# LAMPIRAN

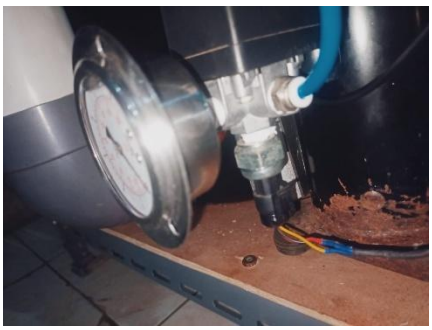
Lampiran 1. Dokumentasi Pengisian Biodigester dengan Kulit Nanas

Lampiran 2. Dokumentasi Kalibrasi Sensor Tekanan









Lampiran 3. Dokumentasi Percobaan Pengisian Biogas ke Tabung Portabel


LIQUIFIED
BUTANE FUEL
EK5055 Max.5kg d=1g


EK5055 Max.5kg d=1g
CAMRY
UNIT
Z/T
ON/OFF


LIQUIFIED
BUTANE FUEL
CAMRY
UNIT
Z/T
ON/OFF


CAMRY
UNIT
Z/T
ON/OFF

Lampiran 4. Form Bimbingan Tugas akhir 1

**HALAMAN BIMBINGAN**

**LAPORAN TUGAS AKHIR**

NAMA : IKHSAN SHIDDIQ ADZ-DZIKRI

NIM : 22010004

JUDUL : RANCANG BANGUN SISTEM KOMPRESI DAN PENGEMASAN BIOGAS BERBASIS MIKROKONTROLER ESP32

PEMBIMBING : Ulil Albab, M.T

| No | Tanggal | Uraian | TTD |
|---|---|---|---|
| 1 | 22 april 25 | Bab I, II | |
| 2 | 23 april 25 | Revisi Bab I, II | |
| 3 | 16 Juni 25 | Bab III | |
| 4 | 24 Juni 25 | Revisi Bab III | |
| 5 | 15 Juli | Bab IV, V | |
| 6 | 28 Juli 2025 | Acc Sidang TA | |
| 7 | | | |

Lampiran 5. Form Bimbingan Tugas akhir 2

**HALAMAN BIMBINGAN**

**LAPORAN TUGAS AKHIR**

NAMA : IKHSAN SHIDDIQ ADZ-DZIKRI

NIM : 22010004

JUDUL : RANCANG BANGUN SISTEM KOMPRESI DAN PENGEMASAN BIOGAS BERBASIS MIKROKONTROLER ESP32

PEMBIMBING : MARTSELANI ADIAS SABARA, M.Kom.

| No | Tanggal | Uraian | TTD |
|---|---|---|---|
| 1 | 2 juli 25 | Rev Bab I<br>· tet untuk kata singkatan | |
| 2 | | · Penjabaran tentang proses Manual<br>· penjabaran Cara kerja otomatis | |
| 3 | | Sistem yg akan dibalas dalam pelaporan | |
| 4 | 23 juli 25 | ACC bab I | |
| 5 | | Rev bab II<br>keterangan format penulisan tata tulis | |
| 6 | 24 juli 25 | Rev bab III<br>· penambahan tabel uji Coba | |
| 7 | 25 juli 25 | · Acc bab III<br>· Acc bab IV | |

