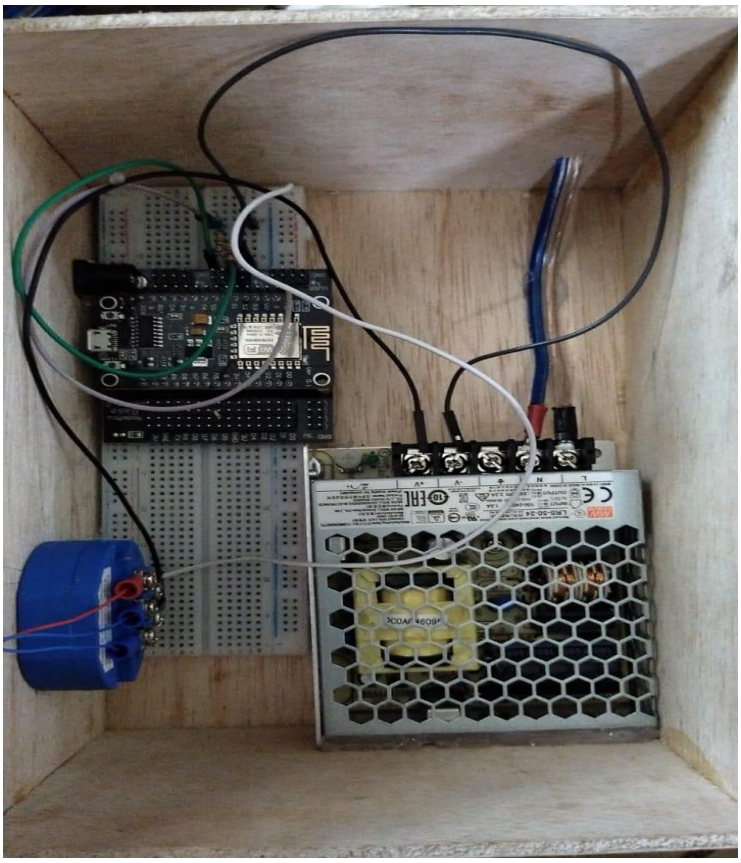
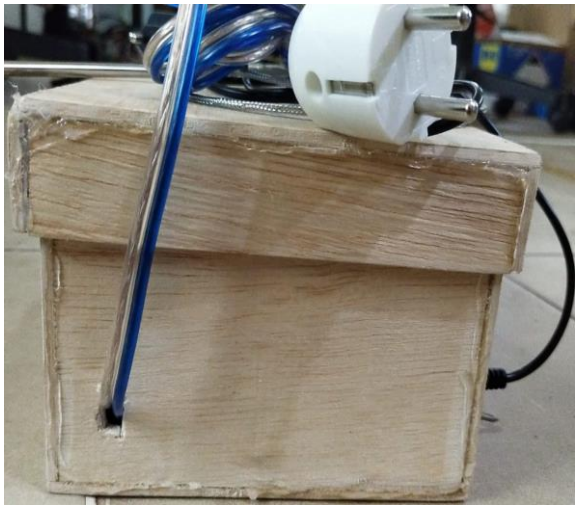
# LAMPIRAN

# Lampiran A

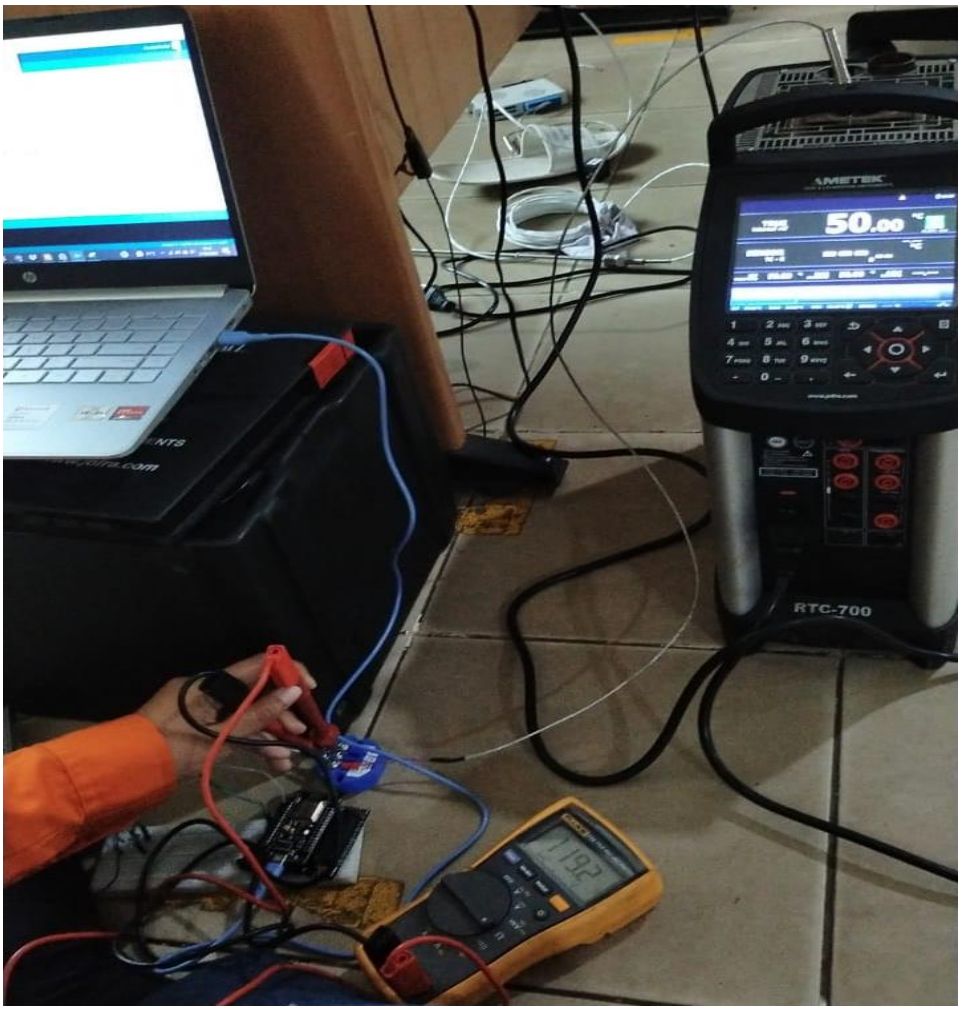
## Hasil Rancangan Hardware





## Lampiran B

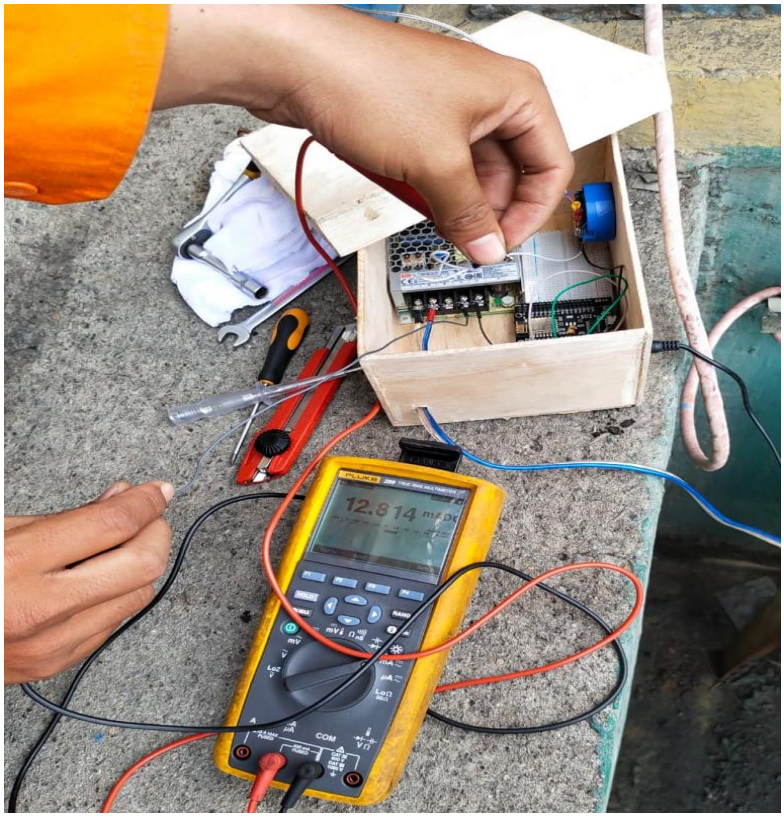
## Proses Uji Karakteristik Alat Ukur



## Lampiran C

## Proses Pengambilan Data Suhu *Induced Draft Fan*


FLUKE
289 TRUE RMS MULTI
142.47 Ω
Save
Auto Range
500 Ω
HOLD
MIN MAX
F1
F2
F3
F4
RANGE
Info


FLUKE 289
12.814 mA DC
COM

**Lampiran D**

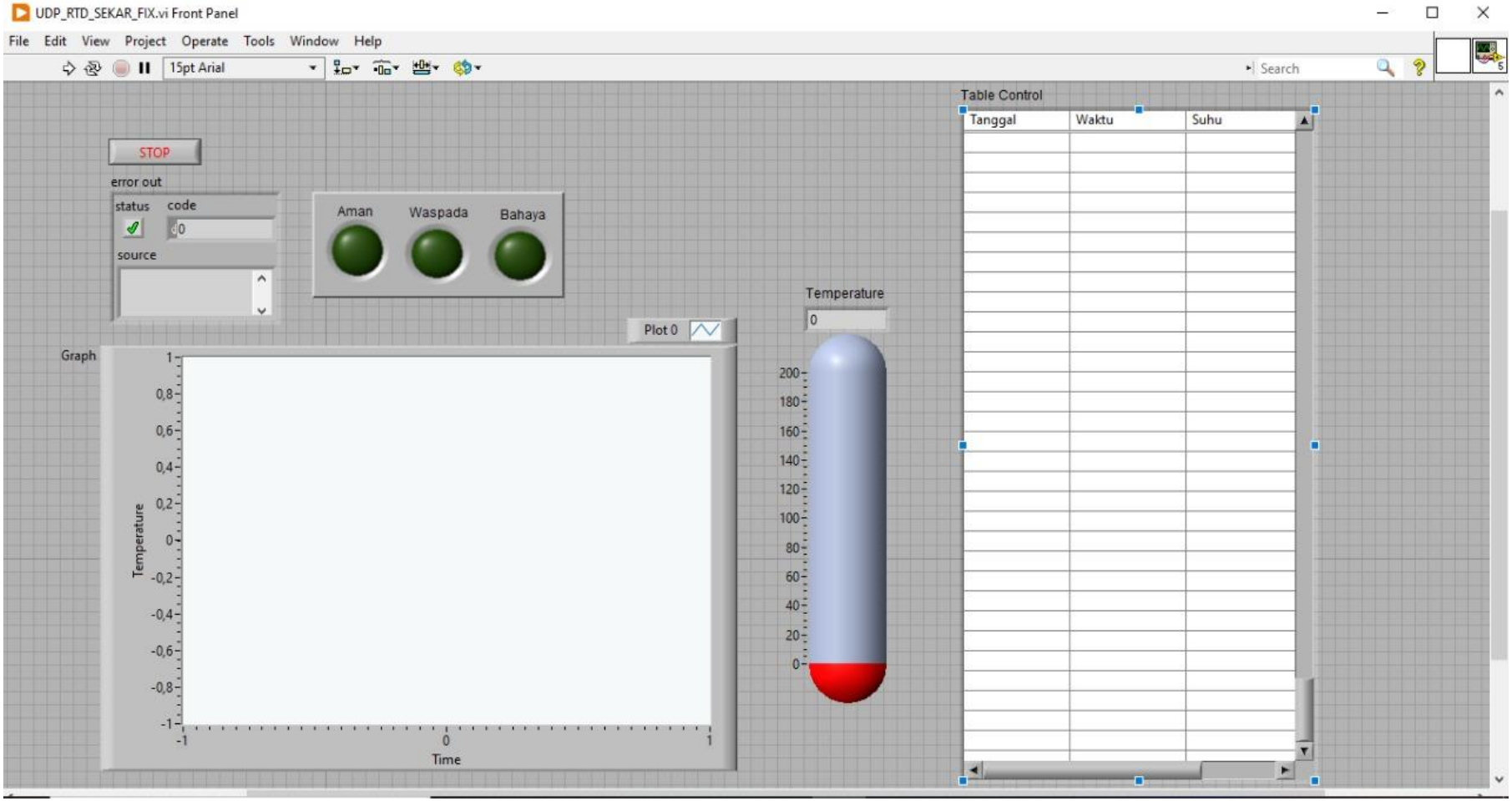
**Program Arduino IDE**

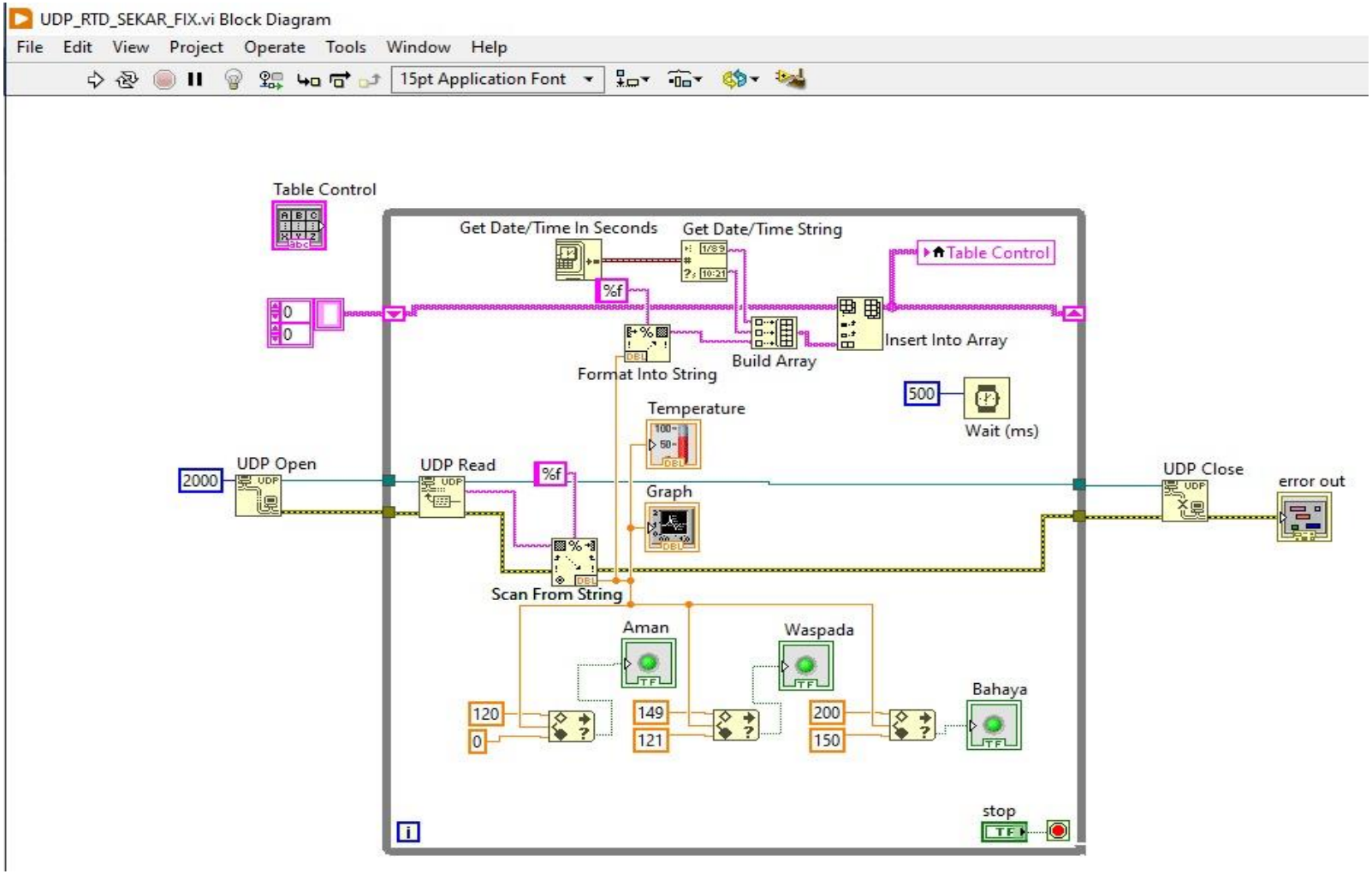
```
#include <ESP8266WiFi.h>
#include <WiFiUdp.h>
#ifndef STASSID
#define STASSID "Mimi Peri"
#define STAPSK  "1234567890"
#endif
int remotePort = 2000; //clien Device port
unsigned int localPort = 8888;// Server local port
IPAddress remoteIp(192,168,110,85);//Server Computer IP
char packetBuffer[UDP_TX_PACKET_MAX_SIZE + 1]; //buffer to
    hold incoming packet,
WiFiUDP Udp;
#define RTD A0
int RTDValue=0;
int temp=0;
float suhu=0.00;
void setup() {
  Serial.begin(115200);
  WiFi.mode(WIFI_STA);
  WiFi.begin(STASSID, STAPSK);
  while (WiFi.status() != WL_CONNECTED) {
    Serial.print('.');
    delay(500);
  }
  Serial.print("Connected! IP address: ");
  Serial.println(WiFi.localIP());
  Serial.printf("UDP server on port %d\n", localPort);
  Udp.begin(localPort);
}
void loop() {
  RTDValue=analogRead(RTD);
```

```
  Serial.println(RTDValue);
  //4mA 1V 205 0 C
  //20 mA 5V 1023 200 C
  temp=map(RTDValue,205,1023,0,200);
  suhu=temp;
  Serial.print(suhu);Serial.println("C");
  Udp.beginPacket(remoteIp,remotePort);
  Udp.print(suhu);
  Udp.print(" ");
  Udp.endPacket();
  delay(1000);
}
```

