Tutorial: Two-way Communication (LED + Serial, Serial1)

This tutorial expands on the first one by adding communication between the two serial ports. The USB port (`Serial`) acts like the laptop, while the Adafruit USB-TTL port (`Serial1`) acts like a second device. You'll send text commands (`ON`, `OFF`) to control the LED and exchange messages between both sides.

```
const int LED = 13;
String serialCmd = "";
String serial1Cmd = "";

void setup() {
  pinMode(LED, OUTPUT);
  Serial.begin(9600);      // Laptop USB
  Serial1.begin(9600);     // TTL cable (pins 19/18)

  Serial.println("Laptop ready!");
  Serial1.println("TTL ready!");
}

void loop() {
  // --- Check for messages from Serial (laptop) ---
  if (Serial.available()) {
    serialCmd = Serial.readStringUntil('\n');
    serialCmd.trim();

    if (serialCmd.equalsIgnoreCase("on")) {
      digitalWrite(LED, HIGH);
      Serial.println("LED turned ON");
      Serial1.println("LED ON");
    }
    else if (serialCmd.equalsIgnoreCase("off")) {
      digitalWrite(LED, LOW);
      Serial.println("LED turned OFF");
      Serial1.println("LED OFF");
    }
    else {
      Serial.println("Unknown command. Type ON or OFF.");
```

```
    }
  }

  // --- Check for messages from Serial1 (TTL) ---
  if (Serial1.available()) {
    serial1Cmd = Serial1.readStringUntil('\n');
    serial1Cmd.trim();

    if (serial1Cmd.equalsIgnoreCase("led on")) {
      Serial.println("I see the light!");
    }
    else if (serial1Cmd.equalsIgnoreCase("led off")) {
      Serial.println("The light went out.");
    }
  }
}
```

1) What this sketch does

- Serial (USB): represents the *laptop* (monitor on `/dev/ttyACM0`).
- Serial1 (pins 19/18): represents the *TTL adapter* (monitor on `/dev/ttyUSB0`).
- You can type commands (`on`, `off`) in the laptop window to toggle the built-in LED (pin 13).
- Whenever the LED changes state, the other serial (`Serial1`) is notified (`LED ON`/`LED OFF`).
- The TTL side can reply (`LED ON` “I see the light!”; `LED OFF` “The light went out.”).

2) Hardware wiring

-TTL USB:

Wires:	**Function:**	**Connects to Mega 2560**
Black	GND	GND
White	RX	TX1 (pin 18)
Green	TX	RX1 (pin 19)
Red	+5 V	leave unconnected (USB Power)

-LED circuit:

LED Pin	**Connects To**	**Description**
Long leg (anode)	Pin 13	Controlled by the Arduino (digital output)
Short leg (cathode)	One end of the resistor	Limits current through LED
Other end of resistor	GND	Completes the circuit

3) How to run it

1. Upload the sketch using the Mega's USB port (choose `/dev/ttyACM0`). Nothing should be plugged into pins 0/1 during upload.
2. After uploading, open two serial monitors (9600 baud each):
    - `/dev/ttyACM0` → the Mega's onboard USB (acts as the laptop).
    - `/dev/ttyUSB0` → your Adafruit TTL cable.
3. In the laptop window, type on and press Enter.
    - The built-in LED lights up.

    - Laptop monitor prints: `LED turned ON`.
    - TTL monitor prints: `LED ON`.
4. In the TTL window, type `LED ON` and press Enter.
    - Laptop monitor prints: `I see the light!`
5. Type `off` → LED goes off, both monitors show the OFF messages.

4) How it works

Input handling

Each port is checked separately using `Serial.available()` and `Serial1.available()`. When a newline (`\n`) is received, the string is trimmed and interpreted.

Command logic

- Laptop sends simple commands on/`off`.
- The Mega toggles the LED accordingly and notifies Serial1.
- Serial1 can send back `LED ON`/`LED OFF`, which the Mega interprets as sensor feedback.

Output sync

Every event is echoed to both ports so that each monitor stays synchronized with the LED state.

5) Testing checklist

-LED toggles correctly when typing on/`off` on the laptop.
-TTL monitor displays `LED ON` / `LED OFF`.
-Sending those same words from TTL triggers a message on the laptop.
-Both monitors stay in sync.

6) Common mistakes

Problem	Likely cause	Fix
Nothing printed on TTL monitor	TX/RX swapped or no ground	Swap green/white; add GND
Both messages appear on one monitor	TTL cable still on pins 0/1	Move to 19/18
Upload fails (timeout)	Port busy or pins 0/1 connected	Unplug TTL cable during upload