MICROPROCESSOR CALCULATION MODULE - S2000

Complying equipments with prescriptions on electromagnetic compability (standard 89/336/CEE.)
Industrial environment, reference standard : EN 50081-2 EMISSION /EN 50082-2 Immunity

Calculation module operating on both analogue and digital signals. Permits any calculation between input quantities, providing the outputs corresponding to the calculation performed.
Provided with:

- 4 analogue inputs for 0 - 20 mA or 4 - 20 mA passive signals, with 100 ohm input resistance; 12 bit analogue/digital conversion.
- 2 digital inputs for drive from contact (free voltage) or open collector npn transistor (1 mA 5 Vdc).
- 2 analogue outputs with 0 - 20 mA or 4 - 20 mA active signal (max 300 ohm); 12 bit analogue/digital conversion not galvanically separated.
- 2 digital outputs with output by means of open collector npn transistor with maximum capacity 300 mA 30 Vdc.
- RS 232 optoisolated standard serial interface for connection to computer.

On request, optoisolated RS 485 interface with possibility of connection to computer via duplex cable up to 32 modules.
The software implemented in the S2000 module permits acquisition of input quantities and reception of output values via the computer.
The configuration software supplied on floppy disk for MS-DOS systems permits total programmability of the calculations and operations performed by the module directly via computer.
The configuration data of the S2000 module are written on EEPROM and are therefore retained for over 10 years even with no power supply.
On request the instrument can be factory-programmed to specific customer requirements, with related instructions for use.
115 / 230 Vac mains power supply selectable in the field, protected against line overvoltages by means of varistors.
The insulation between the mains supply and the input and output circuits is 4500 Volt.
The case is of the DIN type with 9 modules, made of self-extinguishing Noryl and designed to fit on a 35 mm mounting rail (DIN 46277).

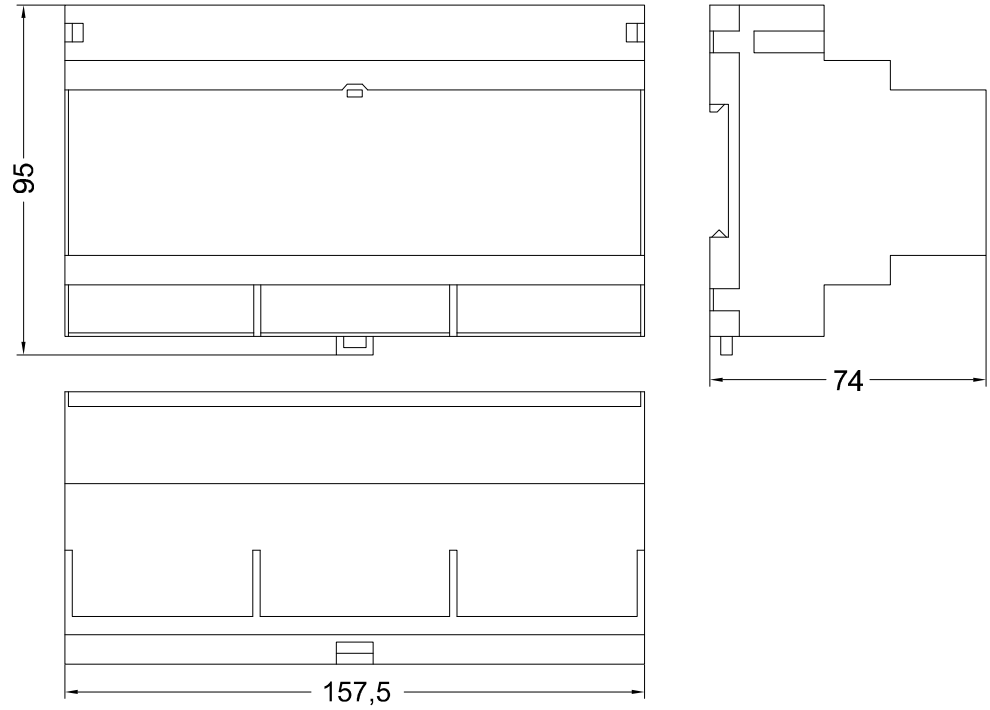
Application examples:

- Transmission of analogue signals from process transducers to a computer via serial line.
- Adder of two flow rate signals to control a metering pump, for example.
- Any situation where it is necessary to perform a calculation or linearisation between the input quantities.
- Integration and counting of calories/refrigeration units.
- Pressure and temperature compensated flow rate measurements.
- Calculation of input measurements and transmission of results on output signals.