## Lampiran E

## Program Labview

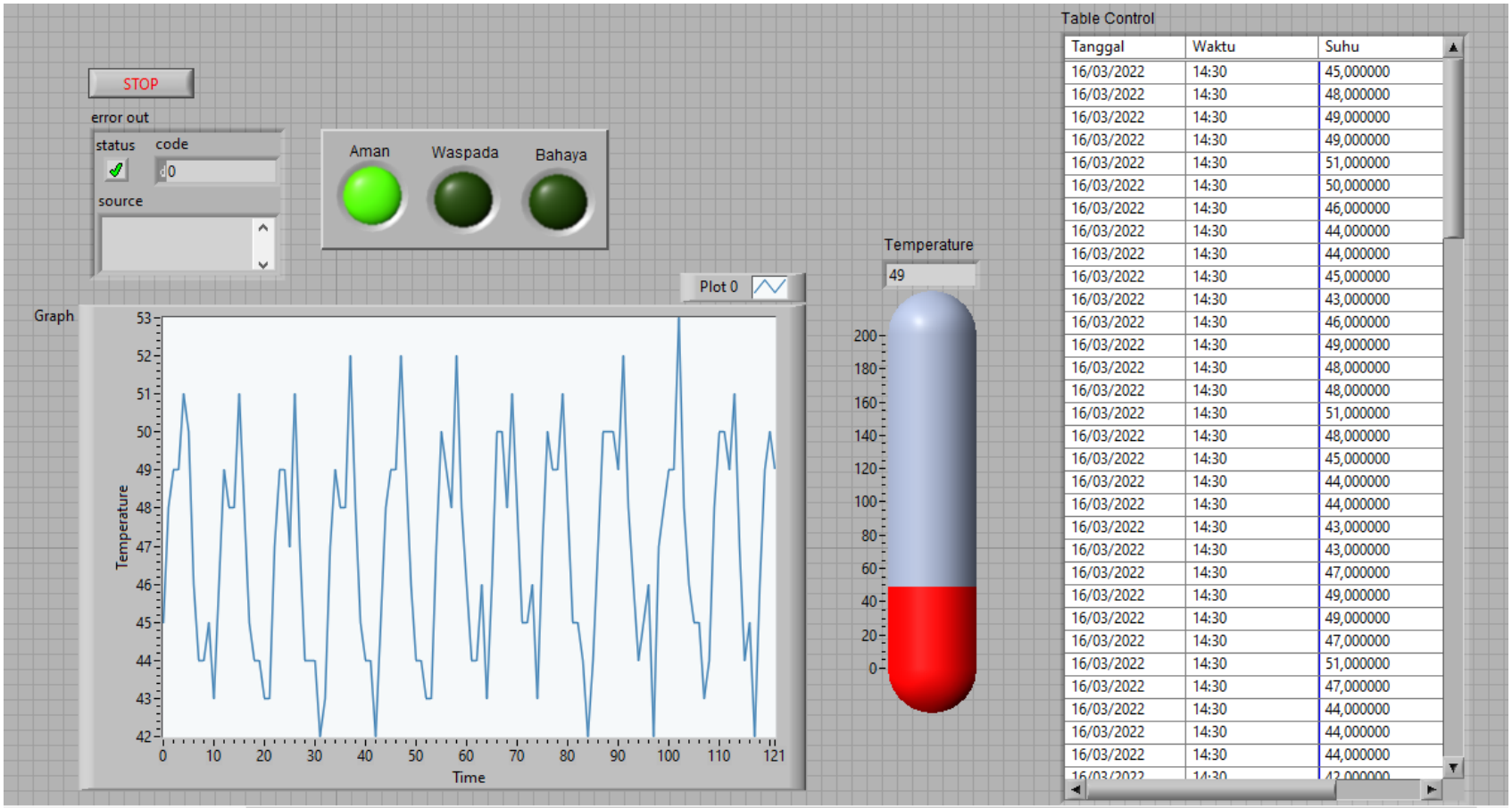



UDP_RTD_SEKAR_FIX.vi Block Diagram
File Edit View Project Operate Tools Window Help
15pt Application Font
Table Control
Get Date/Time In Seconds
Get Date/Time String
Table Control
%f
0
0
Format Into String
Build Array
Insert Into Array
500
Wait (ms)
Temperature
2000
UDP Open
UDP Read
%f
Graph
UDP Close
error out
Scan From String
Aman
Waspada
Bahaya
120
0
149
121
200
150
stop

## Lampiran F

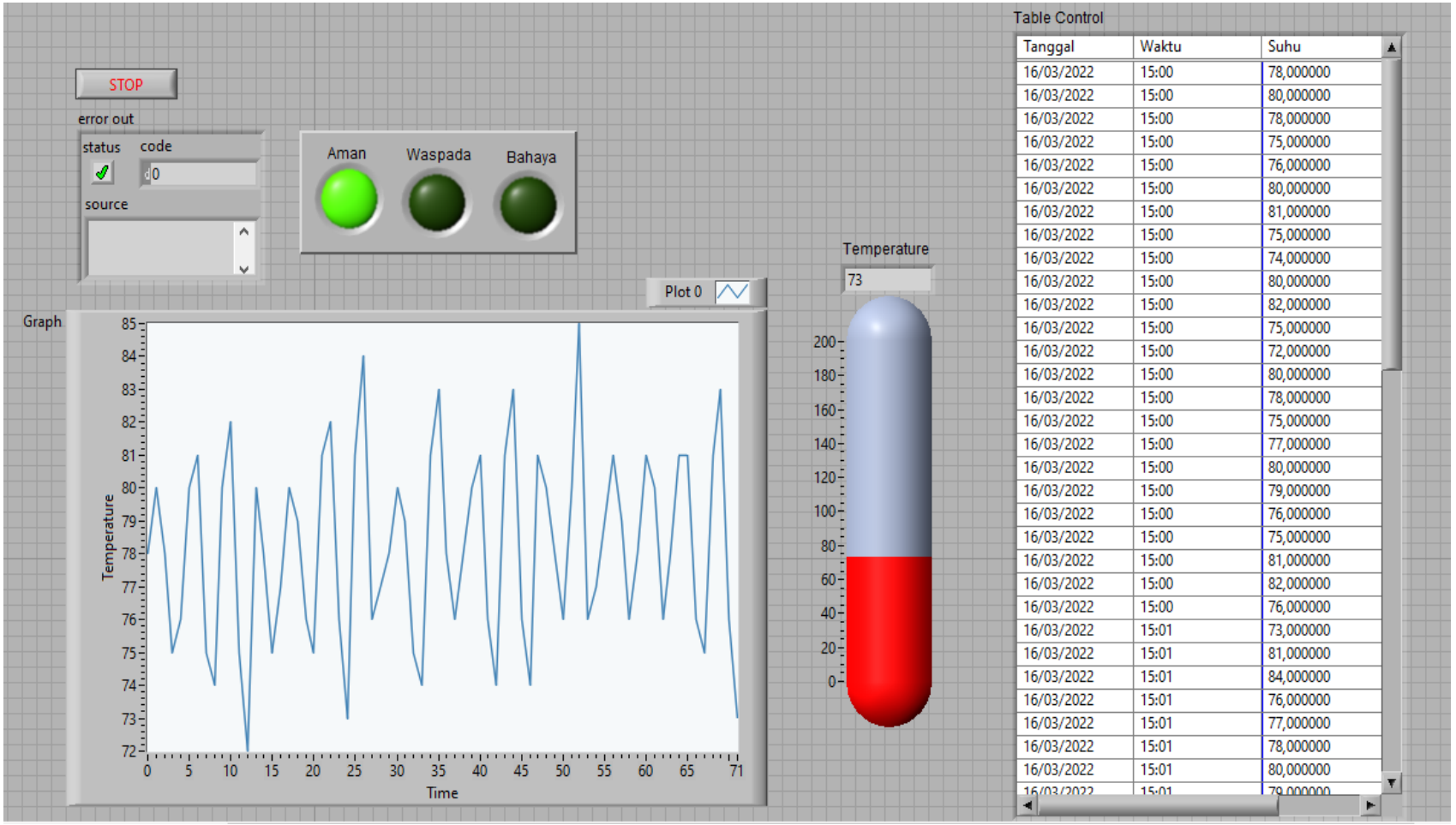
## Data Uji Karakteristik Alat Ukur Suhu

- Suhu 50 ℃




| Tanggal | Waktu | Suhu |
|---|---|---|
| 16/03/2022 | 14:30 | 45,000000 |
| 16/03/2022 | 14:30 | 48,000000 |
| 16/03/2022 | 14:30 | 49,000000 |
| 16/03/2022 | 14:30 | 49,000000 |
| 16/03/2022 | 14:30 | 51,000000 |
| 16/03/2022 | 14:30 | 50,000000 |
| 16/03/2022 | 14:30 | 46,000000 |
| 16/03/2022 | 14:30 | 44,000000 |
| 16/03/2022 | 14:30 | 44,000000 |
| 16/03/2022 | 14:30 | 45,000000 |
| 16/03/2022 | 14:30 | 43,000000 |
| 16/03/2022 | 14:30 | 46,000000 |
| 16/03/2022 | 14:30 | 49,000000 |
| 16/03/2022 | 14:30 | 48,000000 |
| 16/03/2022 | 14:30 | 48,000000 |
| 16/03/2022 | 14:30 | 51,000000 |
| 16/03/2022 | 14:30 | 48,000000 |
| 16/03/2022 | 14:30 | 45,000000 |
| 16/03/2022 | 14:30 | 44,000000 |
| 16/03/2022 | 14:30 | 44,000000 |
| 16/03/2022 | 14:30 | 43,000000 |
| 16/03/2022 | 14:30 | 43,000000 |
| 16/03/2022 | 14:30 | 47,000000 |
| 16/03/2022 | 14:30 | 49,000000 |
| 16/03/2022 | 14:30 | 49,000000 |
| 16/03/2022 | 14:30 | 47,000000 |
| 16/03/2022 | 14:30 | 51,000000 |
| 16/03/2022 | 14:30 | 47,000000 |
| 16/03/2022 | 14:30 | 44,000000 |
| 16/03/2022 | 14:30 | 44,000000 |
| 16/03/2022 | 14:30 | 44,000000 |

- Suhu 80 ℃


STOP
error out
status
code
0
source
Aman
Waspada
Bahaya
Plot 0
Graph
Temperature
Time
Temperature
73
Table Control
Tanggal
Waktu
Suhu
16/03/2022 15:00 78,000000
16/03/2022 15:00 80,000000
16/03/2022 15:00 78,000000
16/03/2022 15:00 75,000000
16/03/2022 15:00 76,000000
16/03/2022 15:00 80,000000
16/03/2022 15:00 81,000000
16/03/2022 15:00 75,000000
16/03/2022 15:00 74,000000
16/03/2022 15:00 80,000000
16/03/2022 15:00 82,000000
16/03/2022 15:00 75,000000
16/03/2022 15:00 72,000000
16/03/2022 15:00 80,000000
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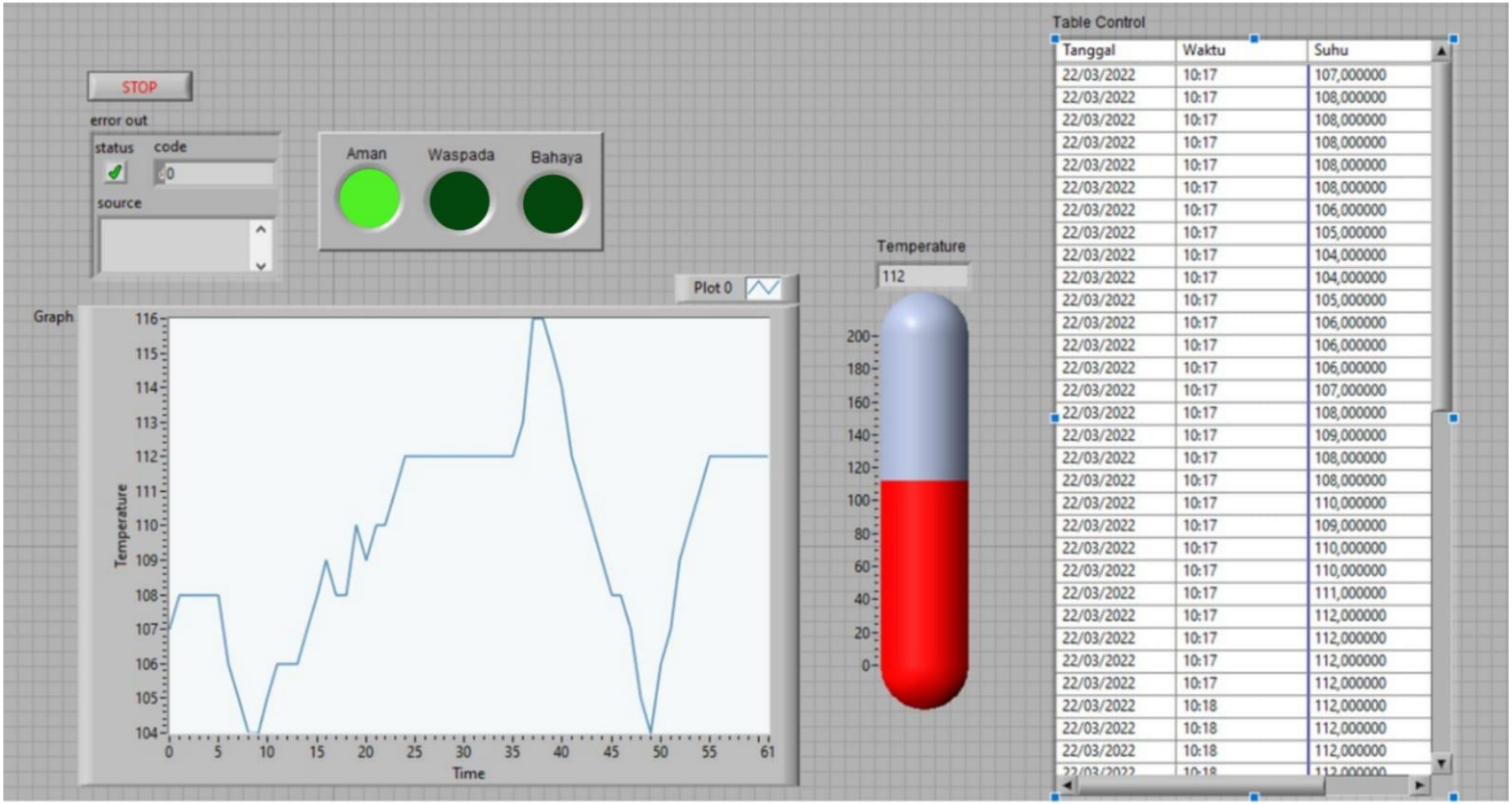
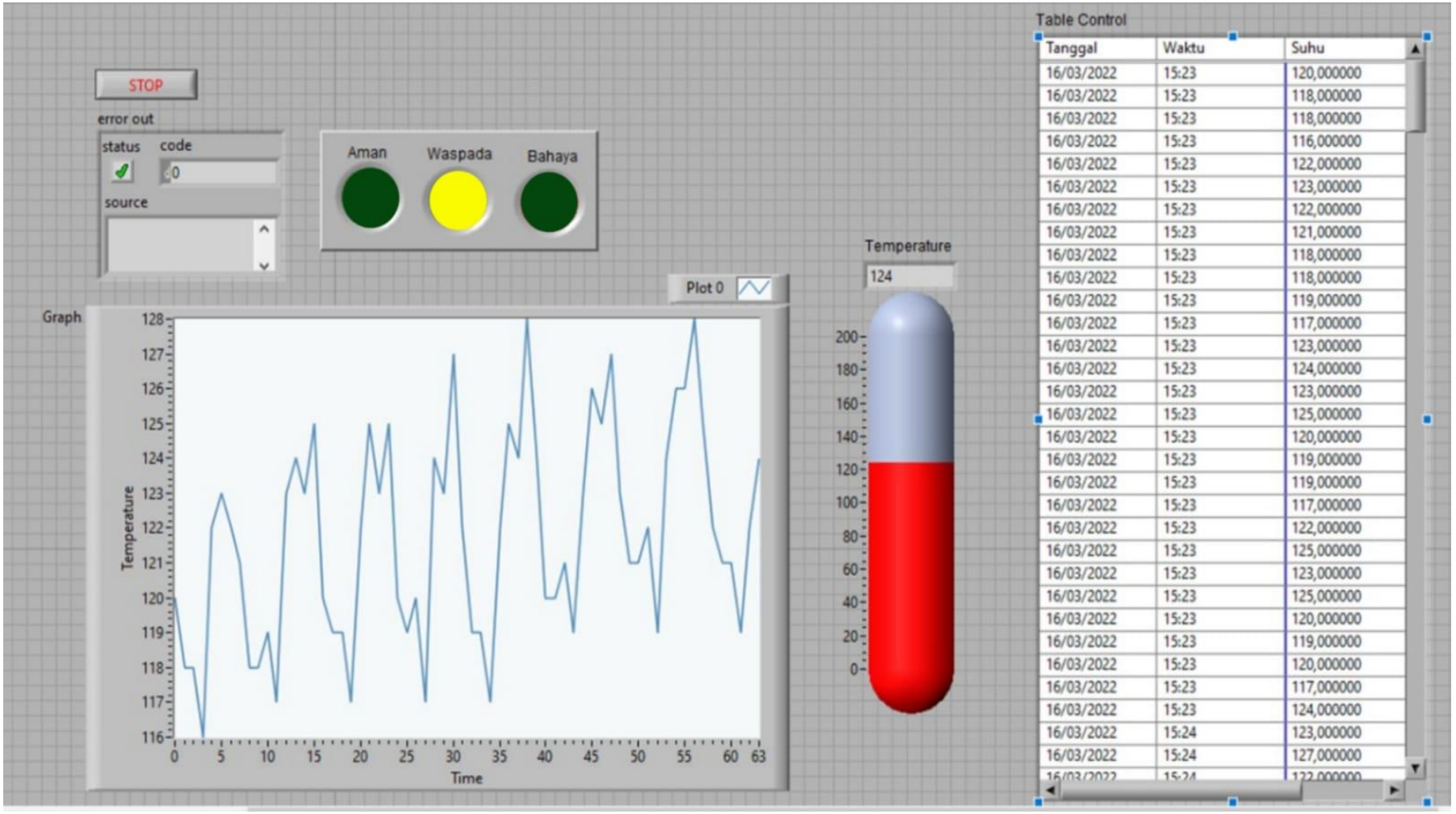
16/03/2022 15:00 77,000000
16/03/2022 15:00 80,000000
16/03/2022 15:00 79,000000
16/03/2022 15:00 76,000000
16/03/2022 15:00 75,000000
16/03/2022 15:00 81,000000
16/03/2022 15:00 82,000000
16/03/2022 15:00 76,000000
16/03/2022 15:01 73,000000
16/03/2022 15:01 81,000000
16/03/2022 15:01 84,000000
16/03/2022 15:01 76,000000
16/03/2022 15:01 77,000000
16/03/2022 15:01 78,000000
16/03/2022 15:01 80,000000

- Suhu 100 ℃




| Tanggal | Waktu | Suhu |
|---|---|---|
| 22/03/2022 | 10:17 | 107,000000 |
| 22/03/2022 | 10:17 | 108,000000 |
| 22/03/2022 | 10:17 | 108,000000 |
| 22/03/2022 | 10:17 | 108,000000 |
| 22/03/2022 | 10:17 | 108,000000 |
| 22/03/2022 | 10:17 | 108,000000 |
| 22/03/2022 | 10:17 | 106,000000 |
| 22/03/2022 | 10:17 | 105,000000 |
| 22/03/2022 | 10:17 | 104,000000 |
| 22/03/2022 | 10:17 | 104,000000 |
| 22/03/2022 | 10:17 | 105,000000 |
| 22/03/2022 | 10:17 | 106,000000 |
| 22/03/2022 | 10:17 | 106,000000 |
| 22/03/2022 | 10:17 | 106,000000 |
| 22/03/2022 | 10:17 | 107,000000 |
| 22/03/2022 | 10:17 | 108,000000 |
| 22/03/2022 | 10:17 | 109,000000 |
| 22/03/2022 | 10:17 | 108,000000 |
| 22/03/2022 | 10:17 | 108,000000 |
| 22/03/2022 | 10:17 | 110,000000 |
| 22/03/2022 | 10:17 | 109,000000 |
| 22/03/2022 | 10:17 | 110,000000 |
| 22/03/2022 | 10:17 | 110,000000 |
| 22/03/2022 | 10:17 | 111,000000 |
| 22/03/2022 | 10:17 | 112,000000 |
| 22/03/2022 | 10:17 | 112,000000 |
| 22/03/2022 | 10:17 | 112,000000 |
| 22/03/2022 | 10:17 | 112,000000 |
| 22/03/2022 | 10:18 | 112,000000 |
| 22/03/2022 | 10:18 | 112,000000 |
| 22/03/2022 | 10:18 | 112,000000 |

