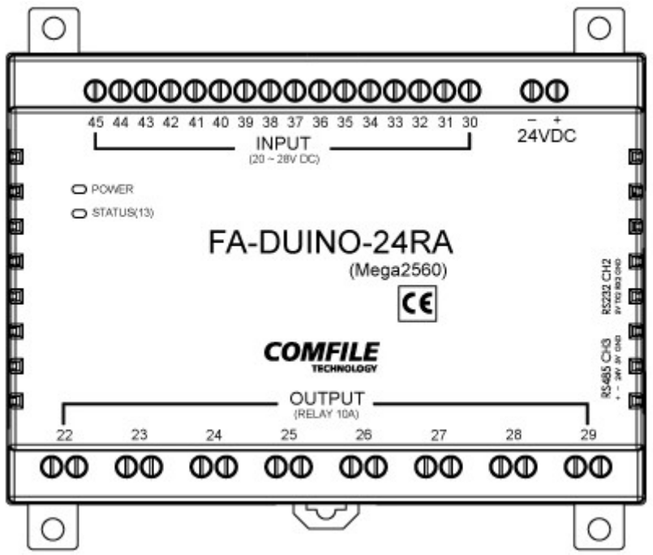
FA-DUINO-24RA User's Manual



Warning

1. **For instruments with risk to life or property (e.g. nuclear power control, medical equipment, vehicles, railways, aviation, combustion equipment, recreation equipment, safety devices, etc.), always employ adequate fail-safe mechanisms.**
   - Risk of fire, personal injury, and/or property damage.
2. **Always mount to a panel.**
3. **Do not attempt to repair, inspect, or wire while power is applied.**
4. **Do not attempt to alter or repair. Refer to a qualified technician.**
5. **Confirm all electrical connections**

Caution

1. **Do not use outdoors.**
2. **Always use the product within its specifications and ratings.**
   - Risk of fire and shortening of product's life.
3. **Do not exceed ratings of relay switching contacts.**
4. **Does not use in environments with flammable or explosive materials, moisture, direct sunlight, radiation, vibration and/or shock.**
5. **Keep product free of dust and debris.**
6. **Make connections correctly and confirm polarity by measuring at the appropriate terminals.**

Overview

The FA-DUINO is an Arduino-based industrial controller. It has features similar to those found in other Arduino products and can be programmed with the Arduino IDE.

Other Arduino products are not very well suited for fields such as factory automation. The FA-DUINO has been designed to handle signals of higher voltage and current, and remove the burden of external circuit design and fabrication from the user.

The FA-DUINO requires only simple connections to its terminal blocks and headers without the need for external peripherals.

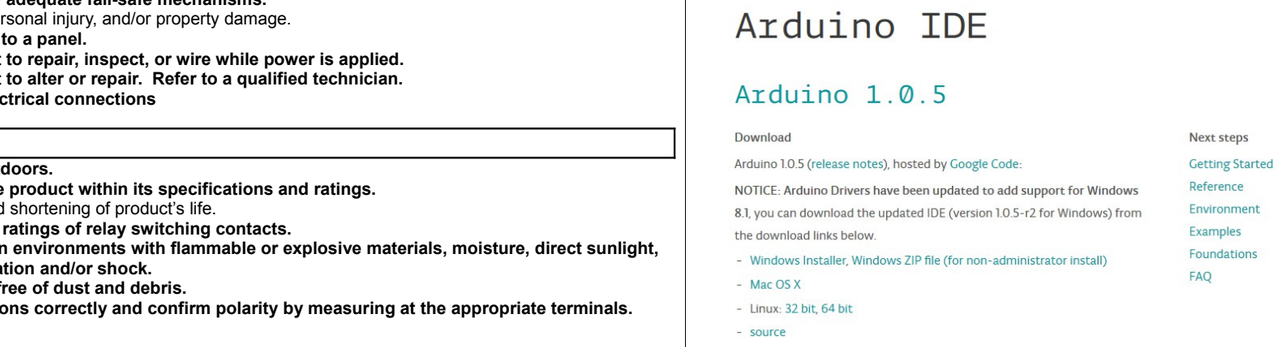
The FA-DUINO-24RA

The FA-DUINO-24RA has a built-in Mega2560 MCU

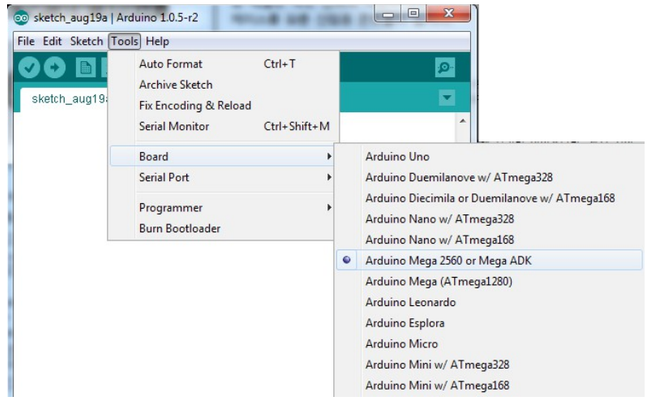
- Program memory: 256KB
- SRAM: 8KB
- EEPROM: 4KB
- Clock Speed: 16MHz
- 16 - 24VDC Inputs (pins 30~45)
- 8 - 10A Relay Outputs (pins 22~29)
- 2 - RS-232C Communication Port
- 1 - RS-485 Communication Port
- 4 - 0~10V Analog Inputs
- 4 - 0~20mA Analog Inputs
- 10-bit ADC (0~1023)
- Powered by 24VDC
- Operating Temperature: 0 ~ 60℃
- Operating Humidity: 35 ~ 85% RH