TECHNICAL SPECIFICATIONS

- Power supply:
- Power consumption: 3.5VA
- Inputs:
  4 analogue 0 - 20 mA or 4 - 20 mA passive, input resistance 100 ohm,
  2 digital for contact or npn (1 mA 5 Vdc)
- ADC conversion speed: 160 ms per channel
- Outputs:
  2 analogue 0 - 20mA or4 - 20 mA active (max load 300 ohm)
  2 digital npn open collector (300 mA 20 Vdc)
  1 RS 232 serial line, RS 485 optional
- DAC conversion speed: 10 ms per channel
- Calibration: greater than 0.1 %
- Drift: below 50 ppm
- Operating temp.: 0° / +60 °C
- Humidity: 90 % at 40 °C (non-condensing)
- Dimensions (b x h x d) : 157.5 x 95 x 69 mm
- Weight: approx. 500 g

DIMENSIONS



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APPLICATION EXAMPLES OF THE MICROPROCESSOR CALCULATION MODULE S2000

GENERAL DESCRIPTION

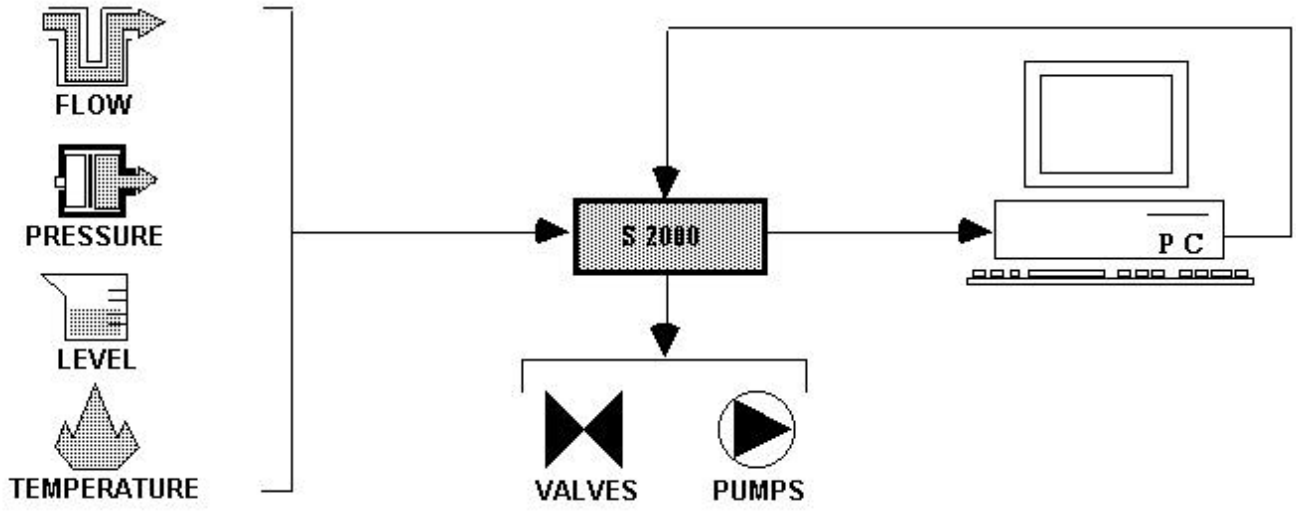
Mathematical microprocessor unit designed to solve easily and at low cost any calculation problem on analogue and digital signals.
Essential for calculation of means, differences, integration of signals etc. for transmission to an indicator, a recorder or directly to a personal computer, acting like an intelligent acquisition card.
The module offers 4 inputs for analogue signals, 2 inputs for digital signals, 2 outputs for analogue signals, 2 outputs for digital signals and an RS232 or RS485 interface for direct connection of several S2000 modules on the same serial line to a personal computer.
The complete set of logic-mathematical operations implemented is described below.
The calculation to be performed is set directly by the user by connecting the S2000 module to the serial socket of his personal computer and writing a simple sequence of instructions which at the end is transmitted to an EEPROM memory within the module.
The storage technology used retains the programming even with no power for at least 10 years and the module can be directly reprogrammed for new operations whenever necessary.
On request it is also possible to program the module directly in the factory before shipment according to specific customer requirements.