- Suhu 120 ℃


STOP
error out
status
code
0
source
Aman
Waspada
Bahaya
Graph
Plot 0
Temperature
Time
Temperature
124
Table Control
Tanggal
Waktu
Suhu
16/03/2022 15:23 120,000000
16/03/2022 15:23 118,000000
16/03/2022 15:23 118,000000
16/03/2022 15:23 116,000000
16/03/2022 15:23 122,000000
16/03/2022 15:23 123,000000
16/03/2022 15:23 122,000000
16/03/2022 15:23 121,000000
16/03/2022 15:23 118,000000
16/03/2022 15:23 118,000000
16/03/2022 15:23 119,000000
16/03/2022 15:23 117,000000
16/03/2022 15:23 123,000000
16/03/2022 15:23 124,000000
16/03/2022 15:23 123,000000
16/03/2022 15:23 125,000000
16/03/2022 15:23 120,000000
16/03/2022 15:23 119,000000
16/03/2022 15:23 119,000000
16/03/2022 15:23 117,000000
16/03/2022 15:23 122,000000
16/03/2022 15:23 125,000000
16/03/2022 15:23 123,000000
16/03/2022 15:23 125,000000
16/03/2022 15:23 120,000000
16/03/2022 15:23 119,000000
16/03/2022 15:23 120,000000
16/03/2022 15:23 117,000000
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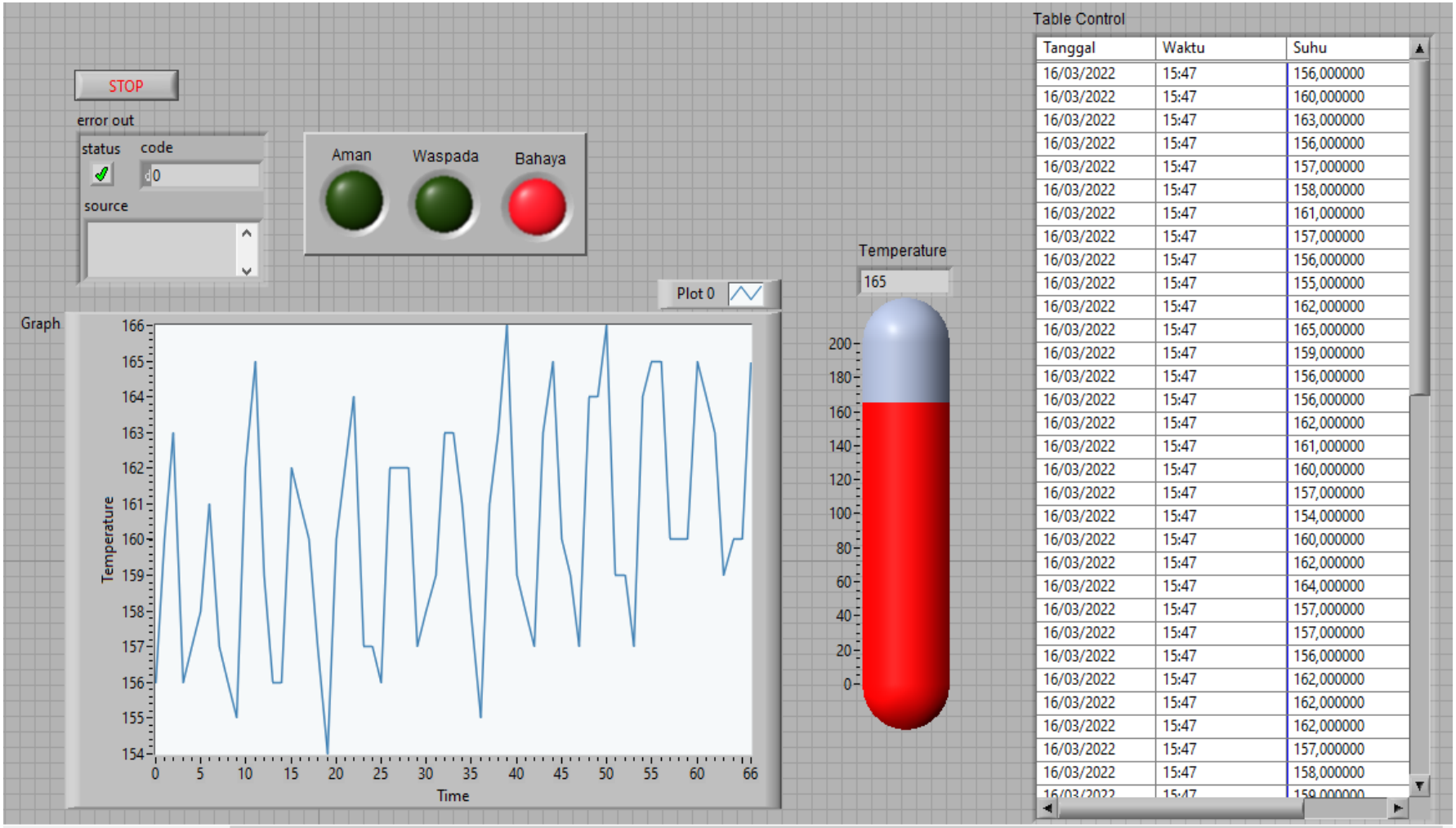
16/03/2022 15:24 127,000000

- Suhu 150 ℃


STOP
error out
status
code
0
source
Aman
Waspada
Bahaya
Plot 0
Graph
Temperature
Time
Temperature
165
Table Control
Tanggal
Waktu
Suhu
16/03/2022 15:47 156,000000
16/03/2022 15:47 160,000000
16/03/2022 15:47 163,000000
16/03/2022 15:47 156,000000
16/03/2022 15:47 157,000000
16/03/2022 15:47 158,000000
16/03/2022 15:47 161,000000
16/03/2022 15:47 157,000000
16/03/2022 15:47 156,000000
16/03/2022 15:47 155,000000
16/03/2022 15:47 162,000000
16/03/2022 15:47 165,000000
16/03/2022 15:47 159,000000
16/03/2022 15:47 156,000000
16/03/2022 15:47 156,000000
16/03/2022 15:47 162,000000
16/03/2022 15:47 161,000000
16/03/2022 15:47 160,000000
16/03/2022 15:47 157,000000
16/03/2022 15:47 154,000000
16/03/2022 15:47 160,000000
16/03/2022 15:47 162,000000
16/03/2022 15:47 164,000000
16/03/2022 15:47 157,000000
16/03/2022 15:47 157,000000
16/03/2022 15:47 156,000000
16/03/2022 15:47 162,000000
16/03/2022 15:47 162,000000
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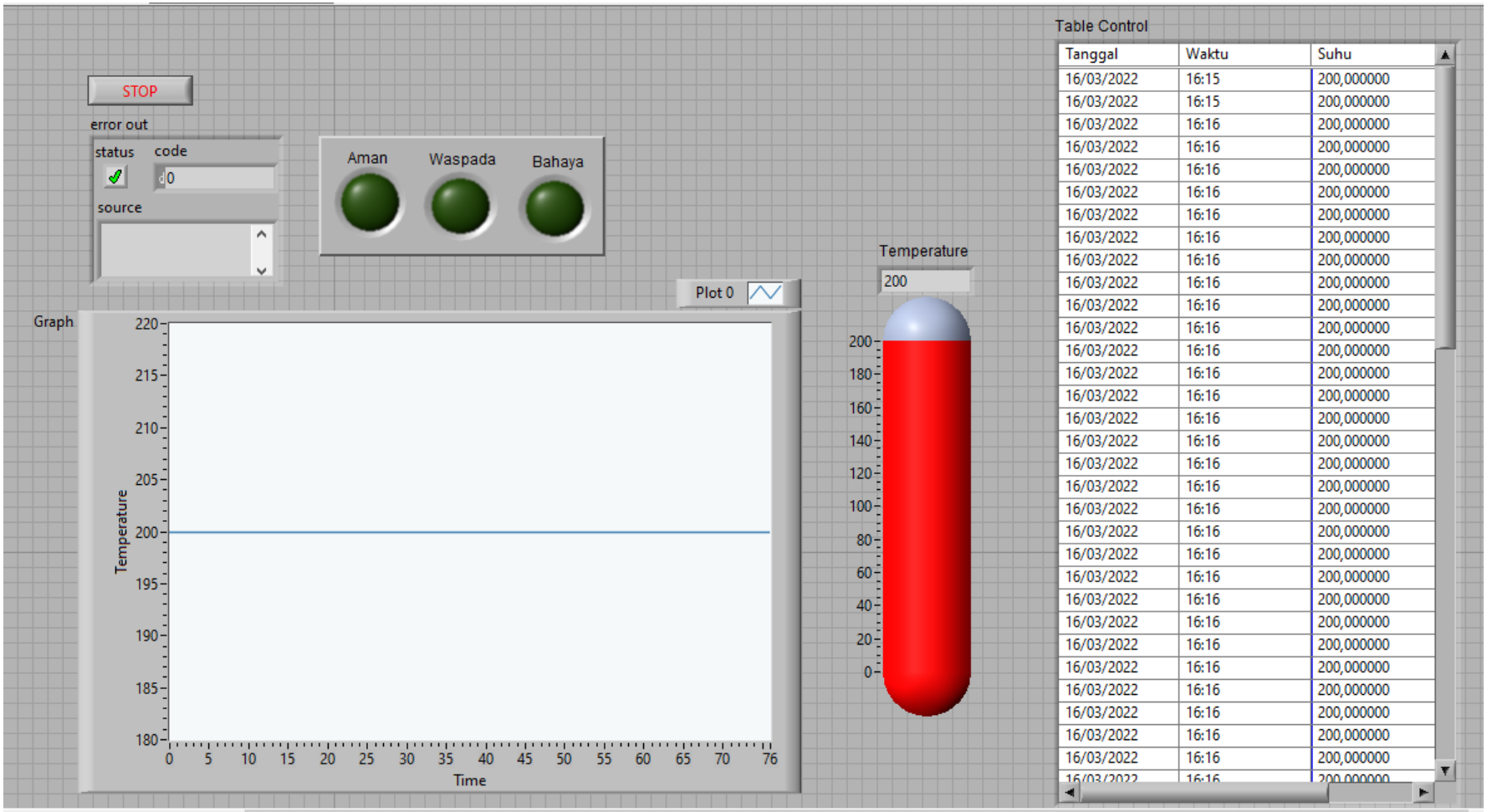
16/03/2022 15:47 158,000000

- Suhu 180 ℃


STOP
error out
status
code
0
source
Aman
Waspada
Bahaya
Plot 0
Graph
Temperature
Time
220
215
210
205
200
195
190
185
180
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 76
Temperature
200
200
180
160
140
120
100
80
60
40
20
0
Table Control
Tanggal
Waktu
Suhu
16/03/2022 16:15 200,000000
16/03/2022 16:15 200,000000
16/03/2022 16:16 200,000000
16/03/2022 16:16 200,000000
16/03/2022 16:16 200,000000
16/03/2022 16:16 200,000000
16/03/2022 16:16 200,000000
16/03/2022 16:16 200,000000
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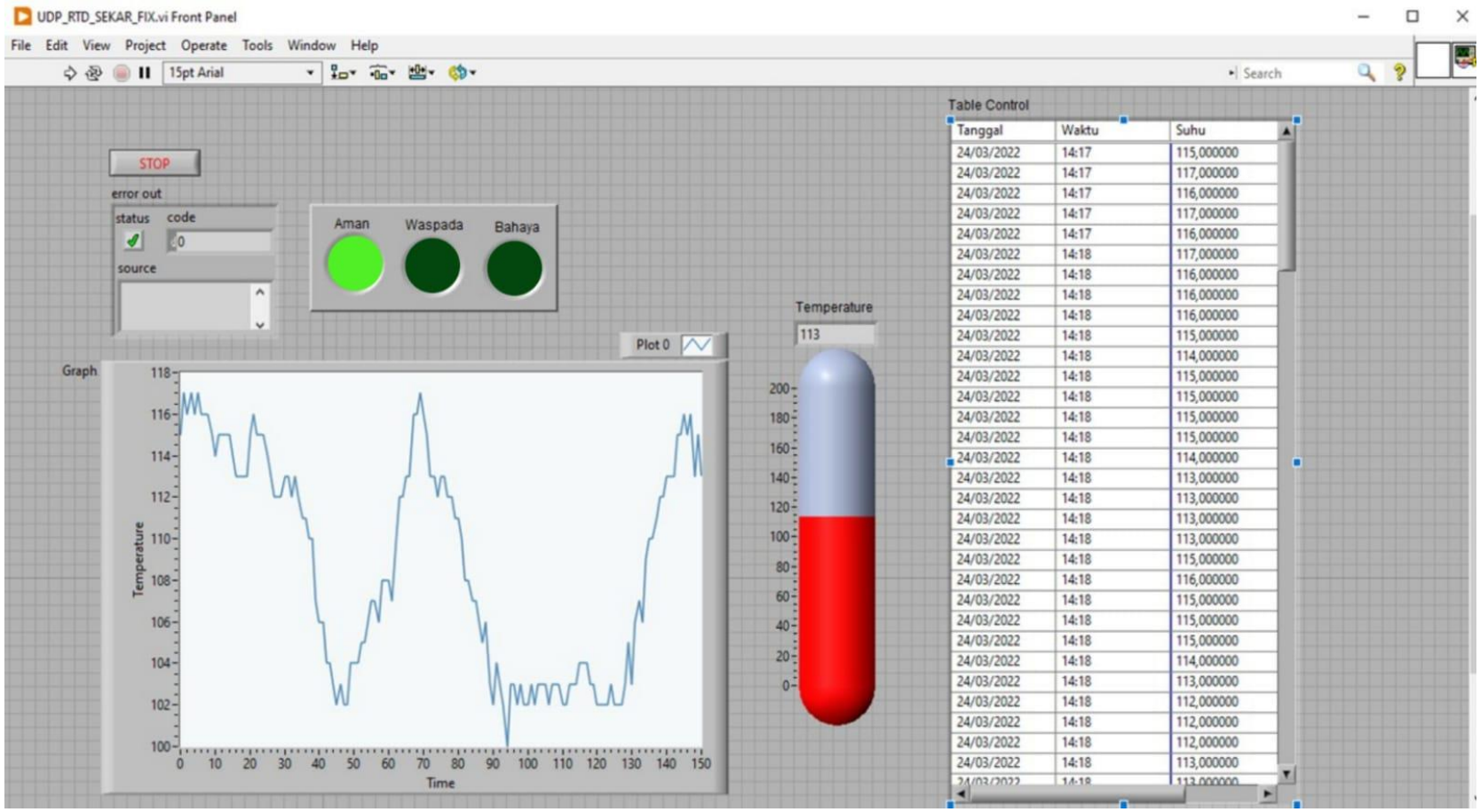
16/03/2022 16:16 200,000000
16/03/2022 16:16 200,000000
16/03/2022 16:16 200,000000
16/03/2022 16:16 200,000000
16/03/2022 16:16 200,000000

