

**IMEKO TC3, TC5, TC22 Joint Conference
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Digitalization - the correctness of a digital value?

A few considerations regarding the correctness of digital value

During years we have met several measurement instruments whose behaviours have not been systematic.

Mainly these are medium accuracy class instruments.

The reasons for unexpected behaviours are not investigated systematically, we can only evaluate them roughly based on long experience.

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Most of the measurement sensors have analogue signal as output

- the quality of the analogue signal should be good
- the relation noise/ signal should correspond to the targeted resolution
- the slew rate of the signal should be defined (for the rate of the converting)

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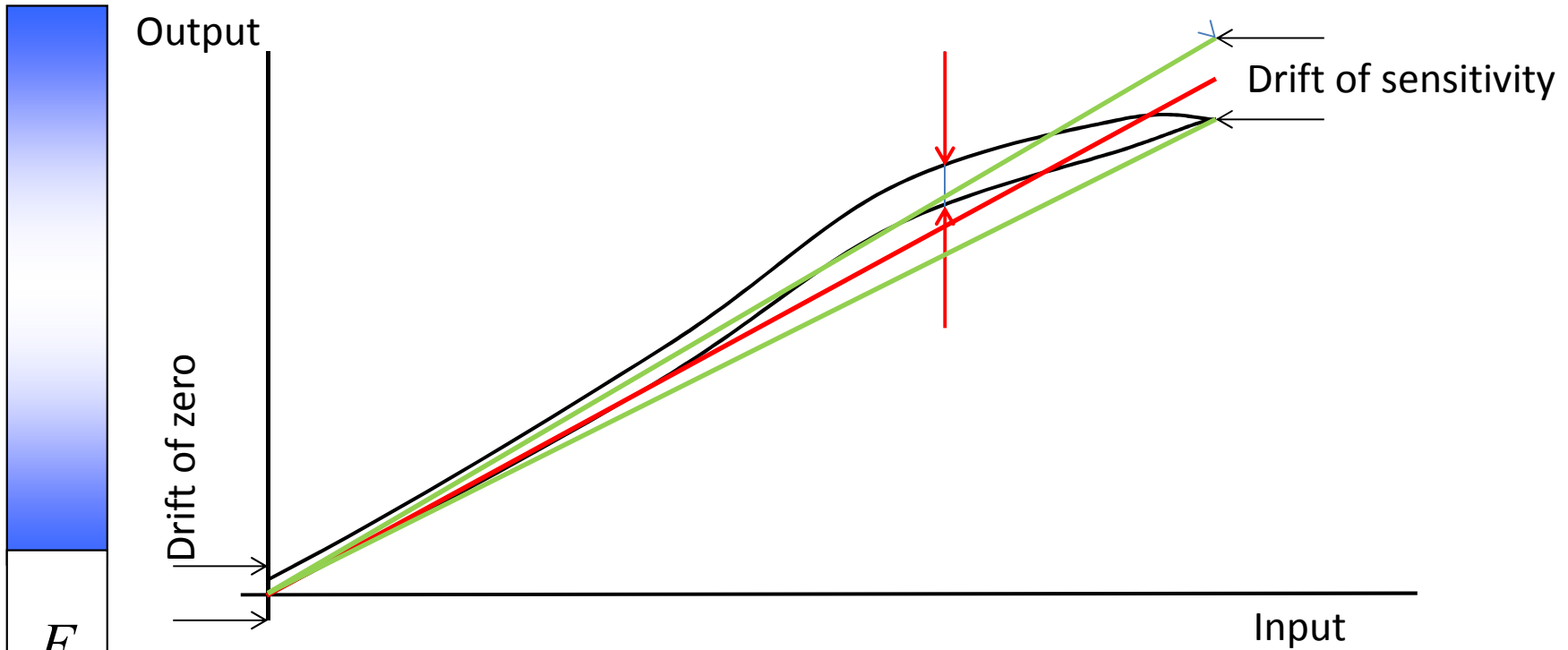


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Analogue signal defines the measurement curve

- linearity
- hysteresis
- zero point error
- sensitivity

Measurement instruments output curve should be repeated in digital form as accurately as possible

- the principle in the standards (e.g. ISO 376) that the zero-load display does not need to be stable, “(with no force applied to the instrument), the resolution shall be deemed to equal to half the range of fluctuation”.

