Panametrics
a Baker Hughes business

flare.IQ

flare control and digital verification.

Global regulations often require periodic calibration checks on flare vent gas meters, with results recorded once or twice a year at regular intervals or based on the manufacturer's recommended frequency. If a flare meter is not regularly and properly maintained, a meter failure can cause significant refinery downtime and possibly incur penalties due to non-compliance.

Users can verify the health of a meter by applying any one of these three options:

- **Ex-situ:** Refers to pulling out sensor probes from flare lines to inspect for potential contamination and defects. The sensor probes are then mounted in a reference box filled with air to verify functionality.
- **In-situ:** Refers to validation by visual inspection of the flare meter system and data collection of meters in process gas.
- **Digital verification:** Allows the flare meter to be validated on-line and in-process through remote communication with a plant's distributed control system (DCS).

The current ex-situ and in-situ methods of verification require a service engineer to travel to the customer's site, pull permits, build the necessary scaffolding, and monitor the meter with support from the plant's technicians. Operational downtime and logistical support also increases costs. Alternatively, remote digital verification safely validates the flare meter on-line by communicating with it through the plant's DCS, reducing unnecessary labor and expense.

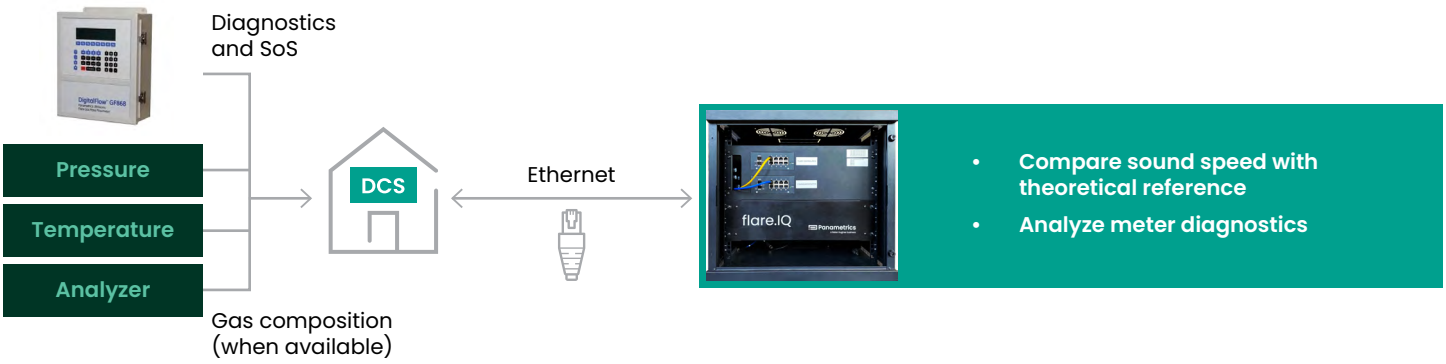
Digital verification powered by flare.IQ

Digital verification powered by flare.IQ collects data from the flare meter along with gas composition from the gas analyzer, and process pressure and temperature (P/T) through a plant's DCS. Once the flare process stabilizes, digital verification uses a proprietary, patented algorithm to calculate theoretical sound speed based on gas composition and P/T and compares it with measured sound speed from the meter. Along with the meter's diagnostics, flare.IQ uses this information to digitally verify if the meter has passed inspection.

Quick results

Digital validation can be scheduled for a pre-determined time or initiated on demand, with the results of digital verification evaluated by a Baker Hughes service engineer. If the service engineer accepts the results, he/she issues a certificate to plant operators as proof of compliance. If the engineer identifies issues during digital verification, he/she analyzes the data to discover the root cause and engages in corrective action. Digital verification is typically available through the Panametrics FlareCare, our supporting service agreement (SSA).

Digital verification powered by flare.IQ



FlareCare powered by flare.IQ

Meet your daily needs with Panametrics FlareCare (SSA)

Panametrics FlareCare supporting service agreements can save your plant unnecessary expense and increase uptime. With many options to choose from, your company can determine what plan works best to support:

- Decreased EHS safety risks
- Reduced liability
- Lowered costs associated with scaffolding installations and transducer extraction

Learn more about the Panametrics FlareCare program.