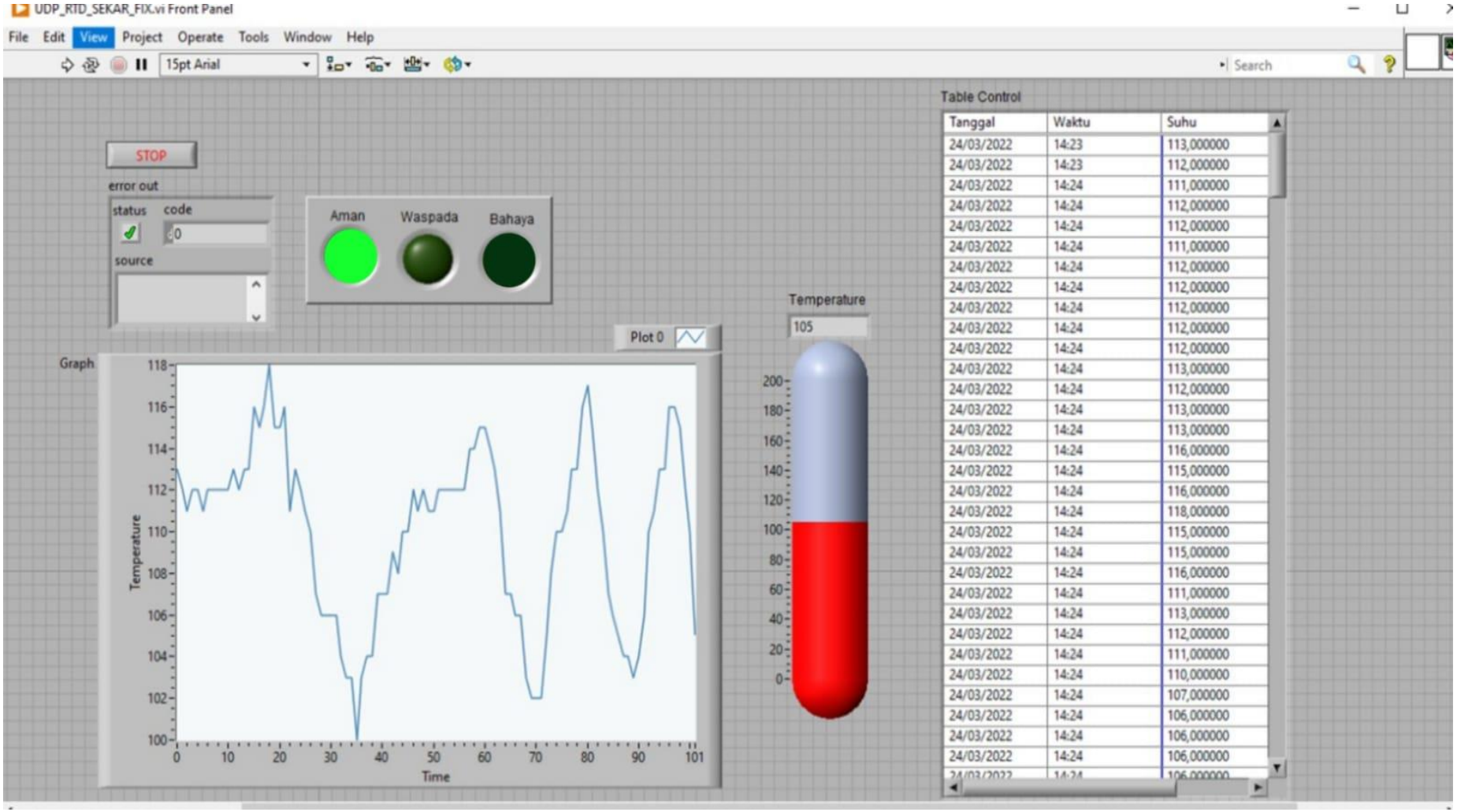
**Lampiran G**

**Data Suhu *Induced Draft Fan* berdasarkan Jangkauan Wifi**

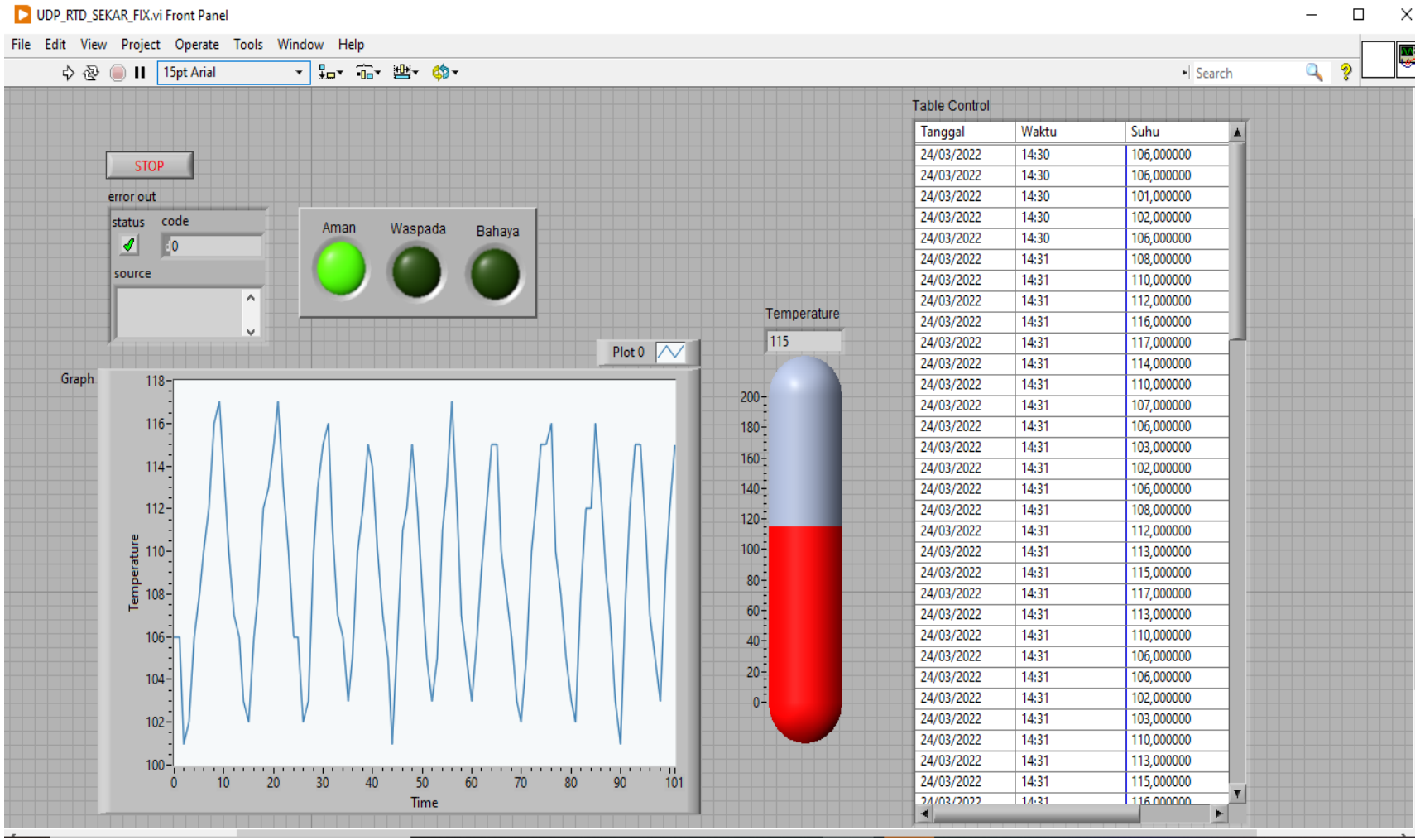
- Jarak 10 meter



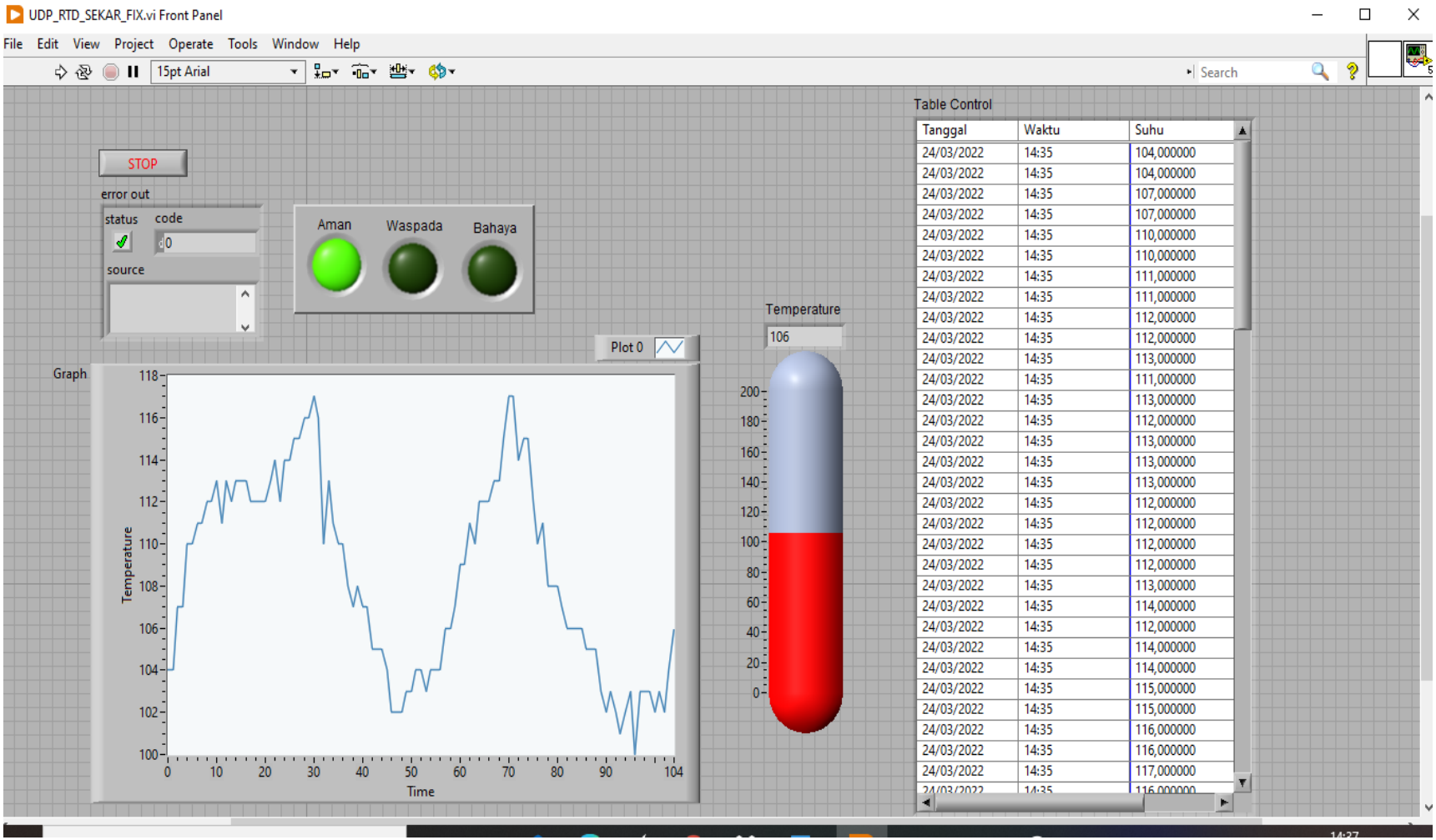
- Jarak 20 meter



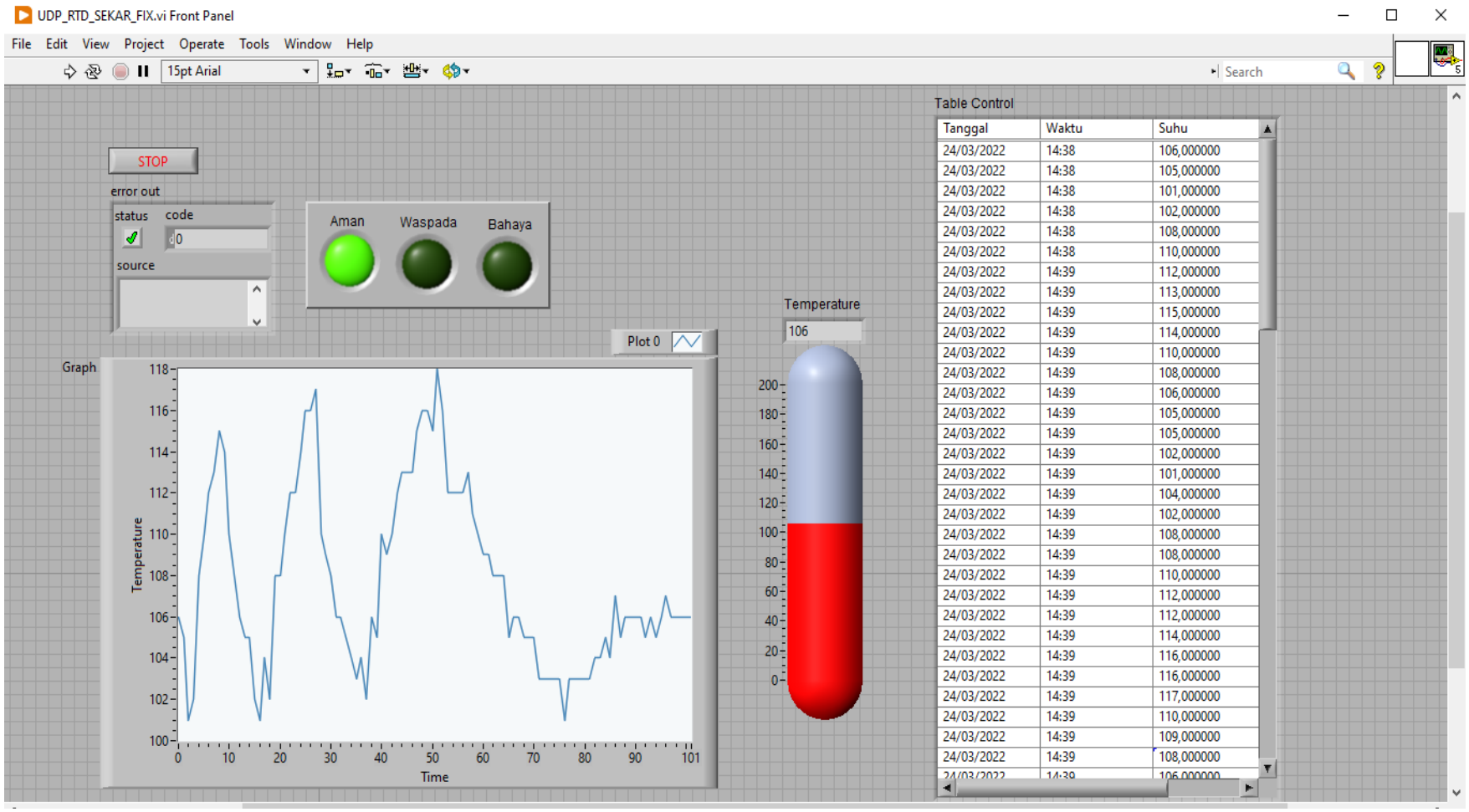
- Jarak 30 meter



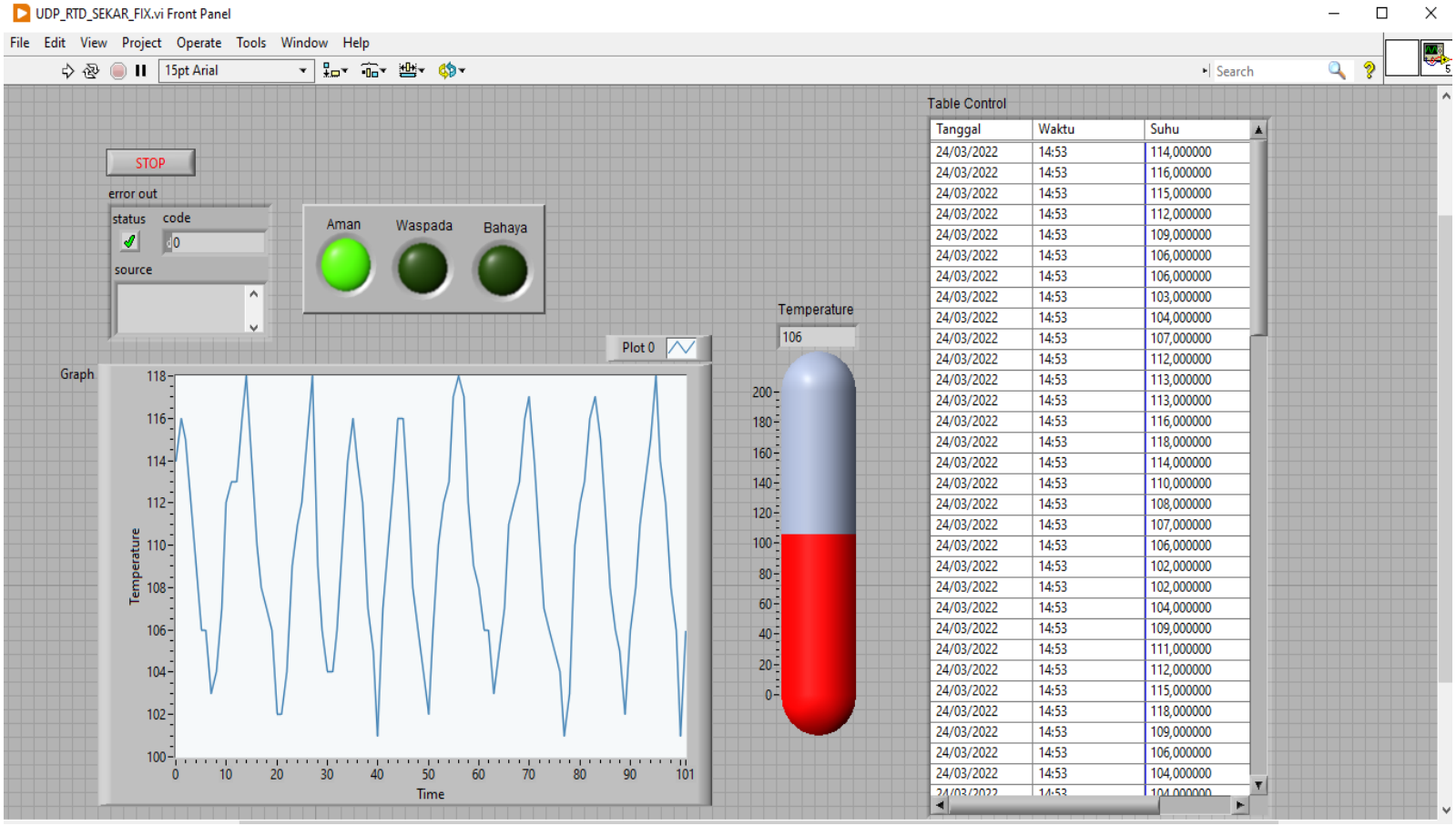
- Jarak 40 meter



- Jarak 50 meter



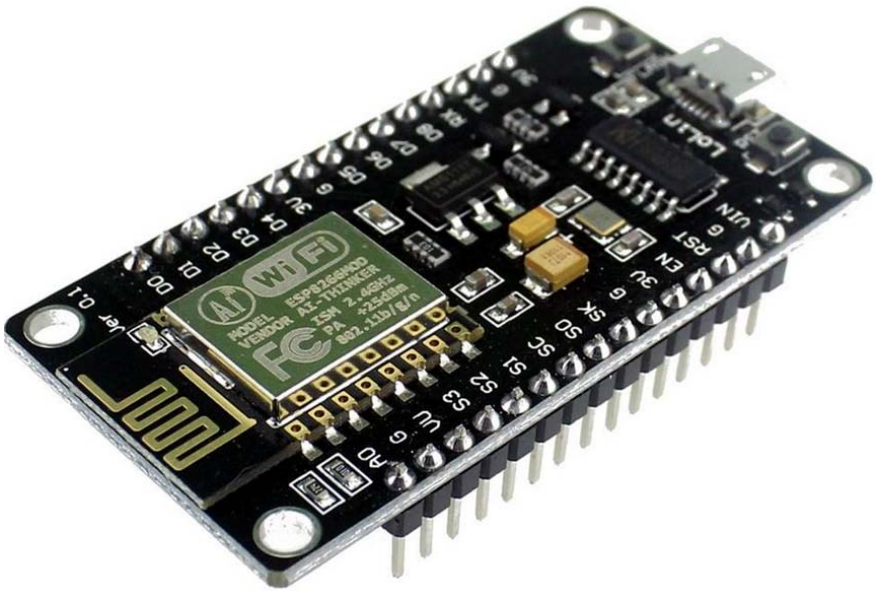
- Jarak 80 meter



# Handson Technology

**User Manual V1.2**

# ESP8266 NodeMCU WiFi Devkit



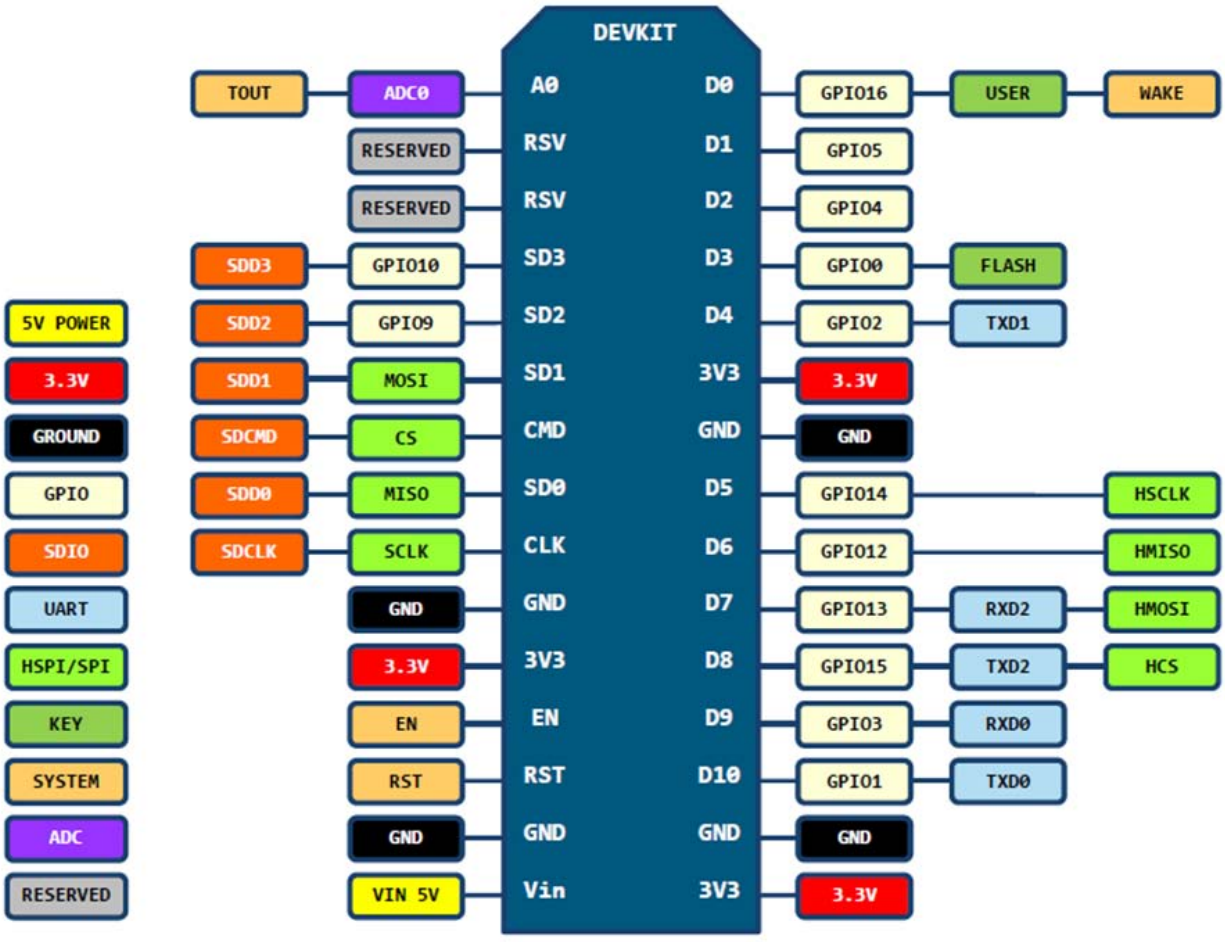
The ESP8266 is the name of a micro controller designed by Espressif Systems. The ESP8266 itself is a self-contained WiFi networking solution offering as a bridge from existing micro controller to WiFi and is also capable of running self-contained applications.