Lampiran 6. Kode program

```
#include <Keypad.h>
#include <Bonezegei_LCD1602_I2C.h>

const byte ROWS = 4;
const byte COLS = 3;
char hexaKeys[ROWS][COLS] = {
  { '1', '2', '3' },
  { '4', '5', '6' },
  { '7', '8', '9' },
  { '*', '0', '#' }
};
byte rowPins[ROWS] = { 15, 2, 0, 4 };
byte colPins[COLS] = { 16, 17, 5 };
Keypad customKeypad = Keypad(makeKeymap(hexaKeys), rowPins, colPins, ROWS, COLS);

const int outputPin = 19;
String input = "";
bool isOn = false;
unsigned long startTime = 0;
unsigned long durasiPengisian = 0;
bool sedangInput = false;

int menuIndex = 0;
bool modeSelected = false;

Bonezegei_LCD1602_I2C lcd(0x27);

int hashPressCount = 0;
unsigned long lastHashTime = 0;

const int pressurePin = 34;
const float sensorMinVoltage = 0.5;
const float sensorMaxVoltage = 5.0;
const float pressureMaxPSI = 174.0;
const float R1 = 1800.0;
const float R2 = 1800.0;
const float dividerRatio = R2 / (R1 + R2);
const float pressureOffsetPSI = 0.0;
```

```
const float correctionSlope = 18.0 / 28.0;
const float correctionOffset = -1.8;

const float pressureStartPSI = 0.0;
const float pressureStopPSI = 40.0;
float manualTargetPSI = 0.0;

unsigned long lastDisplayUpdate = 0;
const unsigned long displayInterval = 500;

void setup() {
  Serial.begin(9600);
  pinMode(outputPin, OUTPUT);
  digitalWrite(outputPin, LOW);
  analogReadResolution(12);
  lcd.begin();
  lcd.print("Pilih Mode:");
  updateMenuDisplay();
}

void loop() {
  char customKey = customKeypad.getKey();
  float pressure = readPressure();

  if (!modeSelected) {
    if (customKey == '4' || customKey == '6') {
      menuIndex = (menuIndex + 1) % 2;
      updateMenuDisplay();
    } else if (customKey == '*') {
      modeSelected = true;
      lcd.clear();
      if (menuIndex == 0) {
        lcd.setPosition(0, 0);
        lcd.print("Mode: AUTO");
        lcd.setPosition(0, 1);
        lcd.print("Tekan * untuk ON");
      } else {
        lcd.setPosition(0, 0);
        lcd.print("Tek: 0.0 PSI     ");
        lcd.setPosition(0, 1);
```

```
      lcd.print("Input: ");
    }
   }
   return;
  }

  if (menuIndex == 0) {
   if (customKey == '*') {
    if (!isOn && pressure < pressureStartPSI) {
     startOutput();
    }
   } else if (customKey == '#') {
    if (isOn) {
     digitalWrite(outputPin, LOW);
     isOn = false;
    } else {
     trackHashAndReset();
    }
   }

   if (isOn && pressure >= pressureStopPSI) {
    digitalWrite(outputPin, LOW);
    isOn = false;
   }

   if (millis() - lastDisplayUpdate >= displayInterval) {
    lastDisplayUpdate = millis();
    lcd.setPosition(0, 0);
    char buffer1[17];
    snprintf(buffer1, sizeof(buffer1), "Tek: %.1f PSI   ", pressure);
    lcd.print(buffer1);

    if (isOn) {
     lcd.setPosition(0, 1);
     char buffer2[17];
     snprintf(buffer2, sizeof(buffer2), "Durasi: %lus      ", (millis() - startTime) /
1000);
     lcd.print(buffer2);
    }
   }
```

```
}

if (menuIndex == 1) {
  if (customKey) {
    sedangInput = true; // user mulai mengetik
    if (customKey == '#') {
      if (isOn) {
        digitalWrite(outputPin, LOW);
        isOn = false;
        durasiPengisian = (millis() - startTime) / 1000;
        sedangInput = false;
        hashPressCount = 0;
      } else if (input.length() > 0) {
        input = "";
        sedangInput = false;
        lcd.setPosition(0, 1);
        lcd.print("Input:           ");
        hashPressCount = 0;
      } else {
        trackHashAndReset();
      }
    } else if (customKey == '*') {
      if (!isOn && input.length() > 0) {
        manualTargetPSI = input.toFloat();
        if (manualTargetPSI <= 0 || manualTargetPSI > pressureMaxPSI) {
          lcd.setPosition(0, 1);
          lcd.print("Batas invalid    ");
          delay(2000);
          input = "";
          sedangInput = false;
        } else if (pressure < manualTargetPSI) {
          startOutput();
          durasiPengisian = 0;
          sedangInput = false;
        } else {
          lcd.setPosition(0, 1);
          lcd.print("Tek. terlalu tinggi");
          delay(2000);
          sedangInput = false;
        }
```

```
      input = "";
    }
  } else {
    input += customKey;
  }
}

if (isOn && pressure >= manualTargetPSI) {
  digitalWrite(outputPin, LOW);
  isOn = false;
  durasiPengisian = (millis() - startTime) / 1000;
  sedangInput = false;
}

if (millis() - lastDisplayUpdate >= displayInterval) {
  lastDisplayUpdate = millis();

  lcd.setPosition(0, 0);
  char buffer1[17];
  snprintf(buffer1, sizeof(buffer1), "Tek: %.1f PSI   ", pressure);
  lcd.print(buffer1);

  lcd.setPosition(0, 1);
  if (isOn) {
    unsigned long durasi = (millis() - startTime) / 1000;
    char buffer2[17];
    snprintf(buffer2, sizeof(buffer2), "Durasi: %lus     ", durasi);
    lcd.print(buffer2);
  } else if (sedangInput || input.length() > 0) {
    lcd.print("Input: ");
    lcd.print(input.c_str());
    lcd.print("       ");
  } else if (durasiPengisian > 0) {
    char buffer2[17];
    snprintf(buffer2, sizeof(buffer2), "Durasi: %lus     ", durasiPengisian);
    lcd.print(buffer2);
  } else {
    lcd.print("Input: ");
    lcd.print(input.c_str());
    lcd.print("       ");
```

```
    }
   }
  }
}

float readPressure() {
  int adcValue = analogRead(pressurePin);
  float voltageAtPin = (adcValue / 4095.0) * 3.3;
  float voltageOriginal = voltageAtPin / dividerRatio;
  float pressurePSI = (voltageOriginal - sensorMinVoltage) * pressureMaxPSI /
(sensorMaxVoltage - sensorMinVoltage);
  pressurePSI = pressurePSI * correctionSlope + correctionOffset;
  pressurePSI += pressureOffsetPSI;
  return (pressurePSI < 0) ? 0 : pressurePSI;
}

void updateMenuDisplay() {
  lcd.setPosition(0, 1);
  if (menuIndex == 0) {
    lcd.print(">Auto   Manual ");
  } else {
    lcd.print(" Auto  >Manual ");
  }
}

void startOutput() {
  digitalWrite(outputPin, HIGH);
  isOn = true;
  startTime = millis();
}

void resetToMenu() {
  modeSelected = false;
  isOn = false;
  input = "";
  hashPressCount = 0;
  durasiPengisian = 0;
  sedangInput = false;
  lcd.clear();
  lcd.setPosition(0, 0);
```

```
  lcd.print("Pilih Mode:");
  updateMenuDisplay();
}

void trackHashAndReset() {
  unsigned long now = millis();
  if (now - lastHashTime < 2000) {
    hashPressCount++;
  } else {
    hashPressCount = 1;
  }
  lastHashTime = now;
  if (hashPressCount >= 2) {
    resetToMenu();
  } else {
    lcd.setPosition(0, 1);
    lcd.print("Tekan # x2 menu ");
  }
}
```

