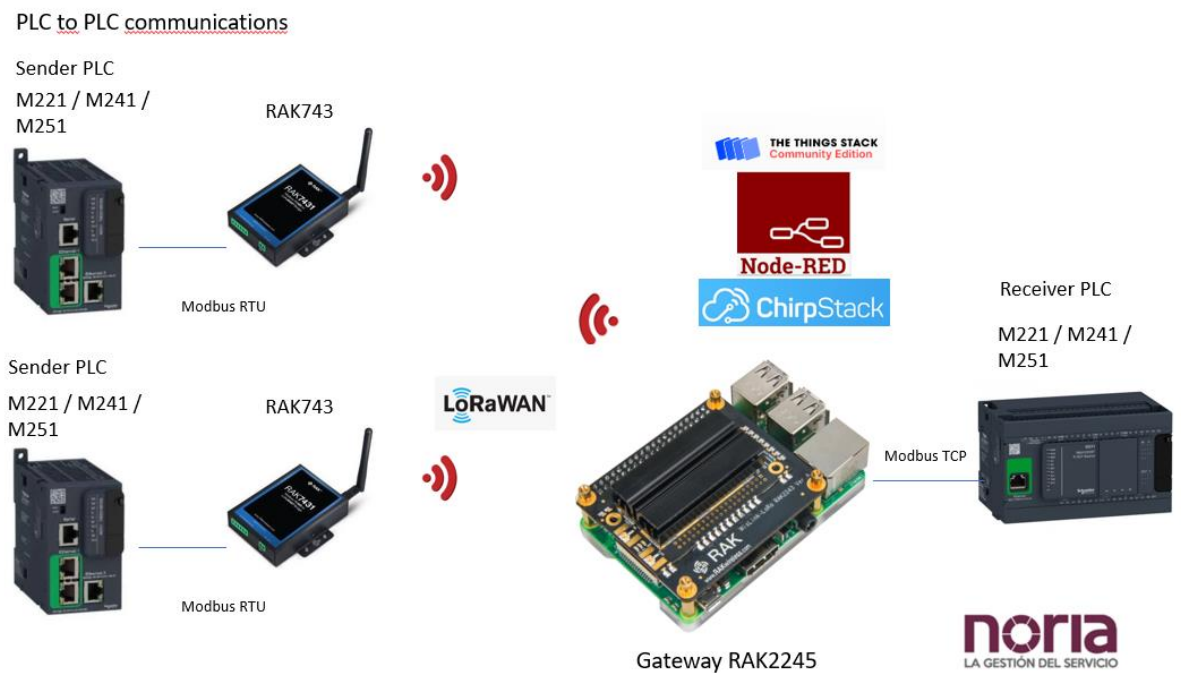


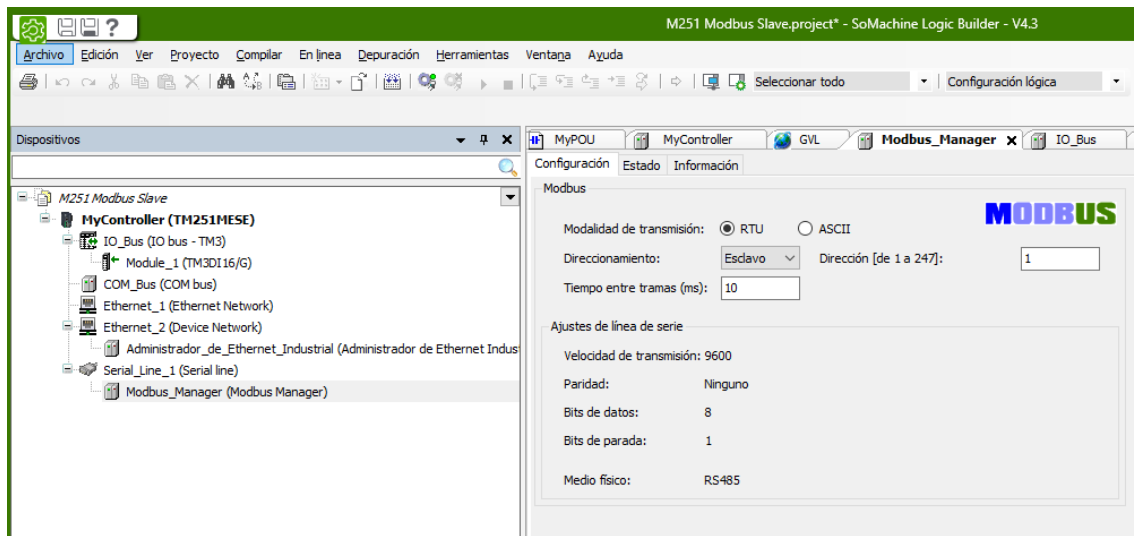
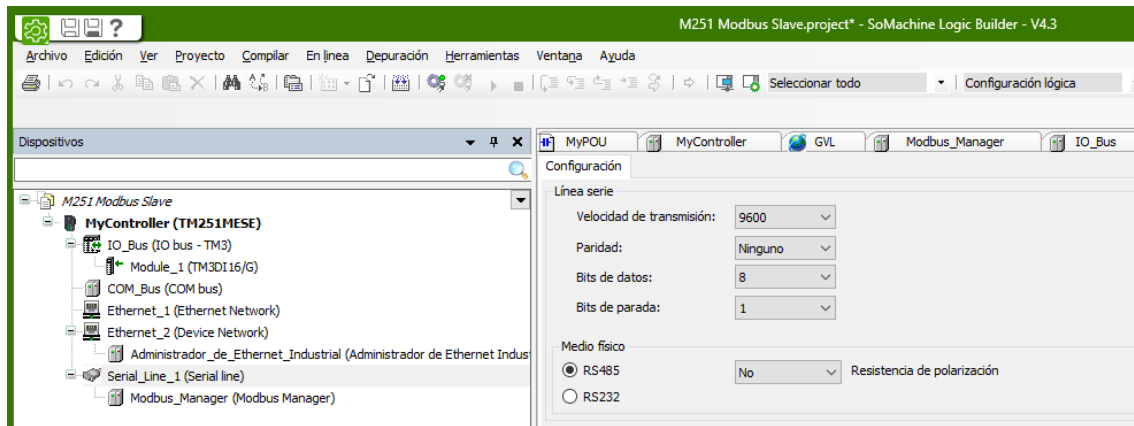
# SCHNEIDER PLC to PLC communications with RAK7431 and LoRaWAN