This module comes with a built in USB connector and a rich assortment of pin-outs. With a micro USB cable, you can connect NodeMCU devkit to your laptop and flash it without any trouble, just like Arduino. It is also immediately breadboard friendly.

## 1. Specification:

- Voltage:3.3V.
- Wi-Fi Direct (P2P), soft-AP.
- Current consumption: 10uA~170mA.
- Flash memory attachable: 16MB max (512K normal).
- Integrated TCP/IP protocol stack.
- Processor: Tensilica L106 32-bit.
- Processor speed: 80~160MHz.
- RAM: 32K + 80K.
- GPIOs: 17 (multiplexed with other functions).
- Analog to Digital: 1 input with 1024 step resolution.
- +19.5dBm output power in 802.11b mode
- 802.11 support: b/g/n.
- Maximum concurrent TCP connections: 5.

## 2. Pin Definition:




*D0(GPIO16) can only be used as gpio read/write, no interrupt supported, no pwm/i2c/ow supported.*

## 3. Using Arduino IDE

The most basic way to use the ESP8266 module is to use serial commands, as the chip is basically a WiFi/Serial transceiver. However, this is not convenient. What we recommend is using the very cool Arduino ESP8266 project, which is a modified version of the Arduino IDE that you need to install on your computer. This makes it very convenient to use the ESP8266 chip as we will be using the well-known Arduino IDE. Following the below step to install ESP8266 library to work in Arduino IDE environment.

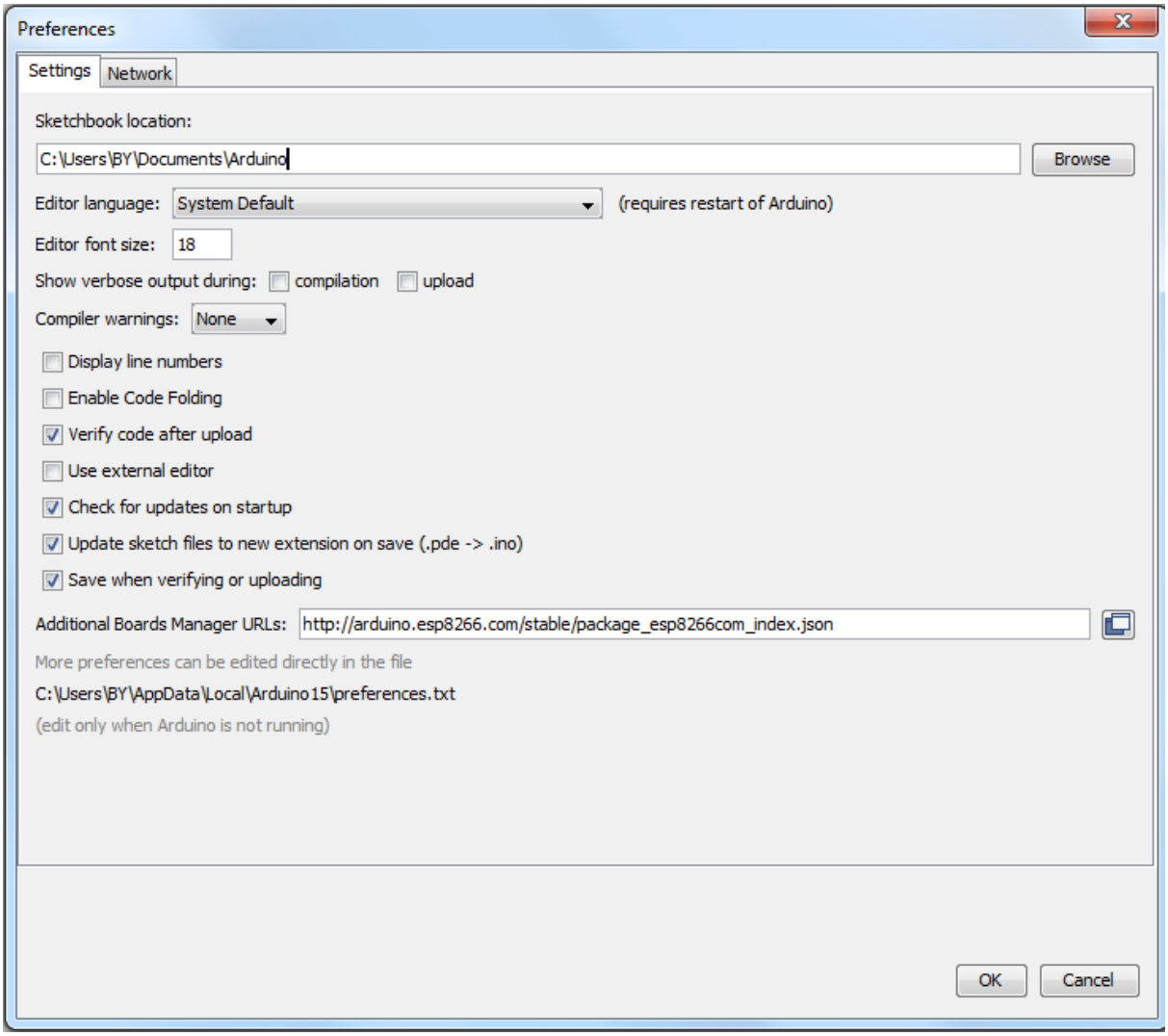
## 3.1 Install the Arduino IDE 1.6.4 or greater

Download Arduino IDE from Arduino.cc (1.6.4 or greater) - don't use 1.6.2 or lower version! You can use your existing IDE if you have already installed it.

You can also try downloading the ready-to-go package from the ESP8266-Arduino project, if the proxy is giving you problems.

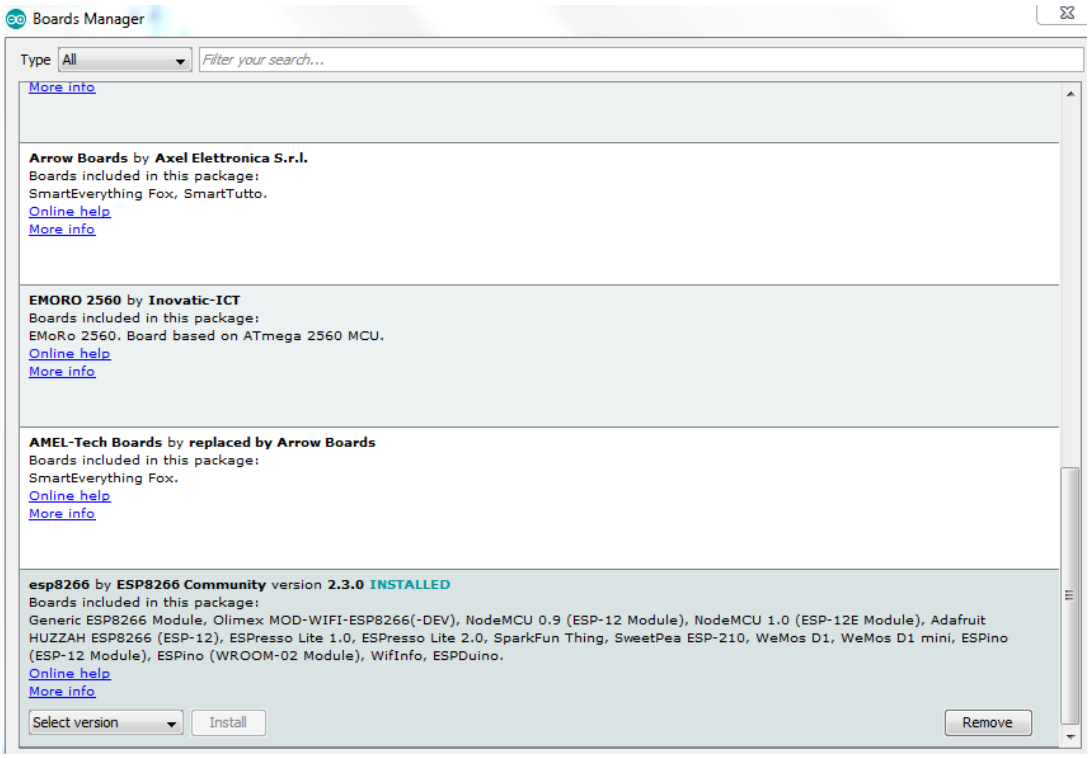
## 3.2 Install the ESP8266 Board Package

Enter ***http://arduino.esp8266.com/stable/package_esp8266com_index.json*** into *Additional Board Manager URLs* field in the Arduino v1.6.4+ preferences.




Click 'File' -> 'Preferences' to access this panel.

Next, use the Board manager to install the ESP8266 package.

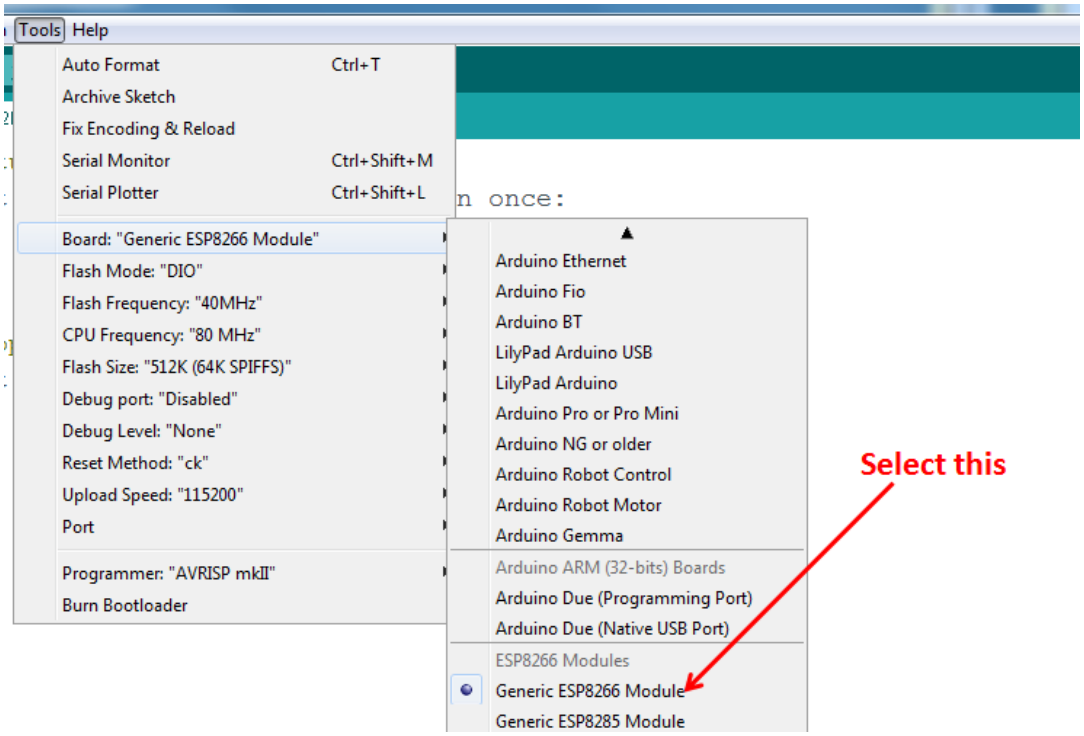



Click 'Tools' -> 'Board:' -> 'Board Manager…' to access this panel.

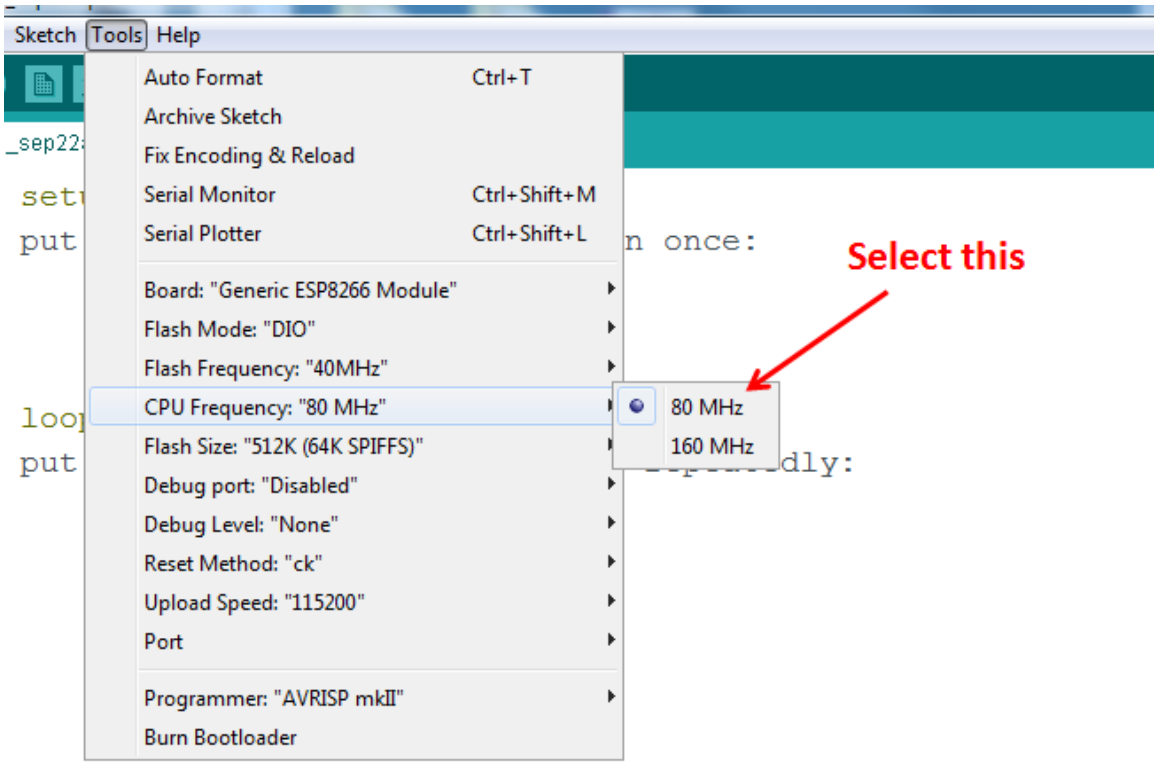
Scroll down to ' esp8266 by ESP8266 Community ' and click "Install" button to install the ESP8266 library package. Once installation completed, close and re-open Arduino IDE for ESP8266 library to take effect.

## 3.3 Setup ESP8266 Support

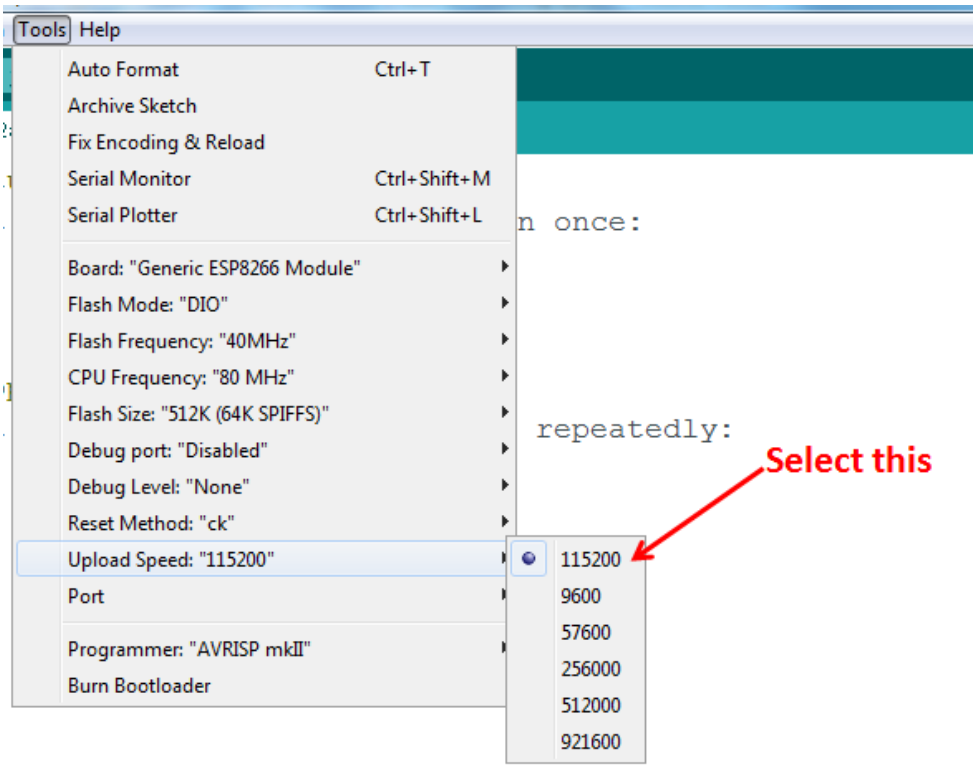
When you've restarted Arduino IDE, select 'Generic ESP8266 Module' from the 'Tools' -> 'Board:' dropdown menu.