Programming the FA-DUINO

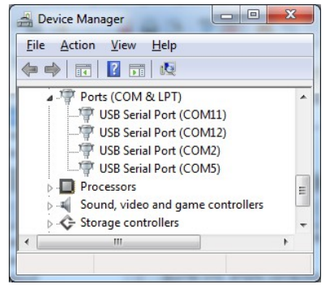
The FA-DUINO can be programmed using the Arduino IDE available from http://arduino.cc

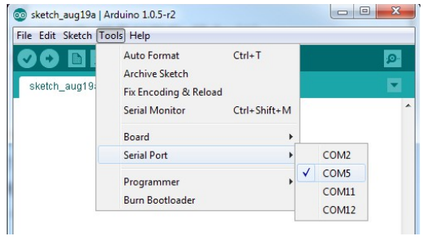


Select the Arduino **Mega 2560** option from the Tools-->Board menu.

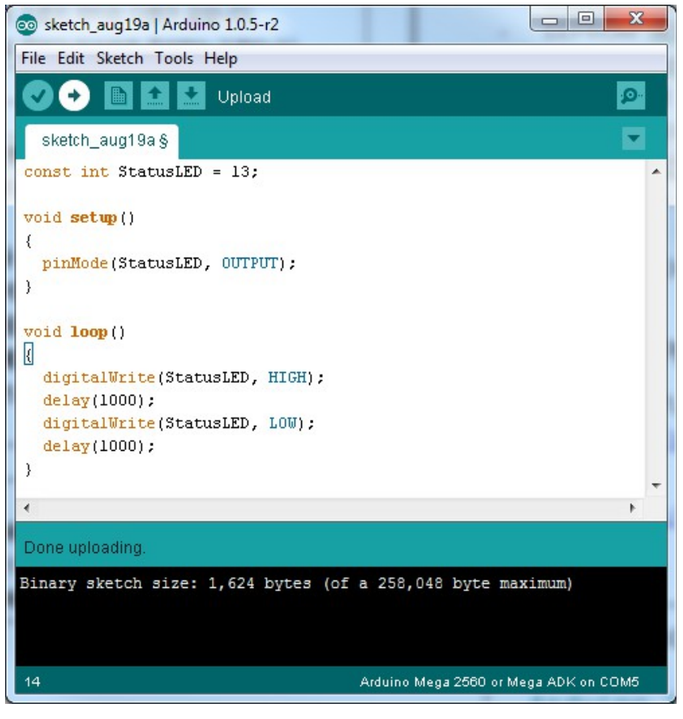


Select the PC COM port that the FA-DUINO is connected to from the Tools-->Serial Port menu. You can find the COM port number in Windows Device Manager.





Write your program, and click the "Upload" icon to compile the program and upload to the FA-DUINO.



IO Map

Direction	Pins	Input Voltage	Description
Input	30~45	0 or 24VDC (20~28V is logic high)	24V = Logic High 0V = Logic Low
Output	22~29	10A Relay Outputs	Logic High = On Logic Low = Off

Analog Input	0~7	0~3 – 0~20mA
		4~7 - 0~10V
			VA = analogRead(A0) // Read channel 0
			VA = analogRead(A4) // Read channel 4

Example:

```
int val = 0;              // Digital input variable
int AD_val = 0;           // Read ADC value

pinMode(22, OUTPUT);      // Set pin 22 to output

val = digitalRead(30);    // Read from digital input 30
digitalWrite(22, val);    // Set digital output to same value as digital input
AD_val = analogRead(A0); // Read ADC channel 0
```

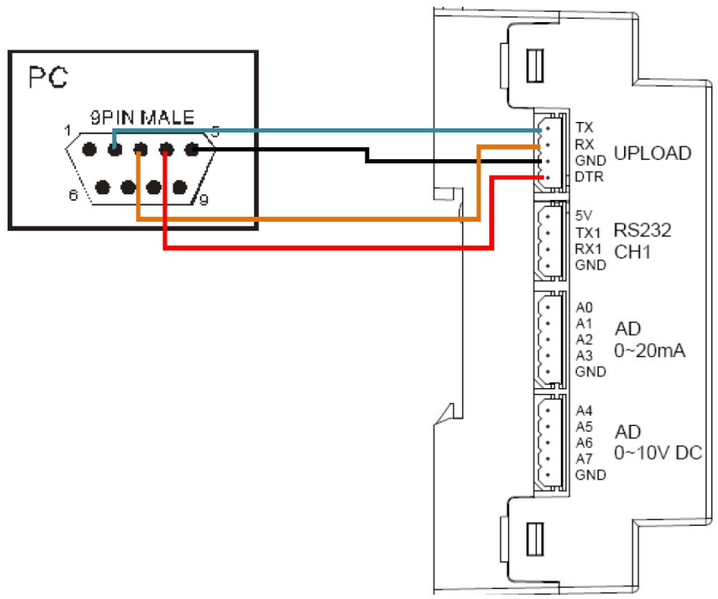
Status LED

The FA-DUINO has a programmable status LED on pin 13 for providing visual indication to the operator.