## System Architecture

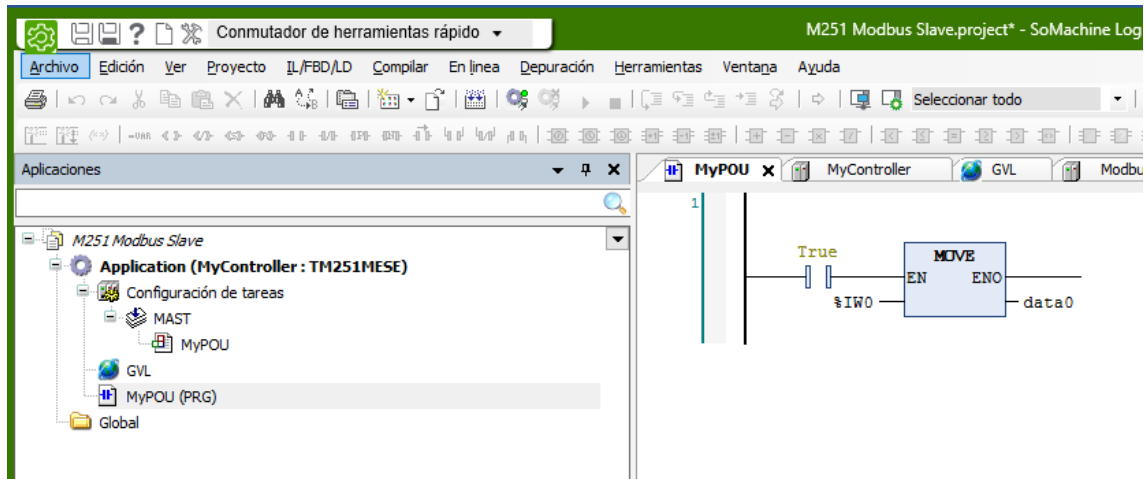


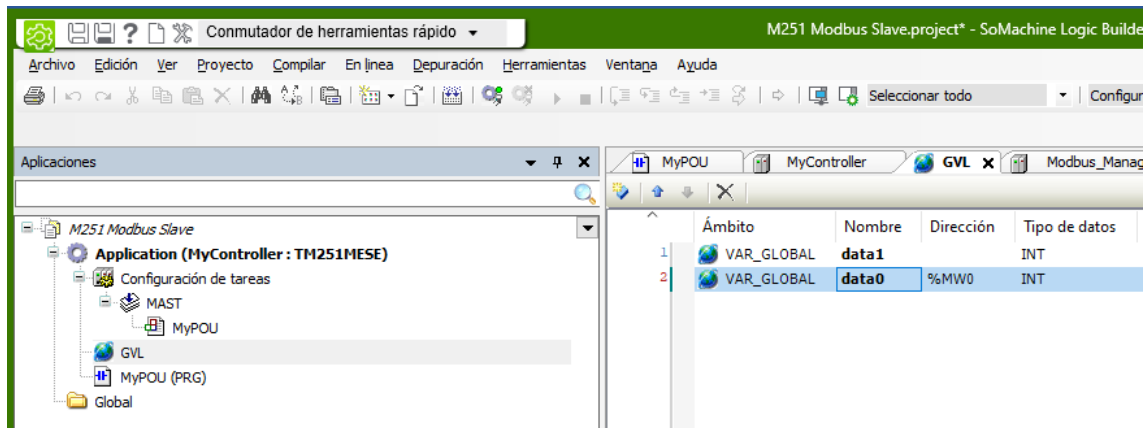
## Sender PLC configuration

We configure the sender PLC as a Modbus RTU slave device with address 1 and register %MW0 to hold the status of the digital inputs of sender PLC.



