers. These flow computers provide volume data at hourly and sometimes fifteen-minute intervals. This large increase in volume data has made data validation as a paper reporting process an extremely tedious exercise. With hundred or thousands of meters reporting data both hourly and daily, reviewing validation violations and acknowledging each one required a more efficient method of handling these exceptions. Gas measurement systems implemented "Exception Editors" or "Exception Processors" to allow analysts to review anomalies in an exception log with a hyperlink to the offending data set. This "Exception Editor" minimizes the analyst's effort and allows for quick and expedient resolution.

Unfortunately, this "Exception Editor" turned out to be overwhelming to many analysts as they waded through the large number of failures. With each validation rule violated, the number of discrete exceptions, especially for hourly meters, could be a page in length, requiring tiresome acknowledgement of many individual exceptions.

Nuisance alarms can generally create an environment where validation failures become ignored or disabled due to improperly set parameters. Maintaining proper validation rules in your measurement system requires constant fine-tuning of the parameters to achieve the optimum results from your validation process. This fine-tuning activity is an ongoing exercise which requires resources which are almost certainly already consumed by other gas measurement tasks such as editing, closing, balancing, and distributing reports. Even the most well-intentioned organizations find their gas measurement systems either buried in too many validation results or have disabled most validation processing because of the difficult in individually configuring all of the rules.

Configuration Of The Validation Rules

Validation rules in a good measurement system can be a very powerful tool if configured accurately and correctly. Most average measurement systems require the user to configure each and every meter and its validations individually, or subscribe the meter to a list for all its validations, which provides little flexibility in system maintenance.

A truly strong gas measurement system will implement validation groups which contains both validation rules and parameters. Parameters can be defined as general data values or limits and rules can be defined as the validation check. For example, temperature high limit is a validation rule and a high limit value of 150 would be the rules parameter. The group can then contain a set of stations, with each station inheriting all the validations of the group, but having the right to override one or more validation rules or parameters.

Finally, the station consists of a set of meters, with each meter inheriting all the validation configuration of the station above it, but also allowing the meter to override one or more rules or parameters. As indicated on Figure 1, analysts has quite a bit of flexibility in controlling the validation configuration by overriding at a low level where appropriate but otherwise having the convenience of inheriting everything else from the group. This translates to a huge savings in time.

An example of how Group Validations can be effective can be demonstrated with Group A on Figure 1 all having a validation rule of:

a) Differential Pressure > 90% of Differential Pressure High Transmitter Range;

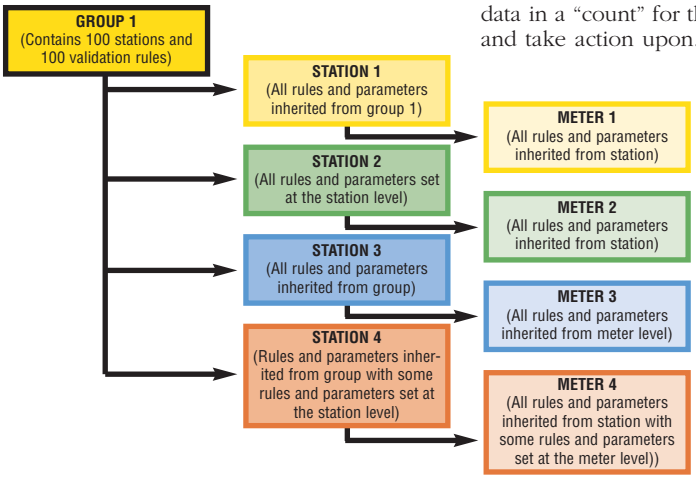
b) Hard Limits such as the validation rule shown would be utilized at the Station or Meter level;

c) Differential Pressure > 40

Of course, incorrectly applying rules or parameters can create an abundance of validations which defeats the purpose of managing and reducing data errors.

Nuisance alarms are repetitive exceptions from various validation rules such as missing volumes, high/low temperatures, etc., which occur continuously over a consecutive time

Figure 1



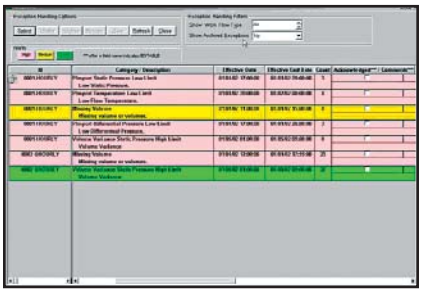


Figure 2

period. The best measurement systems provide an "accumulation" of the instances of failures and provides that data in a "count" for the analyst to review and take action upon. Figure 2 shows an example of an accumulation of validation alarms. The analyst avoids frustration of dealing with 240 hours of missing volumes over 240 rows in an Exception Editor, also saving time in the disposition of the exception since the exceptions are grouped together.

Actions After Validation Failure

Once an anomaly in your data is identified, how your gas measurement system handles the data is as important as the configuration of your validations. After a rule is violated, several choices are provided to the operator to handle the exception. In a good measurement system, the following options to control processing are provided in some form or another:

- **Enable:** The option to turn the rule on or off.
- **Causes Exception:** Create an exception for the data that failed, moves that anomaly into an Exception Editor table for review and further action before exception is approved or disapproved.
- **Exception Action:** Does the user want to discard, hold, or continue processing the data associated with the exception.
- **Disallow Downstream Access:** Until the exception is resolved, do not move the data to further tables in the system.
- **Severity:** Each rule should have a severity level assigned to allow for convenient sorting and filtering
  - Critical
  - Failure
  - Warning
  - Information

User Friendly

In the past, some gas companies have spent very large sums of money to build highly complex sophisticated validation systems that failed, primarily because they were too difficult to use. There are two lessons to be learned from this: 1) validation software must be simple to understand and easy to configure with little or no learning curve and 2) the validation capabilities must be fully and seamlessly integrated into the measurement system. Taking these lessons to heart can make the difference between becoming validation "shelfware" or a valuable capability that is actually used. ***P&GJ***