HOWTO use NodeRED® on C4-8CO Controller

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STRIVE IN PERFECTION
IN WHATEVER YOU
DO
TAKE THE BEST THAT
EXISTS AND MAKE IT
BETTER
WHEN IT DOES NOT
EXIST. DESIGN IT.
Sir Henry Royce

CONTENT

In this application note you will find ...

PREREQUISITES

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PREREQUISITES

We assume that the reader is familiar how to use WINDOWS® operating system, how to configure a LINUX® Ethernet interface, how to use a remote desktop program or SSH console to configure LINUX®. Also we assume that the reader is able to install and open NodeRED® in a browser.

Furthermore we assume, that the reader is able to create a correct NodeRED® flow and that the reader is able to writhe a JavaScript script. If not, please consult the internet or book a education workshop. RESI is in no way responsible, if you or your customer cannot use the given advice here, because of lack of education in your or their staff!

With the purchase of a IoT Controller from RESI, you have not purchased the right of free education or free consulting from RESI!

RESI delivers IoT controllers with the ability to run NodeRED® on it, but RESI is not liable for any functional problems, software errors, law suits or other issues which results out of using NodeRED® on our devices in your project or machinery!

IMPORTANT SAFETY NOTES
Important hint:

Before you start with the installation and the initial setup of the device, you have to read this document and the attached installation guide and the actual manual for the device very carefully. You have to follow all the herein given information very accurate!

- Only authorized and qualified personnel are allowed to install and setup the device!
- The connection of the device must be done in de-energized state!
- Do not perform any electrical work while the device is connected to power!
- Disable and secure the system against any automatic restart or power on procedure!
- The device must be operated with the defined voltage level!
- Supply voltage jitters must not exceed the technical specifications and tolerances given in the technical manuals for the product. If you do not obey this issue, the proper performance of the device cannot be guaranteed. This can lead to fail functions of the device and in worst case to a complete breakdown of the device!
- You have to obey the current EMC regulations for wiring!
- All signal, control and supply voltage cables must be wired in a way, that no inductive or capacitive interference or any other severe electrical noise disturbance may interfere with the device. Wrong wiring can lead to a malfunction of the device!
- For signal or sensor cables you have to use shielded cables, to avoid damages through induction!
- You have to obey and to apply the current safety regulations given by the ÖVE, VDE, the countries, their control authorities, the TÜV or the local energy supply company!
- Obey country-specific laws and standards!
- The device must be used for the intended purpose of the manufacturer!
- No warranties or liabilities will be accepted for defects and damages resulting from improper or incorrect usage of the device!
- Subsequent damages, which results from faults of this device, are excluded from warranty and liability!
- Only the technical data, wiring diagrams and operation instructions, which are part to the product shipment are valid!
- The information on our homepage, in our datasheets, in our manuals, in our catalogues or published by our partners can deviate from the product documentation and is not necessarily always actual, due to constant improvement of our products for technical progress!
- In case of modification of our devices made by the user, all warranty and liability claims are lost!
- The installation has to fulfill the technical conditions and specifications (e.g. operating temperatures, power supply, ...) given in the devices documentation!
- Operating our device close to equipment, which do not comply with EMC directives, can influence the functionality of our device, leading to malfunction or in worst case to a breakdown of our device!
- Our devices must not be used for monitoring applications, which solely serve the purpose of protecting persons against hazards or injury, or as an emergency stop switch for systems or machinery, or for any other similar safety-relevant purposes!
- Dimensions of the enclosures or enclosures accessories may show slight tolerances on the specifications provided in these instructions!
- Modifications of this documentation is not allowed!
- In case of a complaint, only complete devices returned in original packing will be accepted!

Install NodeRED®
on RESI-T4/C4 controller

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Install NodeRED® on RESI-T4/C4 controller

Please search in the internet for a tutorial or more information, how to install NodeRED on a Raspberry Pi. We do not want to write yet another manual for the installation of NodeRED.

Open with VNCViewer the Raspberry Desktop or connect your monitor direct to HDMI and keyboard+mouse to the USB interface of our C4/T4 controllers. But do NOT login with root user. Choose your local user like pi. In the desktop choose Settings → Add/remove Software. Enter in the search field Options NodeRED. Select the package and click OK. After a while NodeRED is installed.

We are using NodeRED Version 4.x based on NodeJS version 18 on a 64 Bit OS (bookworm)

WHERE IS NODE RED?

Determine the exact location of the node-red command.
If you have done a global install of node-red, then on Linux/OS X the node-red command will probably be either: /usr/bin/node-red or /usr/local/bin/node-red. The command which node-red can be used to confirm the location.

If you have done a local install, it will be node_modules/node-red/bin/node-red, relative to where you ran npm install from.

INSTALL PROCESS MANAGER2

Install pm2 to start/stop the NodeRED system

```
sudo npm install -g pm2
```

HOWTO START/STOP NodeRED

We are using pm2 to manually start or stop NodeRED after system power on.

```
pm2 start /usr/bin/node-red -- -v
```
or
```
pm2 start /usr/local/bin/node-red -- -v
```

You can get info from NodeRED with
```
pm2 info node-red
pm2 logs node-red
```

You can stop NodeRED with
```
pm2 stop node-red
```

Install NodeRED® on RESI-T4/C4 controller

HOWTO AUTOMATICALLY START NODE RED AT SYSTEM STARTUP?
We are using pm2 to automatically start NodeRED after system power on.
First start NodeRED with

```
pm2 start /usr/bin/node-red -- -v
```
or
```
pm2 start /usr/local/bin/node-red -- -v
```

Then save the current setup with
```
pm2 save
```
and
```
pm2 startup
```

Then execute the shown command as described:
```
sudo env PATH=$PATH:/usr/bin /usr/local/lib/node_modules/pm2/bin/pm2 startup systemd -u resi --hp /home/resi
```

Finished!

Install NodeRED® on RESI-T4/C4 controller

```
resi@RESI-C4:~ $ pm2 startup
[PM2] Init System found: systemd
[PM2] To setup the Startup Script, copy/paste the following command:
sudo env PATH=$PATH:/usr/bin /usr/local/lib/node_modules/pm2/bin/pm2 startup systemd -u resi --hp /home/r
esi
resi@RESI-C4:~ $ sudo env PATH=$PATH:/usr/bin /usr/local/lib/node_modules/pm2/bin/pm2 startup systemd -u
resi --hp /home/resi
[PM2] Init System found: systemd
Platform systemd
Template
[Unit]
Description=PM2 process manager
Documentation=https://pm2.keymetrics.io/
After=network.target

[Service]
Type=forking
User=resi
LimitNOFILE=infinity
LimitNPROC=infinity
LimitCORE=infinity
Environment=PATH=/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/local/games:/usr/games
:/usr/bin:/bin:/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin
Environment=PM2_HOME=/home/resi/.pm2
PIDFile=/home/resi/.pm2/pm2.pid
Restart=on-failure

ExecStart=/usr/local/lib/node_modules/pm2/bin/pm2 resurrect
ExecReload=/usr/local/lib/node_modules/pm2/bin/pm2 reload all
ExecStop=/usr/local/lib/node_modules/pm2/bin/pm2 kill

[Install]
WantedBy=multi-user.target

Target path
/etc/systemd/system/pm2-resi.service
Command list
[ 'systemctl enable pm2-resi' ]
[PM2] Writing init configuration in /etc/systemd/system/pm2-resi.service
[PM2] Making script booting at startup...
[PM2] [-] Executing: systemctl enable pm2-resi...
Created symlink /etc/systemd/system/multi-user.target.wants/pm2-resi.service → /etc/systemd/system/pm2-re
si.service.
[PM2] [v] Command successfully executed.
+---------------------------------------+
[PM2] Freeze a process list on reboot via:
$ pm2 save

[PM2] Remove init script via:
$ pm2 unstartup systemd
```

NodeRED® sample for RESI-C4-8CO controller

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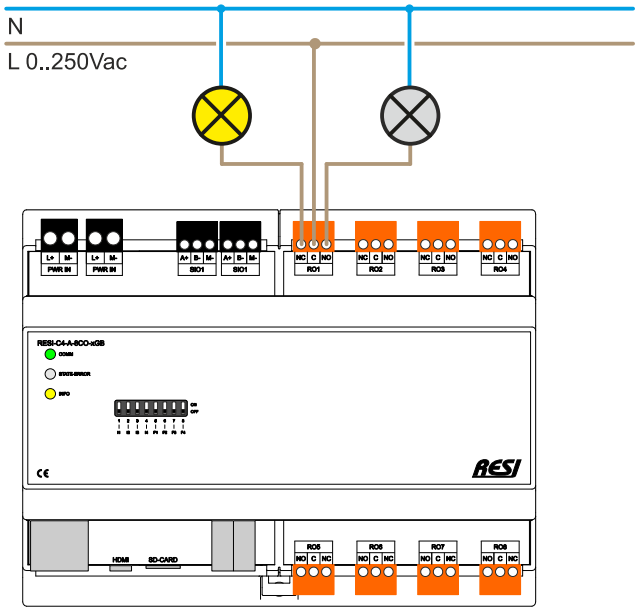
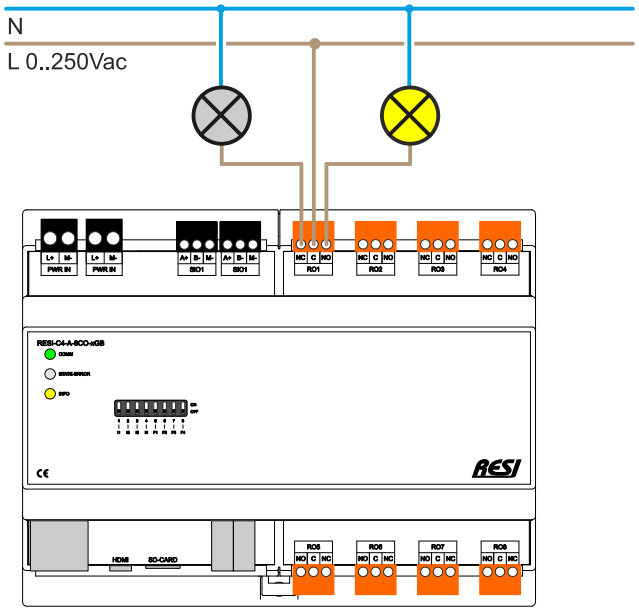
NodeRED® on our RESI-C4-A-8CO-xGB controllers



RELAY=OFF

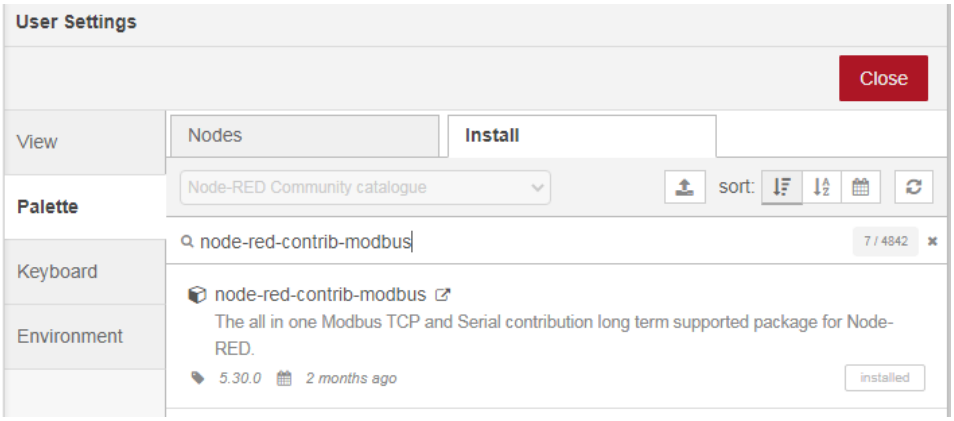


RELAY=ON

Install NodeRED® components node-red-contrib-modbus

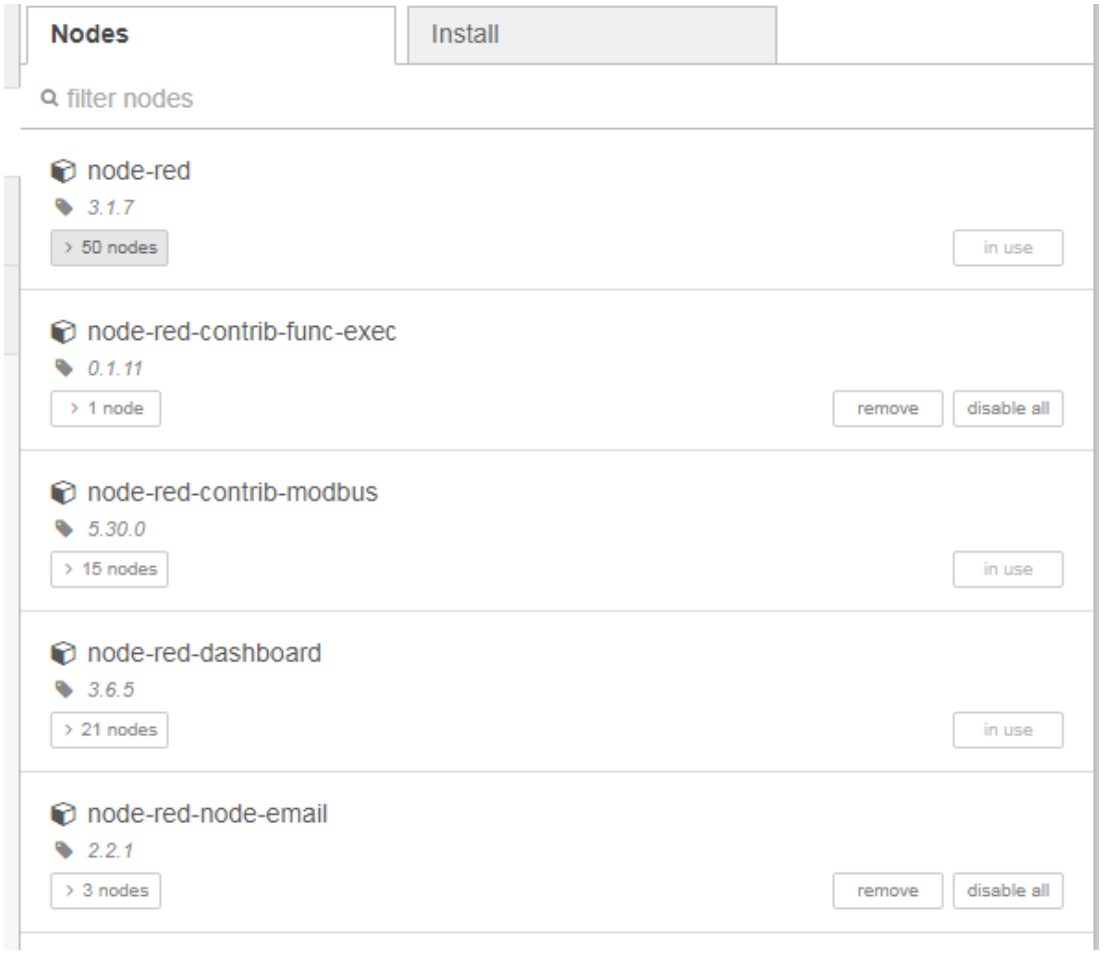
INSTALL node-red-contrib-modbus

Open menu "Manage palette" and select tab install. Enter node-red-contrib-modbus in the search field. You should see an similar screen:



Click on Install. We have installed this component already.