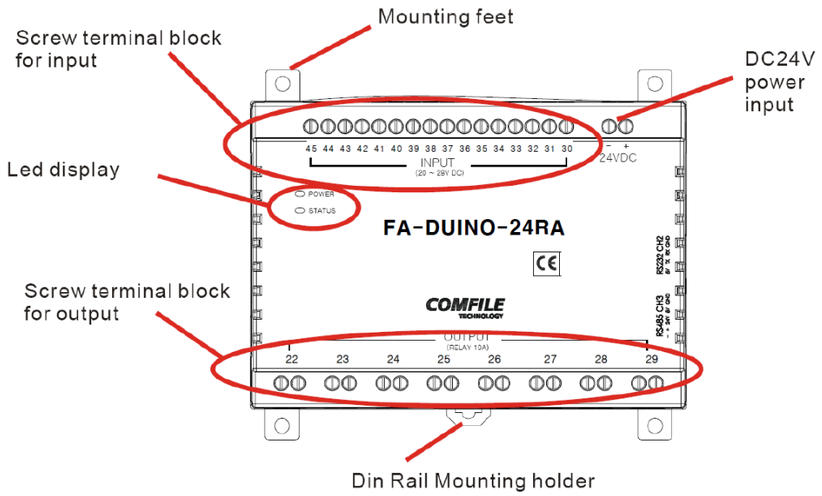
Example:

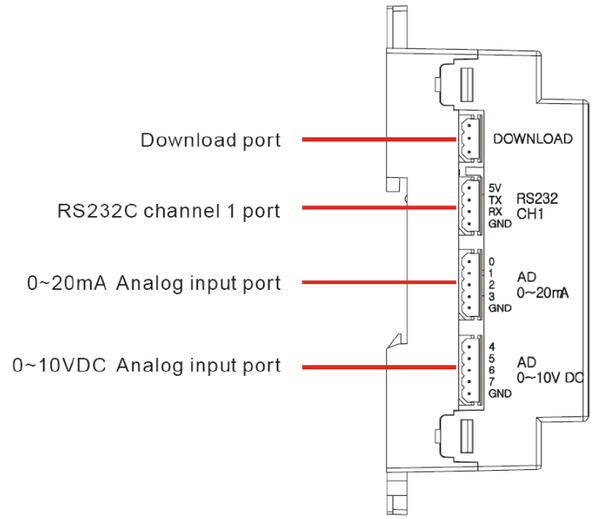
```
digitalWrite(13, HIGH);          // Turn status LED on
delay(1000);                     // Delay for 1 second
digitalWrite(13, LOW);           // Turn status LED off
delay(1000);                     // Delay for 1 second
```