Complete plug-and-play solution for flare compliance

Designed for operators, the Panametrics flare.IQ digital platform provides new plug-and-play capabilities for the plant DCS. The flare.IQ platform offers two major modules: one for flare system control and the latest for ultrasonic flare meter digital verification.

flare.IQ for control

Given the potential complexities, complications and overwhelming risks associated with developing an all-encompassing flare system solution, flare.IQ enables plant operators to eliminate control challenges with automated software algorithms that remove the need to manually control the flare.

flare.IQ for digital verification

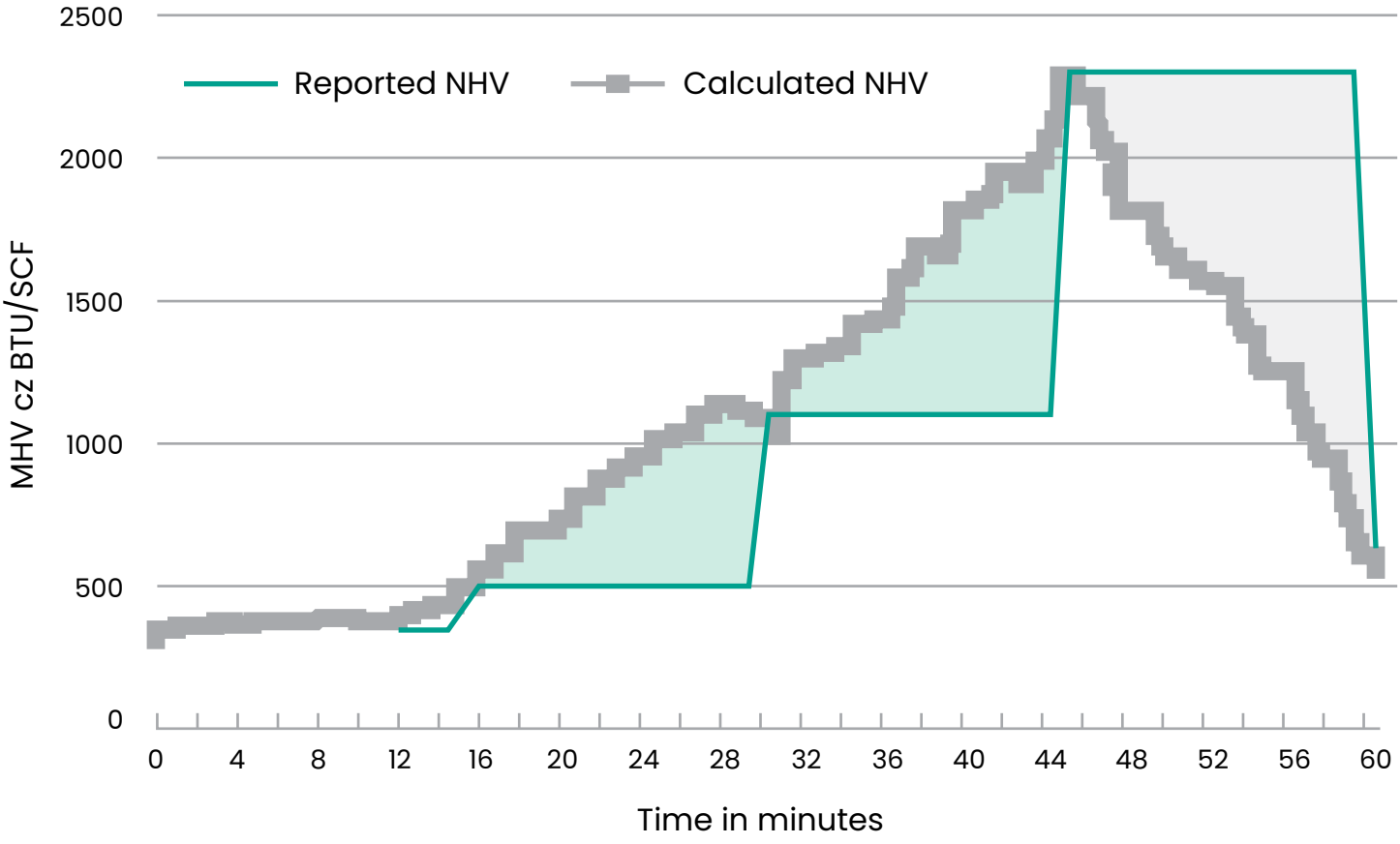
In addition to optimizing combustion efficiency of the flare, the Panametrics flare.IQ digital verification platform allows operators to meet regulation-mandated meter verifications. Probe verifications of ultrasonic flow meters usually require removal from the process in order to inspect and test. The digital verification platform sends data, not people, which saves your company time and costs while reducing risk.