We update the digital input state on every scan



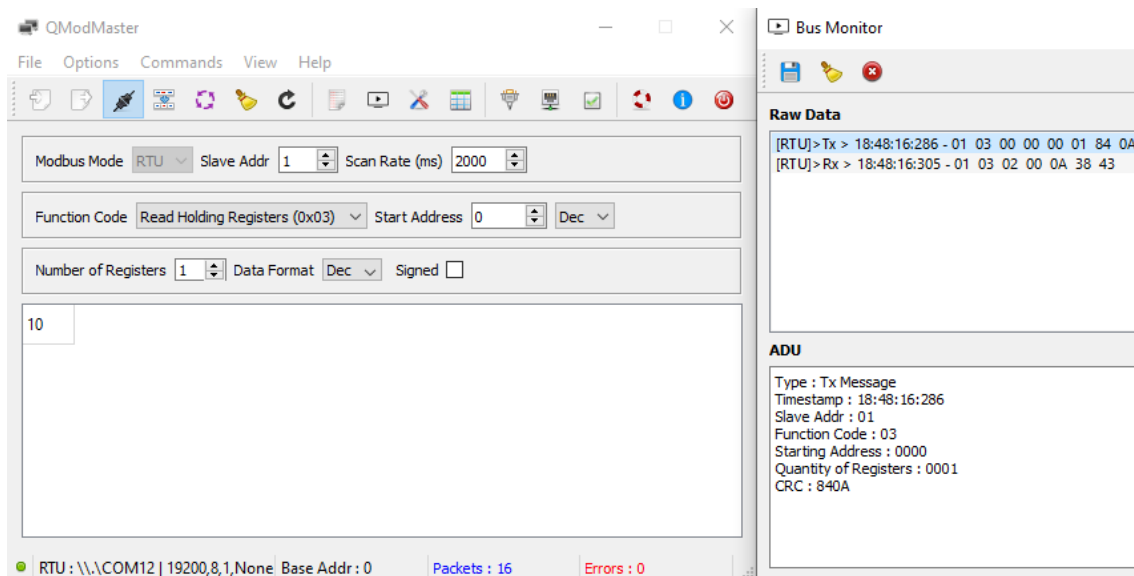


So we have such data available thru Modbus RTU

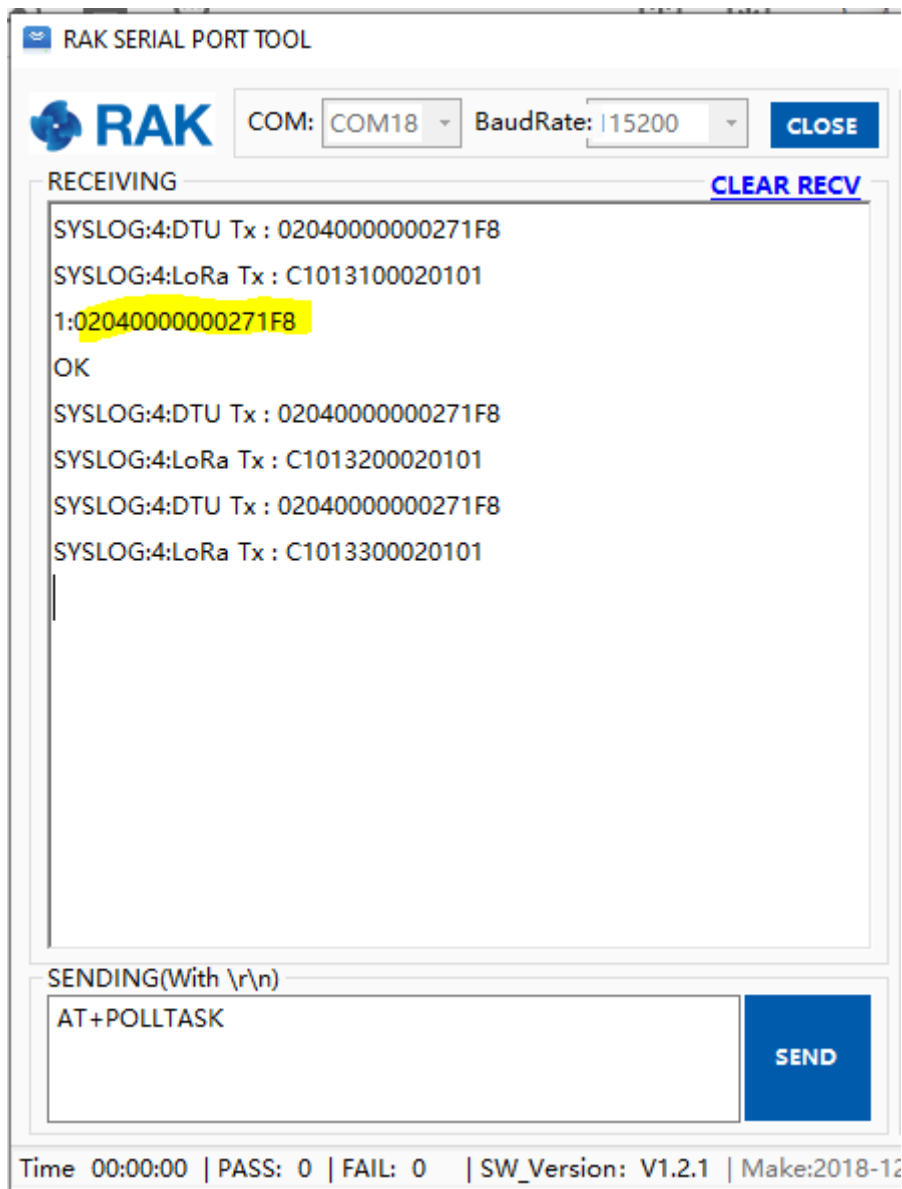
## Modbus test

Let's see the Modbus response from PLC with the PC and qModMaster tool

Let's read from Modbus slave 1 (PLC) and address %MW0 (0) wich value is 10 for instance.








We have to change this since we want to point to Modbus address 01 and message type 03 as we have seen on [Modbus Test](#)

Let's remove it  
AT+RMPOLL=1

Now we add a new POLL task to measure Voltage  
And this will be the right poll task according to the previous chapter  
AT+ADDPOLL=1:010300000001840A

RAK SERIAL PORT TOOL

 COM:  BaudRate:


RECEIVING [CLEAR RECV](#)

```
OK
SYSLOG:4:DTU Tx : 010300000001840A
SYSLOG:4:DTU Rx : 01030200063846
SYSLOG:4:LoRa Tx : 81015000080101030200063846
SYSLOG:4:DTU Tx : 010300000001840A
SYSLOG:4:DTU Rx : 01030200063846
SYSLOG:4:LoRa Tx : 81015100080101030200063846
```

SENDING(With \r\n)

Time 00:00:00 | PASS: 0 | FAIL: 0 | SW\_Version: V1.2.1 | Make:2018-1

And we receive the response from PLC register %MW0 that in this case is 6  
Bit 1 and Bit 2 to ON state so this is 6  
But we receive a long payload, Since we are in non transparent mode.