We have additionally installed the components node-red-dashboard for creating a simple UI



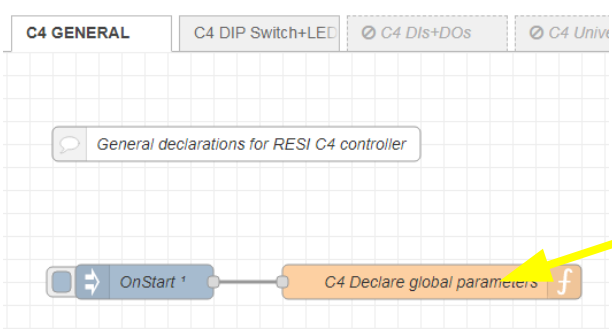
First NodeRED® flow for RESI-C4-8CO controller

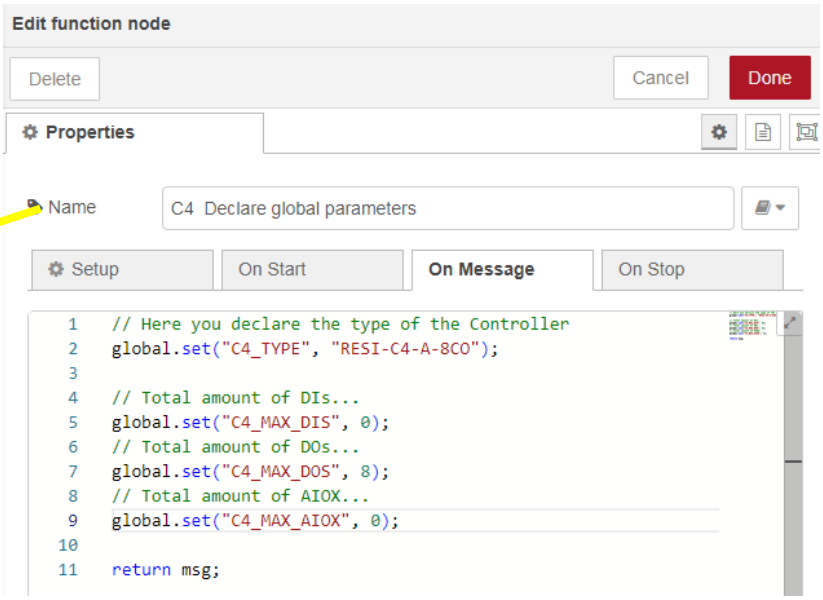
First Flow

Now we create our first flow C4 GENERAL. Import this flow:

```
[{"id":"6f86f58cac7ec48d","type":"tab","label":"C4 GENERAL","disabled":false,"info":"","env":[]},
{"id":"48bcbb8a512940c3","type":"comment","z":"6f86f58cac7ec48d","name":"General declarations for RESI C4
controller","info":"","x":220,"y":80,"wires":[]},
{"id":"d6308c2bd6764109","type":"inject","z":"6f86f58cac7ec48d","name":"OnStart","props":[{"p":"payload"},
{"p":"topic","vt":"str"}],"repeat":"","crontab":"","once":true,"onceDelay":"0","topic":"","payload":"","payloadType":"date","x":140,"y"
:200,"wires":[["020af8fc1079e4c5"]]},{"id":"020af8fc1079e4c5","type":"function","z":"6f86f58cac7ec48d","name":"C4  Declare global
parameters","func":"// Here you declare the type of the Controller\nglobal.set(\"C4_TYPE\", \"RESI-C4-A-8CO\");\n\n// Total amount of
DIs...\nglobal.set(\"C4_MAX_DIS\", 0);\n// Total amount of DOs...\nglobal.set(\"C4_MAX_DOS\", 8);\n// Total amount of AIOX...\
nglobal.set(\"C4_MAX_AIOX\", 0);\n\nreturn msg;","outputs":0,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":
[],"x":390,"y":200,"wires":[]}]
```

Your result should look like this. Double click on the function node to see the java code.





We use the **global.set**("<Name>",<Value>) function to define some global parameters for all other nodes. After you have successfully deployed the flow and you select the context menu and refresh the entries, you will see under the section global the new variables C4_TYPE, C4_MAX_DIS, C4_MAX_DOS and C4_MAX_AIOX.