Increase efficiency of the complete flare system

flare.IQ is pre-programmed with all required algorithms necessary to address the most difficult aspects of proper flare control and it can also be customized to the unique fingerprint of each flare system. The program utilizes surrogate modeling to draw correlations between flare flow conditions and the required steam input to operate with no visible emissions.

flare.IQ also employs patented technology that addresses BTU measurements' latency that results from gas chromatograph (GC) technology. The BTU readings of the flare flow system obtained by the GC deliver critical input to achieve the required destruction efficiency in the flare combustion zone. flare.IQ utilizes sound speed to help bridge the GC's infrequent BTU readings with near-continuous feedback and improved operator control of the entire flare system.

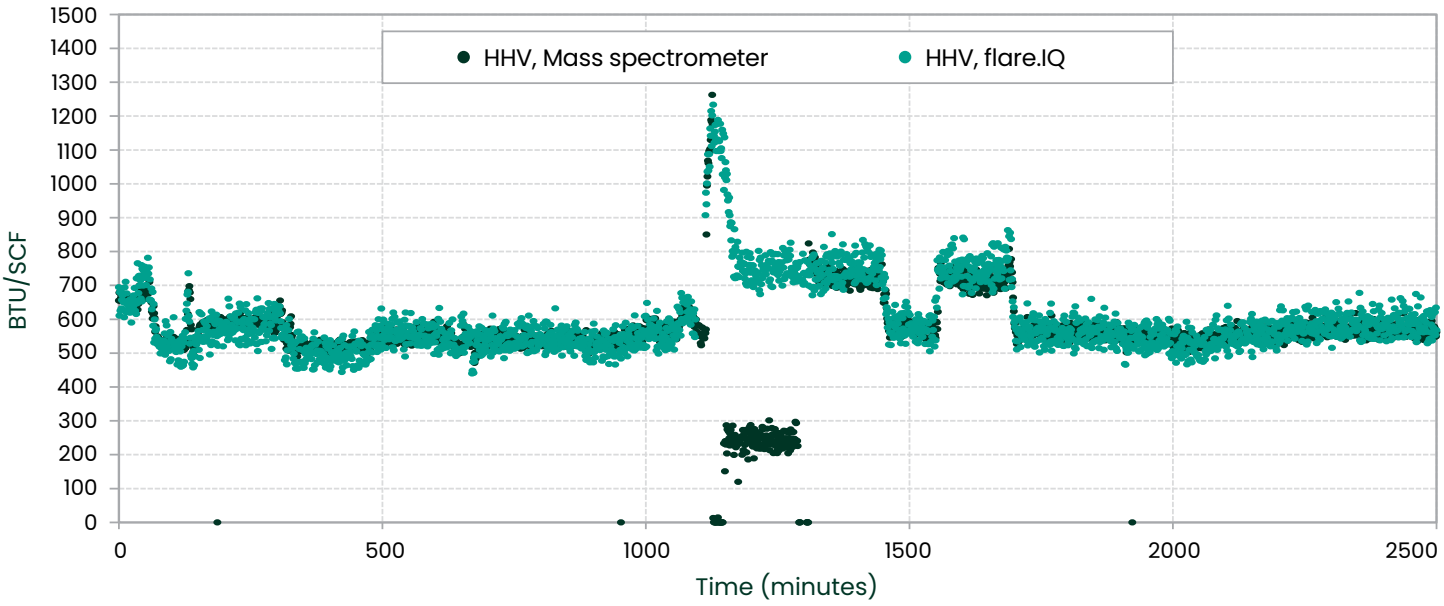
The BTU measurement typically updates every 15 minutes due to the latency inherent in the GC sampling. flare.IQ includes a tuning algorithm that provides course adjustments to the make-up/supplemental gas and steam flow, allowing the flare to operate within a tighter control window between the 15-minute updates from the GC, as illustrated schematically in the figure below. This better optimizes the use of make-up gas and steam (or air assist) to maintain the proper BTU level in the flare combustion zone. When the GC updates, flare.IQ's tuning algorithm learns and adjusts its control set-point values.