I believe that recommendation inherited from pure analogue technology where the fluctuation is more easily to evaluate. At least digital fluctuation cannot be more than 1 ... 2 digits, otherwise it is difficult to evaluate it correct.

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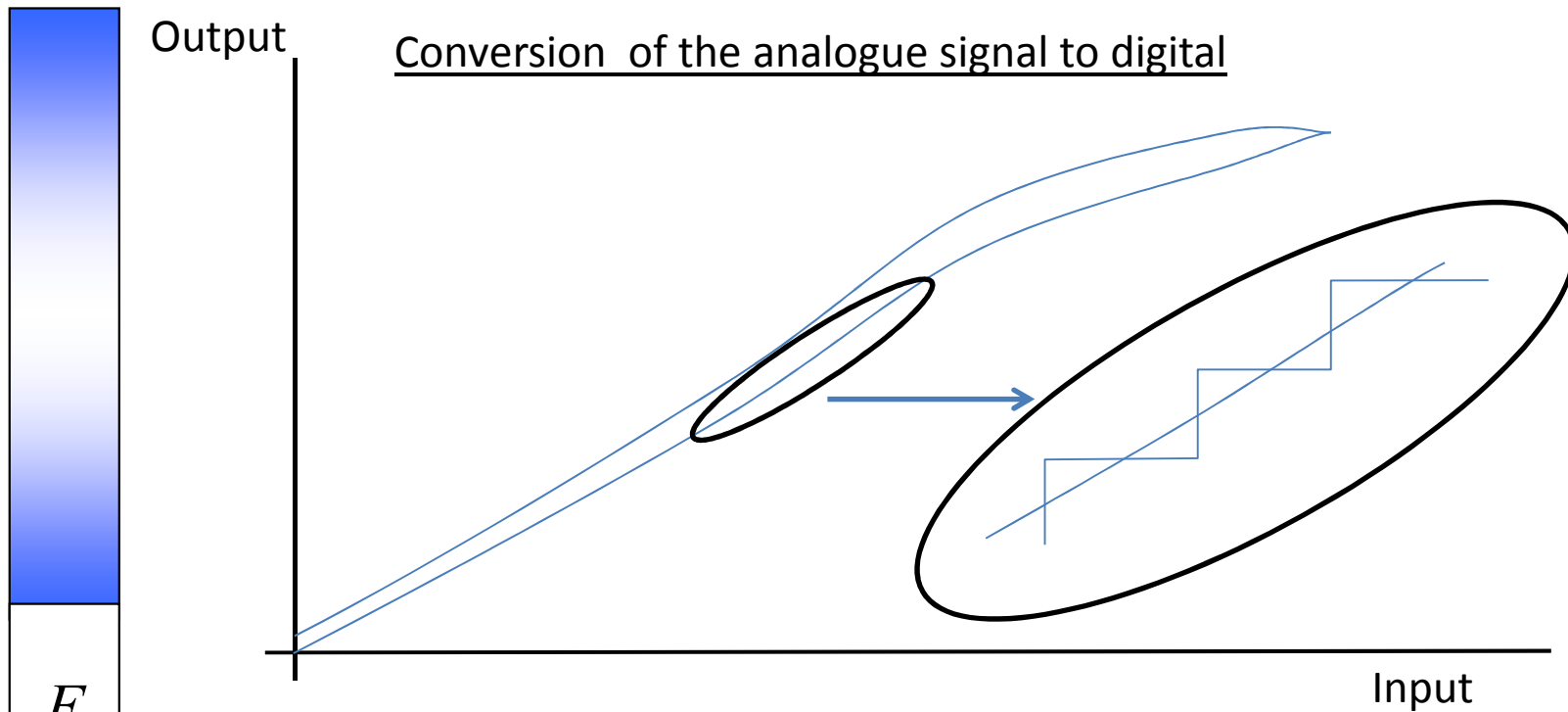