Lampiran 7. Form Penilaian Bimbingan

PENILAIAN BIMBINGAN TUGAS AKHIR INDIVIDU

Judul : RANCANG BANGUN SISTEM KOMPRESI DAN PENGEMASAN BIOGAS BERBASIS MIKROKONTROLER ESP32

Nama : Ikhsan Shiddiq Adz-Dzikri

NIM : 22010004

Kelas : 6A / D3 Teknik Elektronika

**I. Nilai Bimbingan Tugas Akhir (Pembimbing I)**

| No | Unsur Yang Dinilai | Nilai |
|---|---|---|
| 1 | Kedisiplinan dalam bimbingan | 75 |
| 2 | Kreativitas pemecahan dalam bimbingan | 85 |
| 3 | Penguasaan materi tugas akhir | 85 |
| 4 | Kelengkapan dan referensi tugas akhir | 80 |
| Total Nilai = (Jumlah Nilai / 4) | | 81,25 |

**II. Nilai Bimbingan Tugas Akhir (Pembimbing II)**

| No | Unsur Yang Dinilai | Nilai |
|---|---|---|
| 1 | Kedisiplinan dalam bimbingan | 70 |
| 2 | Kreativitas pemecahan dalam bimbingan | 85 |
| 3 | Penguasaan materi tugas akhir | 85 |
| 4 | Kelengkapan dan referensi tugas akhir | 80 |
| Total Nilai = (Jumlah Nilai / 4) | | 80 |