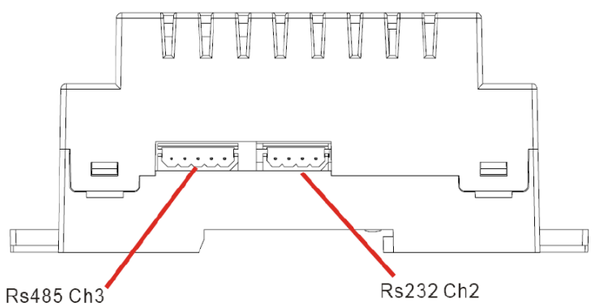
Connecting the Upload Cable



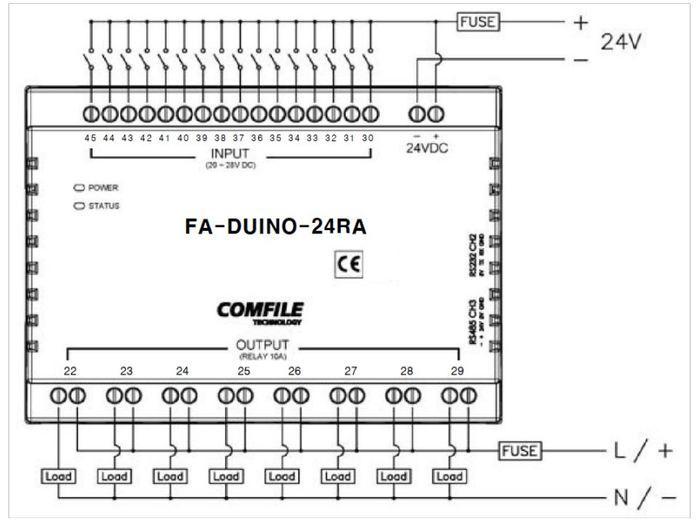
Physical Connections

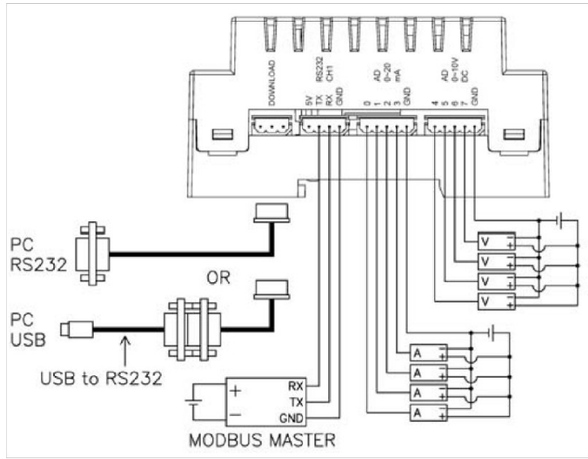


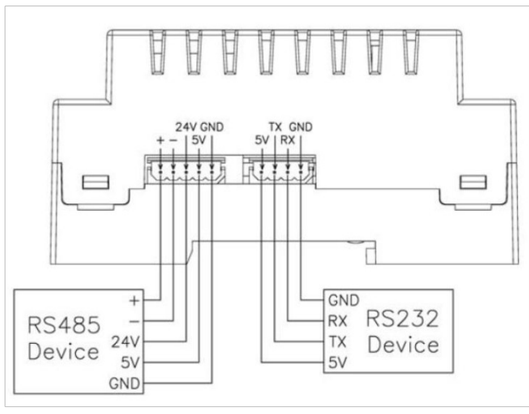




Digital IO Connections





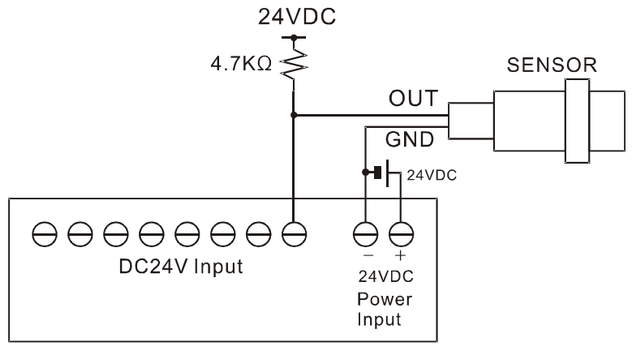


Using Proximity Sensors

Proximity sensors can be used to detect the existence, movement, and displacement of objects without any physical contact with the object. They are used quite often in the field of automation.

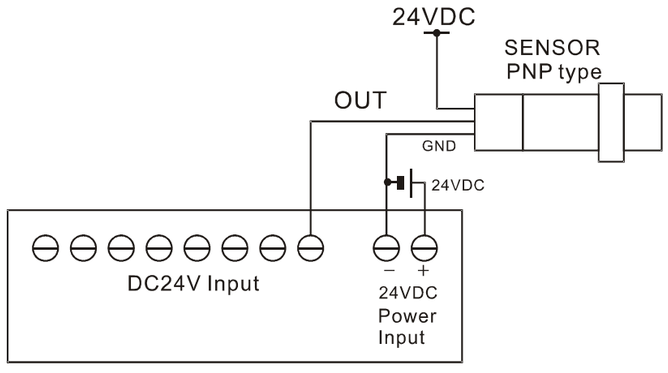
DC 2-Wire Model

Sensor output connected in reverse



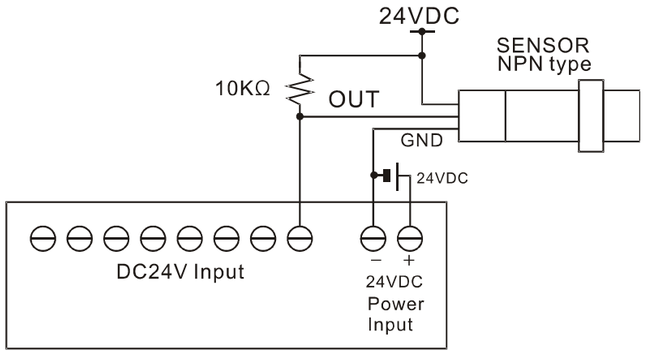
DC 3-Wire Model (PNP type)

Sensor output connected in reverse



DC 3-Wire Model (NPN type)

Sensor output connected in reverse



Digital I/O Specifications

Input Specifications	
Number of Inputs	16
Input Voltage Range	20VDC ~ 28VDC
Recommended Operating Voltage	24VDC
On/Off Switching Speed	10ms (Ladder Scan Time is 10ms)
Input Impedance	2.2kΩ @ 24VDC

Output Relay Specifications	
Number of Outputs	8
Input Voltage Range	5 ~ 30VDC / 4 ~ 264VAC
Recommended Operating Voltage	6 ~ 27VDC / 6 ~ 240VAC
On/Off frequency	10Hz (10 times per second)
Maximum Current	10A per relay
Minimum Current	100mA per relay

Analog I/O Specifications

Analog Current Input (0 ~ 3) Specification	
Resolution and Error	10-bit, +/- 2%
Input Current Range	0mA ~ 22mA
Recommended Operating Current	4mA ~ 20mA
Type	Non-isolated, Built-in LPF

Analog Voltage Input (4 ~ 7) Specifications	
Resolution and Error	10-bit, +/- 2%
Input Voltage Range	-0.5VDC ~ 10.5VDC Don't connect series resistance
Operating Voltage	0VDC ~ 10VDC
Type	Non-isolated, Built-in LPF

Communication Specifications

Communication Port Specifications	
Type	RS-232 (+/- 10VDC)
Flow Control	No RTS Flow Control
Maximum Baud Rate	115200
Maximum Distance	2 meters

Simple Examples

Example 1 – Flashing the Status LED

```
const int StatusLED = 13;

void setup()
{
  pinMode(StatusLED, OUTPUT);
}

void loop()
{
  digitalWrite(StatusLED, HIGH);
  delay(1000);
  digitalWrite(StatusLED, LOW);
  delay(1000);
}
```

Example 2 – Toggling a Relay

```
const int Relay22 = 22;

void setup()
{
  pinMode(Relay22, OUTPUT);
}

void loop()
{
  digitalWrite(Relay22, HIGH);
  delay(1000);
  digitalWrite(Relay22, LOW);
  delay(1000);
}
```

Example 3 – Input and Output Control

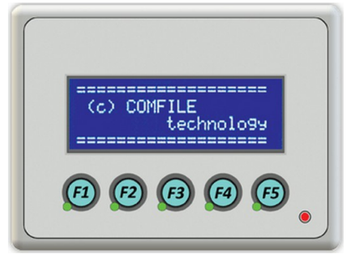
```
const int StatusLED =  13;
const int Relay22 =  22;
const int Input_4 =  4;

void setup()
{
  pinMode(StatusLED, OUTPUT);
  pinMode(Relay22,   OUTPUT);
  pinMode(Input_30,   INPUT );
}

void loop()
{
  if(HIGH==digitalRead(Input_30))
  {
    digitalWrite(StatusLED, HIGH);
    digitalWrite(Relay22, HIGH);
  }
  else
  {
    digitalWrite(StatusLED, LOW);
    digitalWrite(Relay22, LOW);
  }
}
```

