

LAMPIRAN

Lampiran ke-1 Listing Program

```
#include <Wire.h>
#include <Adafruit_INA219.h>
#include <LiquidCrystal_I2C.h>

// Inisialisasi sensor INA219
Adafruit_INA219 ina219_panel(0x40);
Adafruit_INA219 ina219_charge(0x41);
Adafruit_INA219 ina219_battery(0x44);

// Inisialisasi LCD
LiquidCrystal_I2C lcd(0x27, 20, 4);

// Pin relay
const int relayChargePin = 8; // Relay untuk pengisian
const int relayBatteryPin = 9; // Relay untuk baterai
const int relayLoadPin = 10; // Relay untuk beban

// Variabel untuk menyimpan status terakhir
bool BatteryFullLCD = false;
bool BatteryLowLCD = false;

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

    // Inisialisasi INA219
    if (!ina219_panel.begin()) {
        Serial.println("Failed to find INA219 panel chip");
    }
}
```

```

    while (1);
}
if (!ina219_charge.begin()) {
    Serial.println("Failed to find INA219 charge chip");
    while (1);
}
if (!ina219_battery.begin()) {
    Serial.println("Failed to find INA219 battery chip");
    while (1);
}

// Inisialisasi relay
pinMode(relayChargePin, OUTPUT);
pinMode(relayBatteryPin, OUTPUT);
pinMode(relayLoadPin, OUTPUT);

// Set relay awal
digitalWrite(relayBatteryPin, LOW); // Relay baterai tidak
    aktif
digitalWrite(relayChargePin, LOW); // Mulai dalam mode
    pengisian
digitalWrite(relayLoadPin, HIGH); // Beban awalnya tidak
    terhubung

// Inisialisasi LCD
lcd.init();
lcd.backlight();
}

void loop() {
    // Baca data dari sensor INA219
    float panelVoltage = ina219_panel.getBusVoltage_V();

```

```

float panelCurrent = ina219_panel.getCurrent_mA() /
    1000.0; // Ubah ke Ampere

float chargeVoltage = ina219_charge.getBusVoltage_V();
float chargeCurrent = ina219_charge.getCurrent_mA() /
    1000.0; // Ubah ke Ampere

// Kontrol relay berdasarkan tegangan baterai
if (batteryVoltage >= 14.40) {
    digitalWrite(relayLoadPin, LOW); // Terhubung ke beban
    digitalWrite(relayChargePin, HIGH); // Pengisian tidak
    aktif
} else if (batteryVoltage < 11.50) {
    delay(2000);

    digitalWrite(relayLoadPin, HIGH); // Beban tidak
    terhubung
    digitalWrite(relayChargePin, LOW); // Terhubung ke
    pengisian
}

// Tampilkan data pada LCD
lcd.setCursor(0, 0);
lcd.print("PV:");
lcd.print(panelVoltage);
lcd.print(" I:");
lcd.print(panelCurrent, 3);
lcd.print("A   ");

lcd.setCursor(0, 1);
lcd.print("CV:");
lcd.print(chargeVoltage);
lcd.print(" I:");
lcd.print(chargeCurrent, 3);

```

```

lcd.print("A   ");

lcd.setCursor(0, 2);
lcd.print("BV:");
lcd.print(batteryVoltage);
lcd.print(" I:");
lcd.print(batteryCurrent, 3);
lcd.print("A   ");

// Tentukan status baterai
lcd.setCursor(0, 3);
if (digitalRead(relayChargePin) == LOW) {
    lcd.print("Status: Pengisian ");
    BatteryFullLCD = false;
    BatteryLowLCD = false;
} else if (batteryVoltage >= 14.40) {
    lcd.print("Battery Full   ");
    if (!BatteryFullLCD) {
        delay(2000); // Tunda 2 detik
        BatteryFullLCD = true;
    }
    BatteryLowLCD = false;
} else if (batteryVoltage < 11.51) {
    lcd.print("Battery Low   ");
    if (!BatteryLowLCD) {
        BatteryLowLCD = true;
        delay(2000); // Tunda 2 detik
    }
    BatteryFullLCD = false;
} else {
    lcd.print("Status: Pemakaian");

```

```
BatteryFullLCD = false;  
BatteryLowLCD = false;  
}  
  
// Tunggu 1 detik sebelum membaca ulang data  
delay(1000);  
}
```