 RAK SERIAL PORT TOOL

COM:  BaudRate:


RECEIVING [CLEAR RECV](#)

```
false
OK
|
```

SENDING(With \r\n)

Time 00:00:00 | PASS: 0 | FAIL: 0 | SW\_Version: V1.2.1 | Make:2018-1

Let's change to transparent mode to reduce payload

 RAK SERIAL PORT TOOL

COM:  BaudRate:

RECEIVING

[CLEAR RECV](#)

false  
OK  
SYSLOG:4:DTU Tx : 010300000001840A  
SYSLOG:4:DTU Rx : 01030200063846  
SYSLOG:4:LoRa Tx : 81016700080101030200063846  
SYSLOG:4:DTU Tx : 010300000001840A  
SYSLOG:4:DTU Rx : 01030200063846  
SYSLOG:4:LoRa Tx : 81016800080101030200063846  
SYSLOG:4:DTU Tx : 010300000001840A  
SYSLOG:4:DTU Rx : 01030200063846  
SYSLOG:4:LoRa Tx : 81016900080101030200063846  
OK  
SYSLOG:4:DTU Tx : 010300000001840A  
SYSLOG:4:DTU Rx : 01030200063846  
SYSLOG:4:LoRa Tx : 01030200063846

SENDING(With \r\n)

Time 00:00:00 | PASS: 0 | FAIL: 0 | SW\_Version: V1.2.1 | Make:2018-

## Chirpstack console

This is the view on Chirpstack console.



ChirpStack

Search organization

Network-servers  
Gateway-profiles  
Organizations  
All users

chirpstack

Org. settings  
Org. users  
Service-profiles  
Device-profiles  
Gateways  
Applications  
Multicast-groups

Applications / rak7431 / Devices / rak7431

DETAILS CONFIGURATION KEYS (OTAA) ACTIVATION **DEVICE DATA**

2:17:32 PM uplink

2:17:08 PM uplink

2:16:44 PM uplink

```

adr: true
applicationID: "5"
applicationName: "rak7431"
data: "AQMCAAY4Rg=="
devEUI: "60c5a8fffe754344"
deviceName: "rak7431"
fCnt: 425
fPort: 1
object: {} 0 keys
txInfo: {} 2 keys
dr: 0
frequency: 868500000

```

Now we see that we have the value of %MW0 on bytes 3 and 4

## Node-RED

Node-RED is running on the same RAK 2245 gateway Raspberry Pi. Just install Node-RED after burning the Gateway operating system SD with the image from RAK Wireless web page.

Let's decode this with Node-RED

```

application/5/device/60c5a8fffe/54344/rx : msg.payload : string[206]
{
  "applicationID": "5", "applicationName": "rak7431", "deviceName": "rak7431", "devEUI": "60c5a8fffe754344", "txInfo": {
    "frequency": 868500000, "dr": 0, "adr": true, "fCnt": 369, "fPort": 1, "data": "AQMCAAY4Rg==", "object": {}
  }
}
26/6/2021 13:53:53 node: a59e7ad9.b85578
application/5/device/60c5a8fffe754344/rx : msg.payload : buffer[7]
[ 1, 3, 2, 0, 6, 56, 70 ]

```

With this Flow

Take into account that payload is base 64 encoded

ChirpStack

Network-servers

Gateway-profiles

Organizations

All users

chirpstack

Org. settings

Org. users

Service-profiles

Device-profiles

Gateways

Applications

Multicast-groups

Applications / rak7431 / Devices / rak7431

DETAILSCONFIGURATIONKEYS (OTAA)ACTIVATIONDEVICE DATA

2:17:32 PMuplink

2:17:08 PMuplink

2:16:44 PMuplink

adr: true

applicationID: "5"

applicationName: "rak7431"

data: "AQMCAAY4Rg=="

devEUI: "60c5a8ffe754344"

deviceName: "rak7431"

fCnt: 425

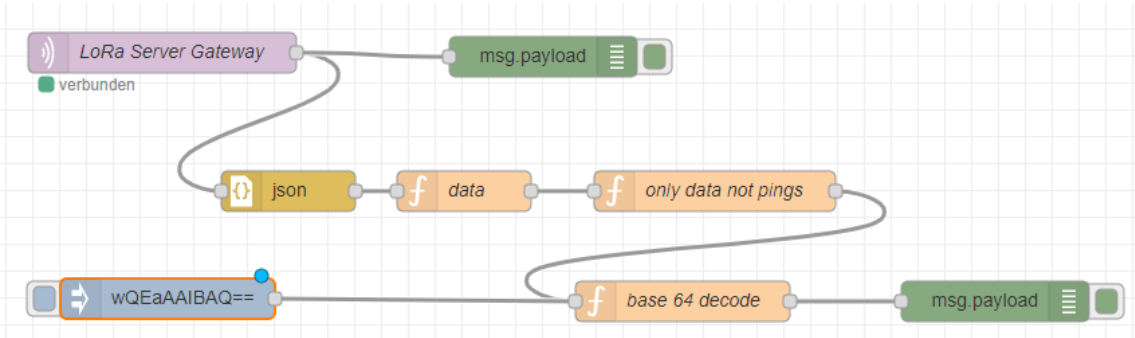
fPort: 1

object: {} 0 keys

txInfo: {} 2 keys

dr: 0

frequency: 868500000



**mqtt in Node bearbeiten**

Löschen

Abbrechen

Fertig

Properties

Server

localhost:1883

Topic

#

QoS

2

Output

auto-detect (string or buffer)

