

# Thermometer bewegingsmelder en clock

## Thermometer bewegingsmelder en clock

Het display laat de temperatuur en luchtvochtigheid zien en toont de trend met een pijltje omhoog of naar beneden.

Op de tweede regel staat de datum en tijd.

Het display gaat alleen 'aan' als er beweging wordt geconstateerd.

Gemeten stroom is ongeveer 40 mA voor de gehele schakeling.



## Aansuitschema

### *PIR Bewegingsmelder*



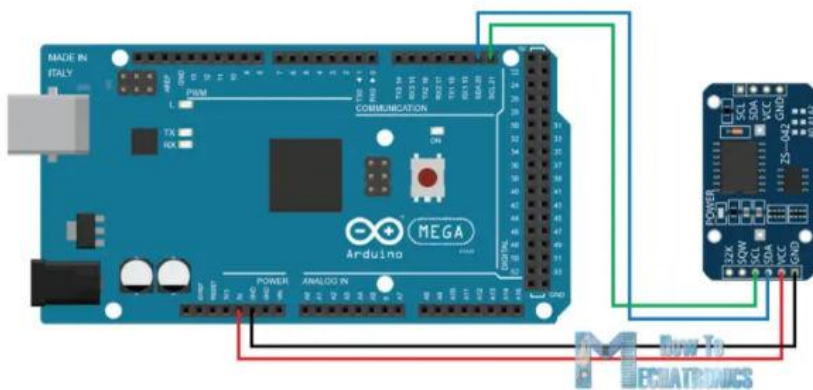
Van onder gezien van links naar rechts

(Let op er zijn verschillende pin configuraties. Verwijder lens/cap om de pin configuratie te zien).

- Plus 5V
- Signaal naar Pin 12 Arduino Leonarde.
- Min

Signaal naar Digitaal pin 12 Arduono Leonarde

## *Clock DS 3231*

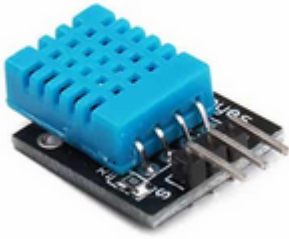


<http://www.rinkydinkelectronics.com/library.php?id=73>

Van links naar rechts van onderkant (niet batterij kant) gezien en *laatste* 4 pootjes.

- SCL naar SCL op Arduino (op Leonarde meest rechter pin)
- SDA naar SDA op Arduino (op Leonarde op een na meest rechter pin)
- Plus 3.3V
- Min

## *Thermometer*



Van links naar rechts (gaatjes van blauwe blokje boven).

- naar pin 4 Arduino Leonarde
- Plus 3.3V
- Min

Zie <https://www.roc.ovh/books/arduino/page/temperatuur-en-luchtvochtigheid>

## Display



Zie <https://www.roc.ovh/books/arduino/page/display>

## Code

```
#include <Wire.h>
#include <LiquidCrystal_I2C.h>
#include <DHT.h>
#include <DS3231.h>

#define DHTPIN 4           // Pin connected to the DHT11 data pin
#define DHTTYPE DHT11     // Specify DHT11 sensor
```

```
#define SIGNAL_INTERVAL 600000 // 10 minutes

DHT dht(DHTPIN, DHTTYPE);

DS3231 myRTC;
bool century = false;
bool h12Flag;
bool pmFlag;

int count = 0;
int pirPin = 12;      // Pin for the HC-S501 sensor
int pirValue;

LiquidCrystal_I2C lcd = LiquidCrystal_I2C(0x27, 16, 2);
unsigned long previousMillis = 0;
const long dhtInterval = 2000; // Interval for DHT readings

// Custom characters for the LCD arrows
byte downChar[] = {
  B00000,
  B00000,
  B00100,
  B00100,
  B00100,
  B00100,
  B10101,
  B01110,
  B00100
};

byte upChar[] = {
  B00100,
  B01110,
  B10101,
  B00100,
  B00100,
  B00100,
  B00100,
  B00000,
  B00000
};
```

```

byte degreeChar[] = {
    B00110,
    B01001,
    B01001,
    B00110,
    B00000,
    B00000,
    B00000,
    B00000
};

//-----
// Generic MeasurementSensor Class Template
//-----
template <typename T>
class MeasurementSensor {
private:
    T measurement;          // Current measurement value
    int arrow;              // Arrow indicator: 0 = no arrow, 1 = down, 2 = up
    unsigned long arrowMillis; // Last time the arrow was updated/reset
    const long signalInterval; // Time interval to reset the arrow

public:
    // Constructor: initializes with an initial measurement value.
    MeasurementSensor(long sigInterval, T initValue)
        : measurement(initValue), arrow(0), arrowMillis(0), signalInterval(sigInterval) {}

    // Update the measurement reading and determine the arrow indicator
    void update(T newMeasurement, unsigned long currentMillis) {
        // If the new measurement equals the previous value and the signal interval has passed, reset arrow.
        if (newMeasurement == measurement && currentMillis - arrowMillis >= signalInterval) {
            arrow = 0;
        } else {
            if (newMeasurement > measurement) {
                arrow = 2; // Up arrow
                arrowMillis = currentMillis;
            }
            if (newMeasurement < measurement) {
                arrow = 1; // Down arrow
                arrowMillis = currentMillis;
            }
        }
    }
};

