



# Thermocouple Interfacing with PIC18F4550

## Introduction

A thermocouple consists of two different conductors forming an electrical junction at different temperatures.

Due to the Thermo effect, thermocouples produce a voltage which is dependent on temperature.

Temperature can be found out from this voltage.

ADC output of this voltage can be processed by a microcontroller to give the temperature.

For more information about Thermocouple and how to use it, refer to the topic Thermocouple (<http://electronicwings.com/sensors-modules/thermocouple>) in the sensors and modules section.

For information about ADC in PIC18F4550 and how to use it, refer to the topic ADC in PIC18F4550 (<http://electronicwings.com/pic/pic18f4550-adc>) in the PIC Inside section.



Thermocouple

## Connection Diagram of Thermocouple With PIC18F4550

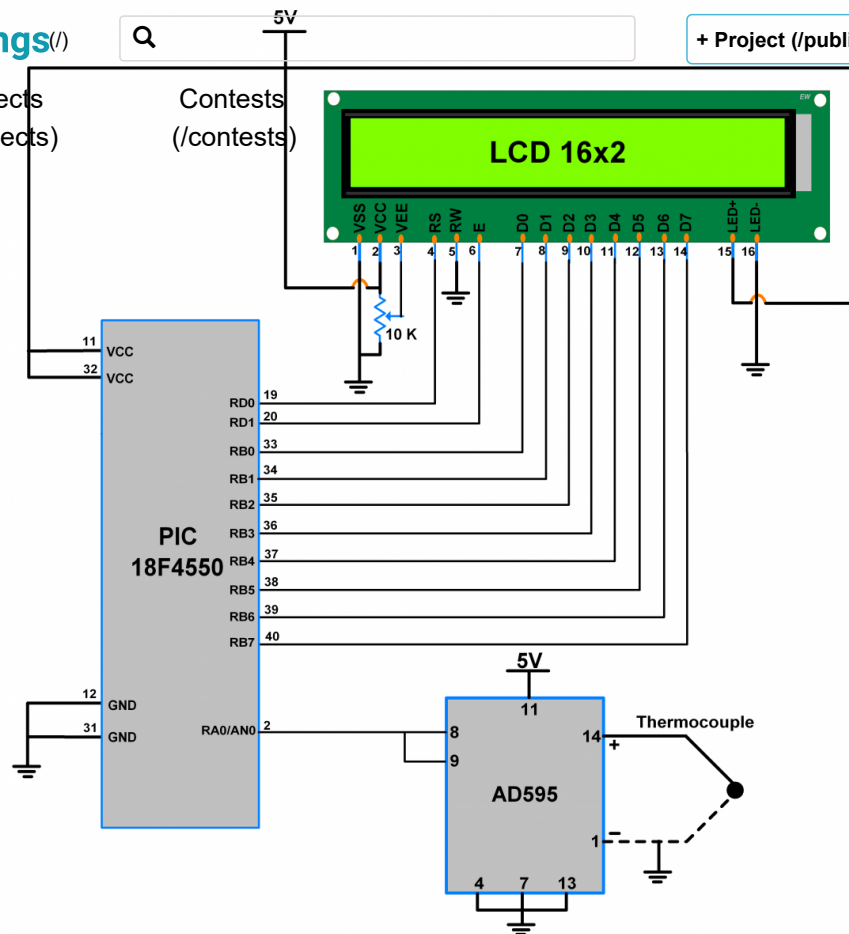
The complete interfacing diagram of the thermocouple is shown in the figure below.



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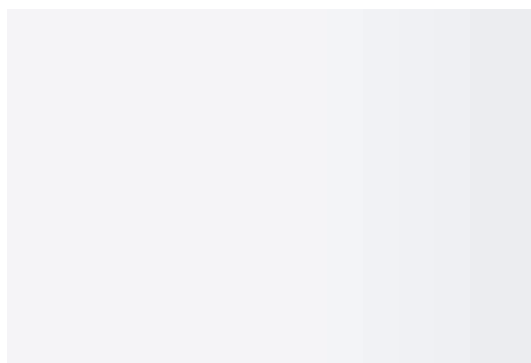
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#### AD595:

- AD595 is a complete instrumentation amplifier (Monolithic Thermocouple Amplifiers) with a Cold Junction Compensation.
- AD595 is compatible with K-type thermocouple, while AD594 is compatible with the J-type thermocouple.
- It combines ice point reference with the pre-calibrated amplifier to produce a high-level output (10mV/°C) directly from the thermocouple output.
- AD595 gain trimmed to match the transfer characteristic of the K-type thermocouple at 25°C. The output of the K-type thermocouple in this temperature range is 40.44μV/°C.
- The resulting gain for AD595 is 247.3 (10mV/°C divided by 40.44μV/°C).
- The input offset voltage for AD595 is 11μV, this offset arises because the AD595 is trimmed for a 250 mV output while applying a 25°C thermocouple input.
- The output of AD595 is,

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- The IC AD595 pin diagram is shown in the figure below.



