Chapter 8

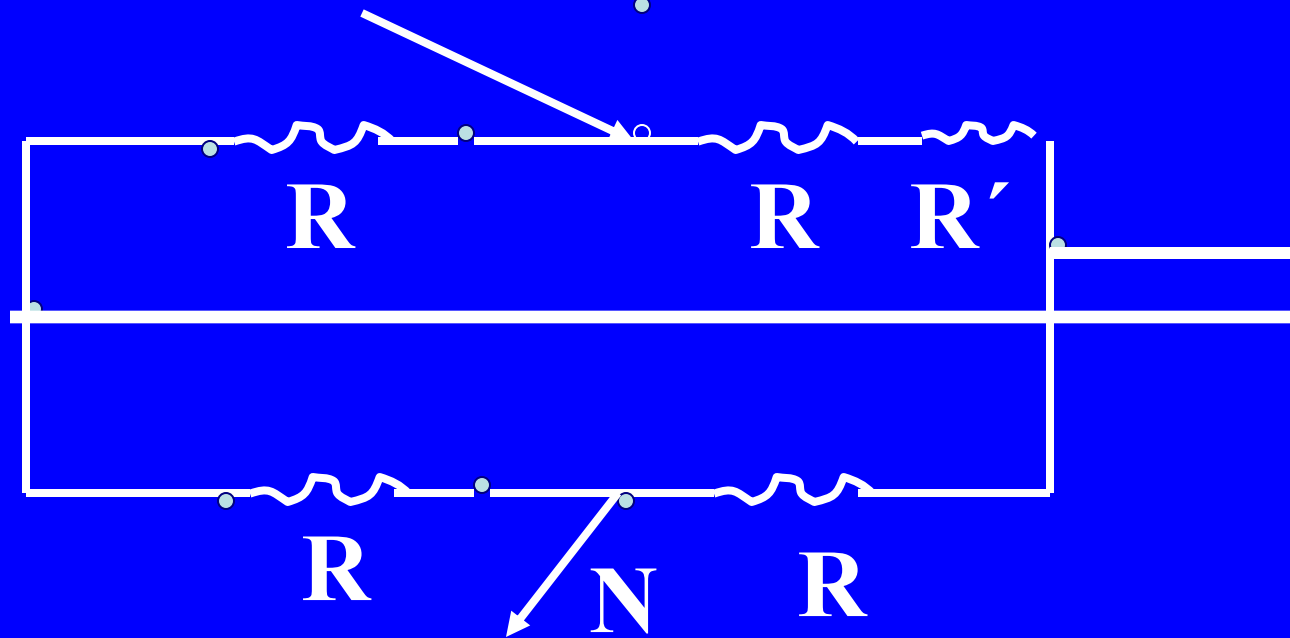# Digital and Analog Interfacing Methods

Lesson 11 Part a

Analog Input and Temperature and pressure measuring Interfaces

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Vdc or a.c. from

an oscillator

Whetstone Bridge

R   R   R´

R   N   R

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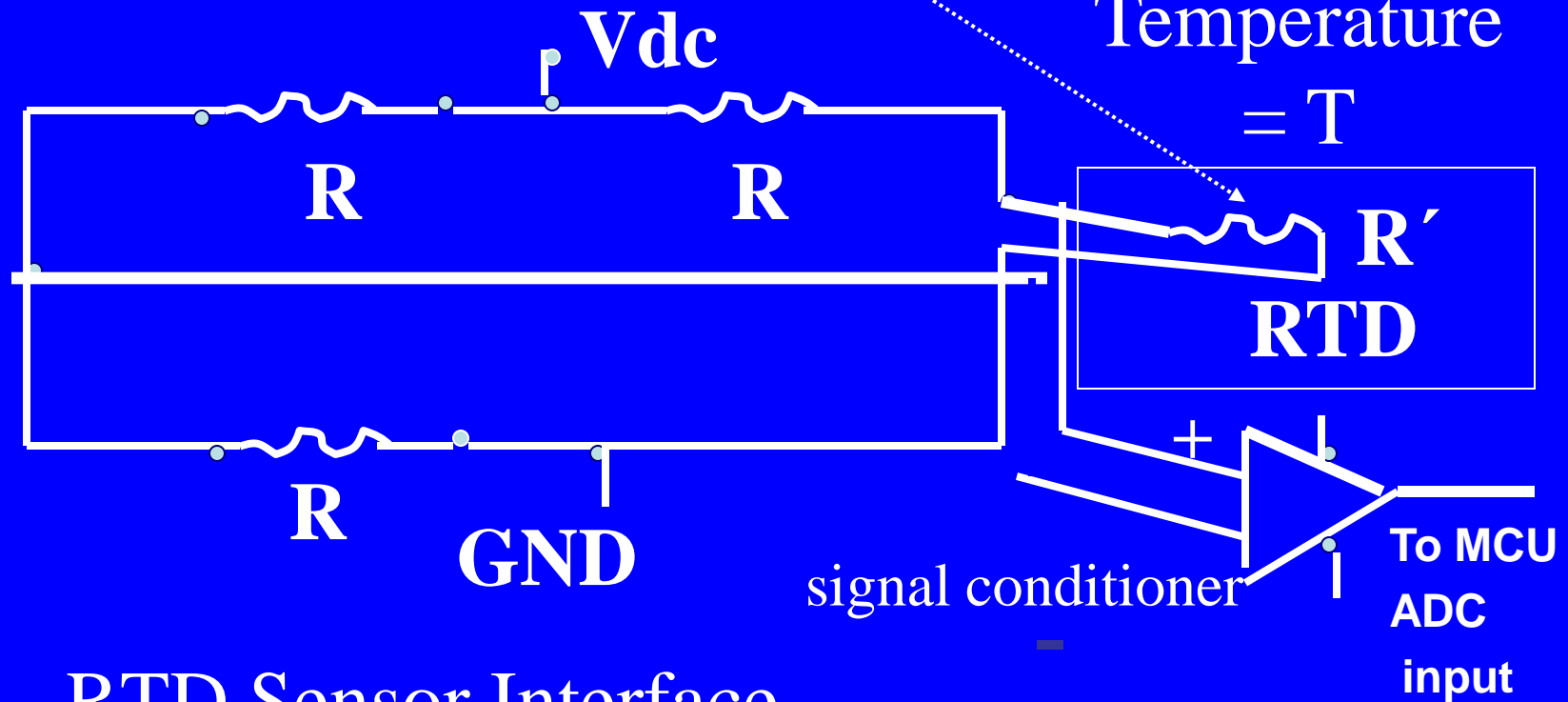Pearson Education

Whetstone Bridge

• All four arms Resistances equal when R´= 0, bridge is balanced

• Output = 0V for any analog input when bridge is balanced

Whetstone Bridge

• Assume R´ is resistance of the sensor of a physical quantity.

•All but one Resistance is equal, the output depends on the ratio of (R + R´)/R, bridge is not balanced

• Output not = 0V for a non-zero analog input when bridge is not balanced

•All Resistances are of the same order, bridge gives maximum sensitivity

RTD (Resistance change on Temperature Detector) senses temperature by resistance changes