```

```

    }
}

// If the previous value is the initial invalid value, clear the arrow indicator.
if (measurement == static_cast<T>(-99)) {
    arrow = 0;
}

    measurement = newMeasurement;
}

// Getters for measurement and arrow
T getMeasurement() const { return measurement; }
int getArrow() const { return arrow; }
};

//-----
// Global Instances for Temperature and Humidity
//-----
MeasurementSensor<float> tempSensor(SIGNAL_INTERVAL, -99.0);
MeasurementSensor<int> humiditySensor(SIGNAL_INTERVAL, -99);

void setup() {
    Serial.begin(9600);
    dht.begin();
    delay(2000);

    lcd.init();
    lcd.backlight();
    lcd.clear();
    lcd.createChar(1, downChar);
    lcd.createChar(2, upChar);
    lcd.createChar(3, degreeChar);

    pinMode(pirPin, INPUT);

    // myRTC.setYear(2025);
    // myRTC.setMonth(3);
    // myRTC.setDate(20);
    // myRTC.setHour(23);

```

```
// myRTC.setMinute(49);
// myRTC.setSecond(0);
}

void print2digits(int number) {
  if (number < 10) {
    lcd.print("0");
  }
  lcd.print(number, DEC);
}

void loop() {
  delay(20);

  // lcd.print(":");
  // print2digits(myRTC.getSecond());

  // Check for movement
  pirValue = digitalRead(pirPin);
  if (pirValue) {
    lcd.backlight();
  }

  // Do we need to update the display?
  unsigned long currentMillis = millis();
  if (currentMillis - previousMillis >= dhtInterval) {
    previousMillis = currentMillis;

    // Update backlight based on PIR sensor
    pirValue = digitalRead(pirPin);
    if (!pirValue) {
      lcd.noBacklight();
    }

    count++;

    // Read new values from the DHT sensor
    float newTemperature = dht.readTemperature();
    int newHumidity = dht.readHumidity();
```

```
if (isnan(newTemperature) || isnan(newHumidity)) {  
    Serial.println("Failed to read from DHT sensor!");  
    return;  
}  
  
// Update our measurement sensors  
tempSensor.update(newTemperature, currentMillis);  
humiditySensor.update(newHumidity, currentMillis);  
  
// Print sensor readings to the Serial Monitor  
Serial.print(count);  
Serial.print(", Temperature: ");  
Serial.print(tempSensor.getMeasurement(), 1);  
Serial.print("°C");  
Serial.print(", Humidity: ");  
Serial.print(humiditySensor.getMeasurement());  
Serial.print("%");  
Serial.println("");  
Serial.println(myRTC.getSecond(), DEC);  
Serial.println("");  
  
// Update the LCD display for temperature  
lcd.setCursor(0, 0);  
if (tempSensor.getArrow()) {  
    lcd.write(tempSensor.getArrow());  
} else {  
    lcd.print(" ");  
}  
lcd.print(tempSensor.getMeasurement(), 1);  
lcd.write(3); // degree symbol  
lcd.print("C ");  
  
// Update the LCD display for humidity (set cursor on second row)  
lcd.setCursor(12, 0);  
if (humiditySensor.getArrow()) {  
    lcd.write(humiditySensor.getArrow());  
} else {  
    lcd.print(" ");  
}  
lcd.print(humiditySensor.getMeasurement());
```



```

lcd.print("%");

lcd.setCursor(1, 1);
print2digits(myRTC.getDate());
lcd.print("-");
print2digits(myRTC.getMonth(century));

lcd.setCursor(10, 1);
print2digits(myRTC.getHour(h12Flag, pmFlag));
lcd.print(":");
print2digits(myRTC.getMinute());
}
}