NodeRED® flow to update RESI-C4-8CO DIP switch+LEDs

Read the DIP switch and set the LEDs from RESI-C4 controller

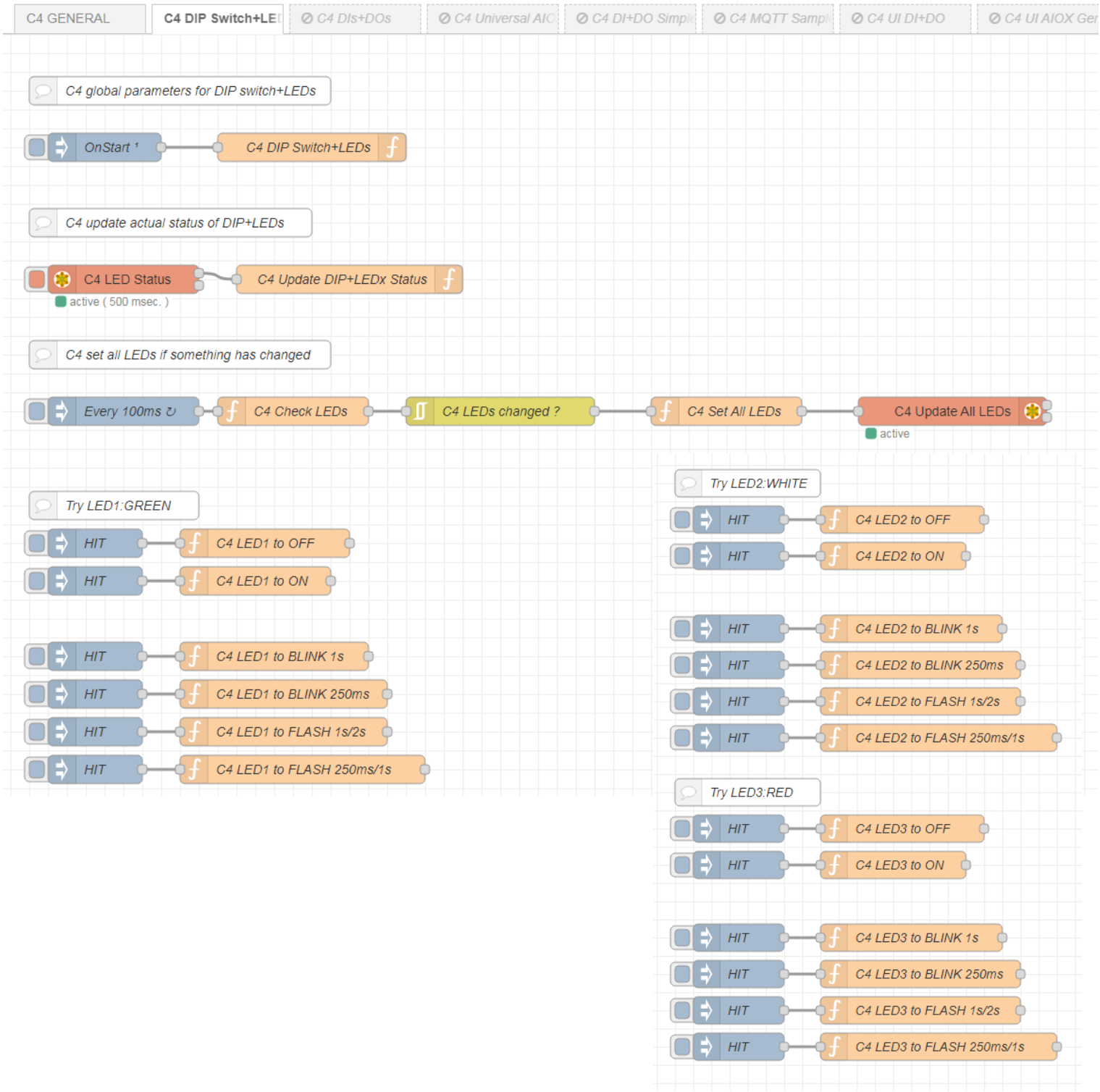
Now we create a new flow C4 DIP Switch+LEDs. Import this flow:


```
[{"id":"bb570f329fdbaf6d","type":"tab","label":"C4 DIP Switch+LEDs","disabled":false,"info":"","env":[]},{"id":"28aefceec8ede485","type":"function","z":"bb570f329fdbaf6d","name":"C4 Update DIP+LEDx Status","func":"// 4x65501, I:65500\n// Actual state of DIP switch\nglobal.set(\"C4_DIP_Actual\", msg.payload[0]);\n\n// 4x65502, I:65501\n// LED1:GREEN: Actual state \nglobal.set(\"C4_LED1_State\", msg.payload[1]);\n// 4x65503, I:65502\n// LED1:GREEN: Actual Time1 in ms\nglobal.set(\"C4_LED1_Time1\", msg.payload[2]);\n// 4x65504, I:65503\n// LED1:GREEN: Actual Time2 in ms\nglobal.set(\"C4_LED1_Time2\", msg.payload[3]);\n\n// 4x65505, I:65504\n// LED2:WHITE: Actual state \nglobal.set(\"C4_LED2_State\", msg.payload[4]);\n// 4x65506, I:65505\n// LED2:WHITE: Actual Time1 in ms\nglobal.set(\"C4_LED2_Time1\", msg.payload[5]);\n// 4x65507, I:65506\n// LED2:WHITE: Actual Time2 in ms\nglobal.set(\"C4_LED2_Time2\", msg.payload[6]);\n\n// 4x65508, I:65507\n// LED3:RED: Actual state \nglobal.set(\"C4_LED3_State\", msg.payload[7]);\n// 4x65509, I:65508\n// LED3:RED: Actual Time1 in ms\nglobal.set(\"C4_LED3_Time1\", msg.payload[8]);\n// 4x65510, I:65509\n// LED3:RED: Actual Time2 in ms\nglobal.set(\"C4_LED3_Time2\", msg.payload[9]);\n\nreturn msg;","outputs":0,"timeout":0,"noerr":0,"initialize":"// Der Code hier wird ausgeführt,\n// wenn der Node gestartet wird\nif (context.get(\"DIPSwitch\") === undefined) {\n\n    context.set(\"DIPSwitch\", 0);\n}","finalize":"","libs":[],"x":380,"y":260,"wires":[]},{"id":"6a638bd274d0b500","type":"inject","z":"bb570f329fdbaf6d","name":"OnStart","props":[{"p":"payload"},{"p":"topic","vt":"str"}],"repeat":"","crontab":"","once":true,"onceDelay":"0","topic":"","payload":"","payloadType":"date","x":120,"y":120,"wires":[["80dd83a51733a0d5"]]},
{"id":"80dd83a51733a0d5","type":"function","z":"bb570f329fdbaf6d","name":"C4  DIP Switch+LEDs","func":"// DIP Switch\nglobal.set(\"C4_DIP\", 0);\nglobal.set(\"C4_DIP_Actual\", 0);\n\n// LED1:GREEN LED\nglobal.set(\"C4_LED1_State\", 0);\nglobal.set(\"C4_LED1_Time1\", 1000);\nglobal.set(\"C4_LED1_Time2\", 1000);\n\nglobal.set(\"C4_LED1_State_Actual\", 0);\nglobal.set(\"C4_LED1_Time1_Actual\", 1000);\nglobal.set(\"C4_LED1_Time2_Actual\", 1000);\n\n// LED1:WHITE LED\nglobal.set(\"C4_LED2_State\", 0);\nglobal.set(\"C4_LED2_Time1\", 1000);\nglobal.set(\"C4_LED2_Time2\", 1000);\n\nglobal.set(\"C4_LED2_State_Actual\", 1);\nglobal.set(\"C4_LED2_Time1_Actual\", 1000);\nglobal.set(\"C4_LED2_Time2_Actual\", 1000);\n\n// LED1:RED LED\nglobal.set(\"C4_LED3_State\", 0);\nglobal.set(\"C4_LED3_Time1\", 1000);\nglobal.set(\"C4_LED3_Time2\", 1000);\n\nglobal.set(\"C4_LED3_State_Actual\", 0);\nglobal.set(\"C4_LED3_Time1_Actual\", 1000);\nglobal.set(\"C4_LED3_Time2_Actual\", 1000);\n\nreturn msg;","outputs":0,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":340,"y":120,"wires":[]},
{"id":"f6aaf4b2c2594d6d","type":"inject","z":"bb570f329fdbaf6d","name":"Every 100ms","props":[{"p":"payload"},
{"p":"topic","vt":"str"}],"repeat":"0.1","crontab":"","once":false,"onceDelay":0.1,"topic":"","payload":"","payloadType":"date","x":140,"y":400,"wires":[["0d3daf0108c81c53"]]},
{"id":"0d3daf0108c81c53","type":"function","z":"bb570f329fdbaf6d","name":"C4 check LEDs","func":"// generate message for all LEDs and all LED parameters...\nvar msgl={ topic: \"C4_LEDs\", payload:[] };\n\nmsgl.payload[0] = global.get(\"C4_LED1_State\");\nmsgl.payload[1] = global.get(\"C4_LED1_Time1\");\nmsgl.payload[2] = global.get(\"C4_LED1_Time2\");\n\nmsgl.payload[3] = global.get(\"C4_LED2_State\");\nmsgl.payload[4] = global.get(\"C4_LED2_Time1\");\nmsgl.payload[5] = global.get(\"C4_LED2_Time2\");\n\nmsgl.payload[6] = global.get(\"C4_LED3_State\");\nmsgl.payload[7] = global.get(\"C4_LED3_Time1\");\nmsgl.payload[8] = global.get(\"C4_LED3_Time2\");\n\nreturn msgl ;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":320,"y":400,"wires":[["1af579507299a840"]]},{"id":"1af579507299a840","type":"rbe","z":"bb570f329fdbaf6d","name":"C4 LEDs changed ?","func":"rbe","gap":"","start":"","inout":"out","septopics":true,"property":"payload","topi":"topic","x":540,"y":400,"wires":[["fe33d5e9e639b1b2"]]},{"id":"fe33d5e9e639b1b2","type":"function","z":"bb570f329fdbaf6d","name":"C4 Set All LEDs","func":"// create message for\n// MODBUS WRITE MULTIPLE HOLDING REGISTERS\nlet C4_LEDs=[ 0,0,0, 0,0,0, 0,0,0];\n\n// 4x65502, I:65501\n// LED1:GREEN: Actual state \nC4_LEDs[0]=global.get(\"C4_LED1_State\");\n// 4x65503, I:65502\n// LED1:GREEN: Actual Time1 in ms\nC4_LEDs[1]=global.get(\"C4_LED1_Time1\");\n// 4x65504, I:65503\n// LED1:GREEN: Actual Time2 in ms\nC4_LEDs[2]=global.get(\"C4_LED1_Time2\");\n\n// 4x65505, I:65504\n// LED2:WHITE: Actual state \nC4_LEDs[3]=global.get(\"C4_LED2_State\");\n// 4x65506, I:65505\n// LED2:WHITE: Actual Time1 in ms\nC4_LEDs[4]=global.get(\"C4_LED2_Time1\");\n// 4x65507, I:65506\n// LED2:WHITE: Actual Time2 in ms\nC4_LEDs[5]=global.get(\"C4_LED2_Time2\");\n\n// 4x65508, I:65507\n// LED3:RED: Actual state \nC4_LEDs[6]=global.get(\"C4_LED3_State\");\n// 4x65509, I:65508\n// LED3:RED: Actual Time1 in ms\nC4_LEDs[7]=global.get(\"C4_LED3_Time1\");\n// 4x65510, I:65509\n// LED3:RED: Actual Time2 in ms\nC4_LEDs[8]=global.get(\"C4_LED3_Time2\");\n\nmsg.payload = { \n    value: [ \n        C4_LEDs[0], C4_LEDs[1], C4_LEDs[2],\n        C4_LEDs[3], C4_LEDs[4], C4_LEDs[5],\n        C4_LEDs[6], C4_LEDs[7], C4_LEDs[8]\n    ],\n    // WRITE MULTIPLE REGISTERS\n    'fc': 16, \n    // INTERNAL UnitID of C4\n    'unitid': 1, \n    // START ADDRESS: 4x65502, I:65501\n    'address': 65501, \n    // 3 LEDS with 3 vaklues each...\n    'quantity': 9 \n}\n\nreturn msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":780,"y":400,"wires":[["00d5c16462d31686"]]},
{"id":"b1213e9cc3a578d0","type":"function","z":"bb570f329fdbaf6d","name":"C4 LED1 to OFF","func":"global.set(\"C4_LED1_State\",0);\n\nreturn msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":290,"y":540,"wires":[[]]},{"id":"5c621e79cd645df","type":"inject","z":"bb570f329fdbaf6d","name":"HIT","props":[{"p":"payload"},
{"p":"topic","vt":"str"}],"repeat":"","crontab":"","once":false,"onceDelay":0.1,"topic":"","payload":"","payloadType":"date","x":110,"y":580,"wires":[["5903787182589c32"]]},
{"id":"5903787182589c32","type":"function","z":"bb570f329fdbaf6d","name":"C4 LED1 to ON","func":"global.set(\"C4_LED1_State\",1);\n\nreturn msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":280,"y":580,"wires":[[]]},{"id":"cc89c0c1d341652f","type":"inject","z":"bb570f329fdbaf6d","name":"HIT","props":[{"p":"payload"},
{"p":"topic","vt":"str"}],"repeat":"","crontab":"","once":false,"onceDelay":0.1,"topic":"","payload":"","payloadType":"date","x":110,"y":660,"wires":[["b6b345944aaa0cc9"]]},
{"id":"b6b345944aaa0cc9","type":"function","z":"bb570f329fdbaf6d","name":"C4 LED1 to BLINK ls","func":"global.set(\"C4_LED1_State\",3);\nglobal.set(\"C4_LED1_Time1\",1000);\n\nreturn msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":300,"y":660,"wires":[[]]},{"id":"2e9cdde2739e1fd4","type":"inject","z":"bb570f329fdbaf6d","name":"HIT","props":[{"p":"payload"},
{"p":"topic","vt":"str"}],"repeat":"","crontab":"","once":false,"onceDelay":0.1,"topic":"","payload":"","payloadType":"date","x":110,"y":700,"wires":[["c658a39f94dcd26c"]]},
{"id":"c658a39f94dcd26c","type":"function","z":"bb570f329fdbaf6d","name":"C4 LED1 to BLINK 250ms","func":"global.set(\"C4_LED1_State\",3);\nglobal.set(\"C4_LED1_Time1\",250);\n\nreturn msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":310,"y":700,"wires":[[]]},{"id":"5851af743f5e05f9","type":"inject","z":"bb570f329fdbaf6d","name":"HIT","props":[{"p":"payload"},
{"p":"topic","vt":"str"}],"repeat":"","crontab":"","once":false,"onceDelay":0.1,"topic":"","payload":"","payloadType":"date","x":110,"y":740,"wires":[["40a55131ed06ab50"]]},
{"id":"40a55131ed06ab50","type":"function","z":"bb570f329fdbaf6d","name":"C4 LED1 to FLASH 1s/2s","func":"global.set(\"C4_LED1_State\",4);\nglobal.set(\"C4_LED1_Time1\",1000);\nglobal.set(\"C4_LED1_Time2\",2000);\n\nreturn msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":310,"y":740,"wires":[[]]},{"id":"891590857cb9df7a","type":"inject","z":"bb570f329fdbaf6d","name":"HIT","props":[{"p":"payload"},
{"p":"topic","vt":"str"}],"repeat":"","crontab":"","once":false,"onceDelay":0.1,"topic":"","payload":"","payloadType":"date","x":110,"y":780,"wires":[["fbde5a99a40acdb0"]]},
{"id":"fbde5a99a40acdb0","type":"function","z":"bb570f329fdbaf6d","name":"C4 LED1 to FLASH 250ms/1s","func":"global.set(\"C4_LED1_State\",4);\nglobal.set(\"C4_LED1_Time1\",250);\nglobal.set(\"C4_LED1_Time2\",1000);\n\nreturn msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":330,"y":780,"wires":[[]]},{"id":"8d4a1bc70ea2d12d","type":"comment","z":"bb570f329fdbaf6d","name":"Try LED1:GREEN","info":"","x":130,"y":500,"wires":[]},
{"id":"b266d4e7cd25a72d","type":"inject","z":"bb570f329fdbaf6d","name":"HIT","props":[{"p":"payload"},
{"p":"topic","vt":"str"}],"repeat":"","crontab":"","once":false,"onceDelay":0.1,"topic":"","payload":"","payloadType":"date","x":110,"y":900,"wires":[["12bbf04905393898"]]},
{"id":"12bbf04905393898","type":"function","z":"bb570f329fdbaf6d","name":"C4 LED2 to OFF","func":"global.set(\"C4_LED2_State\",0);\nreturn msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":290,"y":900,"wires":[[]]},{"id":"6fb3dfa94fcedd54","type":"inject","z":"bb570f329fdbaf6d","name":"HIT","props":[{"p":"payload"},
{"p":"topic","vt":"str"}],"repeat":"","crontab":"","once":false,"onceDelay":0.1,"topic":"","payload":"","payloadType":"date","x":110,"y":940,"wires":[["04a1653b150104bd"]]},
{"id":"04a1653b150104bd","type":"function","z":"bb570f329fdbaf6d","name":"C4 LED2 to ON","func":"global.set(\"C4_LED2_State\",1);\nreturn msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":280,"y":940,"wires":[[]]},{"id":"1b46108aad67bcac","type":"inject","z":"bb570f329fdbaf6d","name":"HIT","props":[{"p":"payload"},
{"p":"topic","vt":"str"}],"repeat":"","crontab":"","once":false,"onceDelay":0.1,"topic":"","payload":"","payloadType":"date","x":110,"y":1020,"wires":[["bf887585c597d09a"]]},
{"id":"bf887585c597d09a","type":"function","z":"bb570f329fdbaf6d","name":"C4 LED2 to BLINK ls","func":"global.set(\"C4_LED2_State\",3);\nglobal.set(\"C4_LED2_Time1\",1000);\n\nreturn msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":300,"y":1020,"wires":[[]]},{"id":"41973b376f755e07","type":"inject","z":"bb570f329fdbaf6d","name":"HIT","props":[{"p":"payload"},
{"p":"topic","vt":"str"}],"repeat":"","crontab":"","once":false,"onceDelay":0.1,"topic":"","payload":"","payloadType":"date","x":110,"y":1060,"wires":[["4cad4194f6f13d88"]]},
{"id":"4cad4194f6f13d88","type":"function","z":"bb570f329fdbaf6d","name":"C4 LED2 to BLINK 250ms","func":"global.set(\"C4_LED2_State\",3);\nglobal.set(\"C4_LED2_Time1\",250);\n\nreturn msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":310,"y":1060,"wires":[[]]},{"id":"958ee02e4f3f015f","type":"inject","z":"bb570f329fdbaf6d","name":"HIT","props":[{"p":"payload"},
{"p":"topic","vt":"str"}],"repeat":"","crontab":"","once":false,"onceDelay":0.1,"topic":"","payload":"","payloadType":"date","x":110,"y":1100,"wires":[["d4523492197b82bf"]]},
{"id":"d4523492197b82bf","type":"function","z":"bb570f329fdbaf6d","name":"C4 LED2 to FLASH 1s/2s","func":"global.set(\"C4_LED2_State\",4);\nglobal.set(\"C4_LED2_Time1\",1000);\nglobal.set(\"C4_LED2_Time2\",2000);\n\nreturn msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":310,"y":1100,"wires":[[]]},{"id":"dd053a67996bb93d","type":"inject","z":"bb570f329fdbaf6d","name":"HIT","props":[{"p":"payload"},
{"p":"topic","vt":"str"}],"repeat":"","crontab":"","once":false,"onceDelay":0.1,"topic":"","payload":"","payloadType":"date","x":110,"y":1140,"wires":[["1f62f77715957a2c"]]},
{"id":"1f62f77715957a2c","type":"function","z":"bb570f329fdbaf6d","name":"C4 LED2 to FLASH 250ms/1s","func":"global.set(\"C4_LED2_State\",4);\nglobal.set(\"C4_LED2_Time1\",250);\nglobal.set(\"C4_LED2_Time2\",1000);\n\nreturn msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":330,"y":1140,"wires":[[]]},{"id":"d32013fbf6b17ac9","type":"comment","z":"bb570f329fdbaf6d","name":"Try LED2:WHITE","info":"","x":120,"y":860,"wires":[]},{"id":"0af4de1c16c96bab","type":"inject","z":"bb570f329fdbaf6d","name":"HIT","props":[{"p":"payload"},
{"p":"topic","vt":"str"}],"repeat":"","crontab":"","once":false,"onceDelay":0.1,"topic":"","payload":"","payloadType":"date","x":110,"y":1240,"wires":[["b7fc93f771f96d8d"]]},
{"id":"b7fc93f771f96d8d","type":"function","z":"bb570f329fdbaf6d","name":"C4 LED3 to OFF","func":"global.set(\"C4_LED3_State\",0);\nreturn msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":290,"y":1240,"wires":[[]]},{"id":"800ccc6ea51888c1","type":"inject","z":"bb570f329fdbaf6d","name":"HIT","props":[{"p":"payload"},
{"p":"topic","vt":"str"}],"repeat":"","crontab":"","once":false,"onceDelay":0.1,"topic":"","payload":"","payloadType":"date","x":110,"y":1280,"wires":[["8d3f9c70c5b738b5"]]},
{"id":"8d3f9c70c5b738b5","type":"function","z":"bb570f329fdbaf6d","name":"C4 LED3 to ON","func":"global.set(\"C4_LED3_State\",1);\nreturn msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":280,"y":1280,"wires":[[]]},{"id":"e566f275ce603739","type":"inject","z":"bb570f329fdbaf6d","name":"HIT","props":[{"p":"payload"},
{"p":"topic","vt":"str"}],"repeat":"","crontab":"","once":false,"onceDelay":0.1,"topic":"","payload":"","payloadType":"date","x":110,"y":1360,"wires":[["e2d0364db361a954"]]},
{"id":"e2d0364db361a954","type":"function","z":"bb570f329fdbaf6d","name":"C4 LED3 to BLINK ls","func":"global.set(\"C4_LED3_State\",3);\nglobal.set(\"C4_LED3_Time1\",1000);\n\nreturn msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":300,"y":1360,"wires":[[]]},{"id":"50f480b7bf6eb4f7","type":"inject","z":"bb570f329fdbaf6d","name":"HIT","props":[{"p":"payload"},
{"p":"topic","vt":"str"}],"repeat":"","crontab":"","once":false,"onceDelay":0.1,"topic":"","payload":"","payloadType":"date","x":110,"y":1400,"wires":[["cd6fa26403595b7f"]]},
{"id":"cd6fa26403595b7f","type":"function","z":"bb570f329fdbaf6d","name":"C4 LED3 to BLINK 250ms","func":"global.set(\"C4_LED3_State\",3);\nglobal.set(\"C4_LED3_Time1\",250);\n\nreturn msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":310,"y":1400,"wires":[[]]},{"id":"831c7d2a8fccd139","type":"inject","z":"bb570f329fdbaf6d","name":"HIT","props":[{"p":"payload"},
{"p":"topic","vt":"str"}],"repeat":"","crontab":"","once":false,"onceDelay":0.1,"topic":"","payload":"","payloadType":"date","x":110,"y":1440,"wires":[["9b3a691da98cfd71"]]},
{"id":"9b3a691da98cfd71","type":"function","z":"bb570f329fdbaf6d","name":"C4 LED3 to FLASH 1s/2s","func":"global.set(\"C4_LED3_Time1\",1000);\nglobal.set(\"C4_LED3_Time2\",2000);\n\nreturn msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":310,"y":1440,"wires":[[]]},{"id":"c2a64798eb7dd5ee","type":"inject","z":"bb570f329fdbaf6d","name":"HIT","props":[{"p":"payload"},
{"p":"topic","vt":"str"}],"repeat":"","crontab":"","once":false,"onceDelay":0.1,"topic":"","payload":"","payloadType":"date","x":110,"y":1480,"wires":[["3573985a522fdc3f"]]},
{"id":"3573985a522fdc3f","type":"function","z":"bb570f329fdbaf6d","name":"C4 LED3 to FLASH 250ms/1s","func":"global.set(\"C4_LED3_State\",4);\nglobal.set(\"C4_LED3_Time1\",250);\nglobal.set(\"C4_LED3_Time2\",1000);\n\nreturn msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":330,"y":1480,"wires":[[]]},{"id":"07ccb4de6d086248","type":"comment","z":"bb570f329fdbaf6d","name":"Try LED3:RED","info":"","x":120,"y":1200,"wires":[]},
{"id":"dc0b2c043c3a9860","type":"comment","z":"bb570f329fdbaf6d","name":"C4 global parameters for DIP switch+LEDs","info":"","x":200,"y":60,"wires":[]},{"id":"51fce16e30b994d8","type":"comment","z":"bb570f329fdbaf6d","name":"C4 update actual status of DIP+LEDs","info":"","x":190,"y":200,"wires":[]},{"id":"de491ec14f45938d","type":"comment","z":"bb570f329fdbaf6d","name":"C4 set all LEDs if something has changed","info":"","x":200,"y":340,"wires":[]},{"id":"5f3c8567699d0421","type":"inject","z":"bb570f329fdbaf6d","name":"HIT","props":[{"p":"payload"},
{"p":"topic","vt":"str"}],"repeat":"","crontab":"","once":false,"onceDelay":0.1,"topic":"","payload":"","payloadType":"date","x":110,"y":540,"wires":[["b1213e9cc3a578d0"]]},{"id":"90ee6d0693ca8574","type":"modbus-read","z":"bb570f329fdbaf6d","name":"C4 LED Status","topic":"","showSettings":true,"showStatusActivities":false,"showErrors":false,"showWarnings":true,"unitid":"1","dataType":"HoldingRegister","adr":"65500","quantity":"20","rate":"500","rateUnit":"ms","delayOnStart":false,"startDelayTime":"","server":"c678772f081bbacd","useIOFile":false,"ioFile":"","useIOForPayload":false,"emptyMsgOnFail":false,"x":140,"y":260,"wires":[["28aefceec8ede485"],[]]},{"id":"00d5c16462d31686","type":"modbus-flex-write","z":"bb570f329fdbaf6d","name":"C4 Update All LEDs","showStatusActivities":true,"showErrors":true,"showWarnings":true,"server":"c678772f081bbacd","emptyMsgOnFail":true,"keepMsgProperties":false,"delayOnStart":false,"startDelayTime":"","x":1020,"y":400,"wires":[[],[]]},
{"id":"c678772f081bbacd","type":"modbus-client","name":"","clienttype":"serial","bufferCommands":true,"stateLogEnabled":false,"queueLogEnabled":true,"failureLogEnabled":true,"tcpHost":"127.0.0.1","tcpPort":"502","tcpType":"DEFAULT","serialPort":"/dev/ttyACM1","serialType":"RTU-BUFFERD","serialBaudrate":"9600","serialDatabits":"8","serialStopbits":"1","serialParity":"none","serialConnectionDelay":"1","serialAsciiResponseStartDelimiter":"0x3A","unit_id":"2","commandDelay":"1","clientTimeout":"1000","reconnectOnTimeout":true,"reconnectTimeout":"2000","parallelUnitIdsAllowed":false,"showErrors":true,"showWarnings":true,"showLogs":true}]
```

