HOFMANN ELECTRONICS

The use of computers as a central monitoring and control station especially in large industrial installations are increasingly gaining acceptance as an economical and practical solution in manufacturing processes. The advantages of such an installation are immediately obvious when a person can have interactive information at their fingertips from any place or machine in a factory. The computer interfacing is now essential particularly where the technique is combined with today's robotics technology. (See Fig. 1)

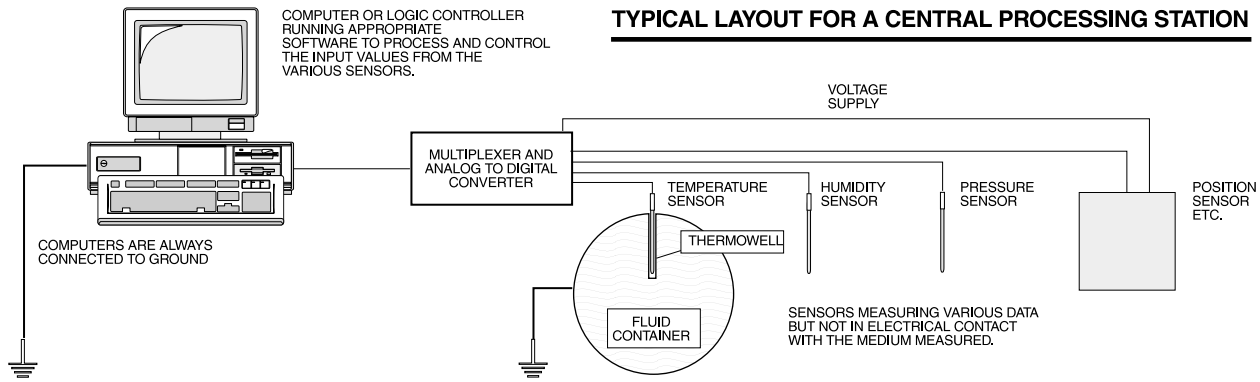

FIG. 1

This concept now increasingly embraces the environmental industry with the ever more stringent pollution controls introduced in factories. The advantages of such a central processing system are immediately obvious especially when highly toxic chemicals are involved. The measurements of pH, Oxidisation Reduction and Conductivity of these mediums provide the main link between a computer screen and the actual mediums held in tanks, containers or the presence of them in a manufacturing process.

The principle of pH, mV and Conductivity measurements require the electrode to be in electrical contact with the water, chemical or medium measured unlike most sensors used in industrial applications. *(A temperature sensor when used in a tank is installed in a stainless steel thermowell and electrically completely isolated from the medium. See Fig. 1)*

The characteristic of a pH electrode also necessitates the use of an input front end with an extremely high input impedance and cannot be connected directly to a typical multiplexing analog to digital converter.

A computer system requires a firm connection to common ground for a reliable and save performance. For economical reasons designers of manufacturing plants prefer to provide a DC voltage directly from a central power supply to the front end rather than supplying each with mains' power. This is done to minimise installation costs and safer operation of the plant due to the absence of high voltages.

A ground loop is created if there is no electrical isolation provided in the instrumentation, showing totally false measurements at the computer monitor. A loop created if several front ends are used will result in equally severe errors in measurements. *(See Fig. 2)* The scale of error is such that *(as example)* an actual pH value of 8.5 can show on the computer monitor with a reading of pH 4.0 or may even show as 'ERROR'.