Nilai Bimbingan $= \frac{TotalNilaiPembimbing1 + TotalNilaiPembibing2}{2}$

$= 80,625$

Tegal, 28 Juli 2025

Mengetahui,

Pembimbing 1

Ulil Albab. M,T

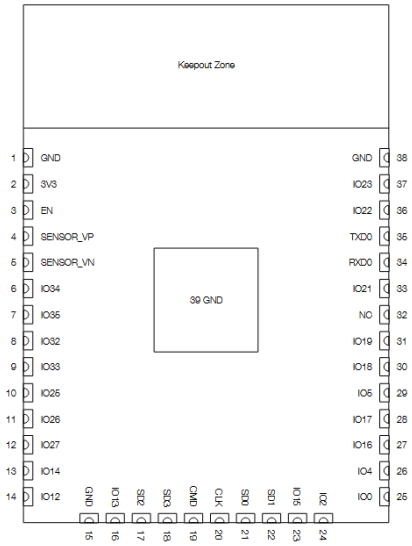
Pembimbing 2

Martselani Adias Sabara, M.KOM

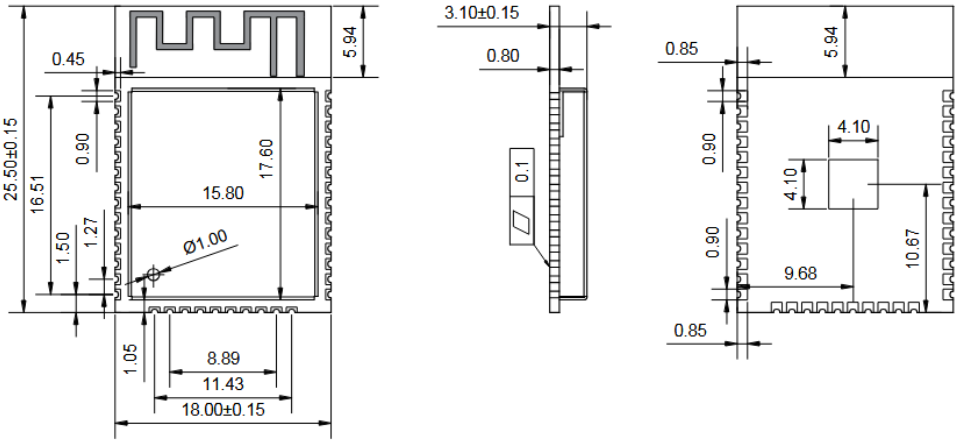
Lampiran 8. Datasheet ESP32

## 2.1 Pin Layout

The pin diagram below shows the approximate location of pins on the module. For the actual diagram drawn to scale, please refer to Figure 9 *Module Dimensions*.



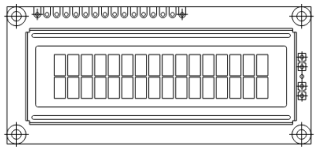

Unit: mm




Top View Side View Bottom View

Lampiran 9. Datasheet LCD I2C 16x2

# 16 x 2 Character LCD



## FEATURES

- Type: Character
- Display format: 16 x 2 characters
- Built-in controller: ST 7066 (or equivalent)
- Duty cycle: 1/16
- 5 x 8 dots includes cursor
- + 5 V power supply
- LED can be driven by pin 1, pin 2, or A and K
- N.V. optional for + 3 V power supply
- Optional: Smaller character size (2.95 mm x 4.35 mm)
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912

Pb-free
RoHS COMPLIANT

**MECHANICAL DATA**

| ITEM | STANDARD VALUE | UNIT |
|---|---|---|
| Module Dimension | 80.0 x 36.0 x 13.2 (max.) | mm |
| Viewing Area | 66.0 x 16.0 | |
| Dot Size | 0.55 x 0.65 | |
| Dot Pitch | 0.60 x 0.70 | |
| Mounting Hole | 75.0 x 31.0 | |
| Character Size | 2.95 x 5.55 | |

**ABSOLUTE MAXIMUM RATINGS**

| ITEM | SYMBOL | STANDARD VALUE | | | UNIT |
|---|---|---|---|---|---|
| | | MIN. | TYP. | MAX. | |
| Power Supply | $V_{DD}$ to $V_{SS}$ | - 0.3 | - | 13 | V |
| Input Voltage | $V_I$ | $V_{SS}$ | - | $V_{DD}$ | |