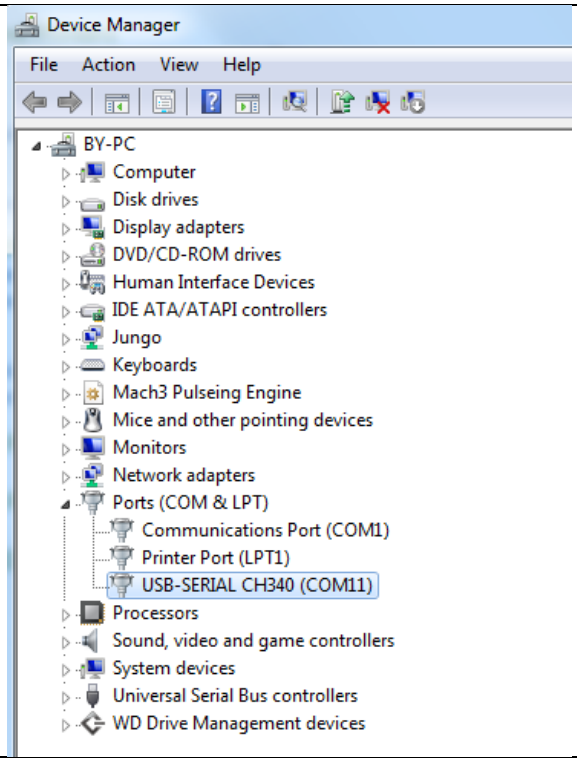

Select 80 MHz as the CPU frequency (you can try 160 MHz overclock later)



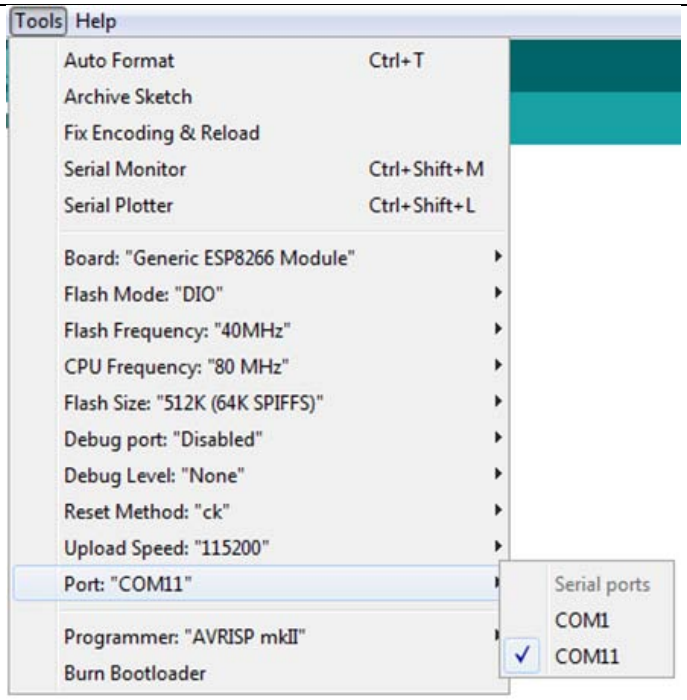

Select '115200' baud upload speed is a good place to start - later on you can try higher speeds but 115200 is a good safe place to start.




Go to your Windows 'Device Manager' to find out which Com Port 'USB-Serial CH340' is assigned to. Select the matching COM/serial port for your CH340 USB-Serial interface.




Find out which Com Port is assign for CH340




Select the correct Com Port as indicated on 'Device Manager"

***Note: if this is your first time using CH340 " USB-to-Serial " interface, please install the driver first before proceed the above Com Port setting. The CH340 driver can be download from the below site:***

***https://github.com/nodemcu/nodemcu-devkit/tree/master/Drivers***

## 3.4 Blink Test

We'll begin with the simple blink test.

Enter this into the sketch window (and save since you'll have to). Connect a LED as shown in Figure3-1.

```
void setup() {
  pinMode(5, OUTPUT);   // GPIO05, Digital Pin D1
}

void loop() {
  digitalWrite(5, HIGH);
  delay(900);
  digitalWrite(5, LOW);
  delay(500);
}
```

Now you'll need to put the board into bootload mode. You'll have to do this before each upload. There is no timeout for bootload mode, so you don't have to rush!

- Hold down the 'Flash' button.
- While holding down ' Flash', press the 'RST' button.
- Release 'RST', then release 'Flash'

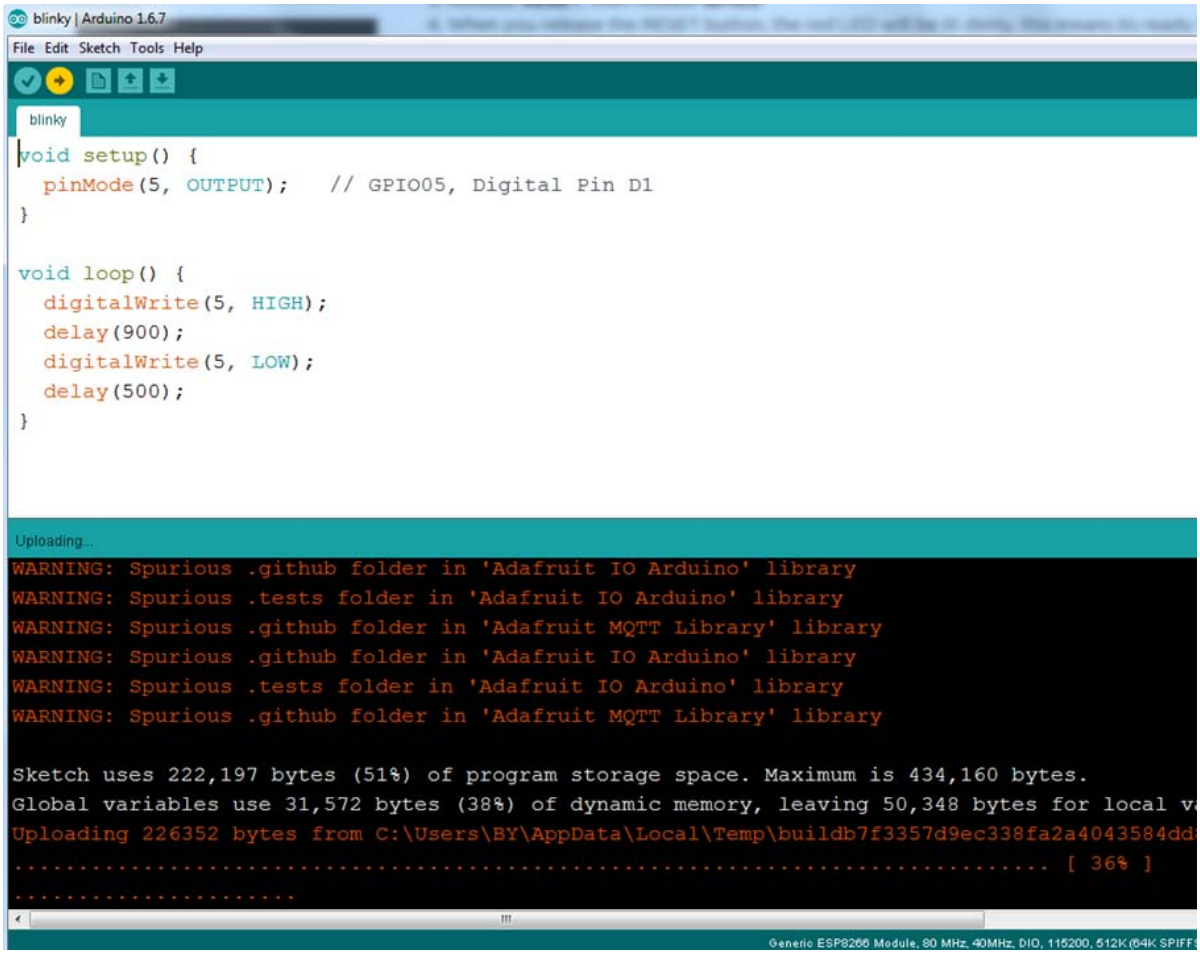



Figure 3.2: Uploading the sketch to ESP8266 NodeMCU module.

The sketch will start immediately - you'll see the LED blinking. Hooray!

## 3.5 Connecting via WiFi

OK once you've got the LED blinking, let's go straight to the fun part, connecting to a webserver. Create a new sketch with this code:

Don't forget to update:

const char* ssid = "yourssid";

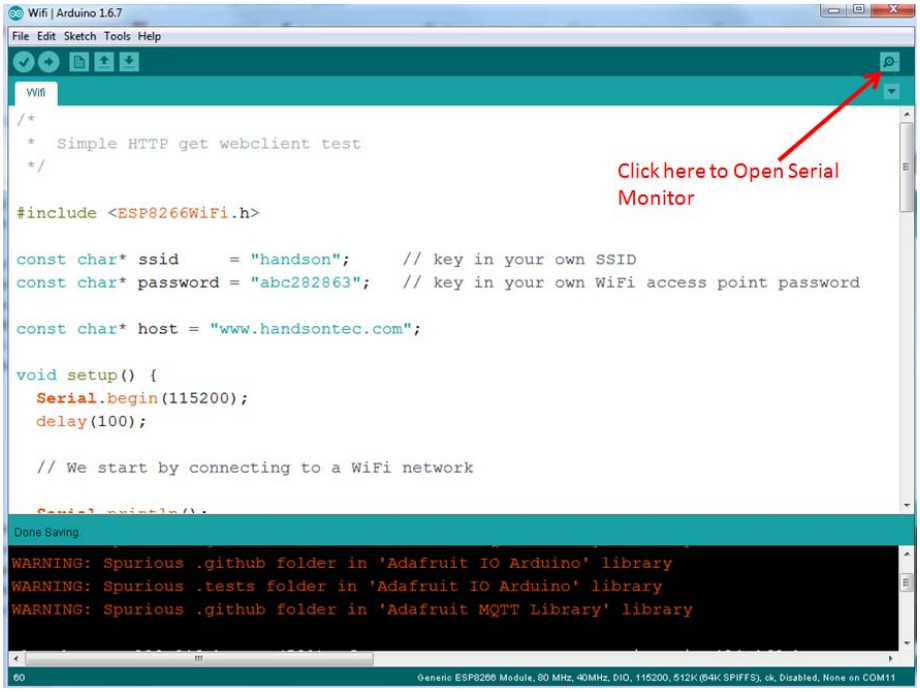
const char* password = "yourpassword";

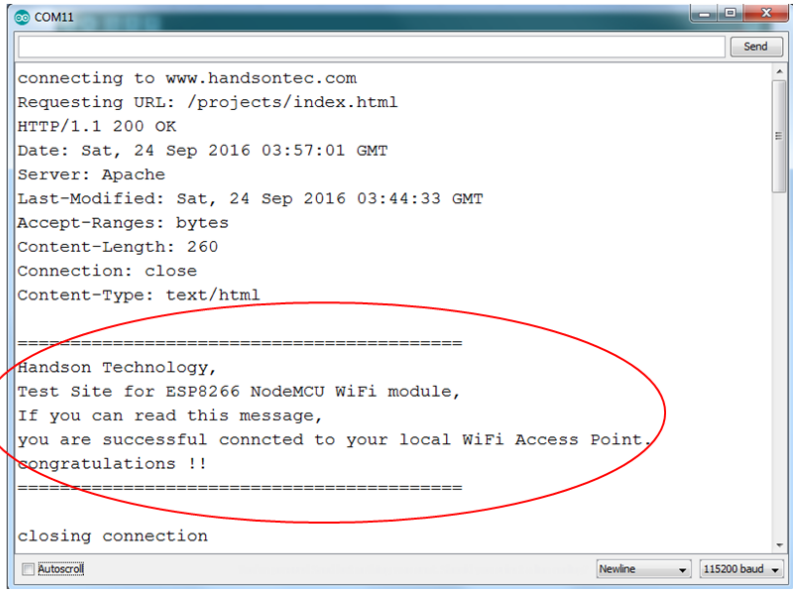
to your WiFi access point and password, then upload the same way: get into bootload mode, then upload code via IDE.

```
/*
 *  Simple HTTP get webclient test
 */

#include <ESP8266WiFi.h>

const char* ssid     = "handson";     // key in your own SSID
const char* password = "abc1234";     // key in your own WiFi access point
password
```

```
const char* host = "www.handsontec.com";

void setup() {
  Serial.begin(115200);
  delay(100);

  // We start by connecting to a WiFi network

  Serial.println();
  Serial.println();
  Serial.print("Connecting to ");
  Serial.println(ssid);

  WiFi.begin(ssid, password);

  while (WiFi.status() != WL_CONNECTED) {
    delay(500);
    Serial.print(".");
  }

  Serial.println("");
  Serial.println("WiFi connected");
  Serial.println("IP address: ");
  Serial.println(WiFi.localIP());
}

int value = 0;

void loop() {
  delay(5000);
  ++value;

  Serial.print("connecting to ");
  Serial.println(host);

  // Use WiFiClient class to create TCP connections
  WiFiClient client;
  const int httpPort = 80;
  if (!client.connect(host, httpPort)) {
    Serial.println("connection failed");
    return;
  }

  // We now create a URI for the request
  String url = "/projects/index.html";
  Serial.print("Requesting URL: ");
  Serial.println(url);

  // This will send the request to the server
  client.print(String("GET ") + url + " HTTP/1.1\r\n" +
               "Host: " + host + "\r\n" +
               "Connection: close\r\n\r\n");
  delay(500);

  // Read all the lines of the reply from server and print them to Serial
  while(client.available()){
    String line = client.readStringUntil('\r');
    Serial.print(line);
  }

  Serial.println();
  Serial.println("closing connection");
}
```

Open up the IDE serial console at 115200 baud to see the connection and webpage printout!



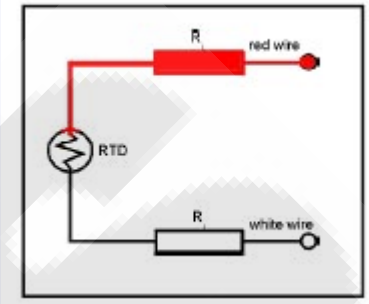




***That's it, pretty easy right ! This section is just to get you started and test out your module.***

## Wiring Configuration.

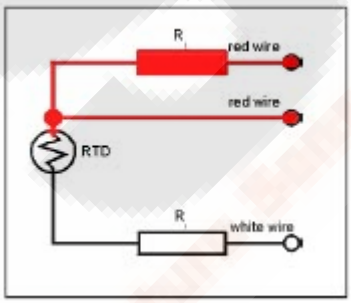
### Two Wire

When accuracy is not critical, a two-wire RTD is the least expensive; offering. Using lead wires to place any distance between a two wire RTD and a receiving device will further compromise its accuracy. The potential for poor accuracy from a two-wire RTD stems from its inability to compensate for lead length, resistance that changes the ohm value of the original signal. A two-wire RTD should be used only in applications where the receiving device connects directly to the sensor



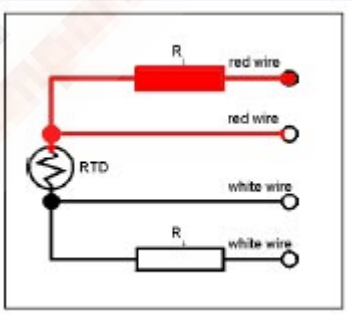

### Three Wire RTD

Three-wire RTD's compensate for resistance resulting from length differences by adding a third lead to the RTD. To accomplish this requires that the wires match exactly. Any difference in resistance between the lead wires will cause an imbalance, which will compromise the accuracy of the RTD. Lead length variance, work hardening or corrosion, and manufacturing irregularities are errors to avoid. Quality manufacturing is critical to insure balance of all three leads.




### Four Wire RTD

Errors caused by resistance imbalance between leads are cancelled out in a four-wire RTD circuit. Four-wire RTD's are used where superior accuracy is critical or if the sensor is installed far from the receiving device. In a four-wire RTD one pair of wires carries the current through the RTD the other pair senses the voltage across the RTD. 2- and three-wire RTD's require heavier lead wire because thicker wire, by creating less resistance to the measured signal, reduces measurement distortion. Therefore lighter gauge wire, less expensive, may be used in four-wire RTD applications. RTD's are limited to temperatures of 1200 ° F and because of the construction of the sensing element, RTD's do not do well in high-vibration and severe mechanical shock environments. When selecting a temperature sensor for an application you should consult your temperature sensor manufacturer for recommendations.



## Accuracy, Stability, and Repeatability.

| Tolerance/Accuracy is calculated as: | |
|---|---|
| Class B | change in t=+/- (0.3+0.005\|t\|) |
| Class A | change in t=+/- (0.15+0.002\|t\|) |
| 1/3 Class B | change in t=+/- 1/3 x (0.3+0.005\|t\|) |
| 1/5 Class B | change in t=+/- 1/5 x (0.3+0.005\|t\|) |
| 1/10 Class B | change in t=+/- 1/10 x (0.3+0.005\|t\|) |
| \|t\| = absolute temperature in °C. Where elements have a resistance of n x 100 Ohms then the basic values and tolerances also have to be multiplied by n | |

These three terms are often confused, but it is important to understand the difference.

- Accuracy. IEC standard 751 sets two tolerance classes for the accuracy of RTDs: Class A and Class B:

Class A: $\Delta t = \pm(0.15 + 0.002 \bullet | t | )$

Class B: $\Delta t = \pm(0.30 + 0.005 \bullet | t | )$

where:

$| t |$ = absolute value of temperature in °C

Class A applies to temperatures from –200°C to 650°C, and only for RTDs with three- or four-wire configurations. Class B covers the entire range from –200°C to 850°C.

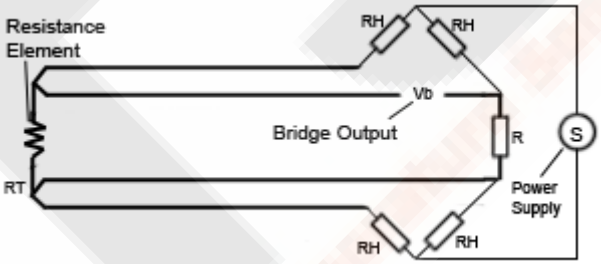



**Figure 3**. Lead wires have resistance that is a function of the material used, wire size, and lead length. This resistance can add to the measured RTD resistance, and improper wire compensation can result in significant errors. The common configurations of RTDs are two (A), three (B), or four wires (C).

- Stability. This is the sensor's ability to maintain a consistent output when a constant input is applied. Physical or chemical changes can cause calibration drift. The material that the platinum is adhered to, whether wound on a mandrel or on a substrate, can expand and contract, straining the wire. Drift rates conservatively specified by manufacturers are typically 0.05°C/yr.
- Repeatability. Repeatability is the sensor's ability to give the same output or reading under repeated identical conditions.

Absolute accuracy is not necessary in most applications. The focus should be on the stability and repeatability of the sensor. If an RTD in a 100.00°C bath consistently reads 100.06°C, the electronics can easily compensate for this error. The stability of RTDs is exceptional, with most experiencing drift rates of 0.05°C over a five-year period.

## Response Time.

Response time varies according to the application. It is the sensor's ability to react to a change in temperature, and depends on the sensor's thermal mass and proximity to the material being tested. For instance, an RTD sensor in a thermowell will react more slowly than the same sensor immersed directly into a process. RTD specifications will list the sensor's time constant, which is the time it takes for an RTD to respond to a step change in temperature and come to 63% of its final equilibrium value. Response times are calculated in water flowing at 0.2 m/s and in air flowing at 1 m/s. This gives a useful comparison of RTD sensor configurations.

# Temperature Transmitter
# Data Sheet

## SBWZ Serial Temperature Transmitter

### Introduction

- SBWR Serial thermocouple temperature transmitter and SBWZ serial RTD temperature transmitter is a spot mounted temperature transmission unit in DDZ-S serial instruments and meters .
- It adopts the two-wire transmission method (the power input and the signal output are two communal conductors).
- There is a linear 4~20m current signal between the output and the measured temperatures.
- The transmitter may be installed inside the terminal box of the thermocouple and the thermal resistance to form an integral structure,and also independently mounted in the instrument panel as a change-over unit.
- Application: To be a new generation thermometric meter, it is widely applied in the industrial and scientific research fields such as petroleum, chemicals, textile, metallurgy, electro-machinery, electric force, aviation, food, processing, pharmaceutical engineering, etc for the purpose of automated temperature testing, transmitting and controlling.