Example 4 – Analog Input with the Serial Monitor

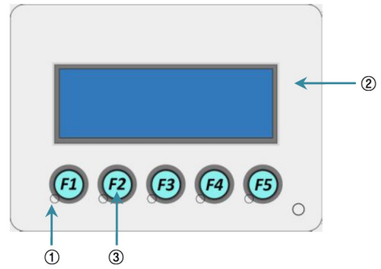
```
int ADI_Value0;
int ADV_Value4;

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

void loop()
{
  ADI_Value0 = analogRead(A0);
  delay(100);

  ADV_Value4 = analogRead(A4);
  delay(100);

  Serial.print("  CH 0  = ");
  Serial.print(ADI_Value0);
  Serial.print("\n" );

  Serial.print("  CH 4  = ");
  Serial.print(ADV_Value4);
  Serial.print("\n\n" );

  delay(200);
}
```

Interfacing with the UIF-5K

The UIF-5K is a 5-key character LCD panel that can be used in conjunction with the FA-DUINO to add a simple user interface.

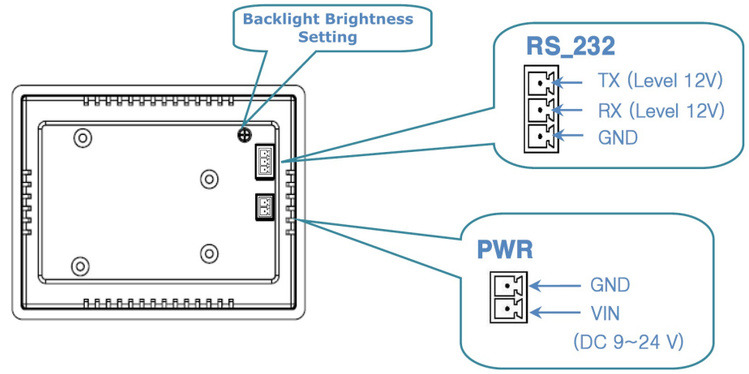


Front View

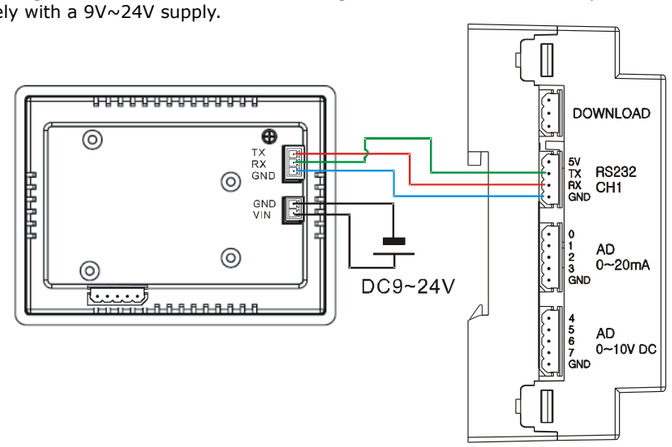


	Description
1	LED Indicator
2	Character LCD (Characters, Numbers and Symbols)
3	Key Value for RS-232 Communication: F1 – 0x01 (1 byte) F2 – 0x02 (1 byte) F3 – 0x03 (1 byte) F4 – 0x04 (1 byte) F5 – 0x05 (1 byte)

Rear View

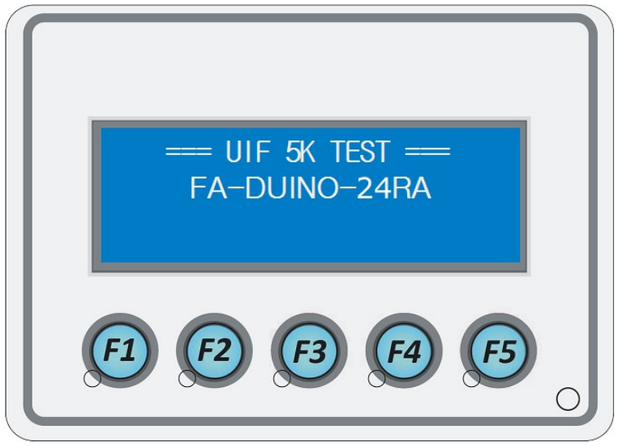


The following shows how to connect the two together. The UIF-5k must be powered separately with a 9V~24V supply.



Example 1

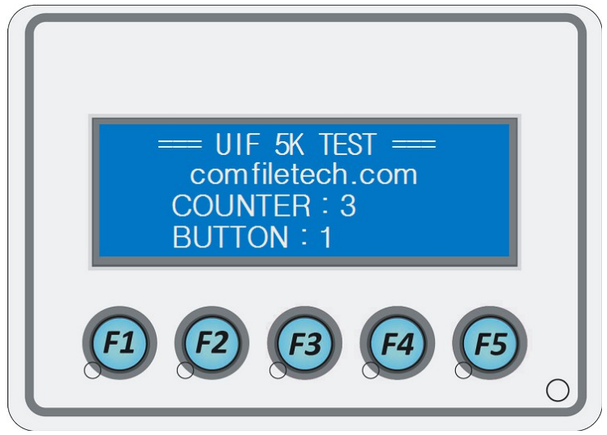
The following source code will output text to the UIF-5K's display.




```
void setup()
{
  Serial1.begin(115200);   //Baud rate 115200
  uif_clear();             //Clear the display
  delay(20);
  uif_buzzer(1);
  delay(20);               //buzzer on
  uif_locate(0,0);
  Serial1.print("=== UIF 5K_TEST ===");
  delay(100);  uif_locate(2,1);
  Serial1.print(" FA-DUINO-24RA ");
  delay(100);
}

void loop()
{ }

// Clear the display
void uif_clear()
{
  Serial1.write(0x1b);
  Serial1.write(0x43);
}

// Set the cursor the given x & y coordinates
void uif_locate(unsigned char x, unsigned char y)
{
  Serial1.write(0x1b);
  Serial1.write(0x4C);
  Serial1.write(x);
  Serial1.write(y);
}

// Turn the buzzer on (1) or off (0)
void uif_buzzer(unsigned char on_off)
{
  Serial1.write(0x1b);
  Serial1.write(0x5a);
  Serial1.write(on_off);
}
```