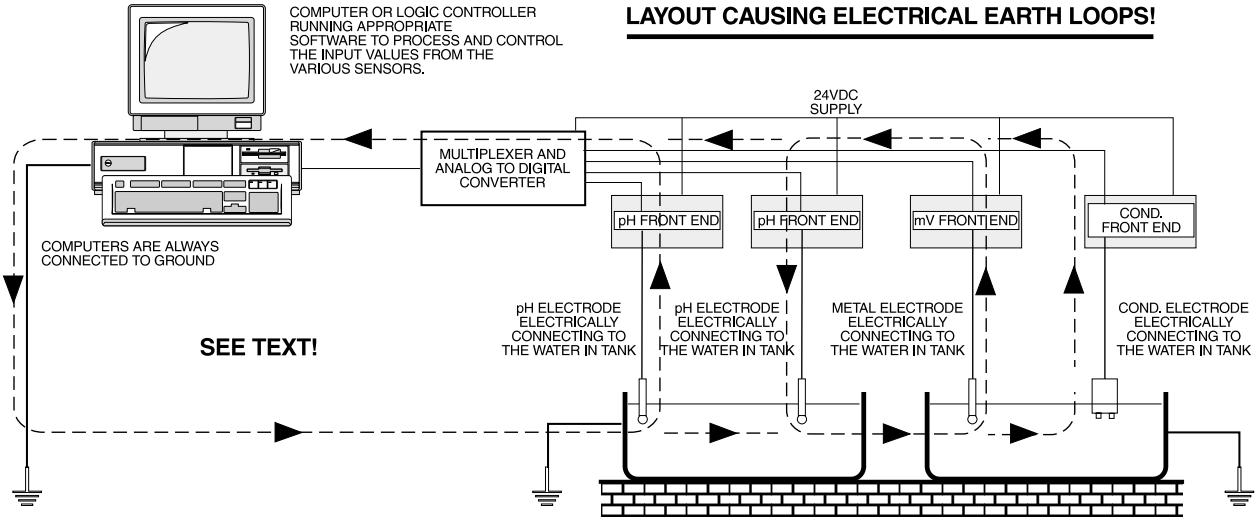

FIG.2

An instrument such as the DMH-41 pH front end overcomes these problems by providing total electrical isolation (infinite resistance) between the electrode and the signal output connected to the computer. The electrode signal also is converted to a more useable low impedance signal that can be safely transmitted over longer distances with normal cables. The DC voltage input of the DMH-41 internally powers a DC to DC isolation power supply providing the appropriate voltages to the input circuit of the DMH-41. *(See Fig.3)*