```

## Code met highest/lowest

```

#include <Wire.h>
#include <LiquidCrystal_I2C.h>
#include <DHT.h>
#include <DS3231.h>

#define DHTPIN 4           // Pin connected to the DHT11 data pin
#define DHTTYPE DHT11      // Specify DHT11 sensor
#define SIGNAL_INTERVAL 600000 // 10 minutes

DHT dht(DHTPIN, DHTTYPE);

DS3231 myRTC;
bool century = false;
bool h12Flag;
bool pmFlag;

int count = 0;
int pirPin = 12; // Pin for the HC-S501 sensor
int pirValue;

LiquidCrystal_I2C lcd = LiquidCrystal_I2C(0x27, 16, 2);
unsigned long previousMillis = 0;
const long dhtInterval = 2000; // Interval for DHT readings

```

```
// Custom characters for the LCD arrows
```

```
byte downChar[] = {
```

```
    B00000,
```

```
    B00000,
```

```
    B00100,
```

```
    B00100,
```

```
    B00100,
```

```
    B10101,
```

```
    B01110,
```

```
    B00100
```

```
};
```

```
byte upChar[] = {
```

```
    B00100,
```

```
    B01110,
```

```
    B10101,
```

```
    B00100,
```

```
    B00100,
```

```
    B00100,
```

```
    B00000,
```

```
    B00000
```

```
};
```

```
byte degreeChar[] = {
```

```
    B00110,
```

```
    B01001,
```

```
    B01001,
```

```
    B00110,
```

```
    B00000,
```

```
    B00000,
```

```
    B00000,
```

```
    B00000
```

```
};
```

```
//-----
```

```
// Generic MeasurementSensor Class Template
```

```
//-----
```

```
template<typename T>
```

```
class MeasurementSensor {
```

```
private:
```

```

T measurement; // Current measurement value
T lowestMeasurement;
T highestMeasurement;
int arrow;      // Arrow indicator: 0 = no arrow, 1 = down, 2 = up
unsigned long arrowMillis; // Last time the arrow was updated/reset
const long signalInterval; // Time interval to reset the arrow

public:
    // Constructor: initializes with an initial measurement value.
    MeasurementSensor(long sigInterval, T initValue)
        : measurement(initValue), arrow(0), arrowMillis(0), lowestMeasurement(0), highestMeasurement(0),
          signalInterval(sigInterval) {}

    // Update the measurement reading and determine the arrow indicator
    void update(T newMeasurement, unsigned long currentMillis) {

        // If this is the first valid measurement, initialize min/max
        if (lowestMeasurement == static_cast<T>(0) && highestMeasurement == static_cast<T>(0)) {
            lowestMeasurement = newMeasurement;
            highestMeasurement = newMeasurement;
        }

        // Determine highest and lowest
        if (newMeasurement < lowestMeasurement) {
            lowestMeasurement = newMeasurement;
        }
        if (newMeasurement > highestMeasurement) {
            highestMeasurement = newMeasurement;
        }

        // If the new measurement equals the previous value and the signal interval has passed, reset arrow.
        if (newMeasurement == measurement && currentMillis - arrowMillis >= signalInterval) {
            arrow = 0;
        } else {
            if (newMeasurement > measurement) {
                arrow = 2; // Up arrow
                arrowMillis = currentMillis;
            }
            if (newMeasurement < measurement) {
                arrow = 1; // Down arrow
            }
        }
    }