Name

LoRa Server Gateway

**json Node bearbeiten**

Löschen

Abbrechen

Fertig

Properties

Aktion

Immer in JavaScript-Objekt konvertieren

Eigenschaft

msg.payload

Name

Name

**function Node bearbeiten**

Löschen

Abbrechen

Fertig

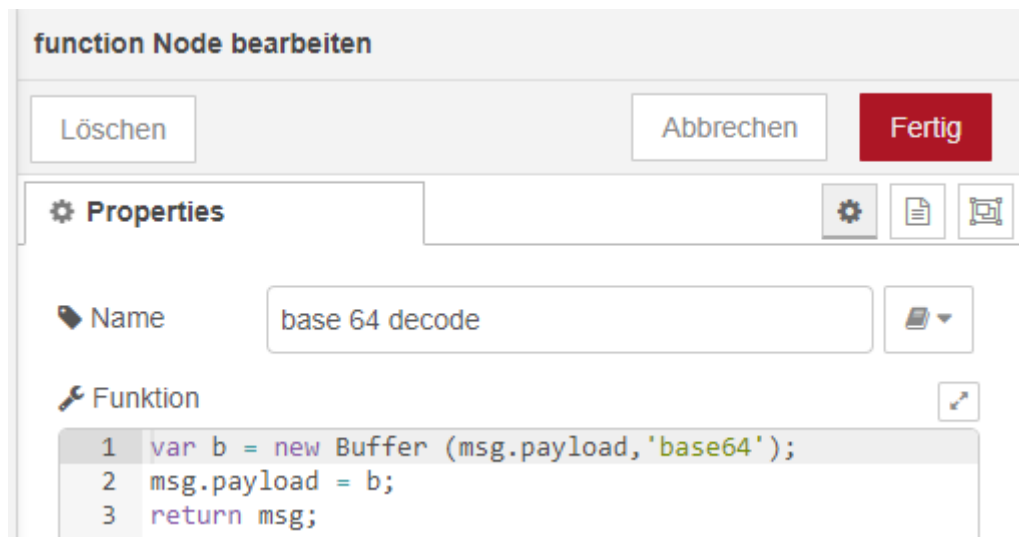
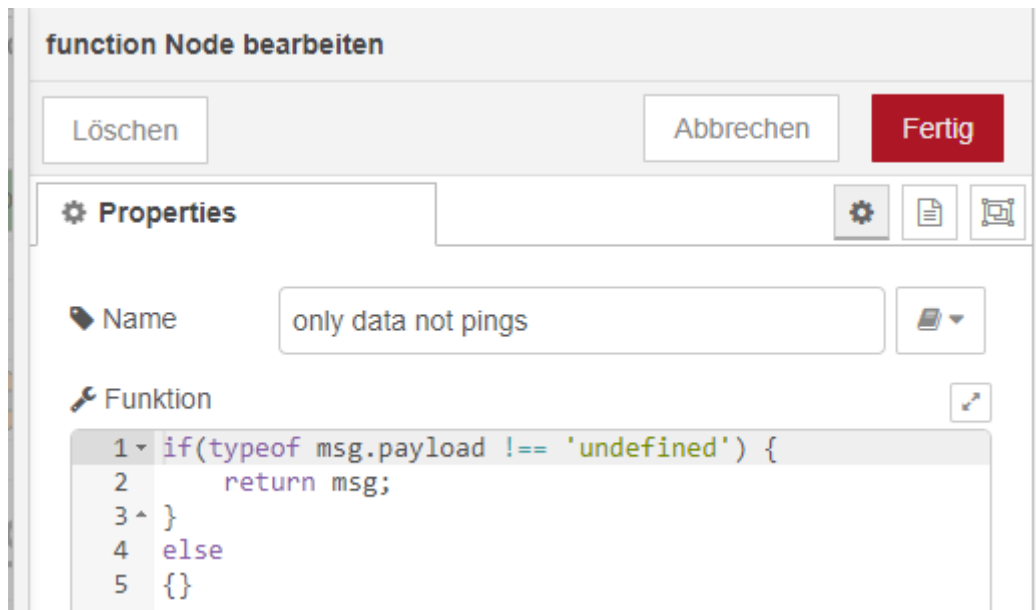
Properties

Name

data

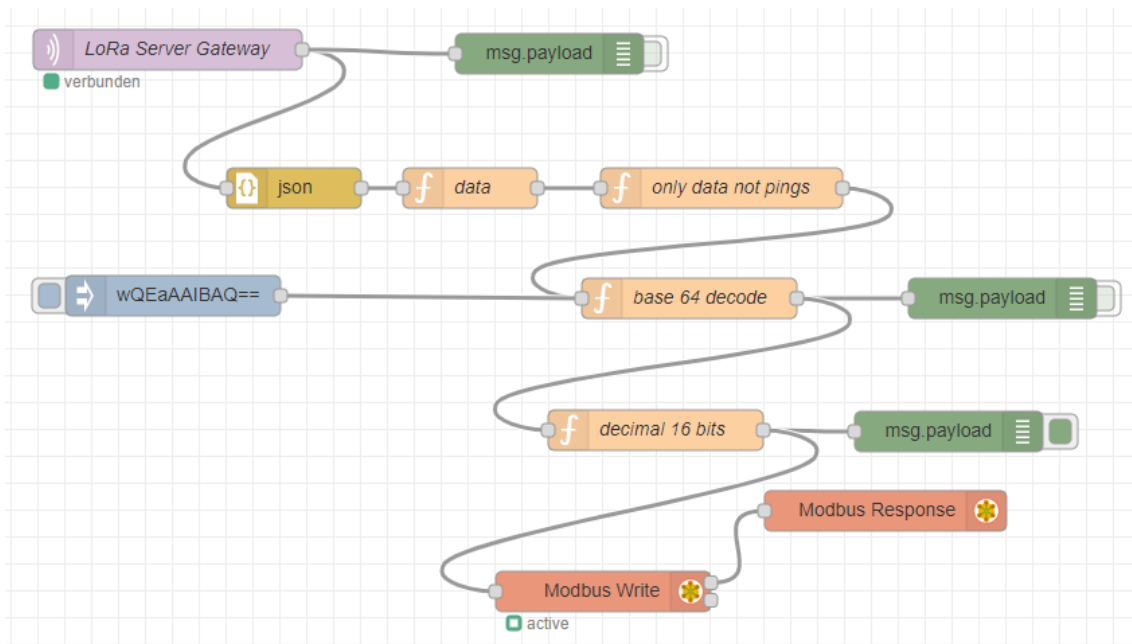
Funktion

```
1 var datastring = msg.payload.data
2 msg.payload = datastring
3 return msg;
```