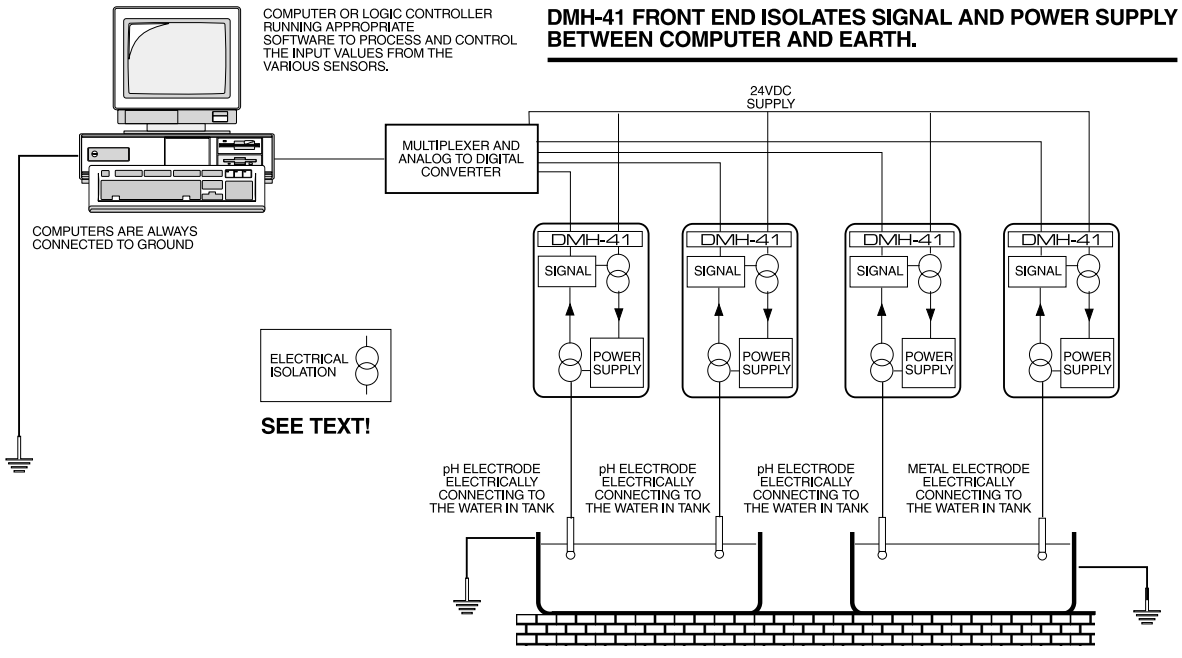

FIG. 3

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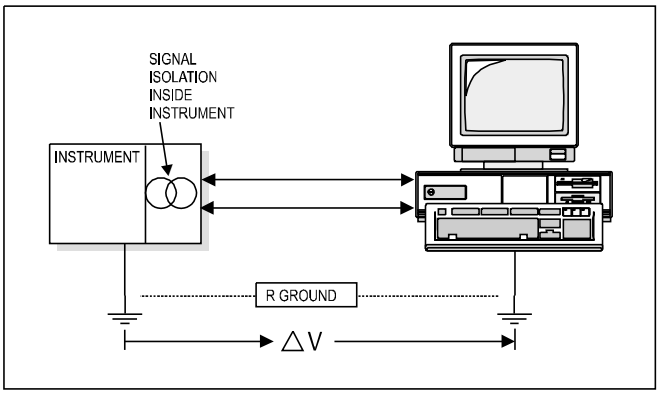
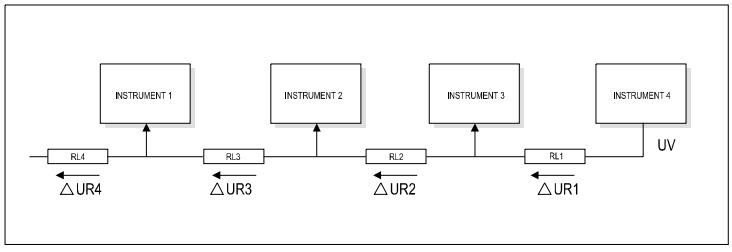
Reliable process control can only be guaranteed if analog signals are transmitted without interference or distortion between measurements control and protocol facilities on the one hand and the sensor and actuators distributed in the field on the other hand. Low-capacity analog signals are particularly prone to external interference during transmission in a harsh industrial environment and require a reliable transmission path.

Everyday experience shows that essential system requirement make it necessary for analog signals to be conditioned and transmitted with great care.

Measurements and control data that are transmitted between the field and control level in the form of analog signals are subject to rough industrial influences during transmission.



The main cause of the distortion of analog signals are potential differences which arise when both the signal source and the signal drain refer to the ground potential at the same time. The ground resistance increases along with the length of the transmission path, resulting in ground potential differences of up to 200V.

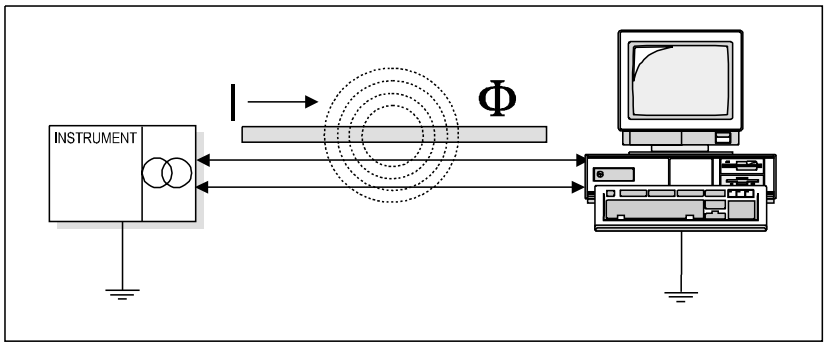


Another sources of potential differences are distributed measurement circuits; the interconnection of several signal circuits causes an increase in the rated voltage.

Particularly in the case of long conductor paths or in harsh industrial environment, coupling of inductive or capacitive interference must be expected.

Apart from the electrical isolation, isolating amplifiers also amplify the signal in order to be able to cover large transmission paths or to connect high apparent ohmic resistance.

Further tasks of signal transmission are filtering interference signals superimposed on the measured values and adapting to the input values required by the control devices.



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Connecting the 4-20mA current output to an external computer or central processing system can create interference problems due to voltage potentials between instruments, floating inputs into the A/D input card, earth loops picking up noise from surrounding power cables etc. Signs of interference are: unstable display, measurement displayed is of wrong value or varies constantly, instrument behaves erratically or locks out.