```

```

        arrowMillis = currentMillis;
    }
}

// If the previous value is the initial invalid value, clear the arrow indicator.
if (measurement == static_cast<T>(-99)) {
    arrow = 0;
}

measurement = newMeasurement;
}

// Getters for measurement and arrow
T getMeasurement() const {
    return measurement;
}
T getLowest() const {
    return lowestMeasurement;
}
T getHighest() const {
    return highestMeasurement;
}
int getArrow() const {
    return arrow;
}
}
void resetMinMax(T currentValue) {
    lowestMeasurement = currentValue;
    highestMeasurement = currentValue;
}
};

//-----
// Global Instances for Temperature and Humidity
//-----

MeasurementSensor<float> tempSensor(SIGNAL_INTERVAL, -99.0);
MeasurementSensor<int> humiditySensor(SIGNAL_INTERVAL, -99);

void setup() {
    Serial.begin(9600);
    dht.begin();

```

```
delay(2000);

lcd.init();
lcd.backlight();
lcd.clear();
lcd.createChar(1, downChar);
lcd.createChar(2, upChar);
lcd.createChar(3, degreeChar);

pinMode(pirPin, INPUT);

// myRTC.setYear(2025);
// myRTC.setMonth(3);
// myRTC.setDate(20);
// myRTC.setHour(10);
// myRTC.setMinute(49);
// myRTC.setSecond(0);
}

void print2digits(int number) {
  if (number < 10) {
    lcd.print("0");
  }
  lcd.print(number, DEC);
}

int lastResetHour = -1; // Initialize to an invalid hour

void loop() {
  delay(20);

  // lcd.print(":");
  // print2digits(myRTC.getSecond());

  // Check for movement
  pirValue = digitalRead(pirPin);
  if (pirValue) {
    lcd.backlight();
  }
}
```

```
// Do we need to update the display?
unsigned long currentMillis = millis();
if (currentMillis - previousMillis >= dhtInterval) {
    previousMillis = currentMillis;

    // Update backlight based on PIR sensor
    pirValue = digitalRead(pirPin);
    if (!pirValue) {
        lcd.noBacklight();
    }

    count++;

    // Read new values from the DHT sensor
    float newTemperature = dht.readTemperature();
    int newHumidity = dht.readHumidity();

    if (isnan(newTemperature) || isnan(newHumidity)) {
        Serial.println("Failed to read from DHT sensor!");
        return;
    }

    // Get current hour from RTC
    int currentHour = myRTC.getHour(h12Flag, pmFlag);
    // Check if hour has changed
    if (currentHour != lastResetHour) {
        tempSensor.resetMinMax(newTemperature);
        humiditySensor.resetMinMax(newHumidity);
        lastResetHour = currentHour;
        Serial.println("min/max values reset");
    }

    // Update our measurement sensors
    tempSensor.update(newTemperature, currentMillis);
    humiditySensor.update(newHumidity, currentMillis);

    // Update the LCD display for temperature
    lcd.setCursor(0, 0);
    if ( count % 6 ) {
        if (tempSensor.getArrow()) {
```

```

    lcd.write(tempSensor.getArrow());
} else {
    lcd.print(" ");
}
lcd.print(tempSensor.getMeasurement(), 1);
lcd.write(3); // degree symbol
lcd.print("C  ");
} else {
    lcd.print("");
    lcd.print(tempSensor.getLowest(),1);
    lcd.write(3);
    lcd.print(" ");
    lcd.print(tempSensor.getHighest(),1);
    lcd.write(3);
    lcd.print(" ");
}

// Update the LCD display for humidity (set cursor on second row)
if (humiditySensor.getArrow()) {
    lcd.write(humiditySensor.getArrow());
} else {
    lcd.print(" ");
}
lcd.print(humiditySensor.getMeasurement());
lcd.print("%");

lcd.setCursor(1, 1);
print2digits(myRTC.getDate());
lcd.print("-");
print2digits(myRTC.getMonth(century));

lcd.setCursor(10, 1);
print2digits(myRTC.getHour(h12Flag, pmFlag));
lcd.print(":");
print2digits(myRTC.getMinute());
}
}

```

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