NodeRED® flow to update RESI-C4-8CO DIP switch+LEDs

Read the DIP switch and set the LEDs from RESI-C4 controller

The flow should look like this:

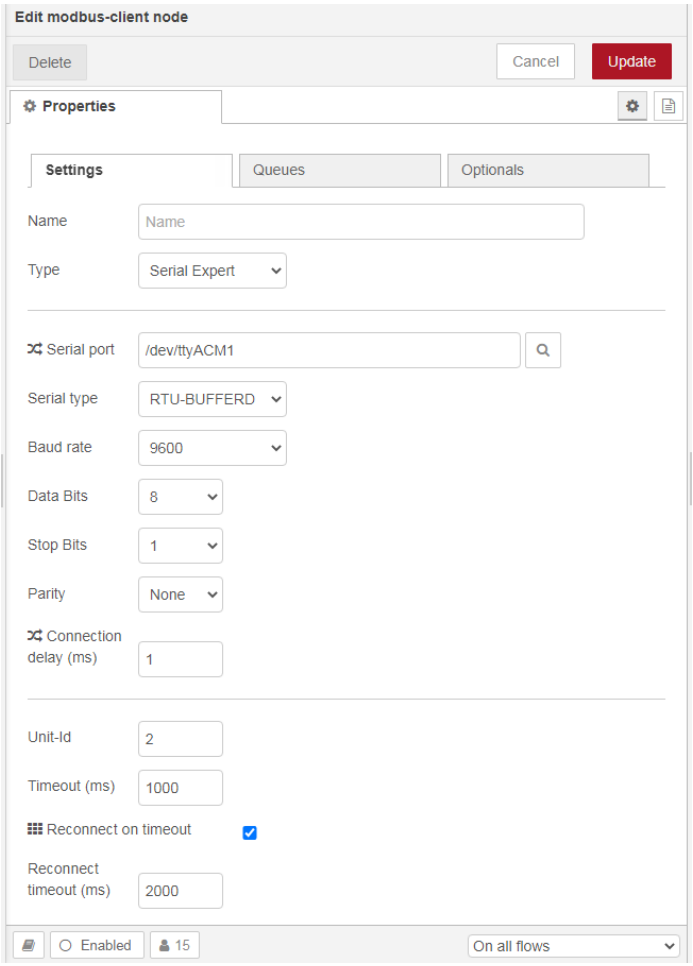


This flow will read the DIP Switch and LED status every 500ms via dev/ttyACM1 serial interface. Also it will set a new state for the LEDs, if you HIT the corresponding event triggers. Check the function nodes, what we have programmed!

NodeRED® flow to update RESI-C4-8CO DIP switch+LEDs

Read the DIP switch and set the LEDs from RESI-C4 controller

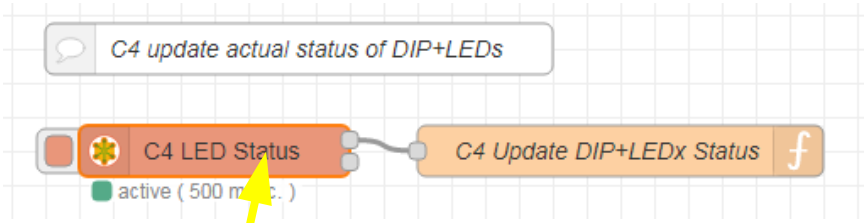
To run this sample flow, you will need to define the serial interface (in the section configuration node). Use this parameters for the **dev/ttyACM1** USB interface of our C4 controller. The settings of the baud rate are not relevant, due to the fact that the device is connected via USB to LINUX.

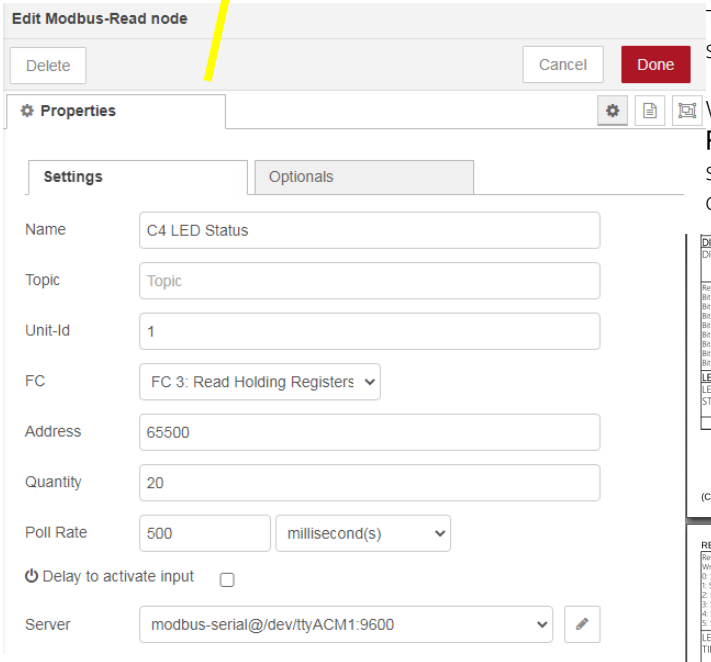


NodeRED® flow to update RESI-C4-8CO DIP switch+LEDs

Read the DIP switch and set the LEDs from RESI-C4 controller

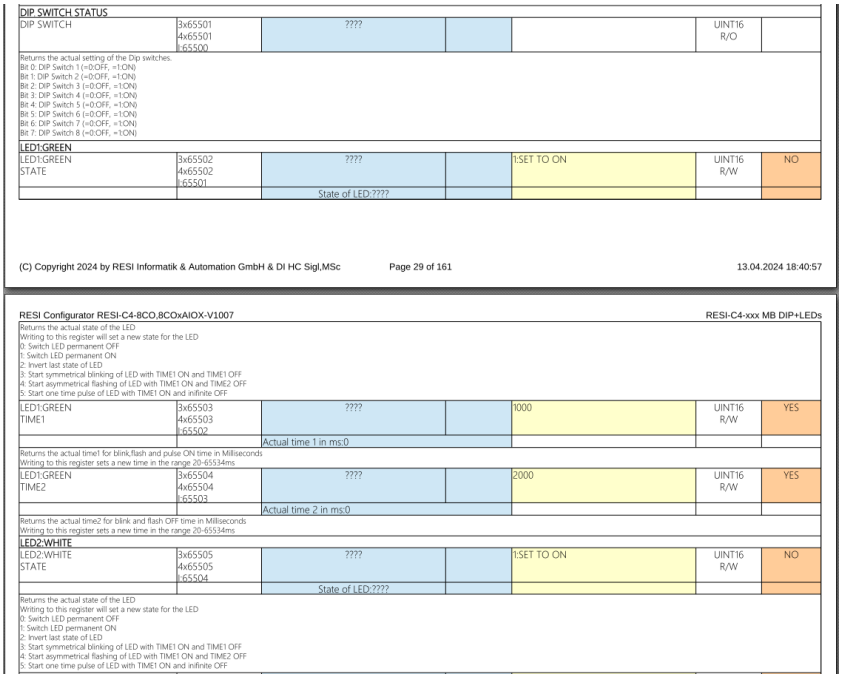
Let's concentrate on the readout of the DIP switch+LED status first. The first node is a MODBUS/RTU read node, with a poll rate of 500ms.





This node read every 500ms the MODBUS/RTU 20 holding registers starting at index 65500.

When you look into our ASCII+MODBUS register document **RESI-L-C4-A-8CO-xGB-MODBUS+ASCII-EN.pdf** you will find the registers starting with I:65500 containng the DIP switch, and then for every LED color some registers with the current status.



DIP SWITCH STATUS

DIP SWITCH	3x65501 4x65501 I:65500	????			UINT16 R/O	

Returns the actual setting of the Dip switches.
Bit 0: DIP Switch 1 (=0:OFF, =1:ON)
Bit 1: DIP Switch 2 (=0:OFF, =1:ON)
Bit 2: DIP Switch 3 (=0:OFF, =1:ON)
Bit 3: DIP Switch 4 (=0:OFF, =1:ON)
Bit 4: DIP Switch 5 (=0:OFF, =1:ON)
Bit 5: DIP Switch 6 (=0:OFF, =1:ON)
Bit 6: DIP Switch 7 (=0:OFF, =1:ON)
Bit 7: DIP Switch 8 (=0:OFF, =1:ON)

LED1:GREEN

LED1:GREEN STATE	3x65502 4x65502 I:65501	????		1:SET TO ON	UINT16 R/W	NO
		State of LED:????				

Returns the actual state of the LED
Writing to this register will set a new state for the LED
0: Switch LED permanent OFF
1: Switch LED permanent ON
2: Invert last state of LED
3: Start symmetrical blinking of LED with TIME1 ON and TIME1 OFF
4: Start asymmetrical flashing of LED with TIME1 ON and TIME2 OFF
5: Start one time pulse of LED with TIME1 ON and infinite OFF

LED1:GREEN TIME1	3x65503 4x65503 I:65502	????		1000	UINT16 R/W	YES
		Actual time 1 in ms:0				

Returns the actual time1 for blink,flash and pulse ON time in Milliseconds
Writing to this register sets a new time in the range 20-65534ms

LED1:GREEN TIME2	3x65504 4x65504 I:65503	????		2000	UINT16 R/W	YES
		Actual time 2 in ms:0				

Returns the actual time2 for blink and flash OFF time in Milliseconds
Writing to this register sets a new time in the range 20-65534ms

LED2:WHITE

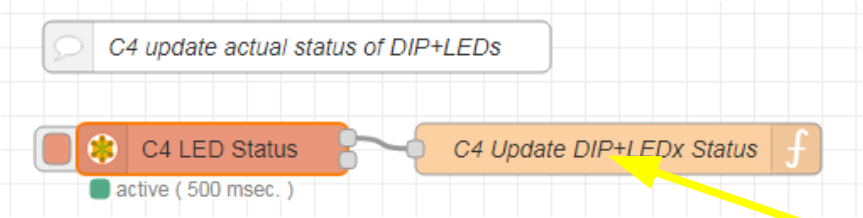
LED2:WHITE STATE	3x65505 4x65505 I:65504	????		1:SET TO ON	UINT16 R/W	NO
		State of LED:????				

Returns the actual state of the LED
Writing to this register will set a new state for the LED
0: Switch LED permanent OFF
1: Switch LED permanent ON
2: Invert last state of LED
3: Start symmetrical blinking of LED with TIME1 ON and TIME1 OFF
4: Start asymmetrical flashing of LED with TIME1 ON and TIME2 OFF
5: Start one time pulse of LED with TIME1 ON and infinite OFF

NodeRED® flow to update RESI-C4-8CO DIP switch+LEDs

Read the DIP switch and set the LEDs from RESI-C4 controller

Let's concentrate on the readout of the DIP switch+LED status first. The first node is a MODBUS/RTU read node, with a poll rate of 500ms.



Double click on the function block to open the JavaScript editor window.

We have now the result of the MODBUS read in the message payload ans an array with 20 elements starting with index 0.

Therefore msg.payload[0] represents the 16-bit content of the holding register I:65500 (The DIP switch). So we save this in the global variable named C4_DIP_Actual. You can use this value in every flow with global.get("C4_DIP_Actual").