Example 2

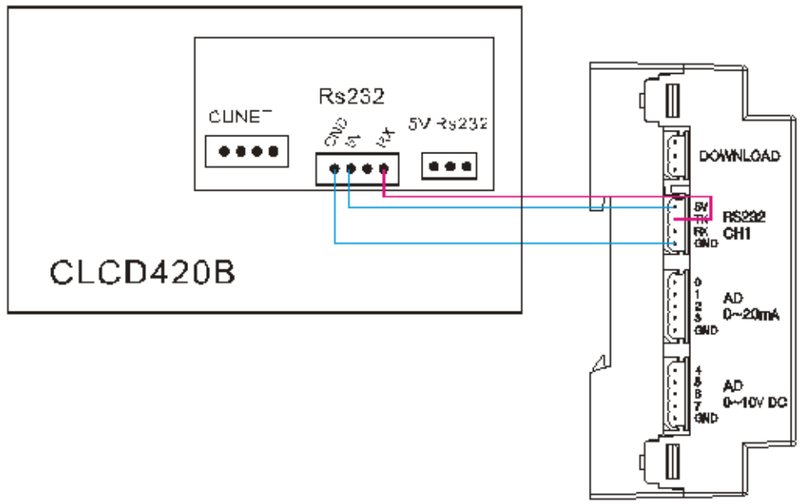
The following example will display the result of a button press on the UIF-5K's display.




```
void setup()
{
  Serial1.begin(115200);     // baud rate 115200
  uif_clear();               // Clear the display
  delay(20);
  uif_light(1);
  delay(20);                 // backlight on
  uif_buzzer(1); delay(20);  // buzzer on
  delay(100);  uif_locate(0,0);
  Serial1.print("=== UIF 5K_TEST ===");
  delay(100);  uif_locate(2,1);
  Serial1.print("comfiletech.com");
  delay(100);  uif_locate(2,2);
  Serial1.print("COUNTER : ");
  delay(100);  uif_locate(2,3);
  Serial1.print("BUTTON : ");
  delay(100);
}

int cnt = 0;
void loop()
{
  cnt++;                    // Increment the counter
  uif_locate(12,2);
  Serial1.print(cnt, DEC); // Display the count
  delay(100);
  serial1Event();
}

void serial1Event()
{
  // Display the value of the button pressed
  while (Serial1.available())
  {
    char inChar = (char)Serial1.read();
    uif_locate(10,3);
    Serial1.print(inChar, DEC);
  }
}

// Display (1) or hide (0) the cursor
void uif_csron(unsigned char on_off)
{
  if(on_off)
  {
    Serial1.write(0x1b);
    Serial1.write(0x53);
  }
  else
  {
    Serial1.write(0x1b);
    Serial1.write(0x73);
  }
}

// Clear the display
void uif_clear()
{
  Serial1.write(0x1b);
  Serial1.write(0x43);
}

// Turn the backlight on (1) or off (0)
void uif_light(unsigned char on_off)
{
  Serial1.write(0x1b);
  Serial1.write(0x42);
  Serial1.write(0x4c);
  Serial1.write(on_off);
}

// Set the cursor to the given x & y coordinates
void uif_locate(unsigned char x, unsigned char y)
{
  Serial1.write(0x1b);
  Serial1.write(0x4C);
  Serial1.write(x);
  Serial1.write(y);
}

// Turn the UIF-5K's LED on (1) or off (0)
void uif_swled(unsigned char on_off)
{
  Serial1.write(0x1b);
  Serial1.write(0x45);
  Serial1.write(on_off);
}

// Turn one of the UIF-5K's button's LEDs on (1) or off (0)
void uif_led(unsigned char number, unsigned char on_off)
{
  Serial1.write(0x1b);
  Serial1.write(0x46);
  Serial1.write(number);
  Serial1.write(on_off);
}

// Turn the buzzer on (1) or off (0)
void uif_buzzer(unsigned char on_off)
{
  Serial1.write(0x1b);
  Serial1.write(0x5a);
  Serial1.write(on_off);
}
```

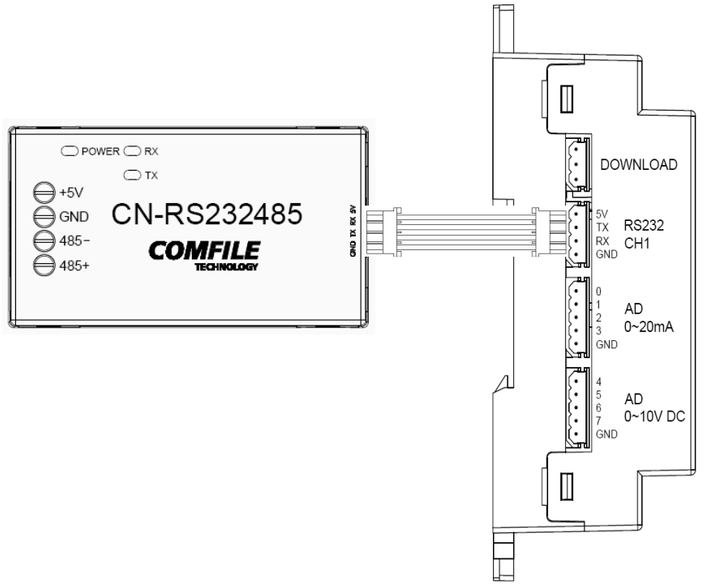
Interfacing to a Character LCD (CLCD)

