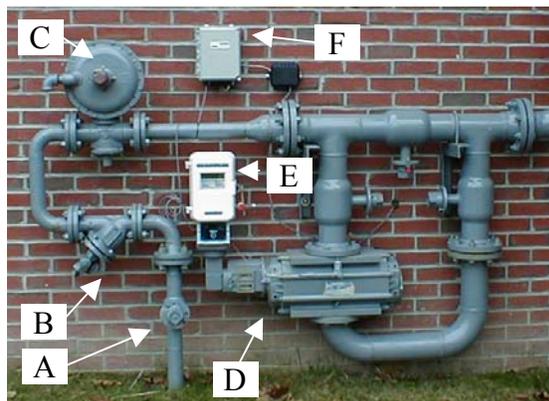


Adding Pulse Output to Utility's Gas Meter – Commercial/Industrial Meters

This document discusses the technical possibilities for getting pulse output from a typical commercial/industrial meter set-up. *Under no circumstances should an end-user or third party attempt to interface with or modify the utility's equipment without their consent and assistance.* The best point of contact is the Local Utility's Account Representative.

A typical utility C&I meter set may consist of:

- A. Isolation valves
- B. Filter
- C. Regulator(s)
- D. Meter(s): Diaphragm, Rotary, Turbine
- E. Correcting Instrument(s): Pressure and Temperature Correctors (Mercury, Actaris, G.A.S, etc.)
- F. AMR Equipment (Automatic Meter Reading): Metscan, Metretek, ITRON etc.



There are a variety of ways to get pulse output from a meter and/or Correcting Instrument.

1. Using Existing Corrected and/or Uncorrected Output from a Correcting Instrument

The easiest way is to simply take the Corrected Pulse Output from the Instrument. The most prevalent Correcting Instruments in the Industry are manufactured by Mercury Instruments. Models include the ECAT, MINI MINI-AT, and MINI-Max. They are typically used as Pressure (P) or Pressure & Temperature (PT) Correctors. For the sake of simplicity this document will discuss the Mercury Mini Series.



Most instruments come with Mechanical Uncorrected Pulse Output. This is generated by a magnet on a drive shaft from the instrument's Mechanical Uncorrected Index (UMB) passing a reed switch. There should be a terminal block on the Meter Pulse (or Switch) Board that facilitates wiring to this pulser. (see Diagram 1, or page 13, sec 6.10 and Page 58, sec. 11.1 of Mercury Mini User's Manual)

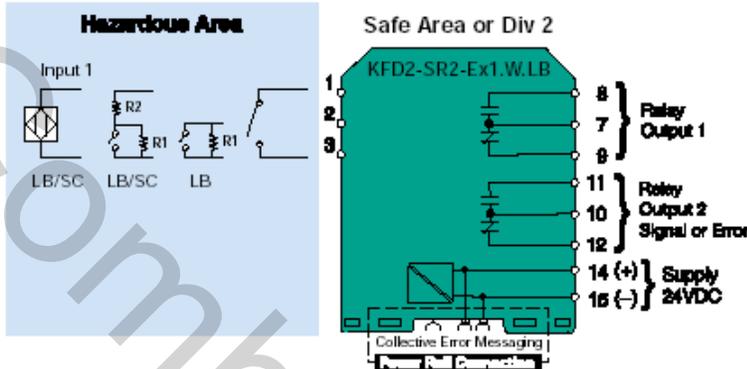
They also will normally have at least one configurable Electronic Corrected Pulse Output. This is an Opto-Isolated Pulse Output with a terminal block (TB1) for Wiring. It comes from the factory configured as either a Form A or Form C Pulse output and must be "enabled" through the Software (see Diagram 1, or Page 58, sec. 11.2 – 11.4 of Mercury Mini User's Manual)

If neither of these pulsers are being used it may be possible to get the utility to provide access and enable the pulser for customer use. (See page 71 of the user's manual for Wiring diagram and

2. Splitting an existing Electronic Pulse Output from the Instrument

In many instances both the Uncorrected and Corrected Pulsers are already wired to an AMR Device so they are not readily available. It may be possible to insert a signal conditioner that acts as a Pulse Replicator. As an example a Pepperl & Fuchs Model KFA5-SR2-EX1.W.LB will

take a single pulse in and provide two isolated Pulses Channels Out. One can be run to the utility the other to the end-users equipment.



See Pepperl & Fuchs web site: www.us.pepperl-fuchs.com for Wiring diagrams and Cut sheets.