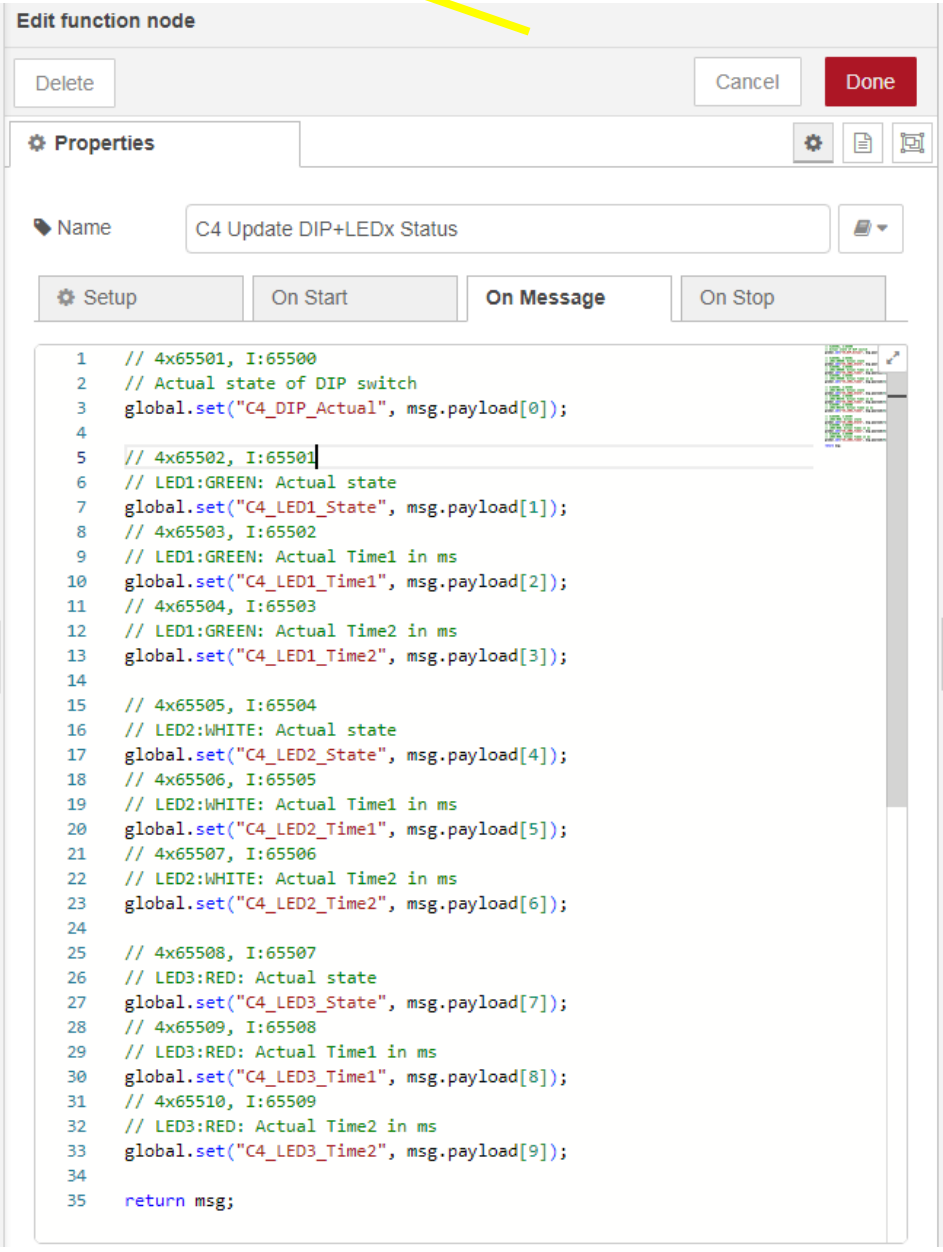
msg.payload[1] to msg.payload[3] represent the contents of the holding registers I:65501 to I:65503 representing the GREEN LED status.

msg.payload[4] to msg.payload[6] represent the contents of the holding registers I:65504 to I:65506 representing the WHITE LED status.

msg.payload[7] to msg.payload[9] represent the contents of the holding registers I:65507 to I:65509 representing the RED LED status.

msg.payload[10] to msg.payload[12] represent the contents of the holding registers I:65510 to I:65512 representing the YELLOW LED status. But this status we do not save, because we cannot control this LED. It represents the current status of the digital outputs. If one output is on, the LED is ON too!

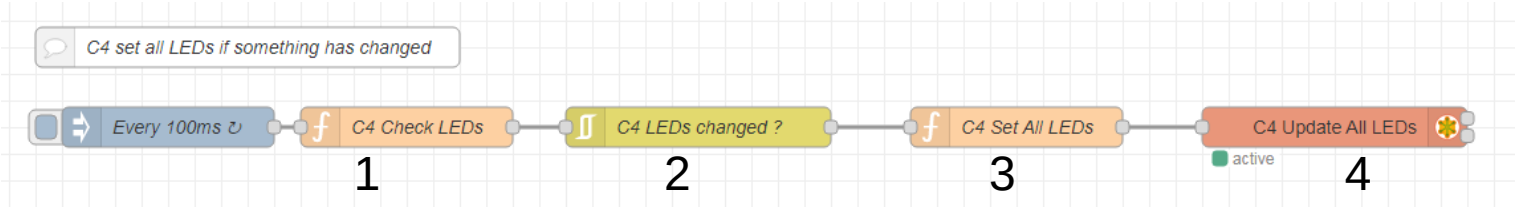
Again you can access the current LED state from every flow with the global variables C4_LEDx_State, C4_LEDx_Time1, C4_LEDx_Time2

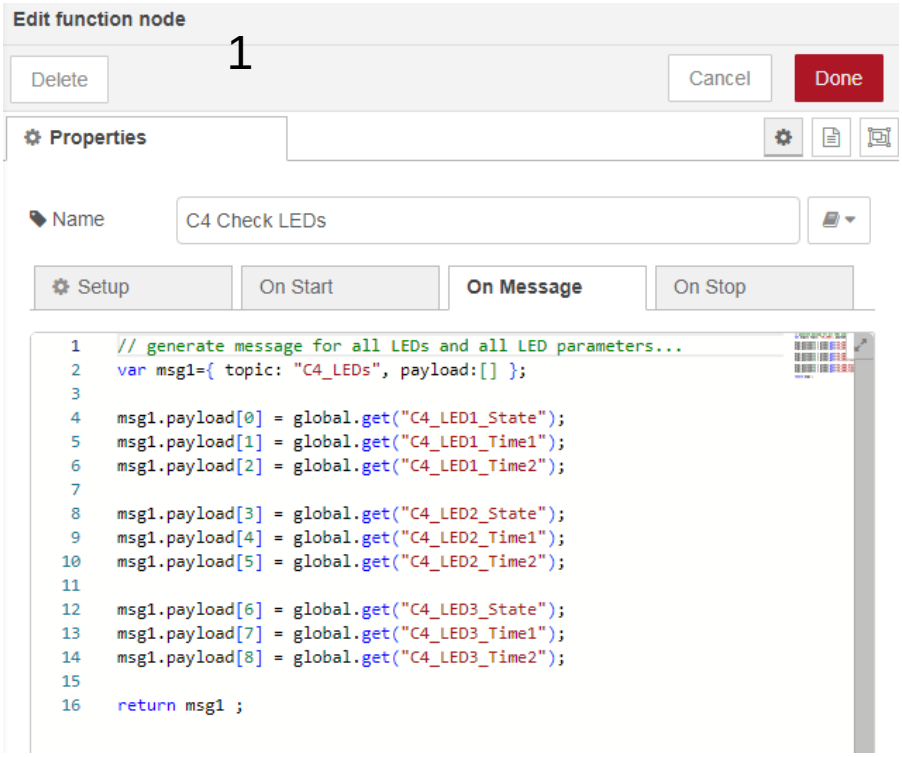


NodeRED® flow to update RESI-C4-8CO DIP switch+LEDs

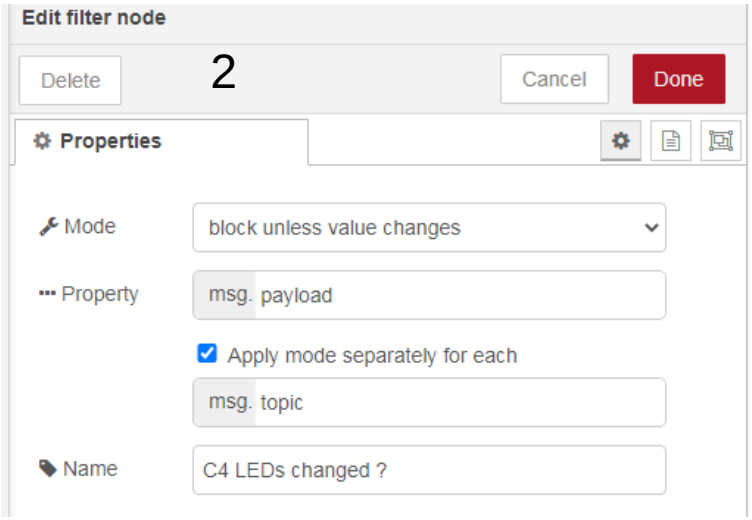
Read the DIP switch and set the LEDs from RESI-C4 controller

The next flow will update the LEDs via MODBUS/RTU write holding register command in the C4, if you write to the global variables.





Every 100ms we build a new message. We add the current content of the global variables for the three LEDs into the payload. Then we return the new created message to the flow for the next node.



This node will block the execution in this flow as long as no value has changed in the message.

NodeRED® flow to update RESI-C4-8CO DIP switch+LEDs

```
// create message for
// MODBUS WRITE MULTIPLE HOLDING REGISTERS 3
let C4_LEDs=[ 0,0,0, 0,0,0, 0,0,0];

// 4x65502, I:65501
// LED1:GREEN: Actual state
C4_LEDs[0]=global.get("C4_LED1_State");
// 4x65503, I:65502
// LED1:GREEN: Actual Time1 in ms
C4_LEDs[1]=global.get("C4_LED1_Time1");
// 4x65504, I:65503
// LED1:GREEN: Actual Time2 in ms
C4_LEDs[2]=global.get("C4_LED1_Time2");

// 4x65505, I:65504
// LED2:WHITE: Actual state
C4_LEDs[3]=global.get("C4_LED2_State");
// 4x65506, I:65505
// LED2:WHITE: Actual Time1 in ms
C4_LEDs[4]=global.get("C4_LED2_Time1");
// 4x65507, I:65506
// LED2:WHITE: Actual Time2 in ms
C4_LEDs[5]=global.get("C4_LED2_Time2");

// 4x65508, I:65507
// LED3:RED: Actual state
C4_LEDs[6]=global.get("C4_LED3_State");
// 4x65509, I:65508
// LED3:RED: Actual Time1 in ms
C4_LEDs[7]=global.get("C4_LED3_Time1");
// 4x65510, I:65509
// LED3:RED: Actual Time2 in ms
C4_LEDs[8]=global.get("C4_LED3_Time2");

msg.payload = {
    value: [
        C4_LEDs[0], C4_LEDs[1], C4_LEDs[2],
        C4_LEDs[3], C4_LEDs[4], C4_LEDs[5],
        C4_LEDs[6], C4_LEDs[7], C4_LEDs[8]
     ],
     // WRITE MULTIPLE REGISTERS
    'fc': 16,
     // INTERNAL UnitID of C4
    'unitid': 1,
     // START ADDRESS: 4x65502,I:65501
    'address': 65501,
     // 3 LEDS with 3 vaklues each...
    'quantity': 9
}
return msg;
```

In this function block we first build an array of 9 elements to keep the new state of the global variables. The array is called C4_LEDs.

Then we want to prepare a message for the MODBUS/RTU flex-write node. Therefore our message must have the correct format.

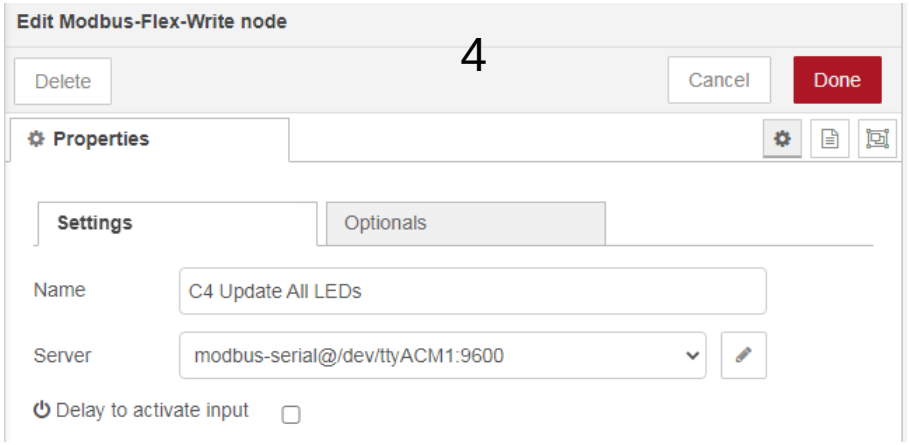
'fc': 16 stands for the MODBUS function code 16 which means write holding registers.

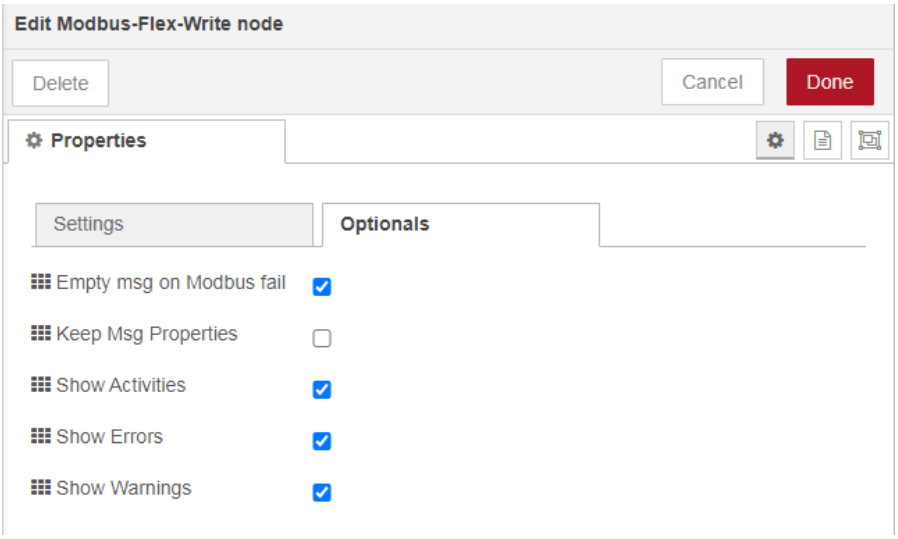
'unitid': 1 stands for the MODBUS unit ID. For our controllers always 1.