Lampiran ke-2 Data sheet Sensor Ina219



INA219

SBOS448G –AUGUST 2008–REVISED DECEMBER 2015

INA219 Zero-Drift, Bidirectional Current/Power Monitor With I²C Interface

1 Features

- Senses Bus Voltages from 0 to 26 V
- Reports Current, Voltage, and Power
- 16 Programmable Addresses
- High Accuracy: 0.5% (Maximum) Over Temperature (INA219B)
- Filtering Options
- Calibration Registers
- SOT23-8 and SOIC-8 Packages

2 Applications

- Servers
- Telecom Equipment
- Notebook Computers
- Power Management
- Battery Chargers
- Welding Equipment
- Power Supplies
- Test Equipment

3 Description

The INA219 is a current shunt and power monitor with an I²C- or SMBUS-compatible interface. The device monitors both shunt voltage drop and bus supply voltage, with programmable conversion times and filtering. A programmable calibration value, combined with an internal multiplier, enables direct readouts of current in amperes. An additional multiplying register calculates power in watts. The I²C- or SMBUS-compatible interface features 16 programmable addresses.

The INA219 is available in two grades: A and B. The B grade version has higher accuracy and higher precision specifications.

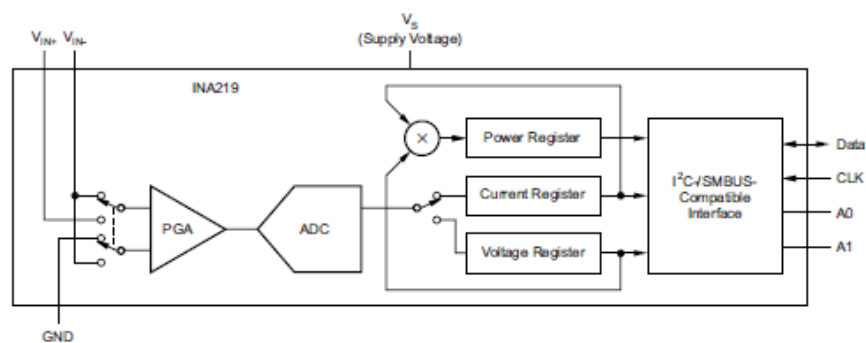
The INA219 senses across shunts on buses that can vary from 0 to 26 V. The device uses a single 3- to 5.5-V supply, drawing a maximum of 1 mA of supply current. The INA219 operates from –40°C to 125°C.

Device Information⁽¹⁾

PART NUMBER	PACKAGE	BODY SIZE (NOM)
INA219	SOIC (8)	3.91 mm × 4.90 mm
	SOT-23 (8)	1.63 mm × 2.90 mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.

Simplified Schematic



AC
Go



INA219

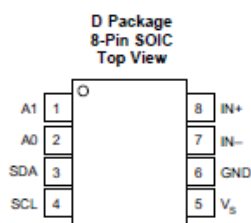
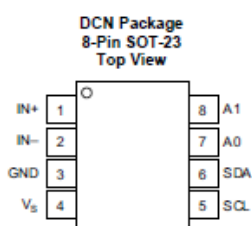
www.ti.com

SBOS448G – AUGUST 2008 – REVISED DECEMBER 2015

5 Related Products

DEVICE	DESCRIPTION
INA209	Current/power monitor with watchdog, peak-hold, and fast comparator functions
INA210, INA211, INA212, INA213, INA214	Zero-drift, low-cost, analog current shunt monitor series in small package

6 Pin Configuration and Functions



Pin Functions

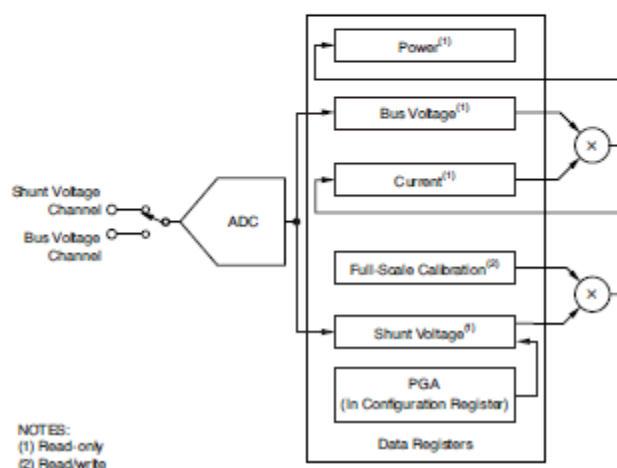
PIN			I/O	DESCRIPTION
NAME	SOT-23	SOIC		
IN+	1	8	Analog Input	Positive differential shunt voltage. Connect to positive side of shunt resistor.
IN-	2	7	Analog Input	Negative differential shunt voltage. Connect to negative side of shunt resistor. Bus voltage is measured from this pin to ground.
GND	3	6	Analog	Ground
V _S	4	5	Analog	Power supply, 3 to 5.5 V
SCL	5	4	Digital Input	Serial bus clock line
SDA	6	3	Digital I/O	Serial bus data line
A0	7	2	Digital Input	Address pin. Table 1 shows pin settings and corresponding addresses.
A1	8	1	Digital Input	Address pin. Table 1 shows pin settings and corresponding addresses.