$R' = R0[1 + \alpha_T T + \beta_T T^2]$

or $R' = R0[1 - \alpha_T T - \beta_T T^2]$

Vdc

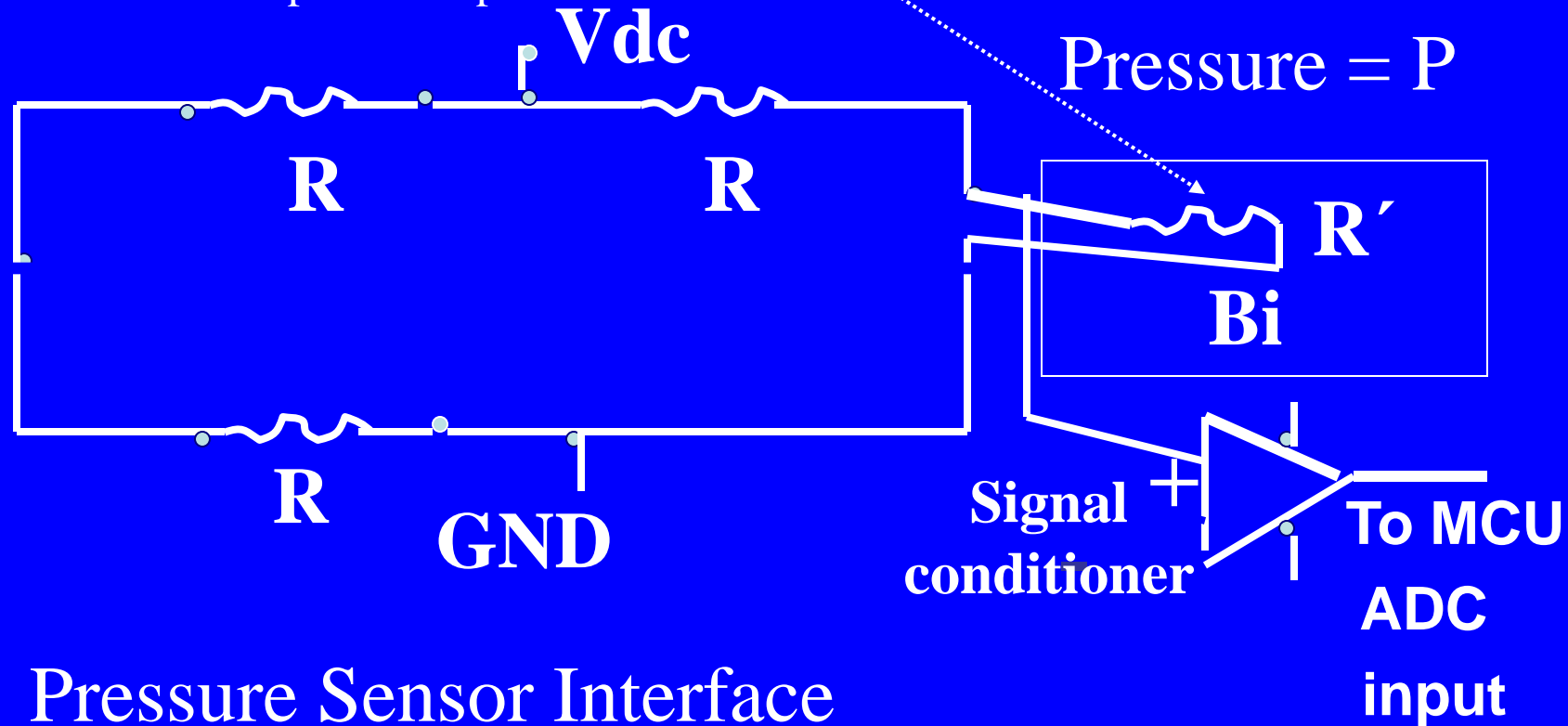**Temperature = T**

R   **R**

R'

RTD

R

GND

+

signal conditioner

To MCU ADC input

RTD Sensor Interface

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Bismuth Resistance change on Pressure Senses Pressure by resistance changes

$$P' = P0 \left[1 + \alpha_p P + \beta_p P^2 \right]$$
$$\text{or } P' = P0 \left[1 - \alpha_p P - \beta_p P^2 \right]$$

Vdc

Pressure = P

R   **R**

R'