'address': 65501 stands for the first MODBUS holding register index (Starting with base=0), which we want to write new values into.

'quantity': 9 defines, that we want to write to 9 consecutive holding registers.

NodeRED® flow to update RESI-C4-8CO DIP switch+LEDs



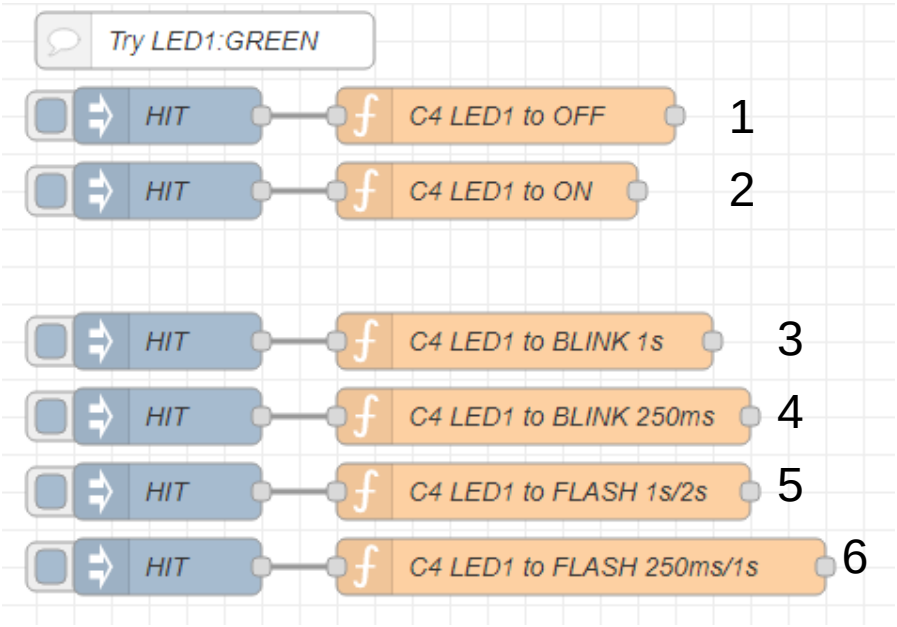


The flex write block executes the MODBUS command defined in the incoming message. We have only to select the correct serial interface dev/ttyACM1

NodeRED® flow to update RESI-C4-8CO DIP switch+LEDs

Control the LEDs with Node-RED

The next flow will update the status of the green LED. The white and red LEDs work similar. We use the event object titled HIT to indicate, that whenever you press this node with the mouse you will trigger the corresponding action to test easily every LED state interactively. But the deeper sense is that you learn, how writing to global variables will trigger MODBUS write actions.



Every 100ms we build a new message. We add the current content of the global variables for the three LEDs into the payload. Then we return the new created message to the flow for the next node.

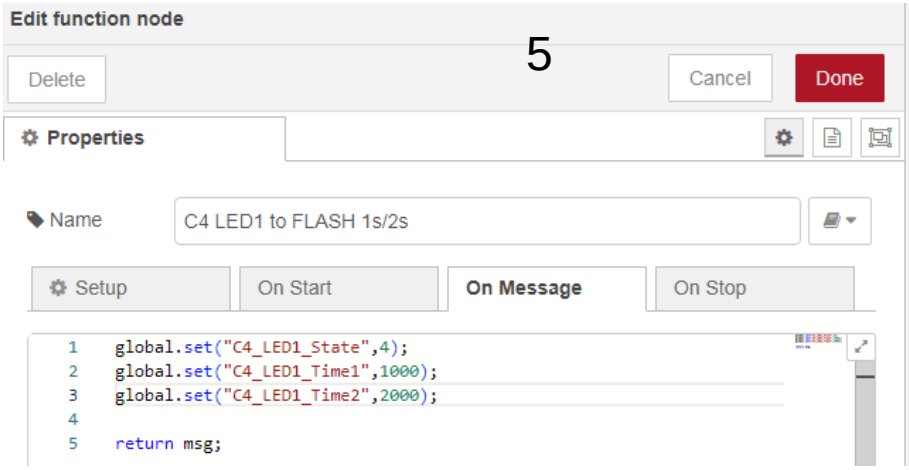
Setting the global variable C4_LED1_State to 0 will update the LED via MODBUS write and switch the LED OFF!

Setting the global variable C4_LED1_State to 1 will update the LED via MODBUS write and switch the LED ON!

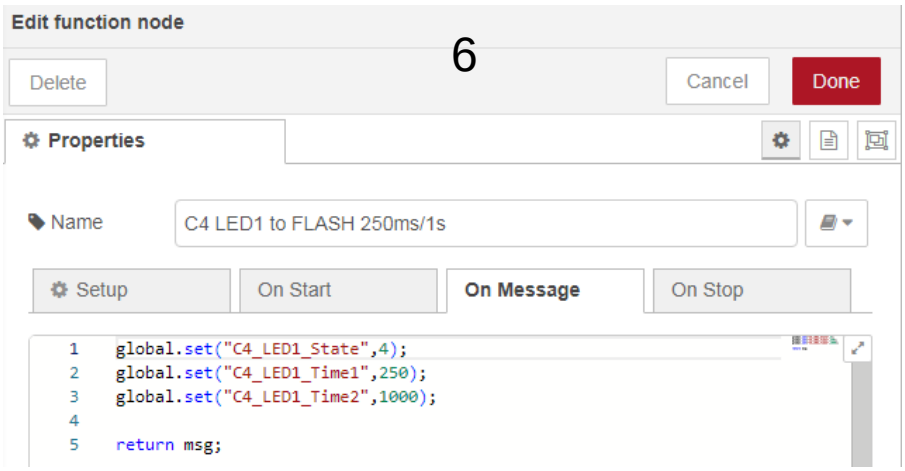
NodeRED® flow to update RESI-C4-8CO DIP switch+LEDs

Setting the global variable C4_LED1_State to 3 will update the LED via MODBUS write. The LED will flash cyclically with 1000ms ON and 1000ms OFF interval!

Setting the global variable C4_LED1_State to 3 will update the LED via MODBUS write. The LED will flash cyclically with 250ms ON and 250ms OFF interval!



Setting the global variable C4_LED1_State to 4 will update the LED via MODBUS write. The LED will flash cyclically with 1000ms ON and 2000ms OFF interval!



Setting the global variable C4_LED1_State to 4 will update the LED via MODBUS write. The LED will flash cyclically with 250ms ON and 1000ms OFF interval!

NodeRED® flow to update RESI-C4-8CO relay outputs

Read/Write the relay outputs from RESI-C4 controller

Now we create a new flow C4 ROs. Import this flow:


```
[{"id":"6336eed489e7bd67","type":"tab","label":"C4 ROs","disabled":false,"info":"","env":[]},{"id":"6e428ef4e1dddlbb","type":"function","z":"6336eed489e7bd67","name":"C4  Update
DOs","func":"var i;\nlet Word=0,Bit=0,V=0;\n\n// Register list for C4-A-8CO\n// 4x10001,I:10000: DIGITAL OUTPUTS DO1-DO8\n\n// n ROs\nfor (i = 0; i < global.get(\"C4_MAX_DOS\"); i++) {\n
   Word=~~(i/16);\n    Bit=~~(i%16);\n    V=(msg.payload[Word]&(1<<Bit)) ? 1:0;\n    global.set(\"C4_DO\"+String(i+1).padStart(2, '0')+\"_Actual\",V);\n}\n\nreturn
msg ;","outputs":0,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":380,"y":260,"wires":[]},
{"id":"1907030632661148","type":"inject","z":"6336eed489e7bd67","name":"OnStart","props":[{"p":"payload"},
{"p":"topic","vt":"str"}],"repeat":"","crontab":"","once":true,"onceDelay":"0","topic":"","payload":"","payloadType":"date","x":120,"y":120,"wires":[["42ef188d1109f161"]]},
{"id":"42ef188d1109f161","type":"function","z":"6336eed489e7bd67","name":"C4  Global settings for DOs","func":"var i;\n\n// n ROs ....\nfor (i=0;i<global.get(\"C4_MAX_DOS\");i++)\n{\n
global.set(\"C4_DO\"+String(i+1).padStart(2, '0'), 0);\n  global.set(\"C4_DO\"+String(i+1).padStart(2, '0')+\"_Actual\", 0);\n}\n\nreturn
msg;","outputs":0,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":360,"y":120,"wires":[]},{"id":"c331ed9f8117e5b8","type":"inject","z":"6336eed489e7bd67","name":"Every
100ms","props":[{"p":"payload"},{"p":"topic","vt":"str"}],"repeat":"0.1","crontab":"","once":false,"onceDelay":0.1,"topic":"","payload":"","payloadType":"date","x":140,"y":360,"wires":
[["b61af0713e7a9681"]]},{"id":"b61af0713e7a9681","type":"function","z":"6336eed489e7bd67","name":"C4 Check DOs","func":"// create message with all DOs\nvar msg1={ topic: \"C4_DOs\",
payload:[] };\nvar i\n\n// n ROs\nfor (i = 0; i < global.get(\"C4_MAX_DOS\"); i++) {\n    msg1.payload[i] = global.get(\"C4_DO\" + String(i+1).padStart(2, '0'));\n}\n\nreturn
msg1 ;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":320,"y":360,"wires":[["855f1bb5a67652ee"]]},
{"id":"855f1bb5a67652ee","type":"rbe","z":"6336eed489e7bd67","name":"C4 DOs
changed ?","func":"rbe","gap":"","start":"","inout":"out","septopics":true,"property":"payload","topi":"topic","x":530,"y":360,"wires":[["479948bf0e5659e3"]]},
{"id":"479948bf0e5659e3","type":"function","z":"6336eed489e7bd67","name":"C4 Set All DOs","func":"var i;\n\n// for C4-A-8CO controller ...\nif (global.get(\"C4_TYPE\")==\"RESI-C4-A-
8CO\")\n{\n    // Our controller offers 8 Relay outputs\n    // therefore we need 1 16 Bit registers\n    // 4x10001,I:10000: OUTPUTS DO1-DO8\n    let C4_DOS=[ 0 ];\n    let
Word=0,Bit=0;\n\n    // 8RO controller\n    C4_DOS[0]=0;\n\n    // Check for new value of C4_DOxx\n    for (i=0;i<global.get(\"C4_MAX_DOS\");i++)\n    {\n        Word=~~(i/16);\n
Bit=~~(i%16);\n        if (global.get(\"C4_DO\" +String(i+1).padStart(2, '0'))==1)\n        {\n            C4_DOS[Word]=C4_DOS[Word]|(1<<Bit);\n        }\n    }\n\n    msg.payload = { \n
        'value': [ C4_DOS[0] ],\n        // WRITE MULTIPLE HOLDING REGISTERS\n        'fc': 16, \n        // Our C4 MODBUS UnitID\n        'unitid': 1, \n        // 4x10001,I:10000:
OUTPUTS DO1-DO8\n        'address': 10000 , \n        // for the 8 DOs or 1 registers...\n        'quantity': 1 \n    } \n}\nelse\n{\n    msg.payload=null;\n}\nreturn
msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":740,"y":360,"wires":[["f14212543419c6045"]]},
{"id":"d76b1c9d05c049b1","type":"comment","z":"6336eed489e7bd67","name":"C4 Global settings for C4 ROs","info":"","x":160,"y":60,"wires":[]},
{"id":"7ff1d599efe73d08","type":"comment","z":"6336eed489e7bd67","name":"C4 cyclic update of all DOs","info":"","x":150,"y":200,"wires":[]},
{"id":"838de142106e4b7f","type":"comment","z":"6336eed489e7bd67","name":"C4 set all DOs if something has changed","info":"","x":200,"y":320,"wires":[]},
{"id":"fe14eec6136309ce","type":"modbus-read","z":"6336eed489e7bd67","name":"C4 Read DO
Staus","topic":"","showStatusActivities":false,"logIOActivities":false,"showErrors":false,"showWarnings":true,"unitid":"1","dataType":"HoldingRegister","adr":"10000","quantity":"1","rate
":"100","rateUnit":"ms","delayOnStart":false,"startDelayTime":"","server":"c678772f081bbacd","useIOFile":false,"ioFile":"","useIOForPayload":false,"emptyMsgOnFail":false,"x":150,"y":260,
"wires":[["6e428ef4e1dddlbb"],[]]},{"id":"f1421254319c6045","type":"modbus-flex-write","z":"6336eed489e7bd67","name":"C4 Update All
DOs","showStatusActivities":false,"showErrors":false,"showWarnings":true,"server":"c678772f081bbacd","emptyMsgOnFail":false,"keepMsgProperties":false,"delayOnStart":false,"startDelayTime
":"","x":950,"y":360,"wires":[[],[]]},{"id":"364f6966f054ef80","type":"function","z":"6336eed489e7bd67","name":"C4 RO1 to OFF","func":"global.set(\"C4_DO01\",0);\n\nreturn
msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":280,"y":480,"wires":[[]]},
{"id":"11230a2bae083336","type":"inject","z":"6336eed489e7bd67","name":"HIT","props":[{"p":"payload"},
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msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":280,"y":520,"wires":[[]]},{"id":"0144e0b0d64f3a1c","type":"comment","z":"6336eed489e7bd67","name":"Try
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msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":640,"y":480,"wires":[[]]},
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msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":640,"y":520,"wires":[[]]},{"id":"4693070dccea18eb","type":"comment","z":"6336eed489e7bd67","name":"Try
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{"id":"f5d3cf0c19319335","type":"function","z":"6336eed489e7bd67","name":"C4 RO3 to OFF","func":"global.set(\"C4_DO03\",0);\n\nreturn
msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":280,"y":620,"wires":[[]]},
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{"p":"topic","vt":"str"}],"repeat":"","crontab":"","once":false,"onceDelay":0.1,"topic":"","payload":"","payloadType":"date","x":110,"y":660,"wires":[["4a23ccdc04c84255"]]},
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msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":280,"y":660,"wires":[[]]},{"id":"30e9ff4195092e62","type":"comment","z":"6336eed489e7bd67","name":"Try
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{"id":"e003824e7ec49006","type":"function","z":"6336eed489e7bd67","name":"C4 RO4 to OFF","func":"global.set(\"C4_DO04\",0);\n\nreturn
msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":640,"y":620,"wires":[[]]},
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{"id":"e0873e264eaff04e","type":"function","z":"6336eed489e7bd67","name":"C4 RO5 to OFF","func":"global.set(\"C4_DO05\",0);\n\nreturn
msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":280,"y":760,"wires":[[]]},
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{"p":"topic","vt":"str"}],"repeat":"","crontab":"","once":false,"onceDelay":0.1,"topic":"","payload":"","payloadType":"date","x":110,"y":800,"wires":[["b0097d4da8395da5"]]},
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msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":280,"y":800,"wires":[[]]},{"id":"edddb6b4dfb9a8f3","type":"comment","z":"6336eed489e7bd67","name":"Try
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{"p":"topic","vt":"str"}],"repeat":"","crontab":"","once":false,"onceDelay":0.1,"topic":"","payload":"","payloadType":"date","x":110,"y":760,"wires":[["e0873e264eaff04e"]]},
{"id":"e1c695460b65bfa5","type":"function","z":"6336eed489e7bd67","name":"C4 RO6 to OFF","func":"global.set(\"C4_DO06\",0);\n\nreturn
msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":640,"y":760,"wires":[[]]},
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{"p":"topic","vt":"str"}],"repeat":"","crontab":"","once":false,"onceDelay":0.1,"topic":"","payload":"","payloadType":"date","x":470,"y":800,"wires":[["7c32317ac71906c1"]]},
{"id":"7c32317ac71906c1","type":"function","z":"6336eed489e7bd67","name":"C4 RO6 to ON","func":"global.set(\"C4_DO06\",1);\n\nreturn
msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":640,"y":800,"wires":[[]]},{"id":"2920e238c7258ce4","type":"comment","z":"6336eed489e7bd67","name":"Try
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msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":280,"y":900,"wires":[[]]},
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{"id":"33bb0be9ce72554e","type":"function","z":"6336eed489e7bd67","name":"C4 RO8 to OFF","func":"global.set(\"C4_DO08\",0);\n\nreturn
msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":640,"y":900,"wires":[[]]},
{"id":"a7cce3bc8c2a9d7b","type":"inject","z":"6336eed489e7bd67","name":"HIT","props":[{"p":"payload"},
{"p":"topic","vt":"str"}],"repeat":"","crontab":"","once":false,"onceDelay":0.1,"topic":"","payload":"","payloadType":"date","x":470,"y":940,"wires":[["deld11d70149a2cd"]]},
{"id":"deld11d70149a2cd","type":"function","z":"6336eed489e7bd67","name":"C4 RO8 to ON","func":"global.set(\"C4_DO08\",1);\n\nreturn
msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":640,"y":940,"wires":[[]]},{"id":"adc3f01a2dc37ccf","type":"comment","z":"6336eed489e7bd67","name":"Try
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{"p":"topic","vt":"str"}],"repeat":"","crontab":"","once":false,"onceDelay":0.1,"topic":"","payload":"","payloadType":"date","x":470,"y":900,"wires":[["33bb0be9ce72554e"]]},
{"id":"c678772f081bbacd","type":"modbus-
client","name":"","clienttype":"serial","bufferCommands":true,"stateLogEnabled":false,"queueLogEnabled":true,"failureLogEnabled":true,"tcpHost":"127.0.0.1","tcpPort":"502","tcpType":"DEF
AULT","serialPort":"/dev/ttyACM1","serialType":"RTU-
BUFFERD","serialBaudrate":"9600","serialDatabits":"8","serialStopbits":"1","serialParity":"none","serialConnectionDelay":"1","serialAsciiResponseStartDelimiter":"0x3A","unit_id":"2","com
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```
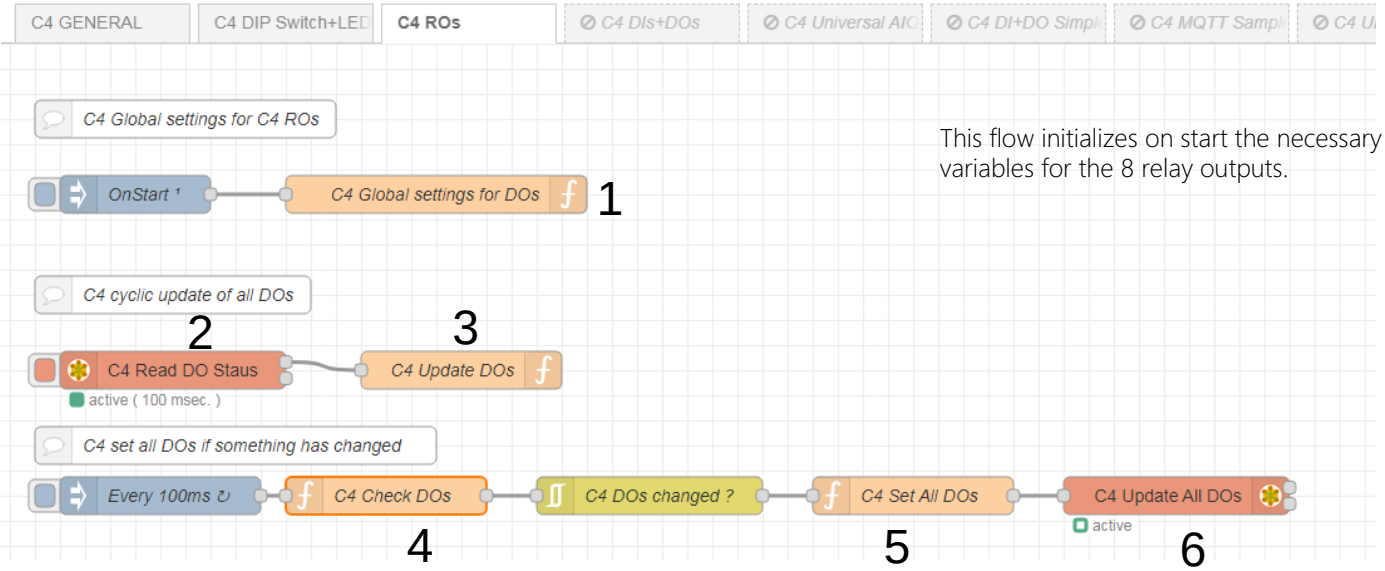

NodeRED® flow to update RESI-C4-8CO relay outputs

Set C4 relay outputs with Node-RED

The next flow will cyclically update the relay outputs to the new status. Therefore we explain every node.

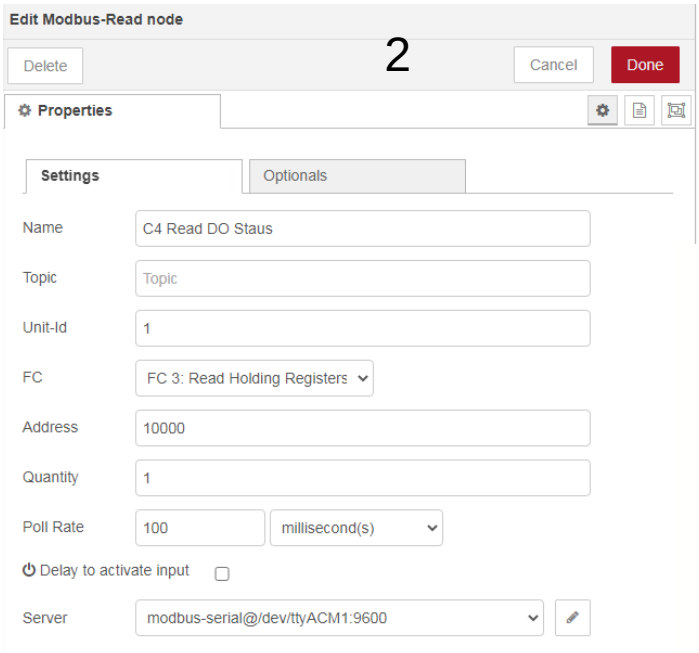


This flow initializes on start the necessary global variables for the 8 relay outputs.