Acti

8.1 Overview

The INA219 is a digital current sense amplifier with an I²C- and SMBus-compatible interface. It provides digital current, voltage, and power readings necessary for accurate decision-making in precisely-controlled systems. Programmable registers allow flexible configuration for measurement resolution as well as continuous-versus-triggered operation. Detailed register information appears at the end of this data sheet, beginning with [Table 2](#). See the [Functional Block Diagram](#) section for a block diagram of the INA219 device.

8.2 Functional Block Diagram



8.3 Feature Description

8.3.1 Basic ADC Functions

The two analog inputs to the INA219, IN+ and IN-, connect to a shunt resistor in the bus of interest. The INA219 is typically powered by a separate supply from 3 to 5.5 V. The bus being sensed can vary from 0 to 26 V. There are no special considerations for power-supply sequencing (for example, a bus voltage can be present with the supply voltage off, and vice-versa). The INA219 senses the small drop across the shunt for shunt voltage, and senses the voltage with respect to ground from IN- for the bus voltage. [Figure 13](#) shows this operation.

When the INA219 is in the normal operating mode (that is, MODE bits of the Configuration register are set to 111), it continuously converts the shunt voltage up to the number set in the shunt voltage averaging function (Configuration register, SADC bits). The device then converts the bus voltage up to the number set in the bus voltage averaging (Configuration register, BADC bits). The Mode control in the Configuration register also permits selecting modes to convert only voltage or current, either continuously or in response to an event (triggered).

All current and power calculations are performed in the background and do not contribute to conversion time; conversion times shown in the [Electrical Characteristics](#) can be used to determine the actual conversion time.

Power-Down mode reduces the quiescent current and turns off current into the INA219 inputs, avoiding any supply drain. Full recovery from Power-Down requires 40 μ s. ADC Off mode (set by the Configuration register, MODE bits) stops all conversions.

Writing any of the triggered convert modes into the Configuration register (even if the desired mode is already programmed into the register) triggers a single-shot conversion. [Table 6](#) lists the triggered convert mode settings.

Feature Description (continued)

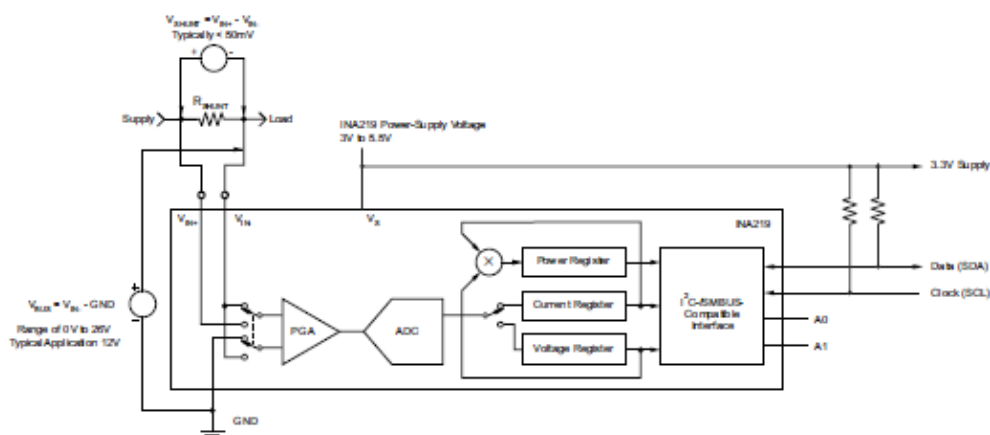


Figure 13. INA219 Configured for Shunt and Bus Voltage Measurement

Although the INA219 can be read at any time, and the data from the last conversion remain available, the conversion ready bit (Status register, CNVR bit) is provided to help coordinate one-shot or triggered conversions. The conversion ready bit is set after all conversions, averaging, and multiplication operations are complete.

The conversion ready bit clears under any of these conditions:

- Writing to the Configuration register, except when configuring the MODE bits for power down or ADC off (disable) modes
- Reading the Status register
- Triggering a single-shot conversion with the convert pin

8.3.1.1 Power Measurement

Current and bus voltage are converted at different points in time, depending on the resolution and averaging mode settings. For instance, when configured for 12-bit and 128 sample averaging, up to 68 ms in time between sampling these two values is possible. Again, these calculations are performed in the background and do not add to the overall conversion time.