EXAMPLES OF USE

ANALOGUE OR DIGITAL SIGNAL ACQUISITION MODULE

An example of very common use of the S2000 calculation module is acquisition and transmission via serial line of the analogue and digital signals from process transducers to a personal computer, as in the case of measurement of flow rate, pressure, level, temperature etc.

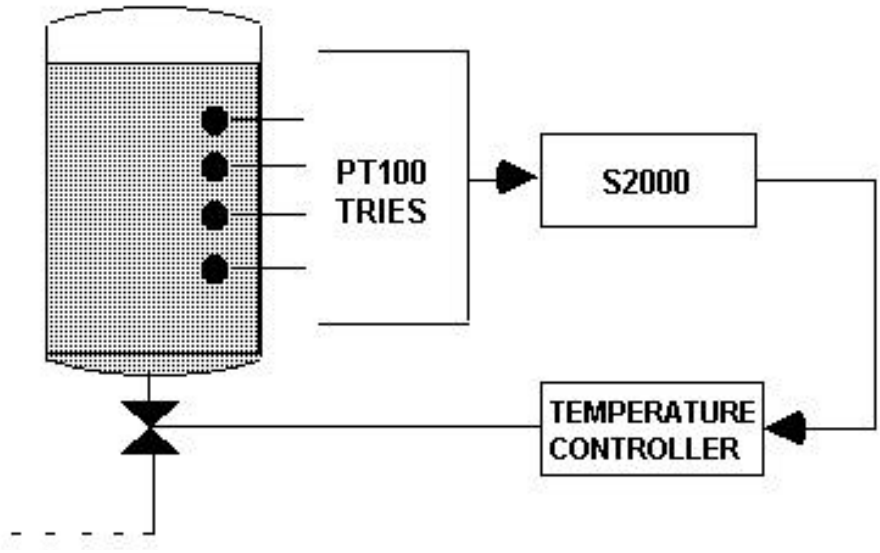
In addition to transmission via serial line, the S2000 module can perform logic-mathematical calculations on the input signals and send the outputs to indicators or recorders.



The signals from transducers go to the analogue inputs of the S2000, which in its turn can use them or otherwise in required logic-mathematical operations and then retransmit the corresponding values via serial line to the PC for display. The PC can also transmit to the S2000 module via serial line the required information for control of devices such as valves or pumps, connected to the analogue outputs of the module itself.

MEAN VALUE OF ANALOGUE SIGNALS

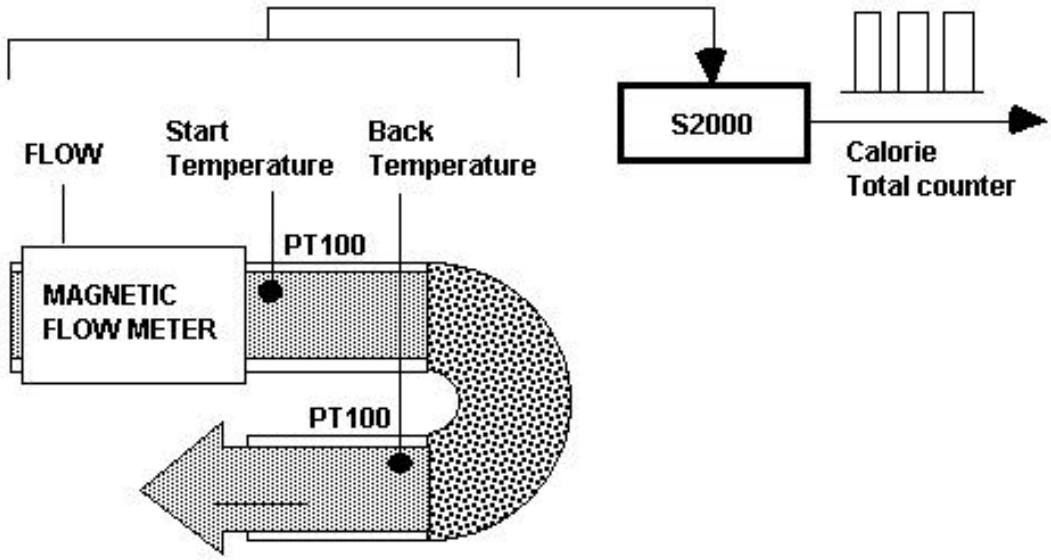
Another example of widespread use is calculation of the mean of the values provided by process transducers as in the case of various PT100 temperature probes located at different heights in a liquid tank.