AD595 Instrumentation Amplifier Pin Diagram

**Note:** if you connect +5 volt and ground to the AD595 you can measure the temperature 0°C to +300°C, for more information refers to AD595 datasheet.

### Programming steps for Thermocouple

#### Steps:

1. Initialize the ADC and LCD.
2. Take the data from the AD595 instrumentation amplifier.
3. Convert the ADC value into °C using below formula,

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$$= (((\text{ADC Value}) * 4.88) - 0.0027) / 10$$

**Why 0.0027 subtracted in above formula**

AD595 provides output as follows,

$$\text{AD595 Output} = (\text{Type K Voltage} + 11 \text{ uV}) \times 247.3$$

· The above formula shows AD595 provides output with amplified offset voltage. So, we must eliminate total offset voltage ( $11 \text{ uV} * 247.3$ ) to get accurate temperature value.

**Note:** 11 uV is an offset voltage of the IC AD-595 instrumentation amplifier for a K-type thermocouple.

4. Display Temperature on 16x2 LCD.

## Thermocouple code for PIC18F4550

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```
#include <pic18f4550.h>
#include <string.h>
#include <stdio.h>
#include "LCD_16x2_8-bit_Header_File.h"
#include "PIC18F4550_ADC_Header_File.h"

void main(void)
{
    OSCCON =0x72;
    LCD_Init();                /* initialize LCD16x2 */
    LCD_Clear();               /* clear LCD */
    ADC_Init();                /* initialize ADC */
    char Temperature_buffer[10];
    int Analog_Input;
    float Temperature;
    LCD_String_xy(0, 0, "Temperature");
    ...
}
```

## Video

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Q

MOUSER

+ Project components/project

(https://www.mouser.in?utm\_source=electronicswing&utm\_medium=display&utm\_campaign=mouser-componentslisting&utm\_content=0x0)

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Components Used


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AD595 THERMOCOUPLER AMPLIFIER  
AD595 THERMOCOUPLER AMPLIFIER

X 1




(https://www.mouser.com/ProductDetail/Analog-Devices/AD595ADZ?qs=NmRFExCfTkG5hTKeP7qMog%3D%3D&utm\_source=electronicswings&utm\_medium=display&utm\_campaign=mouser-componentslisting&utm\_content=0x0)




Datasheet (/components/ad595-thermocoupler-amplifier/1/datasheet)

K TypeThermocouple Glass Braid Insulated  
K TypeThermocouple Glass Braid Insulated

X 1



(https://www.mouser.com/ProductDetail/Adafruit/270?qs=GURawfaeGuACMa%252Bo9T3i3g%3D%3D&utm\_source=electronicswings&utm\_medium=display&utm\_campaign=mouser-componentslisting&utm\_content=0x0)



Datasheet (/components/k-typethermocouple-glass-braid-insulated/1/datasheet)

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# Components Used

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**PIC18f4550**  
PIC18f4550 X 1

(https://www.mouser.in/ProductDetail/Microchip-Technology/PIC18F4550-I-P?qs=oKK8NaWdAJs8nLDXBGwMXw%3D%3D&utm\_source=electronicswing&utm\_medium=display&utm\_campaign=mouser-componentslisting&utm\_content=0x0)

Datasheet (/components/pic18f4550/1/datasheet)

**LCD16x2 Display**  
LCD16x2 Display X 1

(https://www.mouser.com/ProductDetail/Adafruit/1447?qs=XAKIUOoRPe6ACImsjw7y7g%3D%3D&utm\_source=electronicswing&utm\_medium=display&utm\_campaign=mouser-componentslisting&utm\_content=0x0)

# Downloads

PIC18F4550 Thermocouple Project File

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AD595 Datasheet

[Download \(/api/download/platform-attachment/238\)](#)

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aliasx410

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2020-04-21 05:24:11

Excuse me, where does the value 4.88 come from?

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Ganimedes

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2021-05-20 05:20:41

maybe if you check the AD595's datasheet you will find the reason of that value.

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igshid=1cip10jjttko)

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