Bi

R

GND

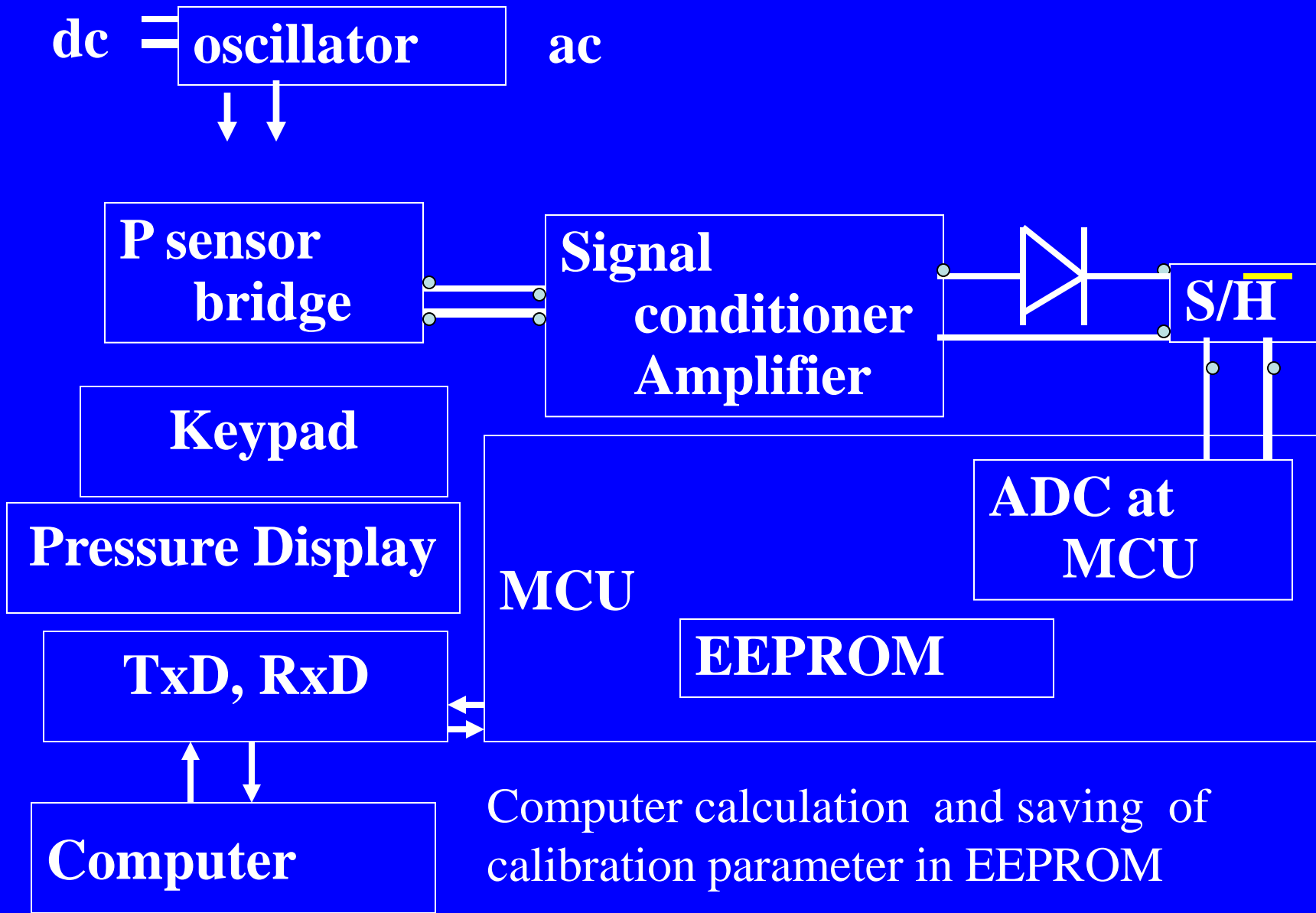**Signal conditioner**

To MCU ADC input

Pressure Sensor Interface

Signal Conditioner

• Design such that output obtained = 0 V for input to ADC when temperature or pressure is at certain minimum limiting value and ADC output is 00000000.

• For obtaining reference Voltage input V_{ref} to ADC when temperature or pressure is at certain maximum limiting value and ADC output is 11111111.