Now we decode such buffer

With bytes 3 and 4 to get a 16bit integer



You can find the code here

<https://github.com/xavierflorensa/Schneider-PLC-to-PLC-comms-with-RAK-wireless>

And here is te video

[https://www.youtube.com/watch?v=Zf8wNpf23Z8&ab\\_channel=XavierFlorensaBerenguer](https://www.youtube.com/watch?v=Zf8wNpf23Z8&ab_channel=XavierFlorensaBerenguer)

```

26/6/2021 14:00:47 node: 3276a1ec.7956ee
application/5/device/60c5a8ffe754344/rx : msg.payload : number
6

26/6/2021 14:01:10 node: 3276a1ec.7956ee
application/5/device/60c5a8ffe754344/rx : msg.payload : number
6

26/6/2021 14:01:34 node: 3276a1ec.7956ee
application/5/device/60c5a8ffe754344/rx : msg.payload : number
6

```

And inject to the receiver PLC thru Modbus TCP on PLC register %MW1

function Node bearbeiten

Löschen

Abbrechen

Fertig

⚙ Properties

⚙

📄

🖼

🔑 Name

decimal 16 bits

📄

▼

🔑 Funktion

↗

1

var a = msg.payload[3];

2

var b = msg.payload[4];

3

msg.payload = a\*256+b;

4

return msg;

Modbus-Write Node bearbeiten

Löschen

Abbrechen

Fertig

⚙ Properties

⚙

📄

🖼

Name

Name

Unit-Id

FC

FC 6: Preset Single Register ▼

Adresse

1

Server

modbus-tcp@192.168.1.58:502 ▼

🔧

Modbus-Write Node bearbeiten > **modbus-client Node bearbeiten**

Löschen

Abbrechen

Aktualisieren

⚙ Properties

⚙

📄

Name

Name

Typ

TCP

▼

Host

192.168.1.58

Port

502

Verbindungstyp

DEFAULT

▼

Unit-Id

1

Timeout (ms)

1000

🔌 Reconnect bei Timeouts

☒

Reconnect-Timeout (ms)

2000

🔌 UnitId's in parallel

☒

Now let's take a look at the receiver PLC, where you only have to set an IP address, allocate a global memory register for instance on %MW1 and create a program to see the PLC digital output as an image of the sender PLC inputs.

Edificio central Gateway PLC Maestro v0.project - SoMachine Logic Builder - V4.3

Archivo Edición Ver Proyecto Compilar En línea Depuración Herramientas Ventana Ayuda

Seleccionar todo Online

Dispositivos

- Edificio central Gateway PLC Maestro v0
  - HMISCUxA5 (HMISCUxA5)
    - Funciones incorporadas
      - ES (ES)
      - HSC (HSC)
      - PTO\_PWM (PTO\_PWM)
    - COM1
      - SoMachine\_Network\_Manager 1 (SoMach
    - Ethernet
      - SoMachine\_Network\_Manager2 (SoMach
    - USB
      - SoMachine\_Network\_Manager3 (SoMach
    - CAN
      - MyController [conectado] (TM241CEC2
  - DI (Digital Inputs)
  - DQ (Digital Outputs)
  - Counters (Counters)
  - Pulse\_Generators (Pulse Generators)
  - Cartridge\_1 (Cartridge)
  - IO\_Bus (IO bus - TM3)
  - COM\_Bus (COM bus)
  - Ethernet\_1 (Ethernet Network)
  - Serial\_Line\_1 (Serial line)
  - SoMachine\_Network\_Manager (SoMa
  - Serial\_Line\_2 (Serial line)
  - Modbus\_Manager (Modbus Manager)
  - CAN\_1 (CANopen bus)

Utilizar conexión de DTM

Aplicaciones Dispositivos Herramientas

Supervisar 1

Mensajes - total 0 error(es), 0 advertencia(s), 0 mensaje(s)

Último Build: 0 0 0 Precompilar: EN EJECUCIÓN Programa cargado Pr

Configuración

Parámetros configurados

Nombre de interfaz EthernetPort0

Nombre de red my\_Device

☐ Dirección IP de DHCP

☐ Dirección IP de BOOTP

☒ Dirección IP fija

Dirección IP 192 . 168 . 1 . 58

Máscara de subred 255 . 255 . 255 . 0

Dirección de pasarela 0 . 0 . 0 . 0

Protocolo Ethernet Ethernet 2

Velocidad de transferencia Auto

Parámetros de seguridad

☒ Protocolo SoMachine activo

☒ Servidor Modbus activo

☒ Servidor web activo

☒ Servidor FTP activo

☒ Protocolo de descubrimiento activo

☒ Protocolo SNMP activo

☒ Protocolo WebVisualisation activo

Identificación del dispositivo esclavo

☒ Servidor DHCP activo [Servidor DHCP activo](#)

Cuando está activo, cada dispositivo que se añadirá al bus de campo puede configurarse para poder identificarlo por su nombre o dirección MAC, en lugar de por su dirección IP.

