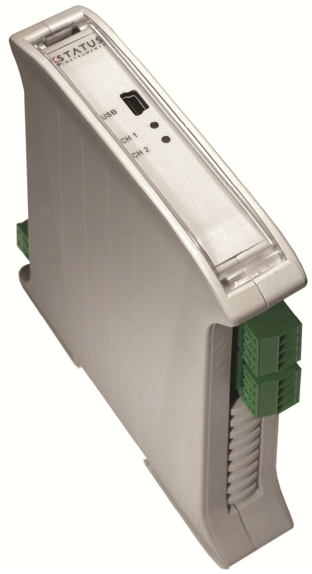
Signal Conditioning Challenges Facing The Process Engineer



Many types of sensor are available for monitoring processes of all types, including temperature, level, flow, pressure, position, light, and so on; the list of applications using signal conditioning is endless.

Any industry, heavy or light, from farming to power generation, will make use of signal conditioning units and each industry will present its own set of requirements and problems.

Some applications will require the comparison of signals and an output based upon the result, for example, the difference between input and output oil flow to a burner will be the amount consumed. This is normally done with the use of complex controllers or PLCs, however, advances in the functionality of signal splitters and multi-channel conditioners now mean some of this work can be done by the conditioning block itself.

Although basic signal conditioning has been in use for many years, it can still present a challenge to the process engineer with several things to be considered in any system that needs to transmit analogue signals representing engineering values from a measurement point to a monitoring or control point. There can be many issues that will affect how a signal is conditioned from the mismatch of inputs to outputs, to the environment in which the system is located:

The output signal type and level from process sensors can cause problems in being matched to the input requirements for controllers or PLCs. It may be a sensor with a (0 to 10) mA output will need to be connected to a controller with a (0 to10) V input, or even a different mA range. Matching the signals is the primary requirement of any signal conditioner.

Isolation of equipment inputs/outputs on the same control loop may be required, if ground loops that can cause signal errors are to be avoided.

Ranging and scaling signals where sensor outputs are not in the same engineering unit or engineering unit multiple, and potential re-ranging if process conditions change, are potential pitfalls.
If the working parameters for a process change, for example a scaled level sensor needing to be re located or changed, can the conditioning block be easily re configured to the new input settings.
A flow sensor representing (0 to 100) l/min may need to be connected to a data logger needing an input representing (0 to 50) l/min and both are using a (4 to 20) mA signal, how will the conditioning unit cope with the miss match.

Signal integrity is important too as a loss of signal or, what can be worse, an incorrect reading may cause a control system to fail or run outside of limits. Integrity can be affected by many factors from inside and outside the control system. The physical ambient conditions, length of cable run, electrical interference, can all cause. A robust system is therefore essential in maintaining signal fidelity.

Isolation between sensors that may become live in a fault condition can be a safety concern in some applications, so a conditioner with a suitable rating can be a major factor in choosing the correct unit for some engineers.

With so many factors to assess, sometimes more than one conditioner may be required, so a single unit that can fulfil all of the requirements can be very useful. The downside to this is that such a sensor can be complex and expensive.

With the ever-growing number of sensor types and manufacturers producing them, it is important that process engineers choose equipment can be easily interfaced. Controllers, PLCs, building management systems, and displays will all need to be integrated to work with each other in many different combinations.

This is why most sensors, or the transducer the sensor may connect to, will look to convert its particular engineering value into something that can be interfaced with the vast majority of control systems on the market, which, to be practical, normally accept only a limited number of inputs. The industry “standards” for analogue signal transmission are within the ranges of (0 to 20) mADC or +/- (0 to10) VDC.

Flexibility in modern signal conditioning technology is helping the process engineer to reduce the number of units required by making them multi-purpose and by making them easy and quick to commission.