8.3.1.2 PGA Function

If larger full-scale shunt voltages are desired, the INA219 provides a PGA function that increases the full-scale range up to 2, 4, or 8 times (320 mV). Additionally, the bus voltage measurement has two full-scale ranges: 16 or 32 V.

8.3.1.3 Compatibility With TI Hot Swap Controllers

The INA219 is designed for compatibility with hot swap controllers such as the TI TPS2490. The TPS2490 uses a high-side shunt with a limit at 50 mV; the INA219 full-scale range of 40 mV enables the use of the same shunt for current sensing below this limit. When sensing is required at (or through) the 50-mV sense point of the TPS2490, the PGA of the INA219 can be set to /2 to provide an 80-mV full-scale range.

Lampiran ke-3 Datasheet Generator Listrik DC

Spesifikasi Umum:

- **Jenis Produk:** Generator Listrik DC
- **Output Tegangan:** 24V - 100V DC (tergantung kecepatan putaran dan torsi)
- **Arus Output Maksimal:** 3 Ampere (tergantung kecepatan putaran dan torsi)
- **Arus Rekomendasi:** Maksimal 2.5 Ampere (untuk beban 150W)
- **Ukuran Generator:**
 - Panjang: 11 cm
 - Lebar: 8 cm
- **Diameter Poros:** 8 mm

Kinerja:

- **Kecepatan Putaran Stabil:** 1500 RPM
- **Output pada 1500 RPM:**
 - Tegangan: 65V - 80V DC
 - Arus: 2A - 3A

Aplikasi Penggunaan:

- Pembangkit listrik tenaga air (kincir air)
- Pembangkit listrik tenaga angin (kincir angin)
- Mini hidro (sungai kecil)
- Penerangan rumah kecil di sawah dengan lampu DC 12V (LED 12V)

Sumber Informasi:

- **Platform:** Shopee
- **Nama Toko:** Jakarta Elektronik Part
- **Link Pembelian:** [Shopee - Jakarta Elektronik Part](#)

Lampiran ke-4 Keterangan baterai



Lampiran ke-5 Datasheet panel surya

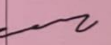
HiMAWARI® SOLAR PANEL	
Model No: 50W	
Rated power (pmax) :	50(W)
Voltage at pmax (Vmp) :	18(V)
Current at pmax (Imp) :	2.78(A)
Open-circuit Voltage (Voc) :	21.6(V)
Short-circuit Current (Isc) :	2.97(A)
Max System Operating Voltage:	1000DC(V)
Maximum Series fuse rating:	10A
Conversion rate:	18.4 %
Standard Test Condition:	1000W/m ² AM1.5 25°C
⚠ Shock Hazard Warning (if maximum system voltage > 50V)	
□ (ISO) CE ROHS SZD 2022.11	

Lampiran ke-7 Dokumentasi pengambilan data



Lampiran ke-8 Kartu Monitoring Bimbingan

1. Kartu Monitoring Bimbingan Proposal

 KARTU MONITORING BIMBINGAN MAHASISWA PROGRAM STUDI TEKNIK ELEKTRO FAKULTAS TEKNIK UNIVERSITAS MUHAMMADIYAH PAREPARE			
PROPOSAL			
Mahasiswa : Muhammad Iqram		Pembimbing I : Asrul, ST., MT.	
NIM : 219180025		Pembimbing II : Ir. Andi Muhammad Syafar, ST., MT., IPM	
Judul Skripsi : Sistem Otomatis Pengisian dan Pengosongan Baterai dengan Sumber Tenaga Surya dan Angin			
ARAHAN PEMBIMBING I	HARI/TGL & PARAF PEMBIMBING	ARAHAN PEMBIMBING II	HARI/TGL & PARAF PEMBIMBING
Konsultasi 1 - Rumusan Masalah. - Batasan Masalah. - Jenis Penelitian		Konsultasi 1 Latar belakang harus lebih fokus sesuai judul yang mau diangkat.	
Konsultasi 2 - Penjelasan tentang Jenis Penelitian.		Konsultasi 2 Teori terkait energi Angin dan energi Surya yang masih kurang.	
Konsultasi 3 - Ace y Seminar Proposal		Konsultasi 3 Flow chart harus lebih menjawab alur rumusan masalah.	
Konsultasi 4		Konsultasi 4 Alat yang dibuat sesuai dengan judul.	
Konsultasi 5		Konsultasi 5 Daftar pustaka disesuaikan dengan referensi.	