**Note**

- $V_{SS}$ = 0 V, $V_{DD}$ = 5.0 V

**ELECTRICAL CHARACTERISTICS**

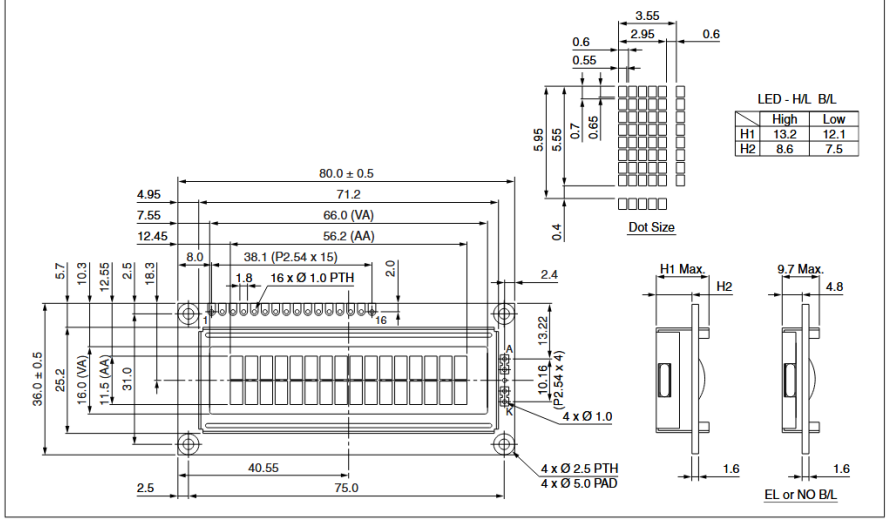
| ITEM | SYMBOL | CONDITION | STANDARD VALUE | | | UNIT |
|---|---|---|---|---|---|---|
| | | | MIN. | TYP. | MAX. | |
| Input Voltage | $V_{DD}$ | $V_{DD}$ = + 5 V | 4.5 | 5.0 | 5.5 | V |
| Supply Current | $I_{DD}$ | $V_{DD}$ = + 5 V | 1.0 | 1.2 | 1.5 | mA |
| Recommended LC Driving Voltage for Normal Temperature Version Module | $V_{DD}$ to $V_0$ | - 20 °C | - | - | 5.2 | V |
| | | 0 °C | - | - | - | |
| | | 25 °C | - | 3.7 | - | |
| | | 50 °C | - | - | - | |
| | | 70 °C | 3.1 | - | - | |
| LED Forward Voltage | $V_F$ | 25 °C | - | 4.2 | 4.6 | V |
| LED Forward Current - Array | $I_F$ | 25 °C | - | 100 | - | mA |
| LED Forward Current - Edge | | | - | 20 | 40 | |
| EL Power Supply Current | $I_{EL}$ | $V_{EL}$ = 110 $V_{AC}$, 400 Hz | - | - | 5.0 | mA |

**DISPLAY CHARACTER ADDRESS CODE**

Display Position

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DD RAM Address | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 0A | 0B | 0C | 0D | 0E | 0F |
| DD RAM Address | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 4A | 4B | 4C | 4D | 4E | 4F |