### Features:

- Can be directly installed in the sensor terminal box
- Accurate signal can be transmitted far way(Max 1000M)
- High accuracy with long-term stability, maintenance-free


CE

RoHS

### Technical Characteristics

| Model | SBWZ |
|---|---|
| Input Siginal | Thermocouple: K E J B S T N<br>RTD: PT100 CU50 CU100 |
| Output Siginal | 4 ～ 20mA DC |
| Working Voltage | Related voltage: 24VDC ± 10% (Ordinary12V~35V ， Intelligent 12V~45V） |
| Intrinsic Error | 0.5%FS,<br>0.2%FS (Intelligent ) |
| Mode Of Connection | Two-wire system, three-wire system, four-wire system |
| Allowed Load Resistance | 500Ω(24VDC) |
| Ultimate Load Resistance | R(max)=50(Vmin-12) |

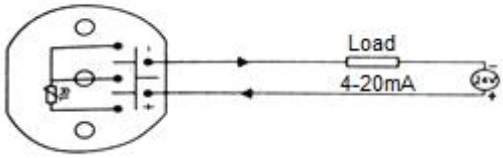


*Cheemi Technology Co., Ltd*
*Tel: 025-85996365 E-mail: info@cheemi-tech.com www. cheemi-tech.com*
*Add:N22, Xianlongwan, Xianyin South Road, Qixia District, Nanjing - China.*

# Temperature Transmitter
# Data Sheet

| | |
|---|---|
| Measuring Range | -200～1800℃ |
| Ratio of Environment Effects | δ≤0.05%/°C |
| Work Environment | Temperature: -25-+80°C(Ordinary)<br>-25-+70°C(Digit Display)<br>-25-+75°C(Intelligent) |
| | Relative Humidity:5%-95% |
| | Mechanical Vibration f≤50Hz, swing≤0.15mm |
| | Non-corrosive gas or similar environment |
| Pipe Spec | Stainless steel pipe diameter:Φ 4 、Φ 6 、Φ 8 、Φ 10 、Φ 12 、Φ 14 、Φ 16<br>Pipe Length: 30mm ～ 100mm ～ 200mm, or customized length available |
| Case | Blue Φ36 × 16 mm |

## Connection



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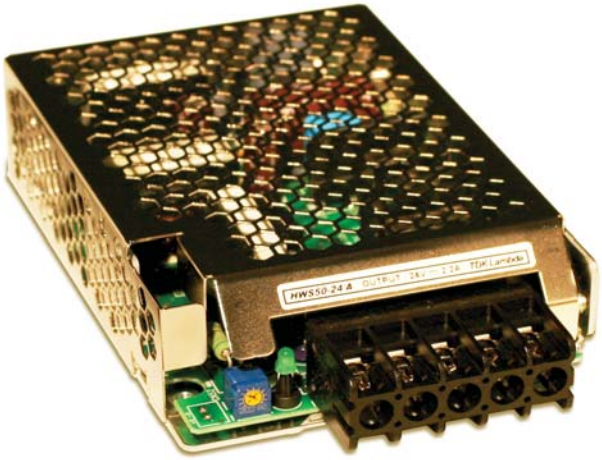
*Add:N22, Xianlongwan, Xianyin South Road, Qixia District, Nanjing - China.*

# DATASHEET AND OPERATING GUIDE

# PWRPAK 24 V

## Switched Mode Power Supply



## FEATURES & BENEFITS

- Overload & Overvoltage Protection
- <1% Noise and Ripple
- 85-260 VAC, 47-63 Hz Input Voltage

## SMALL SIZE, EFFICIENT

Wavelength offers the PWRPAK-24V low noise switched power supply for the QCL Series Laser Drivers.

One of the most important components affecting noise performance is the power supply used to power the QCL driver. Wavelength has extensively tested the TDK/ Lambda switching power supply, and recommends this power supply for most QCL applications. A linear supply will offer lower noise, but a much larger size and lower efficiency.

## USED WITH

- QCL Series Quantum Cascade Laser Drivers

## CONTENTS



## ORDERING INFORMATION

| PART NO | DESCRIPTION |
|---|---|
| PWRPAK-24V | 24 V Switched Power Supply |
| WCB312 | QCL Power Supply Wiring Kit |
| WCB313 | QCL 3-Pin Power Cable |

RoHS Compliant


406-587-4910

www.teamWavelength.com




WAVELENGTH ELECTRONICS

# QUICK CONNECT GUIDE

To determine if the PWRPAK-24V power supply is appropriate for your application, it is imperative that you verify the unit will be operating within the internal heat dissipation Safe Operating Area (SOA).

Visit the Wavelength Electronics website for the most accurate, up-to-date, and easy to use SOA calculator.

The SOA calculator for Laser Diode Drivers is at this page:
http://www.teamwavelength.com/support/calculator/soa/soald.php,
then choose the appropriate QCL driver.

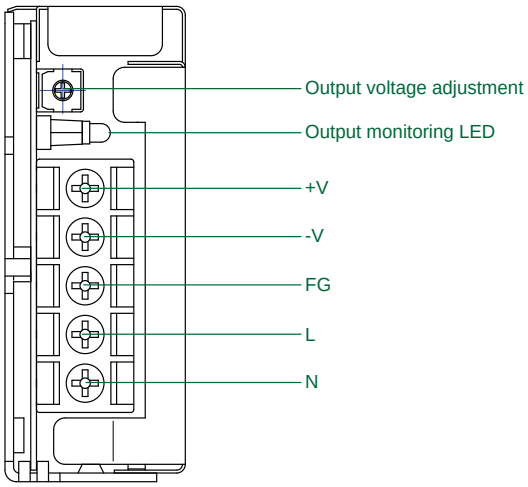
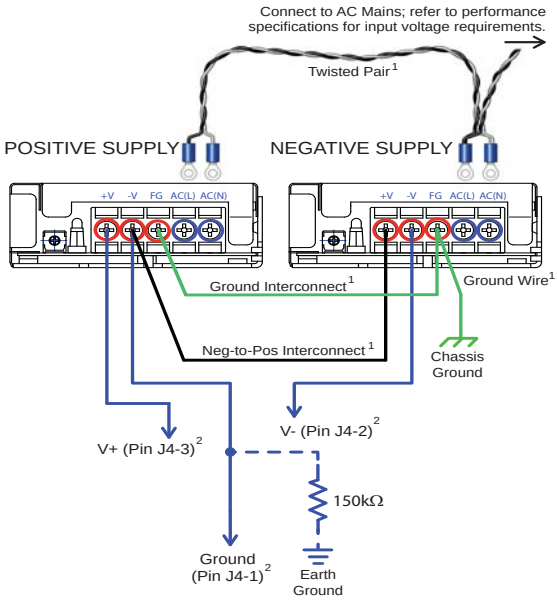



**Figure 1. Power Supply Wiring Connections**

**Figure 2** shows an example of a correctly connected grounded load.




1. Cable included as part of the WCB312 Power Supply Wiring Kit
2. Included with the QCL Driver. (WCB313)

**Figure 2. Power Supply Wiring Diagram, Dual Supply Operation**

## WIRING THE PWRPAK-24V

**Figure 1** illustrates the power supply connections for single supply operation:
+V — positive output terminal
-V — negative output terminal
FG — frame ground
L — live line input terminal (fuse in line)
N — neutral input terminal
Output voltage adjustment
Output monitoring LED

## WIRING POWER SUPPLY TO QCL DRIVER

Follow these instructions to wire the power supplies using the WCB312 Wiring Kit and WCB313 Power Cable. Refer to **Figure 2.**

- AC Safety Ground #1: 24 AWG green wire, 10” with ring lugs on each end; connect to the Frame Ground terminals on the power supplies.
- AC Safety Ground #2: 24 AWG green wire; 10” with one ring lug; connect to the Frame Ground terminal on one power supply; connect the other end to AC Chassis Ground.
- Common Ground: 24 AWG black wire; 10” with ring lugs on each end; connect between V– of Positive Supply and V+ of Negative Supply.
- Use the remaining ring lugs to connect the power supply cable (WCB313) to the V+, Power Ground, and V– terminals of the power supplies.

**Figure 2** indicates a 150 kΩ resistor connecting the power supplies to ground; this resistor is necessary if the electronics ground is tied to earth ground at some point within your system, such as at a DAQ card, computer, or USB cable connection.

This resistor provides a lossy connection from system ground to earth ground, and will prevent the ground potential of isolated power supplies from drifting. Note that if this resistor is used the remote POWER and ENABLE inputs must be optically isolated in order to function properly.

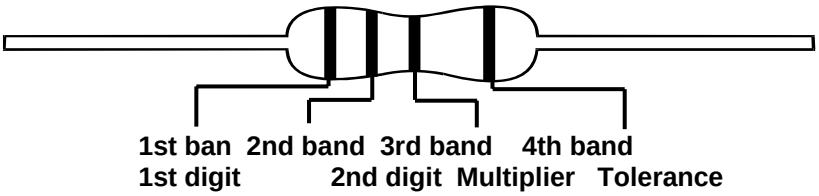
If you are unsure whether to include this resistor in your system, contact Wavelength Electronics for technical assistance.

# PERFORMANCE SPECIFICATIONS

| PARAMETER DESCRIPTION | PARAMETER VALUE | NOTES |
|---|---|---|
| **INPUT** | | |
| Input Voltage | 85 - 265 VAC | |
| Frequency | 47 - 63 Hz | |
| **OUTPUT** | | |
| Output Power Maximum | 52.8 W | |
| Output Voltage | 24 V | Output voltage is within ±20% of nominal output voltage: |
| Output Current | 2.2 A | |
| Hold Up Time | 20 ms | |
| Line Regulation | 96 mV | |
| Load Regulation | 192 mV | |
| Ripple & Noise | 150 mV | 100 MHz bandwidth |
| Overvoltage Protection | 30 - 34.8 V | Inverter shutdown, manual reset. When OVP triggers, the output will be shutdown. Remove the input and re-connect to reset power. The OVP setting is fixed, not user adjustable. In the case of an inductive load, use a decoupling diode at the output terminal. |
| Overload Protection, hiccup trip & auto restart | >104% | Constant current limiting and hiccup with automatic recovery when overload condition clears. |
| Temperature Coefficient | < 0.02% / °C | |
| **GENERAL** | | |
| Efficiency | 82 / 84 % | 100 / 200 VAC input. Power Thermistor Protection |
| Operating Temperature [1] | -10 to + 71 °C | See derating chart above 50°C |
| **EMC** | | |
| Emissions, FCC B<br>EN55011 / EN55022 | Yes | |
| **SAFETY** | | |
| UL/cUL, CB, CE Mark Approved | Yes | |
| Weight | 280 g | |
| Size | 1.46 x 3.23 x 6.3 inches | |

[1] Derating information can be found in **Table 1 on page 4**.

## ■Marking & Resistance Tolerance




| ±5% | E-24 | 1.0 | 1.1 | 1.2 | 1.3 | 1.5 | 1.6 | 1.8 | 2.0 | 2.2 | 2.4 | 2.7 | 3.0 | 3.3 | 3.6 | 3.9 | 4.3 | 4.7 | 5.1 | 5.6 | 6.2 | 6.8 | 7.5 | 8.2 | 9.1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| Cold | Digit | Multiplier | Tolerance | |
|---|---|---|---|---|
| Without | - | - | - | - |
| Silver | - | $10^{-2}$ | - | - |
| Gold | - | $10^{-1}$ | ±5.0% | J |
| Black | 0 | $10^{0}$ | - | - |
| Brown | 1 | $10^{1}$ | - | - |
| Red | 2 | $10^{2}$ | - | - |
| Orange | 3 | $10^{3}$ | - | - |
| Yellow | 4 | $10^{4}$ | - | - |
| Green | 5 | $10^{5}$ | - | - |
| Blue | 6 | $10^{6}$ | - | - |
| Violet | 7 | $10^{7}$ | - | - |
| Grey | 8 | $10^{8}$ | - | - |
| White | 9 | $10^{9}$ | - | - |

temperature

JOFRA calibration

# Easy Temperature Calibrator

# ETC-series

Heats up by up to 100°C / 212°F per minute and completes a full dual-point test in less than 10 minutes, including stability time; timesavings at your fingertips! The ETC- series is designed for field testing of temperature measurement devices.

The small size and light weight make it a perfect instrument to verify sensors in difficult to reach places.

All JOFRA ETC units have many of the same useful and timesaving features offered in the more advanced JOFRA dry-block series.

Designed for people who perform tests and verifications of temperature sensing devices in the field. This instrument is ideal when time is a critical factor and the highest accuracy is not a critical factor.

Reduced size and weight are important considerations because the unit is able to fit into a tool box or instrument carrying case and can be used for sensors that are difficult to access.

One-key-one-function user interface provides immediate access to setting the temperature and the auto-step timesaving function. There is no need for manipulation of sophisticated menus.

The Stability indicator provides audible and visual prompts when the temperature is stable. This function also includes a 3 minute countdown before the stable condition.

Stainless steel and rubber side panels make the instrument suitable for many years of faithful duty in an industrial environment.

### » Temperature ranges

ETC-125 A -10 to 125°C / 14 to 257°F
ETC-400 A 28 to 400°C / 82 to 752°F
ETC-400 R 28 to 400°C / 82 to 752°F

### » Fast calibration saves money

Heats up as quickly as 100°C / 212°F per minute and stabilizes in just 3 minutes. Completes a 2-point test in less than 10 minutes

### » Extreme flexibility

The small size makes it perfect to store in a tool box and to check temperature sensors that are difficult to access

### » Fully-featured despite the small size

The multi-information display shows actual and set temperatures, a stability indicator, and a stability countdown timer

### » Timesaving features

Fast one-key-one-function access to set the temperature and the auto-stepping function

### » Documentation made easy

RS232 communication interface and JOFRACAL calibration software are part of the ready-to-use standard delivery

### » Easy IR calibration

Standard delivery of the ETC-400 R includes JOFRA IR-LAB software enabling the user to calibrate IR thermometers with a fixed emission factor setting

### » Complete marine program

Part of a complete program of marine approved temperature, pressure and signal calibrators; including temperature sensors

**ISO 9001 Manufacturer**



AMETEK®
TEST & CALIBRATION INSTRUMENTS

## ETC-400 R for infrared thermometers

The ETC-400 R is designed for optimum speed in connection with calibration of infrared thermometers. The 36 mm target provides the optimum size for reliable calibration of infrared thermometers in the process industry as it is designed for high accuracy and long-term stability while maintaining speed.

With regard to the coating of the target it has been especially designed for space technology applications, which secure long time performance under high temperature influence. In combination with the shape of the target it ensures the emissivity of 0.96.

If higher accuracy is required, and for recalibration, a 3 mm external JOFRA STS reference probe can be placed under the surface of the target.

## Super fast heating - ETC-400 A dry-block

The ETC-400 A is designed for optimum speed. The heating block is built around a highly efficient heating element. The insertion holes for the temperature device under test are located around this element. To reduce mass and increase effectiveness, there is no removable insertion tube; the holes are drilled directly into the block. The minimal mass offers an extremely fast heating and cooling time. The different layouts also make it possible to use an external JOFRA STS reference probe during the calibration. Choose the combination of holes that best suits your needs from our various design combinations.

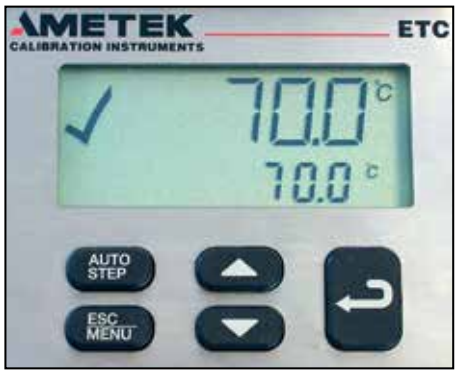
If your application requires a dry-block that can handle large sensors or more than one sensor at a time, we offer several other JOFRA dry-block calibrators that can meet your needs.

## Cooling and heating - ETC-125 A dry-block

The ETC-125 A is a simple yet effective tool for verifying temperature instruments that also require references below ambient temperatures: e.g. air-conditioning and cold counters. The predrilled holes allow the use of an insertion tube in the largest bore. This increases the flexibility to match many sensor-under-test sizes.

## Easy-to-use, intuitive operation

All instrument controls are accessed directly from the front panel. The main functions on the ETC series are designed with one-key-one-function logic. This means that there are no difficult multiple keystrokes to remember to access primary functions. The easy-to-read, backlit display features dedicated icons, which help in identifying instrument conditions and operational steps.




## Set temperature

The ''Up'' and ''Down'' arrow keys allow the user to set the exact temperature desired with a resolution of 0.1°C or °F.

## Instrument setups

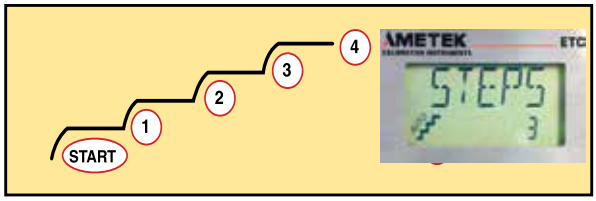
The ETC-series stores the complete instrument setup, including: engineering units, stability criteria, resolution, auto-step settings, and maximum temperature.

## Stability indicator

The bold checkmark on the display indicates that the calibrator has reached the desired set temperature and is stable. The operator may change the stability criteria and establish a greater level of confidence in the calibration results as desired. A convenient countdown timer is activated three minutes before the unit reaches stability. This prompts you to be prepared to record results.

## Auto-stepping

This feature saves time. The operator may stay in the control room, or another remote location, monitoring the output from the sensor-under-test while the ETC- series calibrator is placed in the process and automatically changes the temperature using a programmed step value and rate. Up to 9 different temperature steps may be programmed, including the hold time for each step. This feature is also ideal for burning-in new sensors prior to installation; this minimizes initial drift and allows for initial testing. It is also useful for testing temperature data loggers.




## Maximum temperature

From the setup menu, you can select a lower maximum temperature limit for the calibrator. This function prevents damage to the sensor-under-test caused by the application of excessive temperatures.

## Re-calibration/adjustments made easy

The ETC- series has a very easy and straightforward procedure for re-calibration/adjustment. There is no need for a screwdriver or PC software. The only thing you need is a reliable reference thermometer. Place the probe in the calibrator and follow the instructions on the display.

*Use the ETC calibrator with JOFRACAL calibration software*

## JOFRA IR-LAB software for the ETC-400 R

As an extra feature the ETC-400 R will be delivered with a small mathematical program, which will constitute a powerful tool together with the calibrator. The program enables you to calculate at which temperatures you need to calibrate, if your IR thermometer is either locked to a fixed emission factor or if you just want to calibrate your thermometer at a certain emission factor. The program facilitates the whole issue of correcting settings of emission factors and temperatures.

The calibration surface of the JOFRA ETC-400 R IR calibrator has an emission factor of 0,96. If your IR-thermometer is using a different emission factor than 0.96, the result will be a faulty temperature reading on your IR thermometer. However if your IR thermometer is using an emission factor of 0.95 or 0.98 – a helpfull diagram is part of the standard delivery.