Configuración actual

Nombre de interfaz EthernetPort0

Nombre de red M241

☐ Dirección IP de DHCP

☐ Dirección IP de BOOTP

☒ Dirección IP fija

Dirección IP 192 . 168 . 1 . 58

Máscara de subred 255 . 255 . 255 . 0

Dirección de pasarela 192 . 168 . 1 . 1

Protocolo Ethernet Ethernet 2

Velocidad de transferencia 100 MBit full

Parámetros de seguridad

☒ Protocolo SoMachine activo

☒ Servidor Modbus activo

☒ Servidor web activo

☒ Servidor FTP activo

☒ Protocolo de descubrimiento activo

☒ Protocolo SNMP activo

☒ Protocolo WebVisualisation activo

Estado adaptador

Dirección MAC 00:80:F4:0A:59:C0

Estado red Intercambios de datos



Edificio central Gateway PLC Maestro v0.project -

Archivo Edición Ver Proyecto IL/FBD/LD Compilar En línea Depuración Herramientas Ventana Ayuda

Aplicaciones

Edificio central Gateway PLC Maestro v0

- Application (HMISCUxA5 : HMISCUxA5)
  - Configuración de tareas
    - MAST
    - GVL
    - Application (MyController:TM241CEC24R)**
      - Configuración de tareas
        - MAST
        - MyPOU
        - GVL
        - MyPOU (PRG)**
      - Global
    - Vijeo Designer Project Container

MyController.Application.MyPOU

WORD\_AS\_BIT\_0

WORD\_AS\_BIT

EN ENO

B00 xq\_salida0 FALSE

B01 xq\_salida1 TRUE

B02 xq\_salida2 TRUE

B03 xq\_salida3 FALSE

B04 xq\_salida4 FALSE

B05 xq\_salida5 FALSE

B06 xq\_salida6 FALSE

B07 xq\_salida7 FALSE

B08 xq\_salida8 FALSE

B09 xq\_salida9 FALSE

B10 FALSE

B11 FALSE

B12 FALSE

B13 FALSE

B14 FALSE

B15 FALSE

RET

Supervisar 1

Expresión	Tipo de datos	Valor	Valor preparado	Dirección	Comentario
MyController.Application.i_var0	UINT	41			
MyController.Application.i_var1	INT	6			
MyController.Application.xq_salida1	BOOL	TRUE		%QX0.1	
MyController.Application.xq_salida2	BOOL	TRUE		%QX0.2	
MyController.Application.xq_salida3	BOOL	FALSE		%QX0.3	

Edificio central Gateway PLC Maestro v0.proje

Archivo Edición Ver Proyecto Compilar En línea Depuración Herramientas Ventana Ayuda

Aplicaciones

- Edificio central Gateway PLC Maestro v0
  - Application (HMISCUxA5 : HMISCUxA5)
    - Configuración de tareas
      - MAST
      - GVL
    - Application (MyController:TM241CEC24R)
      - Configuración de tareas
        - MAST
        - MyPOU
        - GVL
        - MyPOU (PRG)
      - Global
      - Vijeo Designer Project Container

MyController.Application.GVL

Expresión	Tipo de datos	Valor	Valor preparado	Dirección
i_var0	UINT	100		%MW0
i_var1	INT	6		%MW1
i_var2	INT	0		%MW2
i_var3	INT	0		%MW3
GEN_0	GEN			

Supervisar 1

Expresión	Tipo de datos	Valor	Valor preparado	Dirección	Comentario
MyController.Application.i_var0	UINT	100			
MyController.Application.i_var1	INT	6			
MyController.Application.xq_salida1	BOOL	TRUE		%QX0.1	
MyController.Application.xq_salida2	BOOL	TRUE		%QX0.2	
MyController.Application.xq_salida3	BOOL	FALSE		%QX0.3	

Mensajes - total 0 error(es), 0 advertencia(s), 0 mensaje(s)

Último Build: 0 0 Precompilar: EN EJECUCIÓN

So it Works!

Now let's decrease the sending period since we are transmitting each 24 seconds

ChirpStack

Search organization

Network-servers

Gateway-profiles

Organizations

All users

chirpstack

Org. settings

Org. users

Service-profiles

Device-profiles

Gateways

Applications

Multicast-groups

Applications / rak7431 / Devices / rak7431

DETAILS

CONFIGURATION

KEYS (OTAA)

ACTIVATION

DEVICE DATA

2:29:21 PM

uplink

2:28:58 PM

uplink

2:28:34 PM

uplink

2:28:10 PM

uplink

2:27:47 PM

uplink

2:27:23 PM

uplink

2:26:59 PM

uplink


2:26:36 PM

uplink

2:26:12 PM

uplink

AT+POLLPERIOD



COM:  BaudRate:

CLOSE

RECEIVING

[CLEAR RECV](#)

20  
OK  
|


SENDING(With \r\n)

SEND

Time 00:00:00 | PASS: 0 | FAIL: 0 | SW\_Version: V1.2.1 | Make:2018-12-

Let's change to 10 seconds

RAK SERIAL PORT TOOL



COM: COM18 BaudRate: 15200 CLOSE

RECEIVING CLEAR RECV

20  
OK  
SYSLOG:4:DTU Tx : 010300000001840A  
SYSLOG:4:DTU Rx : 01030200063846  
SYSLOG:4:LoRa Tx : 01030200063846  
OK  
SYSLOG:4:DTU Tx : 010300000001840A  
SYSLOG:4:DTU Rx : 01030200063846  
EVENT:2:LEAVE\_NETWORK  
SYSLOG:4:OTAA Join Request  
|

SENDING(With \r\n)