**DIMENSIONS** in millimeters

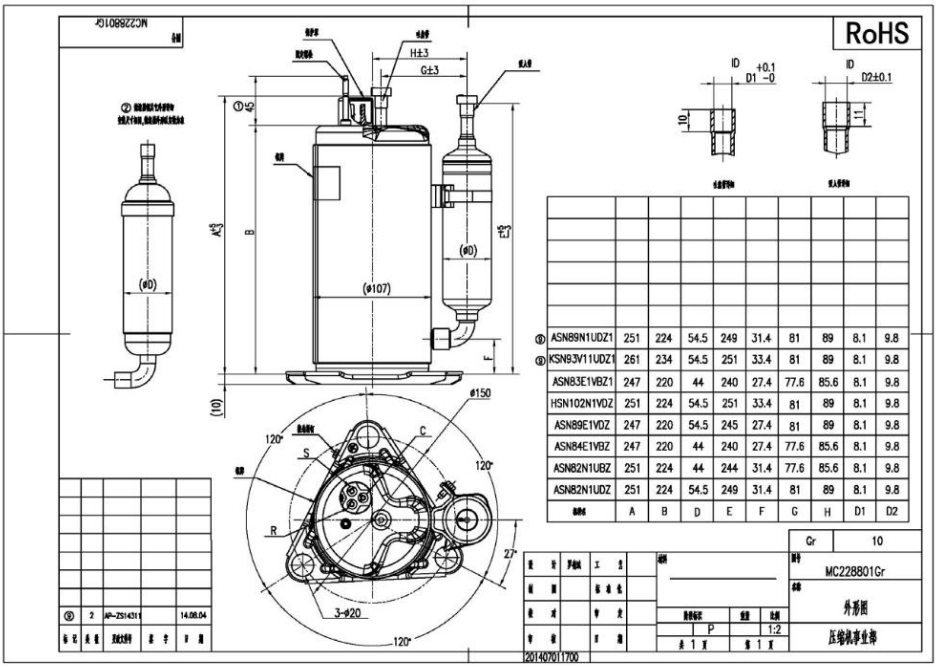


Lampiran 10. Datasheet Kompresor GMCC KSN93V11UDZ1

| | |
|---|---|
| Teknologi | ROTARY |
| tekanan | HT |
| Jenis perlindungan motor | Intern |
| Desain | VERTIKAL |
| CE | TIDAK |
| UL | TIDAK |
| Aplikasi | AC |
| Jenis minyak | RB74AF |
| PED | SAYA |
| Jenis motor | PSC FASE TUNGGAL |
| Tinggi | 271 mm |
| Tingkat suara | 65 dB |
| LRA | 19 Sebuah |
| Arus terukur | 3,95 A |
| Diameter | 107 mm |

GMCC KSN93V11UDZ1

外形图 (COMPRESSOR DRAWING)



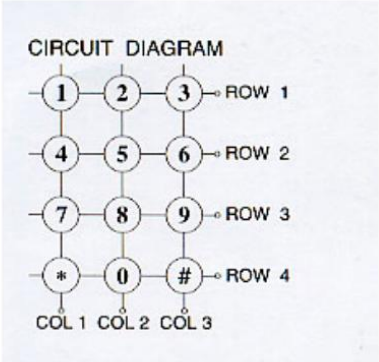

| | A | B | D | E | F | G | H | D1 | D2 |
|---|---|---|---|---|---|---|---|---|---|
| ① ASN89N1UDZ1 | 251 | 224 | 54.5 | 249 | 31.4 | 81 | 89 | 8.1 | 9.8 |
| ② KSN93V11UDZ1 | 261 | 234 | 54.5 | 251 | 33.4 | 81 | 89 | 8.1 | 9.8 |
| ASN83E1VBZ1 | 247 | 220 | 44 | 240 | 27.4 | 77.6 | 85.6 | 8.1 | 9.8 |
| HSN102N1VDZ | 251 | 224 | 54.5 | 251 | 33.4 | 81 | 89 | 8.1 | 9.8 |
| ASN89E1VDZ | 247 | 220 | 54.5 | 245 | 27.4 | 81 | 89 | 8.1 | 9.8 |
| ASN84E1VBZ | 247 | 220 | 44 | 240 | 27.4 | 77.6 | 85.6 | 8.1 | 9.8 |
| ASN82N1UBZ | 251 | 224 | 44 | 244 | 31.4 | 77.6 | 85.6 | 8.1 | 9.8 |
| ASN82N1UDZ | 251 | 224 | 54.5 | 249 | 31.4 | 81 | 89 | 8.1 | 9.8 |