The S2000 module can assess the mean of the values corresponding to the analogue signals from the probes and control a temperature regulator on the basis of this mean.

CREATION OF A CALORY COUNTER OR REFRIGERATION UNIT COUNTER

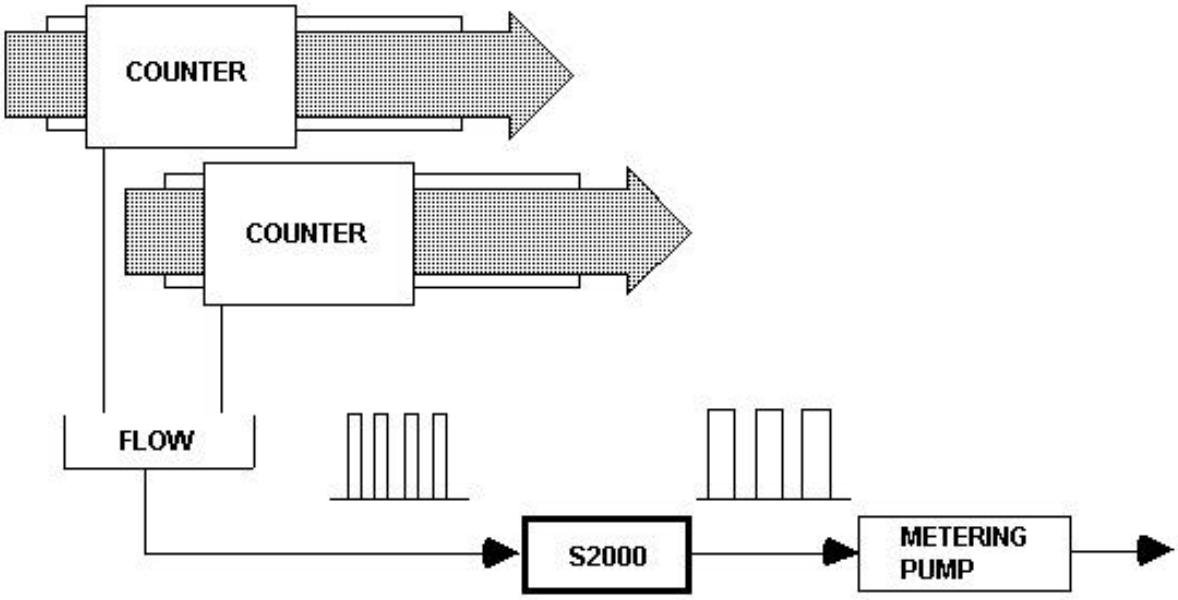
The creation of a calory or refrigeration unit counter is an example of one of the many uses of the S2000 calculation module in the field of analogue value integrations.



As a calory counter the S2000 is able to totalise the thermal energy developed in a pipe used for heating, for example, calculating the difference between the two temperatures, high and low, provided by two PT100 probes and multiplying it by the flow rate of the pipe measured by means of a magnetic meter.