Green: Under-steamed condition, potentially resulting in a smoking flare or consumption of excess supplemental gas.

Grey: Potential over-steaming condition. The flare.IQ controller reduces or eliminates these control gaps so that the flare operates and responds to NHV changes in real time.

As seen in the chart on the next page, flare.IQ (green dots) provides an accurate estimation of net heating value (NHV) compared to the on-line analyzer (black dots). flare.IQ even serves as back-up when the on-line analyzer is off-line for calibration or maintenance, shown between the 1,000th minute and 1,500th minute interval. Once the on-line analyzer returns to service, users can see that the heating value estimate from flare.IQ agrees with real-time data from the on-line analyzer.



Reduce cost, time and risk

Panametrics' patented process optimization algorithms provide near-continuous feedback on flare performance, helping drive down operational costs with reduced steam and supplemental gas consumption, and reducing the need for further capital investment in measurement assets.

flare.IQ helps the control engineer better manage the schedule and implementation risk to meet regulatory emissions goals. With all the algorithms that control the entire flare system, flare.IQ enables the control engineer to focus on optimizing process control by removing the need to spend valuable time and expense programming the flare system.

Specifications

Please review this list of flare.IQ specifications for digital verification and control:

Installation

- 19" rack mountable (enclosed with tool access), 2 interconnected modules – top (4U) and bottom (3U)
- Flare Control software always comes with redundant DPUs (i.e., 2 DPUs/flare); Digital Verification software by itself does not come with redundant DPUs unless combined with Flare Control.

Processor

- Intel Atom® E3815 Single Core 1.46GHz

Memory

- Onboard 4GB DDR3L 1066 MHz
- Onboard 32GB eMMC storage

Connectivity

- One 10/100/1000 Mbps IEEE 802.3u (Ethernet) connection for Modbus TCP/IP
- One 10/100/1000 Mbps IEEE 802.3u (Ethernet) connection for DPU configuration/monitoring

Power

- AC configuration: Universal power supply adjusts automatically from 100 to 240 VAC, 50/60 Hz
- Max power consumption 45 W
- DC configuration: Not available

Size/dimensions

- Top module: 19.02" (483 mm) Width x 6.93" (176 mm) Height X 4.94" (126 mm) Depth
  - Weight = 8.65 lbs. (3.92 kg)
- Bottom Module: 19.02" (483 mm) Width x 5.22" (133 mm) Height X 8.05" (204.5 mm) Depth
  - Weight = 8.55 lbs. (3.88 kg) – with maximum number of DPU's (6) installed

Operating temperature

- 0°C to +40°C (32°F to +140°F)

Storage temperature

- -40°C to +70°C (-40°F to +158°F)

Relative humidity

- 10% – 95% RH @ 25°C, non-condensing

Maximum operating altitude

- 2000 m (6562 ft)

Overvoltage (installation) category

- II

Pollution degree

- 2

Ingress protection

- IP 10 (Protected from touch by hands greater than 50 mm; Not protected from liquids)

Warm-up time

- Meets specified accuracy within 5 minutes of turn-on

Baker Hughes