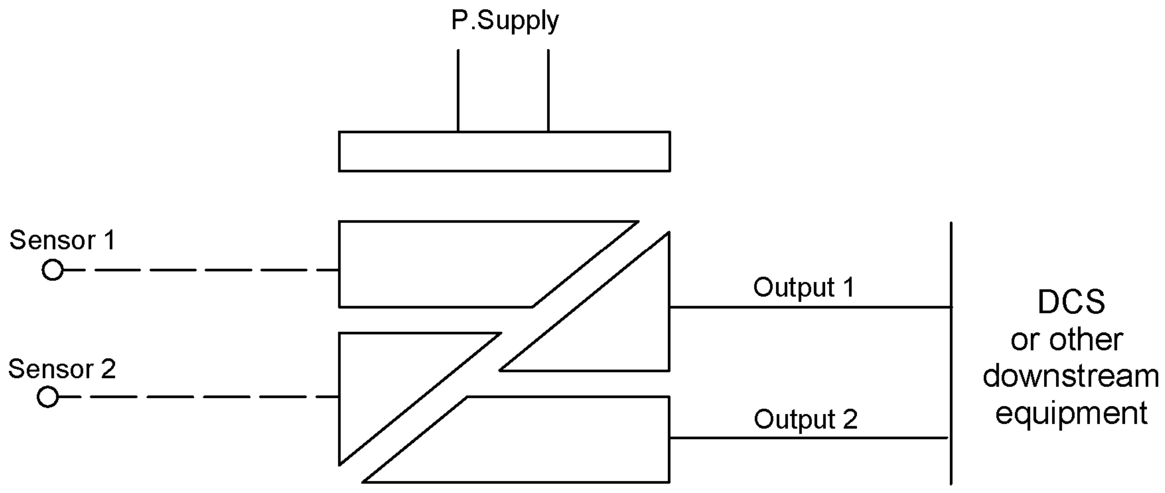
Many of the problems presented to the process engineer can be solved by the correct choice of signal conditioning unit.

Status Instruments’ rail mounted **SEM1700 range** of single and dual channel conditioning and splitter products from Status Instruments has been designed with a view to overcoming many of the common problems associated with signal conditioning.

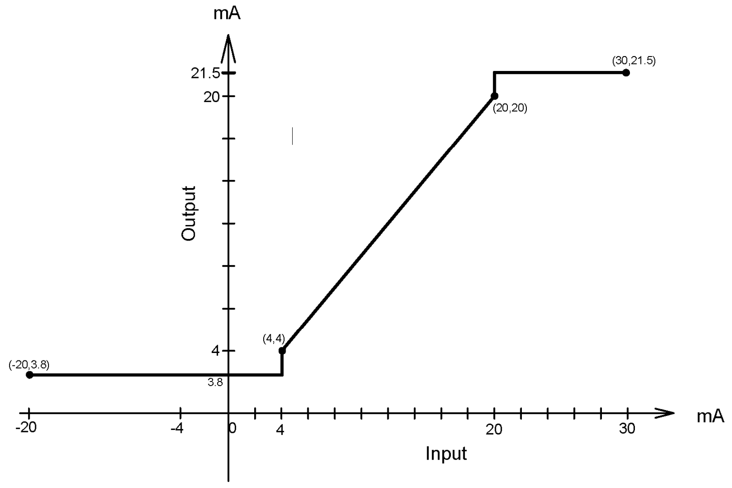
With a worldwide power supply operating from 24 VDC all the way up to mains voltage, 3k75 V isolation between inputs and outputs, and a wide range of input and output configuration, gives the user flexibility in the field.