Example: Your thermometer is locked to an emission factor of 0,98 and you have set the JOFRA ETC-400 R to 300°C. The diagram indicates that 3,9°C must be subtracted from the calibrator temperature, to obtain the “true” IR thermometer reading (296,1°C).

If you are working with IR thermometers where the emission factor is different than 0.95, 0.96 or 0.98, or other parameters differ from “standard”, use the PC program JOFRA IR-Lab. The JOFRA IR-Lab program allows you to type in various emission factors, in order to get a “true” temperature readout on your thermometer or the other way around - what is the true surface temperature of the calibrator. But the IR-Lab will do more than that; it allows you to calculate “true” temperatures in simulated surroundings that approximate your actual test environments.

## Calibration of up to 24 sensors with JOFRA ASM

Using the JOFRA ETC series together with the ASM Advanced Signal Multi-scanner offers a great time-saving automatic solution to calibrate multiple temperature sensors at the same time.

The ASM series is an eight channel scanner controlled by JOFRACAL software on a PC. Up to 3 ASM units can be stacked to calibrate up to 24 sensors at the same time. It can handle signals from 2-, 3- and 4 wire RTD’s, TC’s, transmitters, thermisters, temperature switches and voltage.

## JOFRACAL CALIBRATION SOFTWARE

JOFRACAL calibration software ensures easy calibration of RTD´s, thermocouples, transmitters, thermoswithes, pressure gauges and pressure switches. JOFRACAL can be used with JOFRA DPC-500, APC, CPC and IPI pressure calibrators, all JOFRA temperature calibrators, as well as JOFRA AMC900, ASC300 multi signal calibrator and ASM-800 signal multi scanner.

JOFRACAL calibration software may also be used for manual calibrations, as it can be set up to accept manual entry of calibration data together with other liquid baths, ice points or dry-block heat sources.

The calibration data collected may be stored on a PC for later recall or analysis. The calibrator stores the calibration procedure and may be taken out to the process site without using a personal computer.

Once all calibrations are completed, the data may be uploaded to the JOFRACAL calibration software for post-processing and printing of certificates. The calibration data collected may be stored on the personal computer for later recall or analysis.

The JOFRACAL temperature calibration software may be donwloaded at www.jofra.com

### JOFRACAL software

Minimum hardware requirements for JOFRACAL calibration software.

- INTEL™ 486 processor
- (PENTIUM™ 800 MHz recommended)
- 32 MB RAM (64 MB recommended)
- 80 MB free disk space on hard disk prior to installation
- Standard VGA (800 x 600, 16 colors) compatible screen
- (1024 x 786, 256 colors recommended)
- CD-ROM drive for installation of the program
- 1 free RS232 serial port

## STANDARD DELIVERY

- JOFRA ETC dry-block calibrator
- Traceable calibration certificate - temperature performance
- JOFRACAL calibration software
- User and reference manual
- Mains power cable
- Shoulder strap
- RS232 cable
- 1 × predrilled insertion tube (ETC-125 A only)
- Tool for insertion tubes (ETC-125 A only)
- Carrying case (ETC-400 R only) 1)
- JOFRA IR-LAB calibration software (ETC-400 R only)
- Emissivity table (ETC-400 R only)

1) The ETC-400 R is delivered with a carrying case as standard because it is important to keep dust away from the surface of the target on the ETC-400 R. The reason being that a clean surface is important to keep the emissivity and thereby the accuracy. The carrying case is optional for ETC-400 A and ETC-125 A.

## ACCESSORIES

| | |
|---|---|
| 122832 | Cleaning Brushes - 4 mm - Package of 3 pcs |
| 60F174 | Cleaning Brushes - 6 mm - Package of 3 pcs |
| 122822 | Cleaning Brushes - 8 mm - Package of 3 pcs |
| 125002 | Edgeport Converter with 4 pcs of RS232 ports |
| 124094 | Carrying Case for ETC Series |

### Carrying case (Optional for ETC-125/400 A) - 124094

The optional protective carrying case ensures safe transportation and storage of the instrument and all associated equipment.

# FUNCTIONAL SPECIFICATIONS

## Temperature range @ ambient temp. 23°C / 73°F

ETC-125 A
Maximum.....125°C / 257°F
Minimum @ ambient temp. 0°C / 32°F ..... -18°C / -0°F
Minimum @ ambient temp. 23°C / 73°F ..... -10°C /14°F
Minimum @ ambient temp. 40°C / 104°F..... 6°C / 43°F
ETC-400 A .....28 to 400°C / 82 to 752°F@ 23°C
ETC-400 R .....28 to 400°C / 82 to 752°F@ 23°C

## Resolution (user-selectable)

Selectable .....1° or 0.1°

## Heating time

ETC-125 A
-10 to 23°C / 14 to 73°F .....3 minutes
23 to 100°C / 73 to 212°F ..... 11 minutes
100 to 125°C / 212 to 257°F .....7 minutes

ETC-400 A / R
28 to 200°C / 82 to 392°F.....2 minutes
200 to 400°C / 392 to 752°F .....3 minutes

## Cooling time

ETC-125 A
125 to 100°C / 257 to 212°F ..... 1 minute
100 to 0°C / 212 to 32°F.....17 minutes
0 to -10°C / 32 to 14°F .....14 minutes

ETC-400 A
400 to 200°C / 752 to 392°F .....6 minutes
200 to 50°C / 392 to 122°F.....15 minutes

ETC-400 R
400 to 200°C / 752 to 392°F .....9 minutes
200 to 50°C / 392 to 122°F.....24 minutes

## Stability

ETC-125 A .....±0.05°C / ±0.09°F
ETC-400 A ..... ±0.15°C / ±0.27°F
ETC-400 R .....±0.3°C / ±0.54°F

Measured after the stability indicator has been on for 10 minutes. Measuring time is 30 minutes.

## Time to stability (approximate)

All models .....3 minutes

## Accuracy

ETC-125 A .....±0.5°C / ±0.9°F 1)
ETC-400 A .....±0.5°C / ±0.9°F 1)
ETC-400 R ..... ±0.5°C / ±0.9°F 2)
ETC-400 R incl. emissivity
..... ±0.4% rdg ±1°C / ±0.4% rdg. ±1.8°F

1) Specification when using the internal reference. (Load 4 mm OD reference probe in the center of the insert).
2) Specification when using the internal reference. (Load 3 mm OD reference probe).

## Immersion depth

ETC-125 A (insulation included) ..... 110 mm / 4.3 in
ETC-400 A .....105 mm / 4.1 in

## Mains specifications

Voltage ETC-125 A.....Multivoltage 115VAC and 230VAC
.....115V(90-132) and 230V(180-264)
Voltage ETC-400 A/R ..... 115V(90-127) or 230V(180-254)
Frequency ETC-125 A.....47 - 63 Hz
Frequency ETC-400 A/R .....45 - 65 Hz
Power consumption (max.) ETC-125 A.....75 VA
Power consumption (max.) ETC-400 A/R .....350 W

# KEY FEATURES

## Auto stepping

Programmable.....Up to 9 steps
Dwell time on each step ..... Programmable

## Multi-information display

Stability indicator.....Clear checkmark
Countdown timer before stable .....3 minutes
Temperature .....SET and READ simultaneously
Alphanumeric messages..... Yes
Calibration status icons..... Yes

## Training mode (heating/cooling block disabled)

Simulation of all functions ..... Yes
Simulating heating and cooling..... Approx. 100° per minute

## Service facilities

Adjustment of the unit from the keypad ..... Yes
Self explaining guide in display..... Yes
Other information: ..... Display serial number,
..... software revision level, and last calibration date

## Setup facilities

Stability criteria: ..... Extra time before ”stable indication”
..... is shown
Display resolution..... .1° or 1°C/°F
Temperature units ..... °C or °F
Slope rate.....0.1 to 9.9°/minute
Maximum temperature .....Any value within range

## PHYSICAL SPECIFICATIONS

### Instrument dimensions

ETC-125 A, ETC-400 A and ETC-400 R
L × W × H: .....172 × 72 × 182 mm / 6.8 × 2.8 × 7.2 in

### Instrument weight

ETC-125 A .....1.8 kg / 3.9 lb
ETC-400 A .....1.6 kg / 3.5 lb
ETC-400 R ..... 1.7 kg / 3.7 lb

### Shipping (including shipping cargo box)

ETC-125 A: .....3.0 kg / 6.6 lb
ETC-400 A: .....2.8 kg / 6.2 lb
ETC-400 R .....4.5 kg / 9.9 lb

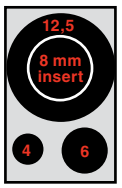
Size, L × W × H:
ETC-125 A / 400 A: .....
.....345 × 235 × 135 mm / 13.6 × 9.3 × 5.3 in
ETC-400 R .....425 x 320 x 165 mm / 16.7 x 12.5 x 6.5 in

### Miscellaneous

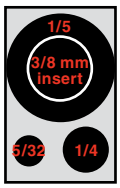
Serial data interface ..... RS232
Operating temperature.....0 to 40°C / 32 to 104°F
Storage temperature .....-20 to 50°C / -4 to 122°F
Humidity .....0 to 90% RH
Protection class ..... IP-10
DNV Marine Approval, Certificate no.....A-10384


## INSERTS FOR ETC SERIES

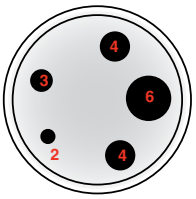
| | | Instruments | |
|---|---|---|---|
| | Type | ETC-125 A | ETC-400 A |
| 5-pack, undrilled inserts | 01 + 02 | 123939 | N/A |
| Predrilled insert, metric 8 mm | 01 | 123938 | N/A |
| Predrilled insert, imperial 3/8 in | 02 | 124045 | N/A |



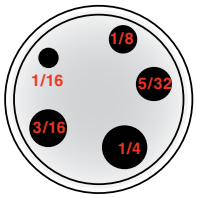

**Metric Type 01**
**(ETC-125 A)**



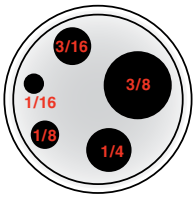

**Imperial Type 02**
**(ETC-125 A)**



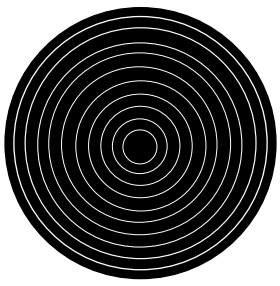

**Metric Multi-hole Type 21**
**(ETC-400 A)**




**Imperial Multi-hole Type 11**
**(ETC-400 A)**




**Imperial Multi-hole Type 12**
**(ETC-400 A)**



**Type 51**
**ETC-400 R**
**36 mm (1.4 in) target**

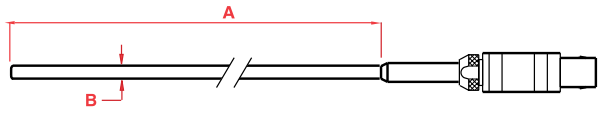
NOTE: All ETC400 calibrators are with fixed inserts. They can NOT be changed.

## JOFRA STS-103 B

It is not easy to make a good quality reference probe. The main requirement of a reference probe is stability. This means minimal drift as a function of operating time at the actual temperature. The less the probe drifts, the lower the measurement uncertainty.

Especially for the ETC-400 R calibrator JOFRA has designed a special 3 mm STS reference sensor, the STS-103 B. The sensor can be used as a reference sensor when a higher accuracy is required or for recalibration of the ETC-400 R. Due to the small immersion depth requirement of the sensor it can be placed under the surface of the target.

| Dimensions | | |
|---|---|---|
| **Ref.** | **mm** | **inch** |
| A | 150 | 5.91 |
| B | 3 | 0.12 |




## ORDERING INFORMATION STS-103 B

| Order no. | Description |
|---|---|
| | **Base model number** |
| STS103 | Pt100 reference probe, 0°C to 400°C |
| | **Diameter of the probe** |
| B | Overall diameter 3 mm |
| | **Shape and length** |
| 150 | Straight probe, 150 mm (5.9 in) |
| | **Cable length and termination** |
| A | Cable 0.5 m (1.6 ft.) + LEMO connector |
| B | Cable 2 m (6.6 ft.) + LEMO connector |
| C | Cable 2 m (6.6 ft.) + Banana plug connectors |
| | **Calibration certificate** |
| H | Accredited calibration certificate (standard) |
| F | NPL traceable calibration certificate |
| G | NIST traceable calibration certificate |
| I | No certificate - Annealed only (Useless without calibration certificate / co-efficients) |
| S | Special calibration certificate |
| **STS103B150AH** | **Sample order number** Reference Pt100 150 mm., cable length 0.5 m (1.6 ft.) with LEMO termination and accredited certificate |

## SPECIFICATIONS STS-103 B

### Temperature range

All probes .....-50 to 400°C / -58 to 752°F

### Accuracy

Hysteresis[1] @0°C / 32°F.....0.01°C / 0.02°F
Long term stability [2] @0°C / 32°F..... typ. 0.014°C / 0.025°F
Repeatability [1].....0.005°C / 0.009°F
Note 1: When used in the range -45 to 400°C / -49 to 752°F.
Note 2: When exposed to 400°C / 752°F for 100 h. Stability will depend on actual use of the sensor.

### Sensing element

Type.....Pt100
Nominal resistance@0°C / 32°F.....100 Ω
Length ..... 6 mm / 0.2 in
Temperature coefficient ..... $\alpha_{100}$=0.00385 1/°C

### Minimum immersion depth

STS-103 B (3 mm / 0.12 in): .....40 mm / 1.6 in

### Self-heating effect

0.06°C/mW / 0.108°F/mW

### Response time

$\tau_{0.5}$ (50%).....5 seconds
$\tau_{0.9}$ (90%).....15 seconds

Liquid in motion v=0.4m/s.

### Electrical connections

Cable.....4 wire + shield
Connection..... LEMO goldplated

### Insulation resistance

@ 23°C / 73°F ..... 100 Gohm
@ 400°C / 752°F ..... 70 Mohm

### Outer tube

Inconel 600

### Operating conditions

(Probe, connection, and cable) .....Max. 70°C / 158°F
Storage temperature .....-20 to 70°C / -4 to 158°F
Humidity .....0 to 90% RH
Protection class (connectors) ..... DIN 40050 IP-50

### Shipping dimensions - including carrying case

L x W x H..... 750 x 140 x 140 mm / 29.5 x 5.5 x 5.5 in

### Shipping weight including packing

STS-103 B .....2 kg / 4.4 lb

## STANDARD DELIVERY

- JOFRA STS-103 B probe
- Cable - according to order number
- Accredited certificate, points: -45, -20, 0, 50, 100, 200, 400°C
- Plastic carrying case with foam insert
- User manual

## ORDERING INFORMATION

| Order no. | Description |
|---|---|
| | **Base model number** |
| ETC125A | ETC-125 A, -10 to 125°C / 14 to 257°F |
| ETC400A | ETC-400 A, 28 to 400°C / 82 to 752°F |
| ETC400R | ETC-400 R, 28 to 400°C / 82 to 752°C |
| | **Power supply** |
| 115 | ETC-400 A/R only: 115 VAC, 50/60 Hz |
| 230 | ETC-400 A/R only: 230 VAC, 50/60 Hz |
| MUL | ETC-125 A only: Multi voltage 115 and 230 VAC |
| | **Mains power cable type** |
| A | European, 230 V, |
| B | USA/Canada, 115 V |
| C | UK, 240 V |
| D | South Africa, 220 V |
| E | Italy, 220 V |
| F | Australia, 240 V |
| G | Denmark, 230 V |
| H | Switzerland, 220 V |
| I | Israel, 230 V |
| | **Holes for sensor-under-test** |
| 01 | ETC125 A - Metric (12.5 mm, 6 mm, 4 mm, 8 mm) |
| 02 | ETC125 A - Imperial (1/2 in, 3/8 in, 1/4 in, 5/32 in) |
| 11 | ETC400 A - Imperial (1/16 in, 1/8 in, 5/32 in, 3/16 in, 1/4 in) |
| 12 | ETC400 A - Imperial (1/16, 1/8 in, 3/16 in, 1/4 in, 3/8 in) |
| 21 | ETC400 A - Metric (2 mm, 3 mm, 4 mm, 6 mm) |
| 51 | ETC400 R |
| | **Calibration certificate** |
| E | NPL and NIST traceable calibration certificate (standard delivery) |
| H | Accredited calibration certificate (on quotation basis) |
| | **Options** |
| C | Carrying case (standard for ETC-400 R) |

**ETC400A230A21EC Sample order number**
JOFRA ETC-400 A series dry-block, 230 VAC power, European power cord, metric drilled multihole block, standard NPL/NIST traceable certificate and carrying case.

**AMETEK Test & Calibration Instruments**
A business unit of AMETEK Measurement & Calibration Technologies Division offering the following industry leading brands for test and calibration instrumentation.

**JOFRA Calibration Instruments**
*Temperature Calibrators*
Portable dry-block calibrators, precision thermometers and liquid baths. Temperature ranges from -90°C(-130°F) to 1205°C(2200°F). Temperature sensors for industrial and marine use.
*Pressure Calibrators*
Convenient electronic systems ranging from -25 mbar to 1000 bar - fully temperature-compensated for problem-free and accurate field use.
*Signal Instruments*
Process signal measurement and simulation for easy control loop calibration and measurement tasks.

**M&G Pressure Testers & Pumps**
Pneumatic floating-ball or hydraulic piston dead weight testers with accuracies to 0.015% of reading. Pressure generators delivering up to 1,000 bar.

**Lloyd Instruments**
Materials testing machines and software from Lloyd Instruments guarantees expert materials testing solutions. The comprehensive program also covers Texture Analysers to perform rapid, general food testing and detailed texture analysis on a diverse range of foods and cosmetics.

**Davenport Polymer Test Equipment**
Allows measurement and characterization of moisture-sensitive PET polymers and polymer density.

**Chatillon Force Measurement**
The hand held force gauges and motorized testers have earned their reputation for quality, reliability and accuracy and they represent the de facto standard for force measurement.

**Newage Testing Instruments**
Hardness testers, durometers, optical systems and software for data acquisition and analysis.

AMETEK®
TEST & CALIBRATION INSTRUMENTS

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1.62. Induced draft fans (design characteristics)

| | | |
|---|---|---|
| - Number | | 2 |
| - Manufacturer | | VIM or EQUAL |
| - Type | | Centrifugal |
| - Capacity per fan | Nm3/h | 175 000 |
| - Temperature | ° C | 150 |
| - Static pressure | mm WG | 220 |
| - Fan speed | rpm | 990 |
| - Static efficiency | % | 83.5 |
| - Power consumption | kW | 300 |
| Characteristics of drive motor | | |
| - Manufacturer | | ALSTHOM or EQUAL |
| - Power / Volt / phase | kW/V/ | 355/6000/50 Hz |
| - Service Factor | % | Later |
| - Speed | rpm | 990 |
| - Efficiency at full load | % | 93.1 |
| - Power factor at full load | % | 0.89 |
| - Full load current | A | Later |
| - Locked rotor current | A | Later |
| - Insulation class | | F |
| - Weight | kg | 3 300 |