3. Installing an Auxiliary Pulse Corrected Output Board.

Another option is to install a dedicated Auxiliary Pulse Output Board inside the instrument. This will permit the end-user to have an “independent” Corrected Pulse Output. The Boards are available as either single or dual output. The standard version has a 62.5 mS pulse width, an option 250 mS version is the alternative. The type of output (either Form A or Form C) is field selectable using a jumper. This option will definitely require the assistance of a Utility Technician as both hardware and software will require slight modification. (See Mercury Document FD-412-B for Field Installation)

4. Installing an Uncorrected Mechanical Pulser

Another pulser option is to install an Uncorrected Mechanical Pulser. This device is actually sandwiched between the Instrument Drive Plate of the meter and the Mechanical Index (UMB) of the Instrument. From an electronic standpoint this is an attractive option to a utility because it is completely electronically isolated from the Correcting Instrument. This alleviates any concerns that the end-users wiring would inadvertently short out the Utility Instrumentation. The major Drawback is that this is normally an Uncorrected Pulse – so average correction factors would need to be calculated to compensate for variations in Pressure and Temperature.

The model used is an IMAC Pulsimatic. It uses a Drive Dog that engages the Instrument Drive to rotate a magnet past a reed switch or a slotted disc past an optical



Pictured above: Rotary Meter with Pulser Installed Under the Galvanic PT Corrector

slot sensor. This permits an end-user to get a higher resolution pulse that can be converted to an electronic pulse, or a 4-20mA output that is proportional to flow. (see attached documents for Pulsimatic Info)

5. Installing a Dedicated Sub-meter

If the Local Gas Utility absolutely will not permit the end customer to attach a pulser to the existing Utility Meter, it may be possible to install a dedicated sub-meter directly downstream of the Gas Utility meter. It is best to install a meter that is a billing Quality meter such as a Diaphragm, Rotary or Turbine Meter. To permit an “apples to apples” comparison it is imperative to correct for Temperature and Pressure fluctuations using a method that is equal to or better than that which is employed by the gas utility. This may include a combination of electronic and/or mechanical temperature and pressure correctors.

Note: The most common error encountered when using sub-meters is a failure to compensate for Temperature and Pressure fluctuations. A highly repeatable meter is of little use if the data is not corrected and read properly. As an example: Most Utility meters are calibrated and read assuming base conditions of 60° F and 14.73 PSIA.

Because Natural Gas is a compressible fluid, it changes volume with changes in Pressure & Temperature. A common convention is to define a Standard Cubic Foot as the volume of 0.6 specific gravity Natural Gas at a Base temperature of 60 °F and Base pressure of 14.73 PSIA. Roughly speaking a Standard Cubic Foot has a heating value of 1000 BTU. A good analogy for understanding the effects of pressure and temperature would be to look at a balloon filled with natural gas at Base conditions. The number of combustible gas molecules is fixed inside the balloon. Put the balloon outside in a cold environment and it will contract. Put it in the sun in a hot environment and it will expand. While the Actual volume of the balloon changed, the Standard Volume and quantity of combustible gas never changed. Pressure has a related, albeit inverse, effect in that increased pressure can compress gas. Most meters are volumetric, so the readings must be put in some standard context to give meaning from an energy consumption standpoint.

As a rule of thumb we say that for every 5°F that the flowing gas temperature deviates from the base temperature of 60°F, one induces a 1% inaccuracy. For Every 15 PSIG in pressure above the base pressure of 14.73 PSIA you effectively double the number of Standard Cubic Feet in an Actual Cubic Foot.

The exact equation to determine the Temperature Correction Factor (CF_T) is:

$$\frac{(460 + \text{Base Temperature in } ^\circ\text{F})}{(460 + \text{Line Temperature in } ^\circ\text{F})}$$

Where:

Base Pressure = 60°F (519.67 °R)
Line Temp. = Prevailing Line Temp in °F

The exact equation to determine the Pressure Correction Factor (CF_P) is:

$$\frac{(\text{Gauge Pressure} + \text{Atmospheric Pressure})}{\text{Base Pressure}}$$

Where:

Atmospheric Pressure = 14.48 PSIA
Base Pressure = 14.73 PSI
Gauge Pressure = Prevailing Line Pressure in PSIG

A custom pulser can then be installed on the end customer’s meter without any coordination with the Gas Utility. While more expensive, this option may also permit an end customer to verify the utility bill as well as providing the desired usage information.