

# Selecting Meters for Your Food or Beverage Processing Facility

*To be effective, a monitoring & targeting (M&T) system must meet your strategic objectives for cost control, be designed to be compatible with your processing flows, and incorporate hardware (and software) to measure and collate data into a useable form. The purchase, installation and commissioning of a monitoring and data management system requires an investment of both time and capital.*

## Getting started

A complete monitoring and data management system should include:

- Flowmeters to monitor gas, electricity, steam, compressed air or any other energy stream
- Transducers and transmitters linked to flowmeters to record and send the data to a receiving location
- A data logger to store and sort the data
- A method to transmit the data to a computer system to be entered in an electronic data management package



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There are many kinds of flowmeters available, each with specific applications. Most meters also require “add-ons” to accommodate different pipe configurations. Although the choice of meter can be relatively straightforward, installation can be complex.

## Application and installation considerations

Practical considerations affect where a meter can be placed within a given location. Disturbances upstream (and sometimes downstream) of a flowmeter (like pipe elbows and control valves) affect a meter’s accuracy. It is important to ensure that valves are located downstream of a flowmeter. The pipes upstream and downstream of a flowmeter need to be long enough to create a laminar flow and remove the disturbances that affect measurement accuracy. In some cases, a section of straight pipe 10 to 50 pipe-diameters in length is required upstream of the meter. A device called a flow straightener can solve this kind of challenge.

**Tip: Most meters must be installed by a licensed technician.**

It’s important to choose the right meter to address installation constraints. Most technologies have many applications, but will fail to perform in certain configurations. Only certain flowmeters may work in your plant. Keeping your application in mind, select the desired meter based on accuracy, cost, durability, and reliability.



A number of meters are good choices for food processing applications. The most common choices are summarized below:

### Thermal mass flowmeters (for gases)

Thermal mass flowmeters use the thermal properties of a gas to measure flow. The detector has two sensors – one to measure the amount of heat applied to it (this heat dissipates into the gas in proportion to the flow) and the second to measure the temperature of the gas (which measures the amount of heat lost by the gas). An electronic transmitter uses heat input and temperature loss to determine flow. The cost of a thermal mass flowmeter, most commonly used to measure natural gas flows, typically starts at \$5,000 for a 2-inch-diameter pipe.

#### Advantages:

- Fast response and can measure low flows
- No moving parts
- Easy to install but may need flow conditioning

#### Disadvantages:

- Can only be used for clean gases (e.g. natural gas)
- Not suitable for gas streams with fluctuating heat load
- Streams must be “dry,” not “wet” gas

### Vortex flowmeters (for fluids and gases)

Vortex meters are good for monitoring fluids and gases like compressed air, steam, boiler feed water, and other clean gases or liquids. The technology uses an engineered obstruction in the middle of the stream to generate a downstream vortex. As flow increases oscillation frequency, a sensor detects the oscillations and an electronic transmitter generates a flow signal. Typical costs increase with pipe diameter. For example, a 3-inch-diameter pipe is \$4,000, a 6-inch diameter is \$7,500, and an 8-inch diameter is \$9,000.

#### Advantages:

- Can measure energy utilities, such as steam, hot water, condensate, compressed air, etc. independent of temperature
- Accurate and easy to install; however, a flow conditioner is often required

#### Disadvantages:

- Turns off at low flow, so applications must be in correct flow range
- Sympathetic pipe vibrations can affect readings

### Magnetic flowmeters

A magnetic flowmeter measure the velocity of a conductive liquid, such as water, acids, caustic and slurries. It works by creating a magnetic field with voltage and sensors on the pipe walls. As the liquid moves faster, more voltage is generated in proportion to the flow. An electronic transmitter processes the voltage signal to determine liquid flow. This flowmeter does not obstruct flow and can be applied to many liquid streams, including clean, dirty, corrosive or abrasive streams. It is commonly used on process water and wastewater streams. Costs are similar to vortex meters (see above).

**Advantages:**

- Highly accurate and does not create a pressure drop
- Can monitor a variety of clean and dirty liquids

**Disadvantages:**

- Not suitable for liquids with low conductivity (i.e. deionized water, boiler feed water)
- Electrodes subject to coating and require regular maintenance

**Electrical meters**

Solid-state meters with LCD display or automatic-reading functions can replace older electro-mechanical meters. They can record load parameters like demand, power factor and reactive power. By adding an electronic clock mechanism, this meter can provide “real-time” or time-of-day use, which is critical for peak electricity demand management. Costs for electrical meters can range from \$500 to \$50,000, depending on the size and complexity of the load being managed.

**From installation to implementation**

Installing a meter is only the first step. Data retrieval and management is an equally important function. A meter’s signal is usually sent to a data logger, which converts the signal to useable data. The data is stored in internal memory to download later to a computer. Although there is a lot of choice in the marketplace, the key components include:

- hardware to digitize the signal and convert it to meaningful units or data
- internal memory and data storage capabilities (the required amount of internal storage can be calculated based on sample or polling rates from the sensors)
- data logging software for data acquisition, analysis, and presentation (many manufacturers provide generic software with the logger to sort and manage the data)

Data from the logger can be transferred to a computer for long-term storage and management. This can be done manually, using a microchip or by connecting the computer to the logger. The best option, however, is to use a modem or wireless technology to transfer the data to a computer or server. A good data logger can cost around \$4,000 but the installation and transmission/distribution of the signal will be extra and will depend on distances, automatic data transfer, etc.

Metering systems can generate large amounts of data. Software is important to translate and analyze the information in order to assess progress in relation to objectives and targets, and to draw conclusions. Software options include commercially available packages, software that comes with the data logger or Excel spreadsheets that you have developed internally. In all cases, the application can include imbedded calculations and graphics that help analyze the data with the click of a mouse.

Software packages designed to manage the data vary widely in cost and are completely dependant on your objectives. Some users are able to integrate the free generic software packages that may come with a data logger. More sophisticated packages develop tailored reports specific to your objectives and can cost between \$5,000 and \$15,000. Highly complex and transnational facilities may need to invest tens of thousands of dollars for a software package that integrates data from their global operations.

*The time you invest in designing the hardware components of your M&T program will help you achieve your strategic objectives. In summary, a successful system will result from:*

- Choosing technically sound meter locations (may require expert advice)
- Having a licensed technician install the meters
- Ensuring data collection and storage are as automatic as budgets allow
- Customizing data management to meet your objectives (potentially using readily available spread-sheet programs, such as Excel)

### Additional resources

See OMAFRA fact sheets on:

- *Utility Monitoring & Targeting: Save Energy, Cut Costs*
- *Benchmarking Utility Performance in the Food Industry*

Companies that specialize in installing M&T systems include:

- Quad Automation Inc. ([www.quadautomation.com](http://www.quadautomation.com))
- JMP Engineering ([www.jmpeng.com](http://www.jmpeng.com))

**We're here to help!**

To find out how the Business Development Branch, Ontario Ministry of Agriculture, Food and Rural Affairs can provide you with knowledge, connections, and resources to help you grow your business, call toll-free at 1-888-466-2372 extension 63795 or e-mail at [foodinvest@ontario.ca](mailto:foodinvest@ontario.ca).