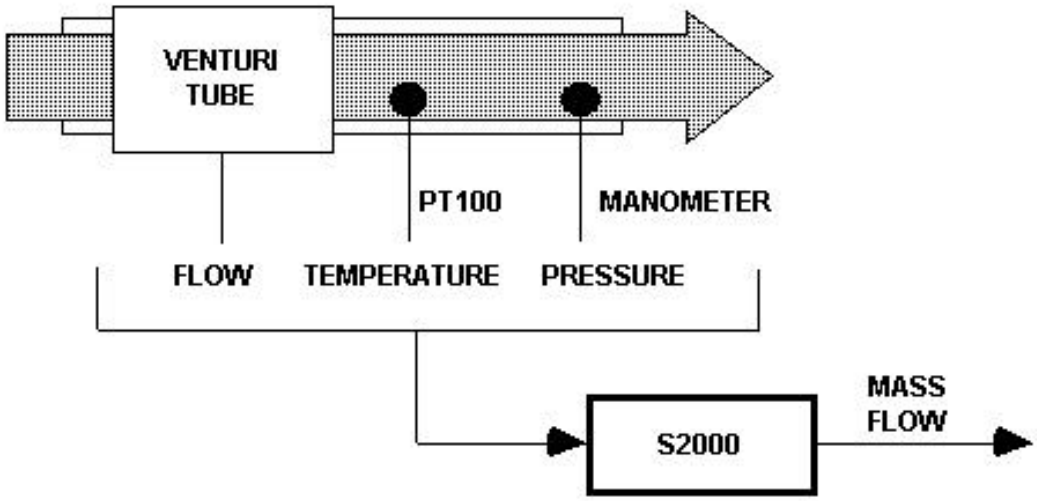
CONTROL OF A METERING PUMP

The S2000 calculation module also has many uses in the field of digital value integrations, for example control of a metering pump by averaging two flow rate pulse signals.



MEASUREMENT OF MASS IN GASES

In various applications determination of the flow rate is required, for example in kilograms, of a gas like water vapour or methane.



The S 2000 module can provide an output analogue signal proportional to the above mass, combining the gas flow rate, measured by means of a Venturi pipe or a calibrated flange or a Vortex etc., with the temperature and pressure of the gas.

PROGRAMMING

THE SET OF OPERATIONS THAT CAN BE PERFORMED BY THE S2000 CALCULATION MODULE IS DESCRIBED BELOW
The program instructions entered by the user consist of operands and operations.
The operands can be constant numbers which the user enters directly, or the values present at the analogue or digital inputs that can be entered via the Input/Output operations.
The operations, depending on their type, act on the last operand entered or on the last two.
To enter the required operation, the user must use the related code.
The description of the set of operations controlled by the S2000, complete with their codes, is divided as follows:

MATHEMATICAL OPERATIONS

+	addition of the last two operands
-	subtraction of the last two operands
*****	multiplication of the last two operands
/	division of the last two operands
NEG	opposite of the value of the last operand
RADQ	square root of the last operand which must be non-negative
LOG	base 10 logarithm of the last operand which must be positive
LN	natural logarithm of the last operand which must be positive
EXP10	base 10 power of the last operand
EXPE	base ‘e’ power of the last operand
EXP	power with base and exponent corresponding to the last two operands

LOGIC OPERATIONS

DUP	duplicates the value of the last operand
DEL	eliminates the last operand
SWAP	swaps the last two operands
COMP	compares the last two operands
SWITCH	selects one of the two previous operands on the basis of the last operand
NOT	negates the value of the last operand

INTEGRATION OPERATIONS

PVAL1, PVAL2	last operand as value associated with the pulse for the 2 digital outputs
IVAL1, IVAL2	last operand as a variable to be integrated
ITYPE	choice of type of integration, digital or analogue

DATA STORAGE OPERATIONS

STO0, STO1, STO2, STO3, STO4	5 memory registers of the operand values
RCL0, RCL1, RCL2, RCL3, RCL4	recovery of values of the operands from the memory registers

I/O OPERATIONS

AI1, AI2, AI3, AI4	recovery of value present in one of the 4 analogue inputs
AO1, AO2	transfer of last operand to one of the 2 analogue outputs
DI1, DI2	recovery of value present in one of the 2 digital inputs
DO1, DO2	transfer of last operand to one of the 2 digital outputs

ZERO REGULATION OPERATIONS

ZA	adds shifting of the zero to the last operand
ZS	removes shifting of the zero to the last operand

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