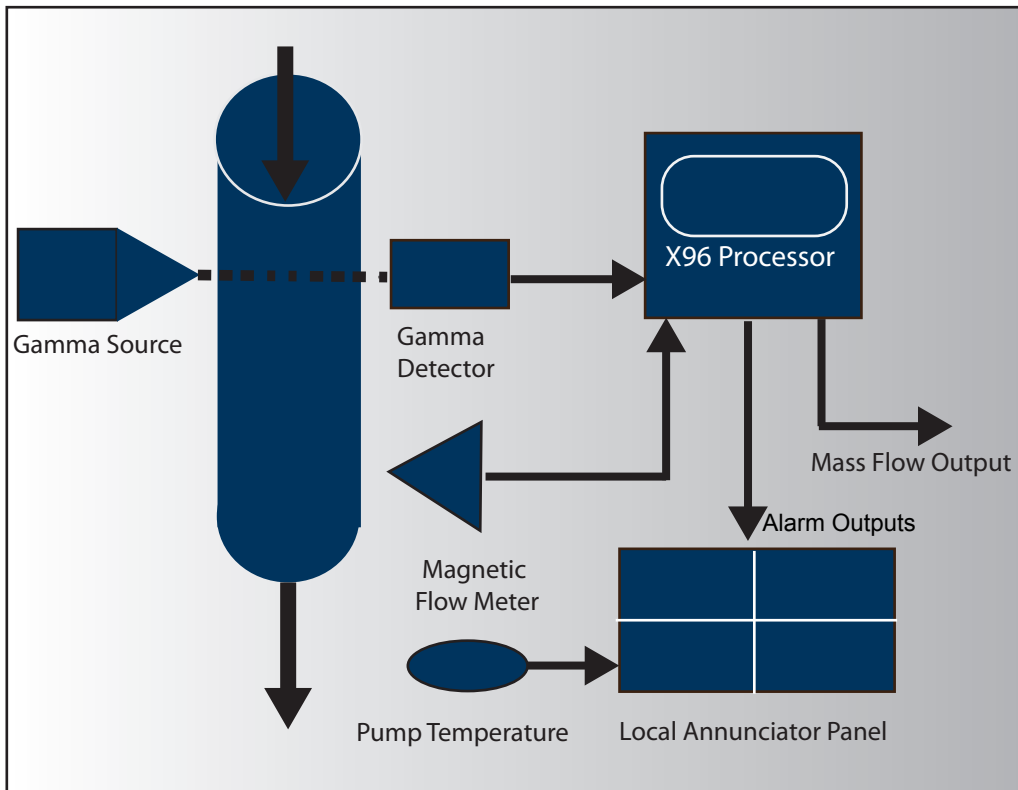


The need to measure densities and mass flow is extremely important to a wide range of industries. A non-contact density sensor in conjunction with a non-contact flow meter may provide measurements of continuous and totalized mass of solids conveyed in liquids, or density compensated mass flow of liquids.



DREDGING APPLICATIONS

Ronan uses gamma radiation to determine the density of a liquid flowing within a pipe. A gamma source provides a beam of energy which will easily penetrate metal piping. The overall level of gamma radiation detected is a function of the density (mass absorption) of the slurry contained within the pipe.



In many applications Ronan's unique RLL technology may be used, significantly reducing the size and cost of the excitation (source). No contact is made to the material, allowing extremely caustic, abrasive or high temperature materials to be safely measured. The density metering system may be installed or removed without disturbing the existing piping and no diverting of the material is required.

Various non-intrusive flow measurement techniques are available, including magnetic flow meters. A magnetic flow meter uses the induced current from a flowing conductive liquid to determine the flow rate, providing a non-intrusive method of measurement. Coupling the non-contact density measurement with a non-contact magnetic flow meter provides a unique, robust solution for the measurement of corrosive or abrasive slurry metal.

NOTES



The Ronan density measurement system is based on an X96 processor which performs the necessary calculations to convert the density and flow information into a Mass Flow reading. Variations in the flow rate or the liquid density are reflected in the changes of the mass flow indication. The continuous or totalized mass flow is available as a 4-20 mA output or through various industry standard communication networks.

In addition to the 4-20 mA calculated mass flow analog output, the X96 product family may be configured to provide alarm contact closures on various process parameters (Flow, Density, or Mass Flow).

These signals may be used to drive local alarm annunciators, may be returned to a centralized PLC or DCS or may be used in a hybrid approach, allowing local alarm annunciation and trouble shooting to support the overall process monitoring and control by a PLC or DCS system.



In the block diagram on the front page, the slurry to be monitored is passed through a steel pipe. The gamma source and detector are externally mounted and measure the density of the material flowing through the pipe which may be displayed on the X96 display. A magnetic flow meter is coupled to the pipe to measure the rate of flow of the slurry. The X96 controller accepts the density and flow data to calculate and display the mass flow of the material.

A local annunciator panel may be used to provide local alarms if any of the process variables are out of range. For example: the density is too low (inefficiency), or is too high (possible clogging), the flow rate is too low (inefficiency) or too high (system stress) or the pump temperature is too high (pending failure). In simple applications, this may provide sufficient controls for the operator to both monitor and trouble shoot the system.

In more complex systems, the alarm points and Mass flow may be returned to a centralized PLC or DCS system using 4-20 mA (HART) plus discreet wiring for the alarm conditions. The local annunciator panel provides a valuable, in-situ maintenance and trouble shooting panel as well as a back-up emergency control system should failures occur in the PLC or DCS system.

To minimize wiring, a range of network communication adapters are available for the X96 products (Modbus, HART, Foundation Fieldbus). These allow the process variables and alarm conditions to be returned to a centralized controller over a single network cable, reducing the required field wiring. Again, the local annunciator panel may be used in parallel support maintenance, troubleshooting and fail-safe controls.

- The X96 product family, when coupled with a non-contact flow meter provides a unique non-intrusive Mass Flow measurement solution. Auxiliary inputs available on the X96 provide additional monitoring of contact closures, allowing the X96 to provide a complete monitoring package. The X96 product family may be easily coupled with Ronan X11 annunciator products to provide the necessary alarm monitoring which may be used as a stand-alone control system. In larger systems, the X11 annunciators provide a local maintenance, troubleshooting and fail-safe control interface.