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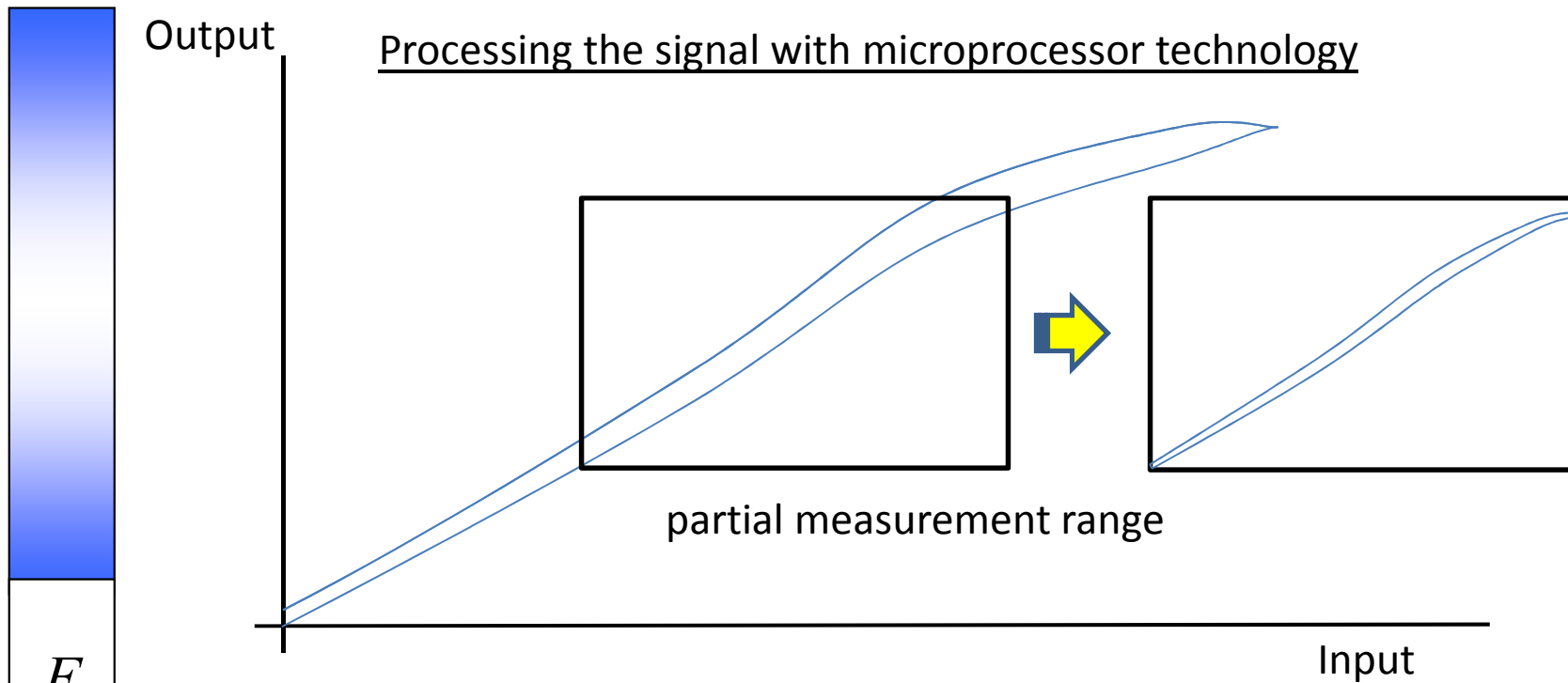


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Resolution, the scale interval

- resolution should be hole number, not the measurement range divided e.g.by 1024
- resolution, the scale interval, is very large; uncertainty is based mainly on the resolution
- resolution, the scale interval, is very small; the resolution is close to the noise



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- new resolution and the value (the scale interval) and new noise/resolution relation
- possible linearization, no information about it
- the real zero point is not known, possible auto-zero function
- some instruments do not allow any other function than the automatic measurement, no calibration mode
- stepwise calibration is maybe not possible

- the traceability of the used amplification is in many cases impossible
- calibration rate slower than real measurement mode, how to evidence the correctness of the calibration for measurement
- by quasi-static measuring the features of the signal are not known, what is the maximal slew rate without falsifying the correctness of the signal

Microprocessor technology gives for us almost infinite possibilities to modify the analogue signal and the user has several different modes to use the measurement instrument.

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THANK YOU FOR YOUR ATTENTION!

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