Connect the FA-DUINO to the CLCD via RS-232 as shown in the image below. Set all the dip switches on the CLCD to the ON position. The baudrate should be 115200.




```
void setup()
{
  Serial1.begin(115200);               // baud rate 115200
  clcd_clear();                        // clear the screen
  delay(20);

  //Position the cursor
  clcd_locate(0,0);
  Serial1.print("=== CLCD Test ===");
  delay(100);

  clcd_locate(2,1);
  Serial1.print(" FA-DUINO-24RA ");
  delay(100);
}

void loop()
{ }

// Clear the display
void clcd_clear()
{
  Serial1.write(0x1b);
  Serial1.write(0x43);
}

// Move the cursor to the given x & y coordinates
void clcd_locate(unsigned char x, unsigned char y)
{
  Serial1.write(0x1b);
  Serial1.write(0x4C);
  Serial1.write(x);
  Serial1.write(y);
}
```

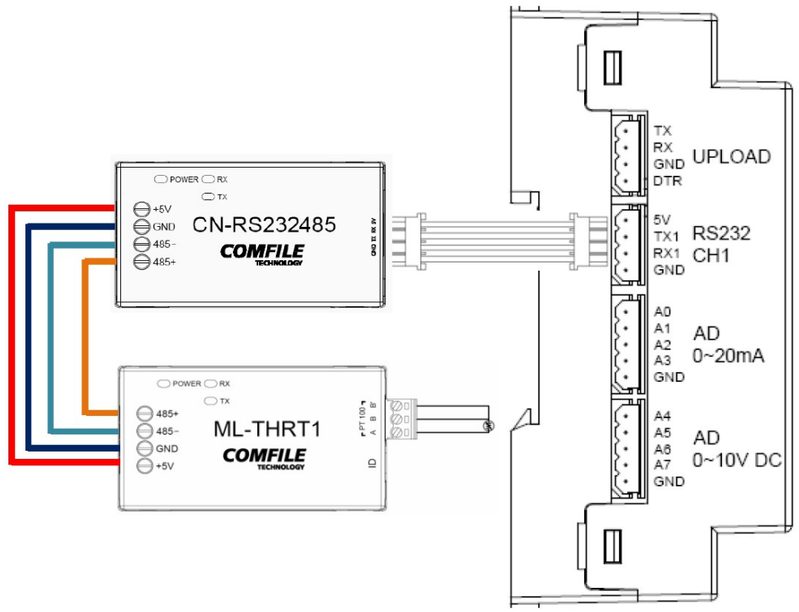
Interfacing to the CN-RS235485



The CN-RS232485 can be used to convert the FA-DUINO's RS-232 signal to RS-485.

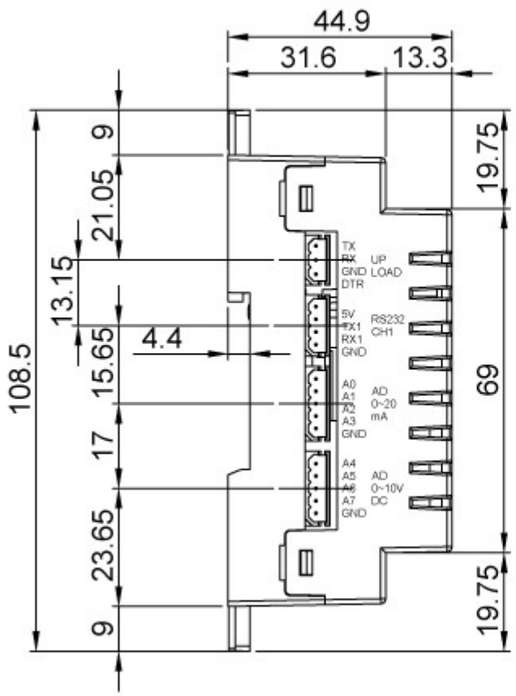
Interfacing to the ML-THRT1

The ML-THRT1 can be used to measure temperatures from -100~500℃ through a PT100 resistance thermometer.