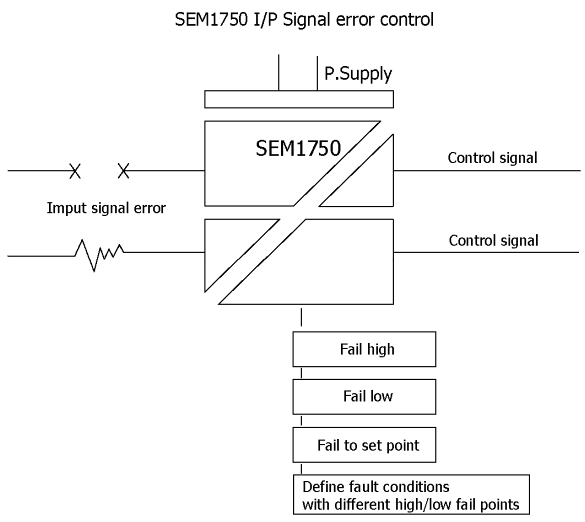
The dual channel unit can be used in two modes: simple - where only the basic features of a signal conditioner/splitter need to be considered, and advanced. In advanced mode the functionality offers: user non lin, signal damping, system diagnostic tool and other options, including recording, are available. Set up is achieved using FOC software and a standard USB lead.

SEM1750 Block diagram



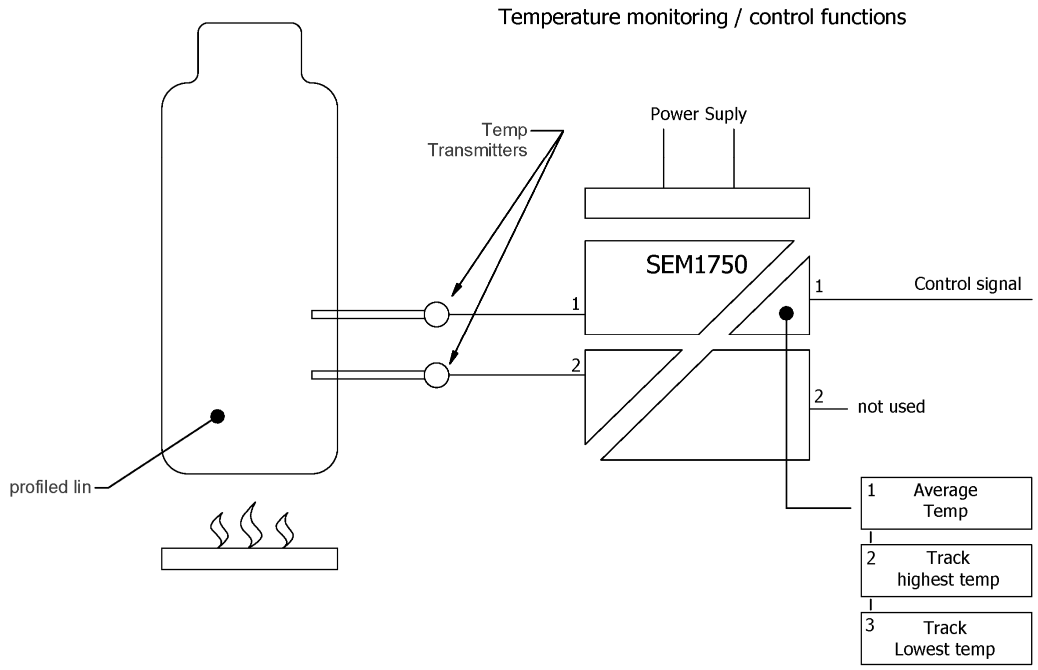
Using the SEM1750 to control the in range and out of range input signal to give a known condition on the output, this is a simple relationship,