```
1   var i;
2
3   // n ROs ....
4   for (i=0;i<global.get("C4_MAX_DOS");i++)
5   {
6     global.set("C4_DO"+String(i+1).padStart(2, '0'), 0);
7     global.set("C4_DO"+String(i+1).padStart(2, '0')+"_Actual", 0);
8   }
9
10  return msg;
```

1

Create the global variables C4_DO01 to C4_DO08 representing the new status for the digital outputs. And also creating C4_DO01_Actual to C4_DO08_Actual representing the current state of the digital outputs



2

This flow will read every 100ms the actual status of the 8 digital outputs and store this status in the global variables C4_DOxx_Actual. The result of the MODBUS read of one holding register is a message with one 16-bit value as payload. We then extract every bit out of this word to save the current status for the 8 relay outputs.

```
1   var i;
2   let Word=0,Bit=0,V=0;
3
4   // Register list for C4-A-8CO
5   // 4x10001,I:10000: DIGITAL OUTPUTS DO1-DO8
6
7   // n ROs
8   for (i = 0; i < global.get("C4_MAX_DOS"); i++) {
9       Word=~~(i/16);
10      Bit=~~(i%16);
11      V=(msg.payload[Word]&(1<<Bit)) ? 1:0;
12      global.set("C4_DO"+String(i+1).padStart(2, '0')+"_Actual",V);
13  }
14
15  return msg ;
```

3

NodeRED® flow to update RESI-C4-8CO relay outputs

```
// create message with all DOs
var msg1={ topic: "C4_DOs", payload:[] };
var i

// n ROs
for (i = 0; i < global.get("C4_MAX_DOS"); i++) {
    msg1.payload[i] = global.get("C4_DO" + String(i+1).padStart(2, '0'));
}

return msg1 ;
```

4

Again we prepare an new message containing the current status of all 8 digital outputs from the global variables C4_DOxx as payload.
The next node C4 DOs changed? will wait as long as there is no change in the digital outputs.
As soon as we change one of the global variables this node will trigger the MODBUS write to the holding register.

```
var i;

// for C4-A-8CO controller ...
if (global.get("C4_TYPE")=="RESI-C4-A-8CO")
{
    // Our controller offers 8 Relay outputs
    // therefore we need 1 16 Bit registers
    // 4x10001,I:10000: OUTPUTS DO1-DO8
    let C4_DOS=[ 0 ];
    let Word=0,Bit=0;

    // 8RO controller
    C4_DOS[0]=0;

    // Check for new value of C4_DOxx
    for (i=0;i<global.get("C4_MAX_DOS");i++)
    {
        Word=~~(i/16);
        Bit=~~(i%16);
        if (global.get("C4_DO" +String(i+1).padStart(2, '0'))==1)
        {
            C4_DOS[Word]=C4_DOS[Word]|(1<<Bit);
        }
    }

    msg.payload = {
        'value': [ C4_DOS[0] ],
        // WRITE MULTIPLE HOLDING REGISTERS
        'fc': 16,
        // Our C4 MODBUS UnitID
        'unitid': 1,
        // 4x10001,I:10000: OUTPUTS DO1-DO8
        'address': 10000 ,
        // for the 8 DOs or 1 registers...
        'quantity': 1
    }
}
else
{
    msg.payload=null;
}
return msg;
```

5

In the function node C4 Set all DOs we prepare the message for a MODBUS flex write to a holding register.

First we check, if the correct controller is defined.
Then we build out of the 8 global variables C4_DOxx a variable, where every bit stands for one digital output.

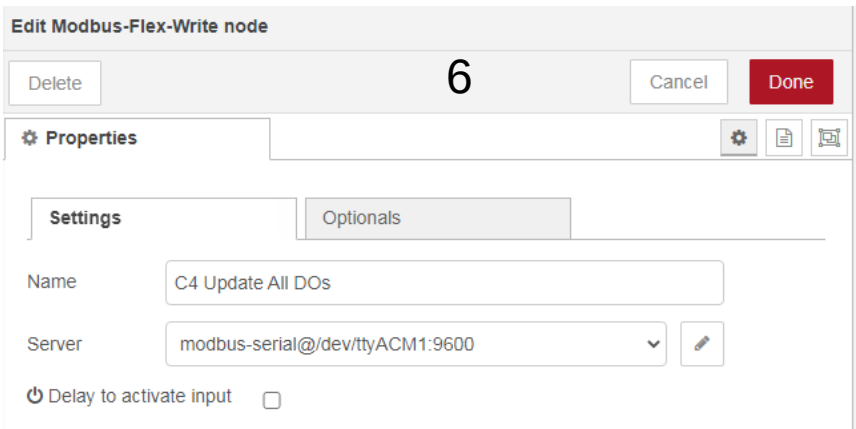
Then we want to prepare a message for the MODBUS/RTU flex-write node. Therefore our message must have the correct format.

'fc': 16 stands for the MODBUS function code 16 which means write holding registers.

'unitid': 1 stands for the MODBUS unit ID. For our controllers always 1.

'address': 10000 stands for the first MODBUS holding register index (Starting with base=0), where we want to write the new output state.

'quantity': 1 defines, that we want to write only one holding register.

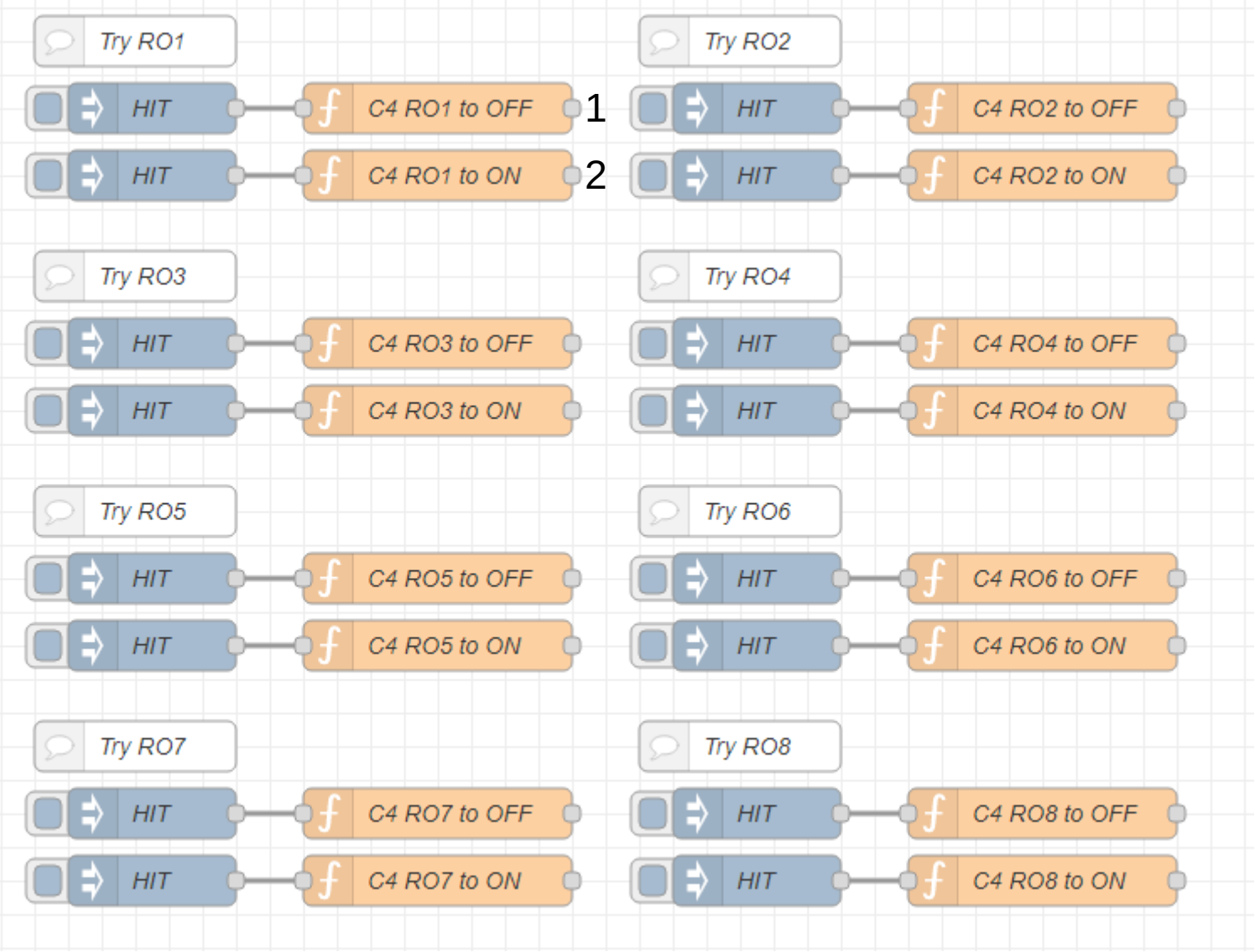


6

NodeRED® flow to test RESI-C4-8CO relay outputs

Testing the relay outputs with Node-RED

The next flows will switch a certain relay output to ON or OFF respectively. We use the event object titled HIT to indicate, that whenever you press this node with the mouse you will trigger the corresponding action to test easily every relay output interactively. But the deeper sense is that you learn, how writing to global variables will trigger MODBUS write actions in other flows.