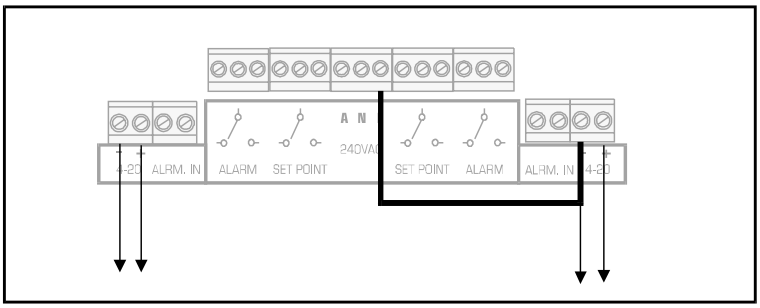
Each installation and its surroundings will differ each time. Problems showing up when connecting the 4-20mA output are caused thought the interaction of instruments. These problems can only be solved on-site.

Disconnect the wires connecting the 4-20mA output. Switch on the controller, go through basic configurations, watch stability of the values displayed and make a note of the accuracy of measurements.

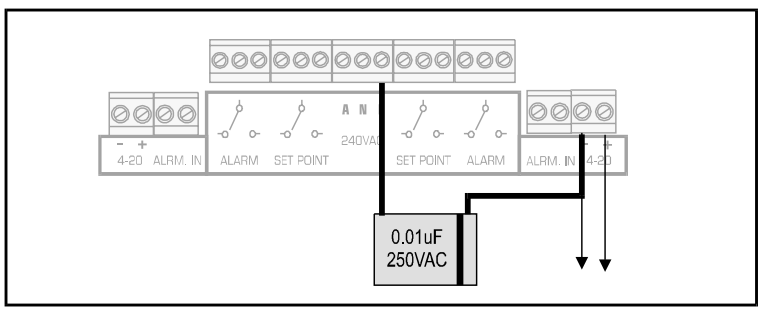
The fault is with the instrument if the problem remains with the 4-20mA wiring removed. If the problem disappears, interference between instruments is occurring, unwanted voltages infiltrate the signal path, the 4-20mA wiring is faulty or picks up strong noise signals.

Reconnect the 4-20mA output and try any of the following.

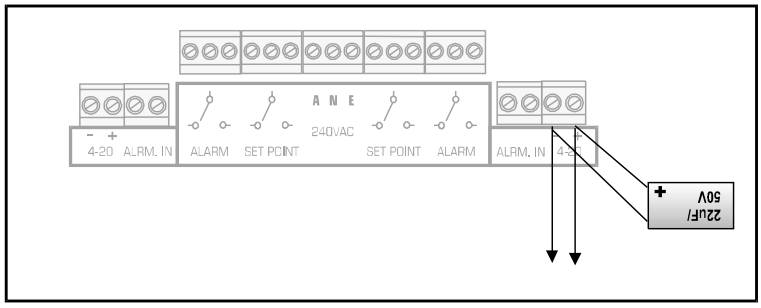
Connect a wire between EARTH and negative terminal.



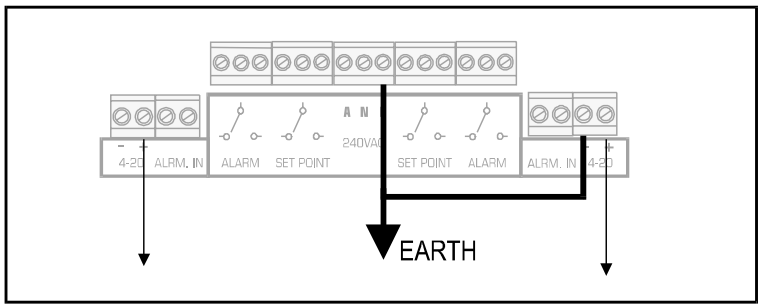
Connect a capacitor (0.01uF/250VAC) between EARTH and negative terminal



Connect an electrolytic capacitor (22uF/50V or similar) between positive and negative terminal.



Connect a wire between EARTH and negative terminal, but disconnect the negative 4-20mA signal wire to the computer.



Use co-axial cable for the 4-20mA signal.

Try one or several of the above mentioned suggestions to rectify a problem.

These suggestions by no means exhaust the troubleshooting. Problems like the above mentioned can only be solved through a process of elimination.

Disconnect any wiring other than the electrode until the controller operates correctly. Reconnect by sections and find the part or combination of parts that causes the problem.

Operators in the field always seem to associate problems with electronic instruments. Experience has shown that in more than 90% of cases the fault in fact is caused by simple problems like broken or corroded wires, wires running through water puddles on the floor, wrong polarity wiring, wires running 50 or more meters together with 240VC cables in the same conduit. Machinery near-by emits radio frequencies affecting sensitive electronic equipment.