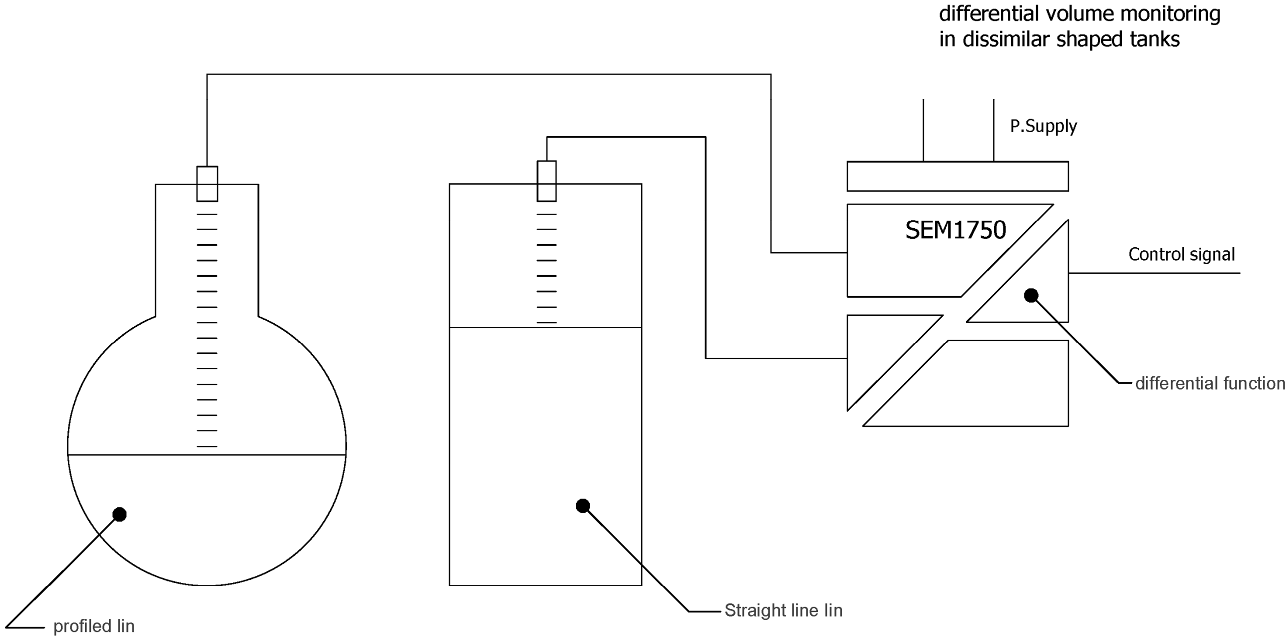


more advanced profiles can be entered using the SpeedLink software

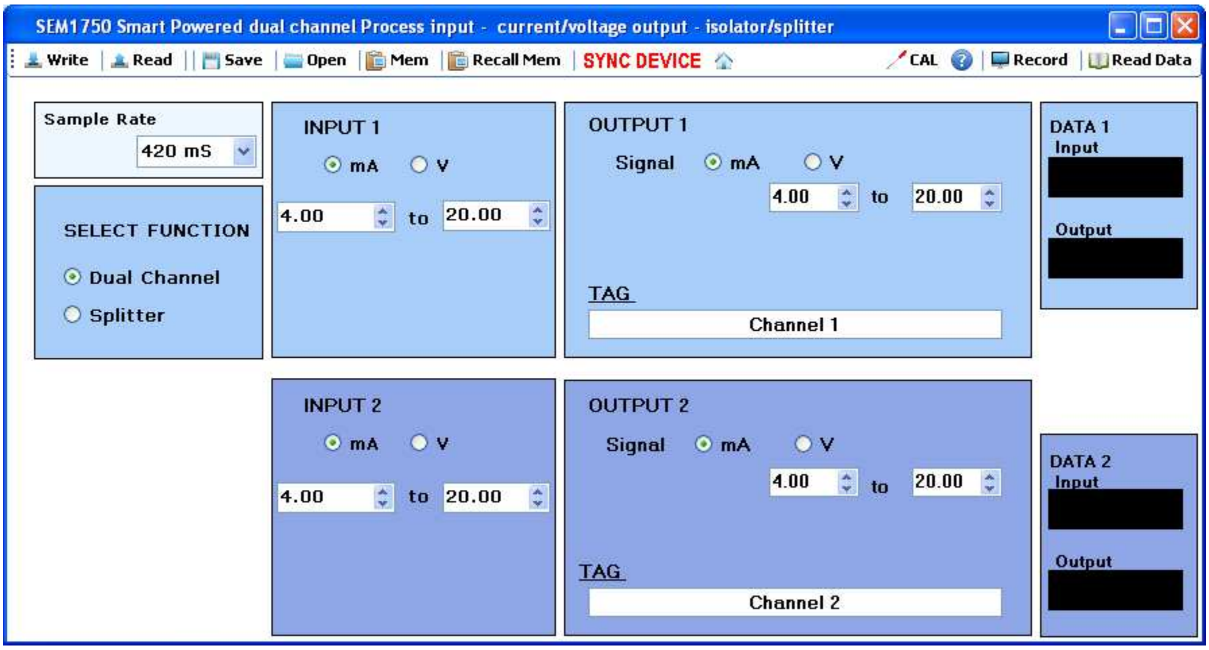
Using the SEM1750 to compare two temperature signals.



