WEB-BASED SOLUTIONS FOR ORIFICE MEASUREMENT & MONITORING

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Introduction

In today's Internet age, the development of practical and cost-effective web-based solutions in energy measurement is a logical extension of the latest technologies. Major pipeline companies have long been dependent on advanced measurement and communication technologies, such as supervisory control and data acquisition (SCADA). But with today's improved electronic flow measurement and communication technologies, ever-increasing bandwidth, ubiquitous Internet access, high energy prices, and chronic personnel shortages, remote monitoring services have become a profitable solution for every segment of the industry…including small and mid-size companies. This whitepaper will provide the basic blueprint of a system for providing leading-edge, web-based measurement and monitoring solutions, and will review some of the benefits and challenges facing this transition to a more digital environment.

Measurement

Field Equipment **-** Selecting a flow computer (i.e., secondary and tertiary devices) for orifice measurement is not usually a major task. Most flow computers support communications, but are generally located in remote areas without electricity or landlines. When identifying your equipment needs, the key factors are location, power, and automation requirements. Accordingly, it's a good idea to conduct an initial study to determine how to accommodate these requirements. Outlined in TABLE 1 are typical specifications for a solar-powered, battery-operated flow computer which is polled every hour; supports orifice measurement for gas; stores turbine meter and well pressure data; alarms; and monitors tanks levels.

Communications - There are several wireless technologies available for communicating with electronic flow computers, such as cellular, spread spectrum radio, and satellite. The communications infrastructure will often incorporate a combination of these technologies, along with a landline connection. CDMA, on which 3G (third-generation) wireless technologies are built, has become one of the most dependable and cost-effective IP addressable communication services available. CDMA is a "spread spectrum" technology, allowing many users to occupy the same time and frequency allocations within a given band/space.

Typical Flow Computer Specifications for Remote Service

Flow Computer Unit which performs current AGA 3 calculations and stores AGA data according to API Chapter 21 specifications including:

- 40 Watt Solar Panel
- 105 Amp/Hour Battery
- Additional Digital I/O
- Additional Analog I/O
- Additional Discrete I/O
- Additional Pulse I/O
- CDMA Modem
- Antenna/Cable Assembly/Polyphaser
- 5-Valve SS Manifold
- Miscellaneous Mounting/Installation Materials

TABLE 1

Data Collection – The data collection system should interface with all major brands of flow computers on the market. This allows consolidated data collection, minimized technical support, and the flexibility to change meter brands, if necessary. It is imperative that the collection system is designed to retrieve data in an API Chapter 21 compliant format so that measurement data is available for validating, editing, and archiving according to acceptable industry standards. This is a critical feature when selecting a system or service since the failure to produce an acceptable audit trail may have serious legal ramifications in the event of a dispute regarding payment for gas sales or revenue distribution.

Data Storage & Retrieval – Data storage and retrieval is as critical as the data collection process itself. You should first determine the amount of data you expect to collect, and then choose a database capable of handling this quantity plus archival and future growth volumes. As data is collected it will be written to this database. It is then available for retrieval when users access the web pages to display, on demand, the most current or historical information.

Flow Data Validation – Meter data should be imported into a measurement software system so that the data may be auto-validated and auto-edited before it is made available for web review. This process is usually completed within seconds, with as many as 300 validations performed on each hourly record. At a minimum, this should include automatically detecting missing data and flow anomalies, updating analytical values, and providing volume corrections wherever necessary. This will eliminate most of the delays in preparing measurement data for invoicing and provide users with near audit quality data every day. While we are not suggesting that this process will fully validate measurement data for custody transfer each day, this process will yield much more reliable daily information as it relates to budgeting, forecasting, maintenance, operations, and nominations.

In order to fully validate gas measurement data, it is necessary to review a complete flow data trend for the month, along with all effective meter inspection and calibration reports and gas analyses. Since that information is often unavailable until the end of the month, a final verification cannot be completed until all of those records have been reviewed and revisions applied, where necessary.

Monitoring

Web Access – Web-based access to flow and well data should be protected and restricted to authorized users through appropriate authentication provisions.

Another important system feature is a user interface that allows field personnel to enter flow or well data from charts or other sources, such as tank levels, well pressures, etc. This information can then be updated, along with similar data from electronic sources, to provide a producer or gatherer with web-based access to an entire system, regardless of whether the production and/or measurement process is manual, automated, or a combination.

Reports & Graphs – Basic system reports should include a summary, current flow, daily volume, hourly volume, station alarm, decline curve, previous month's activity, and well data. These reports should be available in both tabular and graphical forms, with options to view and save in standard spreadsheet formats.

In addition, a system summary report should automatically be e-mailed each morning to provide the user with the previous day's information including a system balance and alarm report. This will enable personnel to schedule and conduct maintenance only where it is required and make more efficient use of their time. The system should also automatically generate a report when the gas "Un-Accounted For" (UAF) exceeds acceptable tolerances.

Demand Polling - The polling engine is often scheduled to retrieve flow and well data only once or twice each day. The demand poll allows the customer a means to activate data collection and retrieve up-to-date information whenever necessary.

Alarms - This is a key feature to ensure that personnel are immediately notified whenever upset conditions occur, thereby providing the opportunity to troubleshoot problems without unnecessary delays. Alarm messages should be delivered via e-mail, pager, cell phone, text message, etc., and routed through a contact tree until notification is both received and fully acknowledged. This is extremely beneficial in minimizing downtime, maximizing production, and responding to emergency situations.

Miscellaneous

System Security & Protection

Security measures or other methods of protecting data are often overlooked until after a breach or failure occurs. Implementing even simple steps will help ensure that your critical data will be intact and readily available. For example, an uninterruptible power supply (UPS) is an inexpensive yet critical piece of hardware that should be used to protect all servers to avoid data loss or equipment damage due to power surges or failures. Additionally, we strongly recommend installing an Internet-facing firewall to protect your network. Firewalls often come preconfigured and, with minimal configuration, ready to run. Strict security should always be an integral component of your overall system design.

Benefits

Web-based measurement services can furnish up-to-date flow and well data, identify upset conditions, provide alarms for exception conditions, furnish information to project revenues, expedite critical business decisions, and, ultimately, increase revenues and profits. Used in conjunction with prudent measurement procedures, they can also verify gas sales; expedite gas accounting and reservoir analyses; and furnish outside parties with on-demand, Internet-based access to flow and well data.

Final Comments

There is a natural tendency to overestimate the integrity and accuracy of raw gas measurement data, especially when computer generated and automatically posted to a website. The evidence is clear since many companies currently rely on raw flow data collected directly from

the field for sales allocations and regulatory reporting purposes. While we recognize that measurement practices for field allocations do not necessarily have to be as stringent as custody transfer measurement guidelines, flow data should be validated and edited by a certified measurement analyst each month in order to furnish the accurate information that is necessary for accounting, regulatory reporting, and revenue distribution. Web-based access to flow and well data is a fairly simple process that can provide users with a wealth of information. Obtaining "accountable" measurement data is an extremely worthwhile, cost-effective objective that is available through highly specialized resources and should be the ultimate goal whenever designing a system or establishing a service requirement.