dc ═ **oscillator** ac

Temp. sensor bridge

Signal conditioner Amplifier

S/H

Keypad

ADC at MCU

Temp.Display

MCU

TxD, RxD

EEPROM

Computer

Computer calculation and saving of calibration parameter in EEPROM

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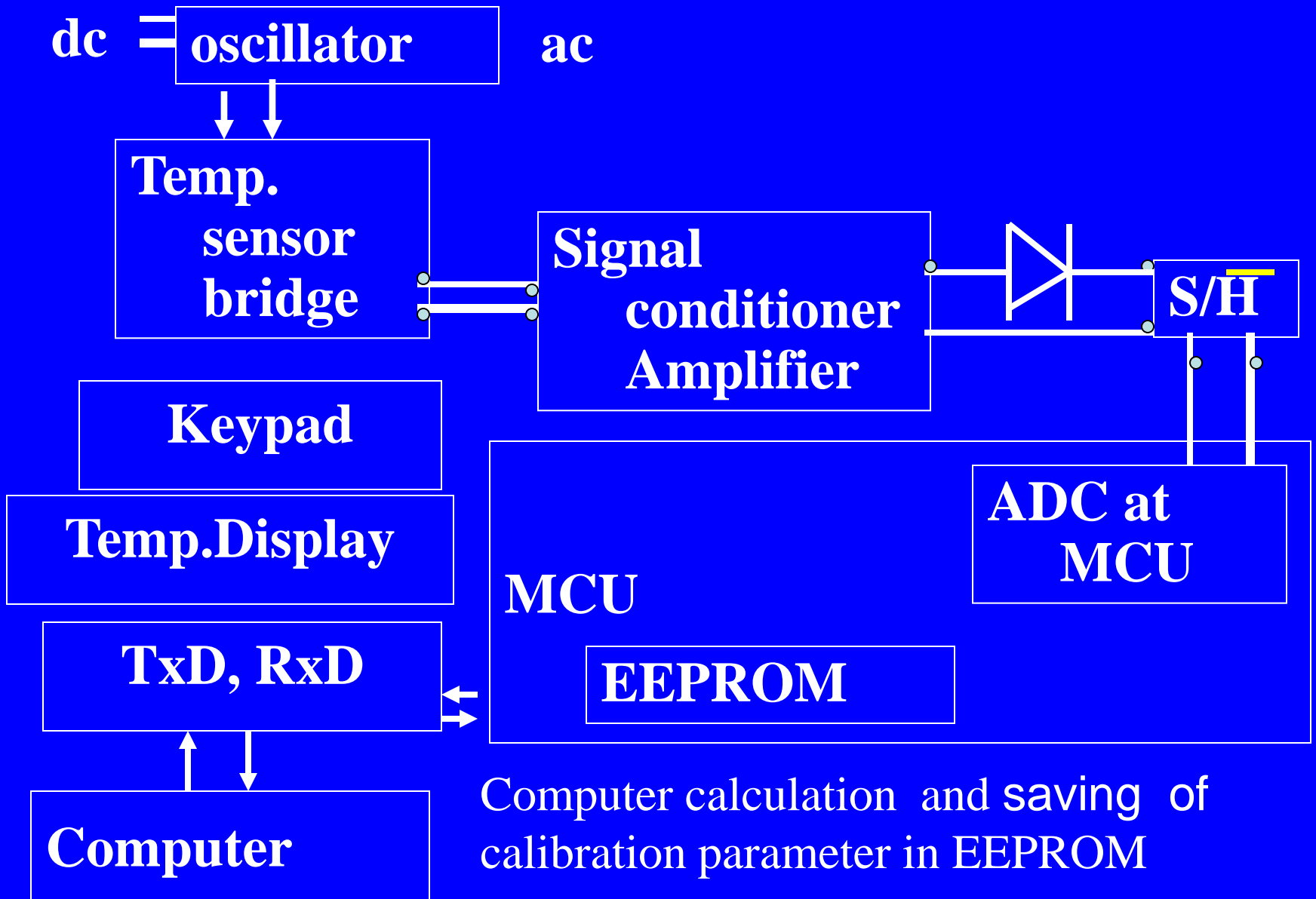
TxD and RxD Interface to Computer

• Keypad for entering the sample name, physical parameter name, time and date of measurements and other features

• Computer calculation of calibration parameters α_T and β_T, α_p and β_p and saving in EEPROM

• Periodic calculation and revision of calibration parameters and saving in EEPROM (if required)

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TxD and RxD Interface to Computer

- Computer records permanently the readings at different instances
- Computer graphical presentations for parameter as a function of time

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Summary

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We learnt

Analog Inputs from sensors

- Whetstone bridge
- Signal conditioning amplifier and S/H circuit
- MCU ADC input

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End of Lesson 11 Part a

Analog Input and Temperature and pressure measuring Interfaces