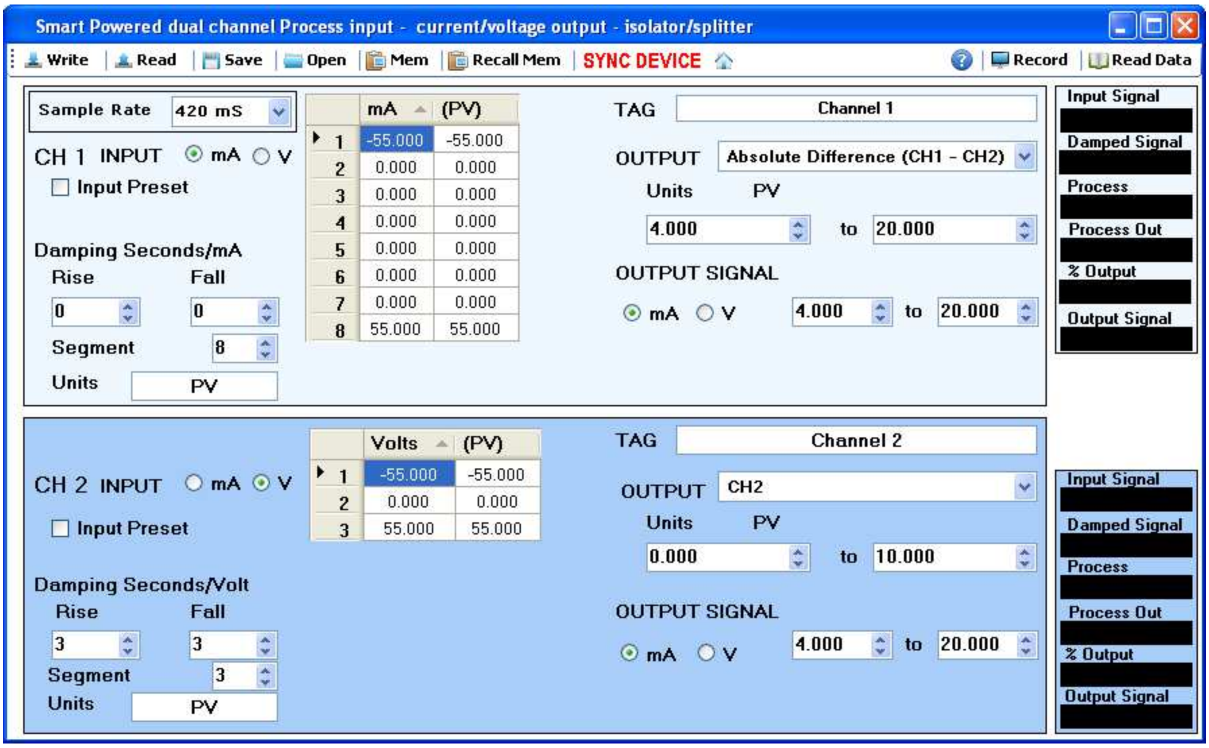
Using the SEM1750 to monitor the level in two dissimilar shaped tanks for direct comparison, A-B, A+B, or other comparisons.



SEM1750 simple configuration screen



SEM1750 advanced configuration screen



SEM1700 configuration screen