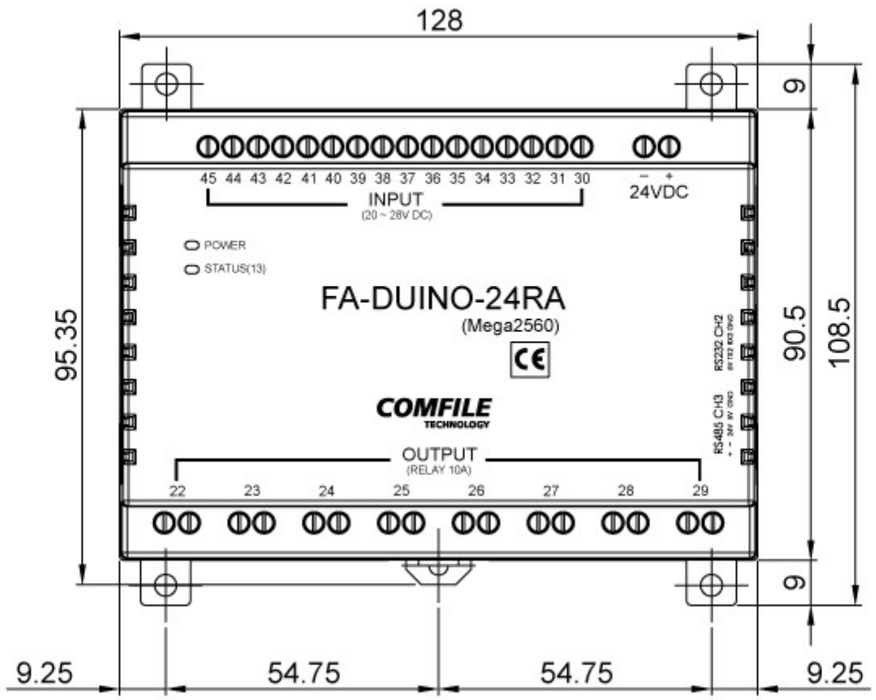


For more information please see the ML-THRT1 user's manual.

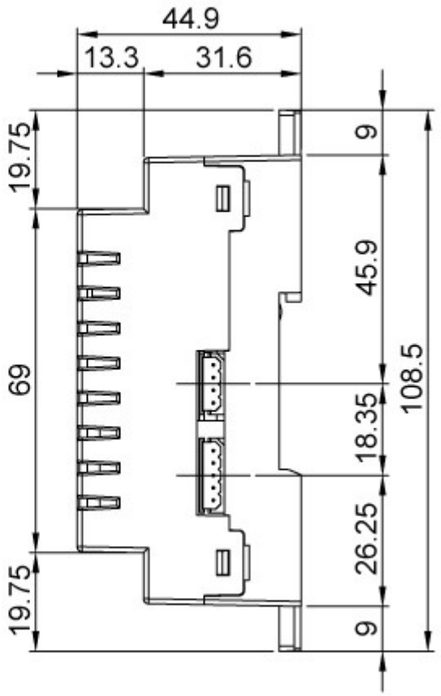
Dimensions



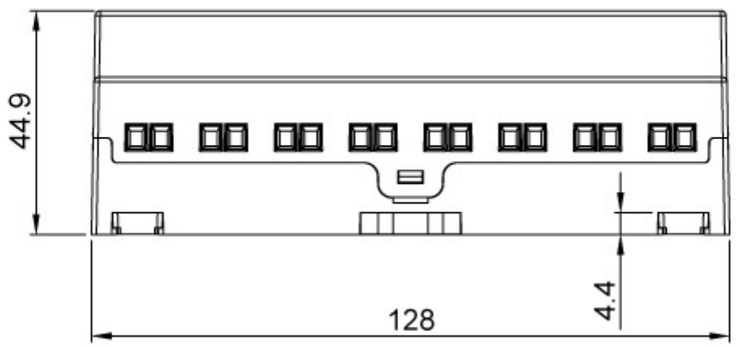
SIDE VIEW



FRONT VIEW

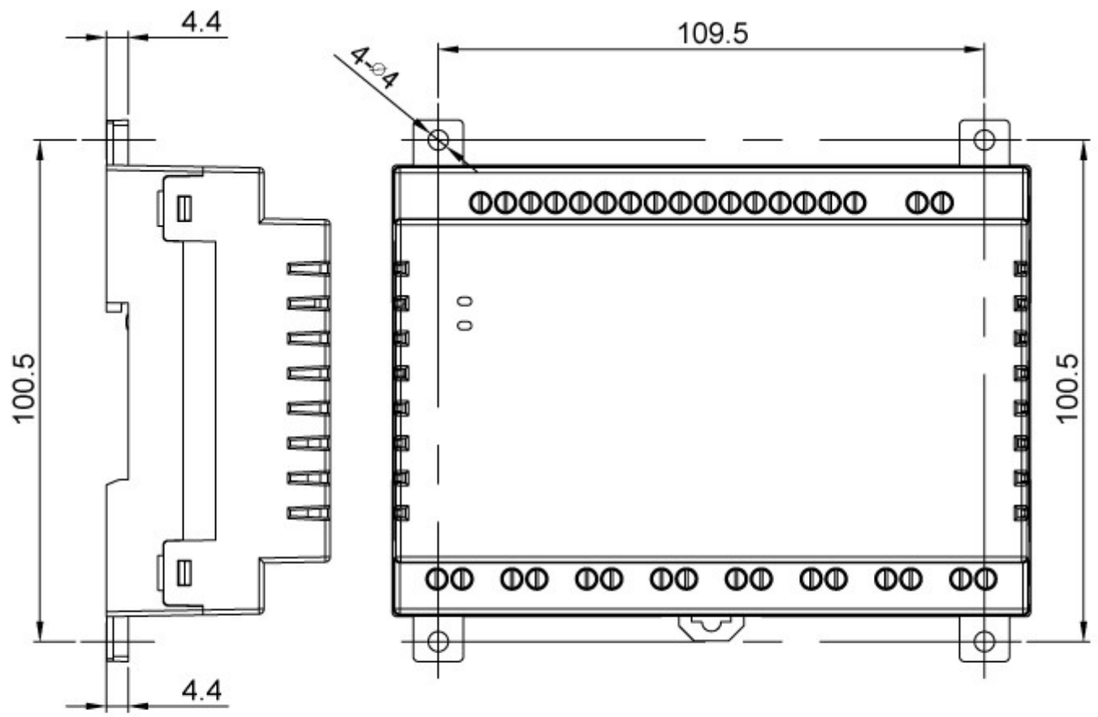


SIDE VIEW



BOTTOM VIEW

Unit: mm



MOUNTING VIEW

Unit: mm