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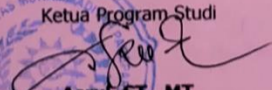
Perhatian :

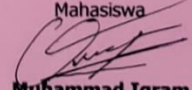
1. Mahasiswa wajib konsultasi minimal 5 kali
2. Kartu ini wajib dibawa oleh mahasiswa disetiap konsultasi dan diisi oleh Pembimbing
3. Kartu ini wajib dilampirkan pada laporan skripsi dan menjadi salah satu persyaratan untuk ikut seminar proposal/ujian skripsi
4. Kartu ini dicetak di atas kertas karton A4 berwarna merah muda dan dicetak timbal balik

Lanjutan ...

ARAHAN PEMBIMBING I	HARI/TGL & PARAF PEMBIMBING	ARAHAN PEMBIMBING II	HARI/TGL & PARAF PEMBIMBING
Konsultasi 6		Konsultasi 6	
Konsultasi 7		Konsultasi 7	
Konsultasi 8		Konsultasi 8	
Konsultasi 9		Konsultasi 9	
Konsultasi 10		Konsultasi 10	

Parepare, 19 Jun 2023

Mengetahui
Ketua Program Studi

Asrul, ST., MT.
NBM. 986 836

Mahasiswa

Muhammad Iqram
NIM. 219180025

Perhatian :

1. Mahasiswa wajib konsultasi minimal 5 kali
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3. Kartu ini wajib dilampirkan pada laporan skripsi dan menjadi salah satu persyaratan untuk ikut seminar proposal/ujian skripsi
4. Kartu ini dicetak di atas kertas karton A4 berwarna merah muda dan dicetak timbal balik

2. Kartu Monitoring Bimbingan Skripsi



KARTU MONITORING BIMBINGAN
 MAHASISWA PROGRAM STUDI TEKNIK ELEKTRO
 FAKULTAS TEKNIK
 UNIVERSITAS MUHAMMADIYAH PAREPARE

SKRIPSI

Mahasiswa : Muhammad Iqram	Pembimbing I : Asrul, ST., MT.
NIM : 219180025	Pembimbing II : Dr. Ir. Andi Muhammad Syafar, ST., MT., IPM
Judul Skripsi : Sistem Otomatis Pengisian Baterai dengan Sumber Tenaga Surya dan Angin	

ARAHAN PEMBIMBING I	HARI/TGL & PARAF PEMBIMBING	ARAHAN PEMBIMBING II	HARI/TGL & PARAF PEMBIMBING
Konsultasi 1 - pengambilan data	/	Konsultasi 1 keter belakang - uraikan yang malaror balok - uraikan yang malaror balok - uraikan yang malaror balok - uraikan yang malaror balok - uraikan yang malaror balok	/
Konsultasi 2 - pengujian pengisian baterai dengan sumber tenaga angin	/	Konsultasi 2 Abstrak terdiri atas tujuan, metode, dan hasil dalam satu paragraf maksimum 150 kata	/
Konsultasi 3 - Buat pengujian kinerja angin rakitan - Buat analisis kinerja rakitan angin rakitan	/	Konsultasi 3 Jawab rangkuman yang meliputi: input, proses, dan output	/
Konsultasi 4 - Penulisan keterangan tabel - Sesuaikan pengambilan data dengan spesifikasi baterai	/	Konsultasi 4 Ace	/
Konsultasi 5 Ace	/	Konsultasi 5	

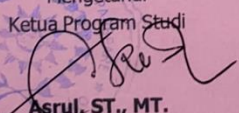
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Perhatian :

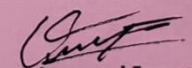
1. Mahasiswa wajib konsultasi minimal 5 kali
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Konsultasi 6		Konsultasi 6	
Konsultasi 7		Konsultasi 7	
Konsultasi 8		Konsultasi 8	
Konsultasi 9		Konsultasi 9	
Konsultasi 10		Konsultasi 10	

Mengetahui
Ketua Program Studi

Asrul, ST., MT.
NBM. 986 836

Parepare, 18 SEPTEMBER 2024

Mahasiswa

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NIM. 219180025

Perhatian :

1. Mahasiswa wajib konsultasi minimal 5 kali
2. Kartu ini wajib dibawa oleh mahasiswa disetiap konsultasi dan diisi oleh Pembimbing
3. Kartu ini wajib dilampirkan pada laporan skripsi dan menjadi salah satu persyaratan untuk ikut seminar proposal/ujian skripsi
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