

# lamaPLC: RP2040\_ETH\_Modul: Modbus TCP sniffer

The program receives and analyses incoming TCP Modbus telegrams, but does not respond.



Important: The Ethernet module is accessible by **RP2040\_ETH** via **UART1** with the following configuration:

```
uart1 = UART(1, baudrate=115200, tx=Pin(20), rx=Pin(21), timeout=50)
```

```
import time
import machine
from machine import Pin, UART

# 1. Initialize UART1 (GP20=TX, GP21=RX) - 9600 baud, 8N1
uart = UART(1, baudrate=115200, bits=8, parity=None, stop=1, tx=Pin(20),
rx=Pin(21))

# Dictionary mapping Modbus Function Codes to human-readable text
FUNCTION_CODES = {
    1: "Read Coils (D0)",
    2: "Read Discrete Inputs (DI)",
    3: "Read Holding Registers (A0)",
    4: "Read Input Registers (AI)",
    5: "Write Single Coil",
    6: "Write Single Register",
    15: "Write Multiple Coils",
    16: "Write Multiple Registers"
}

def analyze_modbus_tcp_packet(packet):
    """Parse, decode, and print Modbus TCP frame encapsulated over serial"""
    raw_hex = " ".join("{:02X}".format(b) for b in packet)
    print("\n" + "="*60)
    print("Raw Modbus TCP over Serial Data (HEX):")
    print(raw_hex)
    print("="*60)

    # Minimum Modbus TCP packet length is 7 bytes (MBAP header) + at least 1
    byte PDU
    if len(packet) < 8:
        print("[ERROR] Packet is too short to be a valid Modbus TCP frame!")
        return
```

```
# --- MBAP HEADER PARSING (First 7 bytes) ---
transaction_id = int.from_bytes(packet[0:2], 'big')
protocol_id = int.from_bytes(packet[2:4], 'big')
expected_length = int.from_bytes(packet[4:6], 'big')
unit_id = packet[6] # Equivalent to Slave ID / Device Address

print("[ - ] MBAP Header Fields:")
print("    -> Transaction ID: 0x{:04X} (Dec: {})".format(transaction_id,
transaction_id))
print("    -> Protocol ID:    0x{:04X} ({})" .format(protocol_id, "Modbus
TCP" if protocol_id == 0 else "INVALID!"))
print("    -> Length Field:   {} byte(s)
remaining".format(expected_length))

# Verify if the physical length matches the length reported in the MBAP
header
actual_remaining_length = len(packet) - 6
if actual_remaining_length != expected_length:
    print("    -> [WARNING] Length mismatch! Header says {}, physically
got {} bytes".format(expected_length, actual_remaining_length))

print("\n[ - ] Modbus PDU Payload:")
print("    -> Unit Identifier (ID): {}".format(unit_id))

# --- PDU PARSING (Starts from byte index 7) ---
func_code = packet[7]
func_name = FUNCTION_CODES.get(func_code, "Unknown Function")
print("    -> Function Code:      {} ({})" .format(func_code,
func_name))

# Standard Modbus query structures (Read/Write requests)
if len(packet) >= 12 and func_code in [1, 2, 3, 4, 5, 6]:
    start_addr = int.from_bytes(packet[8:10], 'big')
    quantity = int.from_bytes(packet[10:12], 'big')

    print("    -> Starting Addr (Hex):  0x{:04X} (Dec:
{})" .format(start_addr, start_addr))
    print("    -> Target Register/Bit:  {} (PLC address:
{})" .format(start_addr, start_addr + 1))

    if func_code in [1, 2, 3, 4]:
        print("    -> Quantity (Length):    {}
item(s)".format(quantity))
    elif func_code == 5:
        state = "ON (0xFF00)" if packet[10:12] == b'\xFF\x00' else "OFF
(0x0000)"
        print("    -> Requested State:      {}" .format(state))
    elif func_code == 6:
        print("    -> Value to Write (Dec): {}" .format(quantity))
```

```
elif func_code in [15, 16] and len(packet) >= 13:
    # Multiple write commands contain additional byte counts
    start_addr = int.from_bytes(packet[8:10], 'big')
    quantity = int.from_bytes(packet[10:12], 'big')
    byte_count = packet[12]
    print("    -> Starting Addr (Dec):  {} (PLC address:
{}))".format(start_addr, start_addr + 1))
    print("    -> Quantity (Length):    {} item(s)".format(quantity))
    print("    -> Data Byte Count:      {} byte(s)".format(byte_count))
else:
    print("    -> [INFO] Complex, exception response, or non-standard
query payload.")

print("Modbus TCP over Serial Sniffer started on UART1...")
print("Waiting for incoming MBAP frames...\n")

# Main execution loop
while True:
    if uart.any():
        # Modbus TCP frames don't rely strictly on the 3.5-char silent
        interval,
        # but when stream-wrapped on UART, waiting a bit ensures the full
        packet buffer builds up.
        time.sleep_ms(20)

        raw_packet = uart.read()
        if raw_packet:
            analyze_modbus_tcp_packet(raw_packet)

    time.sleep_ms(5)
```

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