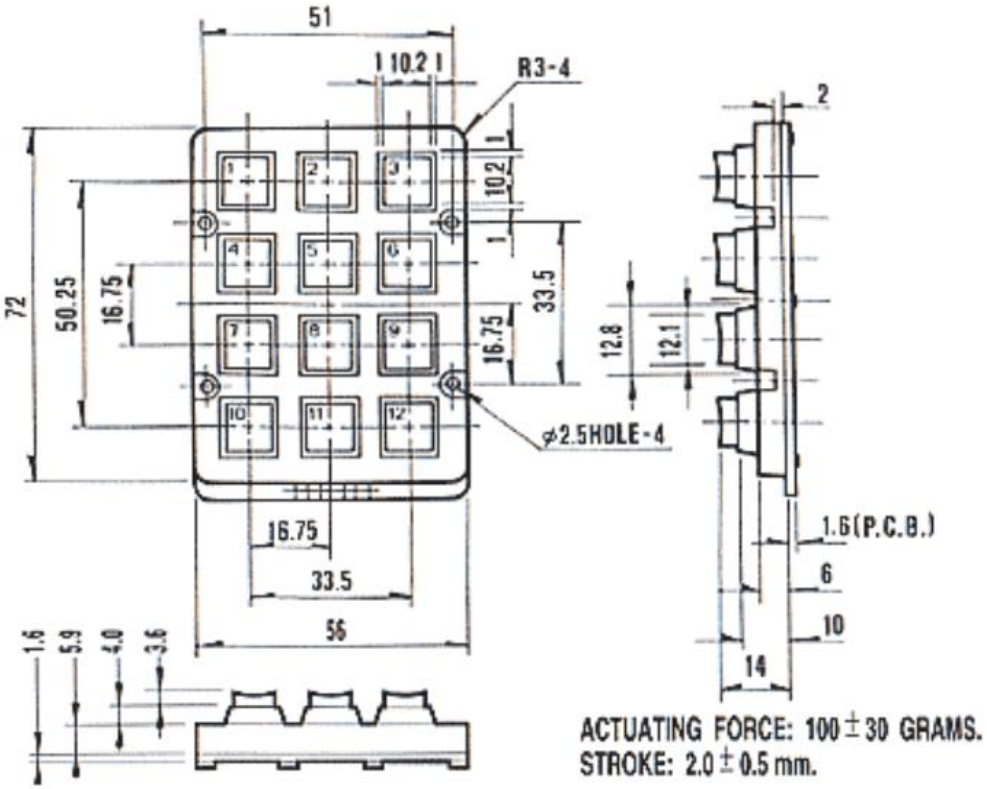
Lampiran 11. Datasheet keypad 3x4

**General Specification**

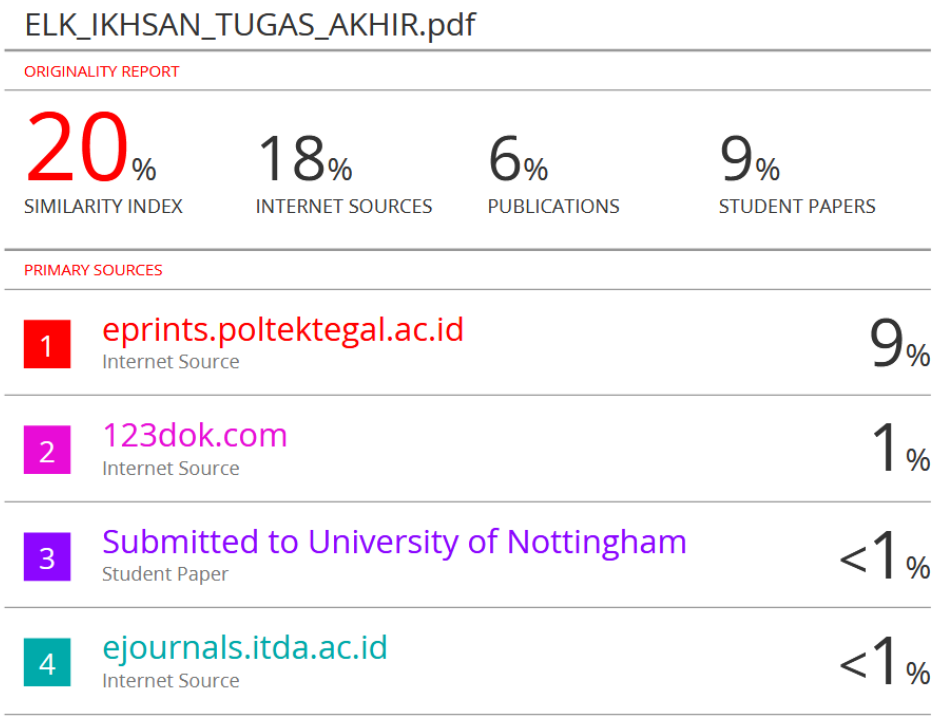
- Contact rating:20mA,24VDC
- Contact resistance:200 ohm max
- Life:1,000,000 cycles per key
- Operating Temperature: -20 to +60
- Storage Temperature: -40 to +65

**Standard Matrix Circuit Diagram**



Lampiran 12. Plagiasi



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