AT+POLLPERIOD=10 SEND

Time 00:00:00 | PASS: 0 | FAIL: 0 | SW\_Version: V1.2.1 | Make:2018-1

Now it is transmitting each 14 seconds

ChirpStack

Search organization

Network-servers

Gateway-profiles

Organizations

All users

chirpstack

Org. settings

Org. users

Service-profiles

Device-profiles

Gateways

Applications

Applications / rak7431 / Devices / rak7431

DETAILSCONFIGURATIONKEYS (OTAA)ACTIVATIONDEVICE DATA

7:07:02 PMuplink

7:06:49 PMuplink

7:06:35 PMuplink

7:06:22 PMuplink

7:06:08 PMuplink

7:05:54 PMuplink

Let's try to find the lower period

Let's try with 5 seconds

ChirpStack

Search organization

Network-servers

Gateway-profiles

Organizations

All users

chirpstack

Org. settings

Org. users

Service-profiles

Applications / rak7431 / Devices / rak7431

DETAILSCONFIGURATIONKEYS (OTAA)ACTIVATIONDEVICE DATA

7:10:10 PMuplink

7:10:02 PMuplink

7:09:53 PMuplink

We are transmitting each 8 seconds

COM: COM18
BaudRate: 115200
CLOSE

RECEIVING

[CLEAR RECV](#)

SYSLOG:4:DTU Rx : 01030200063846  
SYSLOG:4:LoRa Tx : 01030200063846  
SYSLOG:4:DTU Tx : 010300000001840A  
SYSLOG:4:DTU Rx : 0103020000B844  
SYSLOG:4:LoRa Tx : 0103020000B844  
SYSLOG:4:DTU Tx : 010300000001840A  
SYSLOG:4:DTU Rx : 0103020000B844  
SYSLOG:4:LoRa Tx : 0103020000B844  
SYSLOG:4:DTU Tx : 010300000001840A  
SYSLOG:4:DTU Rx : 0103020000B844  
SYSLOG:4:LoRa Tx : 0103020000B844  
SYSLOG:4:DTU Tx : 010300000001840A  
SYSLOG:4:DTU Rx : 0103020000B844  
SYSLOG:4:LoRa Tx : 0103020000B844  
OK

SENDING(With \r\n)

AT+POLLPERIOD=5

SEND

Time 00:00:00 | PASS: 0 | FAIL: 0 | SW\_Version: V1.2.1 | Make:2018-1

Let's try to go Lower

We are transmitting each 6 seconds

ChirpStack

Search organization

- Network-servers
- Gateway-profiles
- Organizations
- All users
- chirpstack
- Org. settings
- Org. users
- Service-profiles

Applications / rak7431 / Devices / rak7431

DETAILS
CONFIGURATION
KEYS (OTAA)
ACTIVATION
DEVICE DATA

7:13:03 PM
uplink

7:12:57 PM
uplink

7:12:51 PM
uplink

COM: COM18

BaudRate: 115200

CLOSE

RECEIVING

CLEAR REC V

SYSLOG:4:DTU Tx : 010300000001840A

SYSLOG:4:DTU Rx : 01030200063846

SYSLOG:4:LoRa Tx : 01030200063846

SYSLOG:4:DTU Tx : 010300000001840A

SYSLOG:4:DTU Rx : 01030200063846

SYSLOG:4:LoRa Tx : 01030200063846

SYSLOG:4:DTU Tx : 010300000001840A

SYSLOG:4:DTU Rx : 01030200063846

SYSLOG:4:LoRa Tx : 01030200063846

SYSLOG:4:DTU Tx : 010300000001840A

SYSLOG:4:DTU Rx : 01030200063846

SYSLOG:4:LoRa Tx : 01030200063846

SYSLOG:4:DTU Tx : 010300000001840A

SYSLOG:4:DTU Rx : 01030200063846

SYSLOG:4:LoRa Tx : 01030200063846

SENDING(With \r\n)

AT+POLLPERIOD=2

SEND

Time 00:00:00 | PASS: 0 | FAIL: 0 | SW\_Version: V1.2.1 | Make:2018-1

Let's find the minimum value POLL period 1 second

We are transmitting each 4-5 seconds

ChirpStack

Search organization

Network-servers

Gateway-profiles

Organizations

All users

chirpstack

Org. settings

Org. users

Service-profiles

Device-profiles

Applications / rak7431 / Devices / rak7431

DETAILS

CONFIGURATION

KEYS (OTAA)

ACTIVATION

DEVICE DATA

7:16:04 PM

uplink

7:15:59 PM

uplink

7:15:55 PM

uplink

7:15:50 PM

uplink





COM: COM18

BaudRate: 115200

CLOSE

RECEIVING

[CLEAR REC](#)

```
SYSLOG:4:DTU Tx : 010300000001840A
SYSLOG:4:DTU Rx : 01030200063846
SYSLOG:4:LoRa Tx : 01030200063846
SYSLOG:4:DTU Tx : 010300000001840A
SYSLOG:4:DTU Rx : 01030200063846
SYSLOG:4:LoRa Tx : 01030200063846
SYSLOG:4:DTU Tx : 010300000001840A
SYSLOG:4:DTU Rx : 01030200063846
SYSLOG:4:LoRa Tx : 01030200063846
SYSLOG:4:DTU Tx : 010300000001840A
SYSLOG:4:DTU Rx : 01030200063846
SYSLOG:4:LoRa Tx : 01030200063846
SYSLOG:4:DTU Tx : 010300000001840A
SYSLOG:4:DTU Rx : 01030200063846
SYSLOG:4:LoRa Tx : 01030200063846
```

SENDING(With \r\n)

AT+POLLPERIOD=1

SEND

Time 00:00:00 | PASS: 0 | FAIL: 0 | SW\_Version: V1.2.1 | Make:2018-1

Not bad!