```
1  global.set("C4_DO01",0);
2
3  return msg;
```

1

```
1  global.set("C4_DO01",1);
2
3  return msg;
```

2

Setting the global variable C4_DOxx to 0 will switch the relay output to OFF, writing 1 to this variable will set the relay output to ON!

NodeRED® flow to read/write relay outputs to MQTT

Read/Write the relay outputs from RESI-C4 controller to MQTT

Now we create a new flow C4 MQTT. Import this flow:

```
[{"id":"b445cbb5f08a2222","type":"tab","label":"C4 MQTT","disabled":false,"info":"","env":[]},
{"id":"a580513f97b702c6","type":"change","z":"b445cbb5f08a2222","name":"C4 Get DO01","rules":
[{"t":"set","p":"payload","pt":"msg","to":"C4_DO01","tot":"global"}],"action":"","property":"","from":"","to":"","reg":false,"x":320,"y":80,"wires":
[["37852fe763aeb3eb"]]},{"id":"829cc13c9b3f65c0","type":"inject","z":"b445cbb5f08a2222","name":"Every 10ms","props":[{"p":"payload"},
{"p":"topic","vt":"str"}],"repeat":"0.01","crontab":"","once":false,"onceDelay":0.1,"topic":"","payload":"","payloadType":"date","x":130,"y":80,"wires":
[["a580513f97b702c6"]]},{"id":"8e48b7566a7ae908","type":"function","z":"b445cbb5f08a2222","name":"C4 Create MQTT DO01 data","func":"var msg1={ \n
topic:\"RESI_C4/DigitalOutputs/C4_DO01\", \n    payload: msg.payload  \n}\n\nreturn
msg1;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":740,"y":80,"wires":[["26286143d8f50be9"]]},
{"id":"37852fe763aeb3eb","type":"rbe","z":"b445cbb5f08a2222","name":"Wait for
Change","func":"rbe","gap":"","start":"","inout":"out","septopics":true,"property":"payload","topi":"topic","x":500,"y":80,"wires":[["8e48b7566a7ae908"]]},
{"id":"9b938ca18f7a3c07","type":"comment","z":"b445cbb5f08a2222","name":"Send DO1 on change to MQTT","info":"","x":170,"y":40,"wires":[]},
{"id":"26286143d8f50be9","type":"mqtt
out","z":"b445cbb5f08a2222","name":"RESI_MQTT","topic":"","qos":"0","retain":"true","respTopic":"","contentType":"","userProps":"","correl":"","expiry":"","
broker":"9d7784867c5e3d27","x":950,"y":80,"wires":[]},{"id":"dd77df4960ebd3b9","type":"mqtt in","z":"b445cbb5f08a2222","name":"C4 Wait for MQTT
DO02","topic":"RESI_C4/DigitalOutputs/C4_DO02","qos":"2","datatype":"auto-
detect","broker":"9d7784867c5e3d27","nl":false,"rap":true,"rh":0,"inputs":0,"x":150,"y":240,"wires":[["0a47ea6ef2f263a3"]]},
{"id":"0a47ea6ef2f263a3","type":"function","z":"b445cbb5f08a2222","name":"C4 Set DO02","func":"if (msg.payload == 0 || msg.payload == 1) {\n
global.set(\"C4_DO02\", msg.payload);\n}\n\nreturn msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":350,"y":240,"wires":
[[]]},{"id":"8da497303a63d932","type":"mqtt in","z":"b445cbb5f08a2222","name":"C4 Wait for all MQTT
DOx","topic":"RESI_C4/DigitalOutputs/#","qos":"2","datatype":"auto-
detect","broker":"9d7784867c5e3d27","nl":false,"rap":true,"rh":0,"inputs":0,"x":150,"y":380,"wires":[["e38c5fafd08b05bf"]]},
{"id":"e38c5fafd08b05bf","type":"function","z":"b445cbb5f08a2222","name":"C4 get MQTT DOx","func":"if (msg.topic.startsWith(\"RESI_C4/DigitalOutputs/\"))\
n{\n    // retrieve the last word in the topic...\n    let DOx=msg.topic.split(\"/\").pop();\n    msg.topic=DOx;\n}\nreturn
msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":410,"y":380,"wires":[["19f5f6c9390cc2f4"]]},
{"id":"19f5f6c9390cc2f4","type":"function","z":"b445cbb5f08a2222","name":"C4 Set DOx","func":"let ok=false;\n\nif (msg.topic.startsWith=\"C4_DO\")\n{\n  let
DOnr=msg.topic.substring(5,100);\n  if (Number.isInteger(parseInt(DOnr)))\n  {\n    let DOx=parseInt(DOnr,10);\n    if (DOx>=1 &&
DOx<global.get(\"C4_MAX_DOS\"))\n    {\n        ok=true;\n    }\n    if ((msg.payload == 0 || msg.payload == 1) && ok) \n    {\n      var
DOxNAME=\"C4_DO\"+String(DOx).padStart(2, '0');\n        global.set(DOxNAME, msg.payload);\n    }\n  }\n}\nreturn
msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":610,"y":380,"wires":[[]]},
{"id":"6d315be4070494d3","type":"inject","z":"b445cbb5f08a2222","name":"Every 10ms","props":[{"p":"payload"},
{"p":"topic","vt":"str"}],"repeat":"0.01","crontab":"","once":false,"onceDelay":0.1,"topic":"","payload":"","payloadType":"date","x":130,"y":500,"wires":
[["781b7bbc8e88990a"]]},{"id":"5516f4ecaba82a26","type":"function","z":"b445cbb5f08a2222","name":"C4 Create MQTT DOx data","func":"var msg1={ \n
topic:\"RESI_C4/DigitalOutputs/C4_DO01\", \n    payload: msg.payload[0]  \n}\n\nvar msg2={ \n    topic:\"RESI_C4/DigitalOutputs/C4_DO02\", \n    payload:
msg.payload[1]  \n}\n\nvar msg3={ \n    topic:\"RESI_C4/DigitalOutputs/C4_DO03\", \n    payload: msg.payload[2]  \n}\n\nvar msg4={ \n
topic:\"RESI_C4/DigitalOutputs/C4_DO04\", \n    payload: msg.payload[3]  \n}\n\nvar msg5={ \n    topic:\"RESI_C4/DigitalOutputs/C4_DO05\", \n    payload:
msg.payload[4]  \n}\n\nvar msg6={ \n    topic:\"RESI_C4/DigitalOutputs/C4_DO06\", \n    payload: msg.payload[5]  \n}\n\nvar msg7={ \n
topic:\"RESI_C4/DigitalOutputs/C4_DO07\", \n    payload: msg.payload[6]  \n}\n\nvar msg8={ \n    topic:\"RESI_C4/DigitalOutputs/C4_DO08\", \n    payload:
msg.payload[7]  \n}\n\n\nreturn [ msg1, msg2, msg3, msg4, msg5, msg6, msg7, msg8 ];","outputs":8,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":
[],"x":820,"y":540,"wires":[["b07102cf31d3807f"],["b07102cf31d3807f"],["b07102cf31d3807f"],["b07102cf31d3807f"],["b07102cf31d3807f"],["b07102cf31d3807f"],
["b07102cf31d3807f"],["b07102cf31d3807f"]]},{"id":"e73f19dad43f20bb","type":"rbe","z":"b445cbb5f08a2222","name":"C4 DOs
changed ?","func":"rbe","gap":"","start":"","inout":"out","septopics":true,"property":"payload","topi":"topic","x":510,"y":500,"wires":
[["5516f4ecaba82a26"]]},{"id":"d3d06edd31deeba0","type":"comment","z":"b445cbb5f08a2222","name":"Send all DOx on change to
MQTT","info":"","x":180,"y":460,"wires":[]},{"id":"b07102cf31d3807f","type":"mqtt
out","z":"b445cbb5f08a2222","name":"RESI_MQTT","topic":"","qos":"0","retain":"true","respTopic":"","contentType":"","userProps":"","correl":"","expiry":"","
broker":"9d7784867c5e3d27","x":1130,"y":540,"wires":[]},{"id":"781b7bbc8e88990a","type":"function","z":"b445cbb5f08a2222","name":"C4 Check DOs","func":"//
create message with all DOs\nvar msg1={ topic: \"C4_DOs\", payload:[] };\nvar i\n\n// n DOs\nfor (i = 0; i < global.get(\"C4_MAX_DOS\"); i++) {\n
msg1.payload[i] = global.get(\"C4_DO\" + String(i+1).padStart(2, '0'));\n}\n\nreturn
msg1 ;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":300,"y":500,"wires":[["e73f19dad43f20bb"]]},
{"id":"7d077fdf70eadd07","type":"comment","z":"b445cbb5f08a2222","name":"Receive from MQTT new status for DO2","info":"","x":190,"y":180,"wires":[]},
{"id":"49b5cb5c7728702b","type":"comment","z":"b445cbb5f08a2222","name":"Receive from MQTT new status for all DOx","info":"","x":200,"y":320,"wires":[]},
{"id":"9d7784867c5e3d27","type":"mqtt-
broker","name":"","broker":"127.0.0.1","port":"1883","clientid":"","autoConnect":true,"usetls":false,"protocolVersion":"4","keepalive":"60","cleansession":t
rue,"autoUnsubscribe":true,"birthTopic":"","birthQos":"0","birthRetain":"false","birthPayload":"","birthMsg":
{},"closeTopic":"","closeQos":"0","closeRetain":"false","closePayload":"","closeMsg":
{},"willTopic":"","willQos":"0","willRetain":"false","willPayload":"","willMsg":{},"userProps":"","sessionExpiry":""}]
```

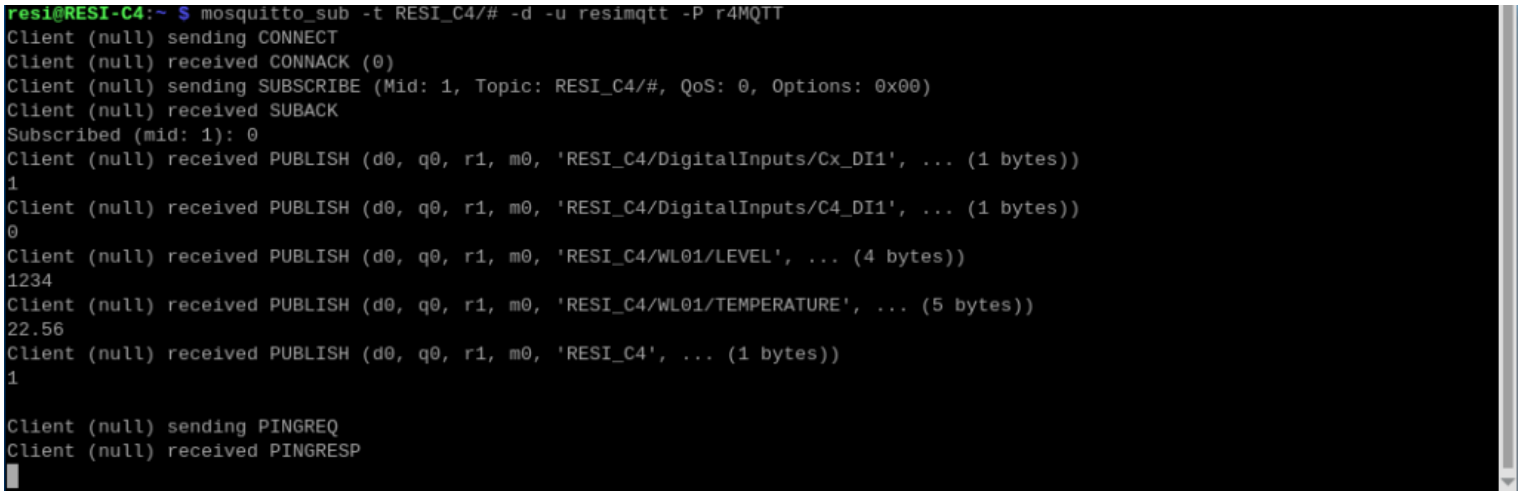
NodeRED® flow to read/write relay outputs to MQTT

HOWTO send actual status to MQTT broker

First of all we setup a MQTT server. We use MOSQUITTO. There are many installation guides, howto setup mosquitto on LINUX.
After successful installation you can check the mosquitto server with. We use resimqtt as user and r4MQTT as password. Please use better and safer credentials in your installation!

mosquitto_sub -t RESI_C4/# -d -u resimqtt -P r4MQTT

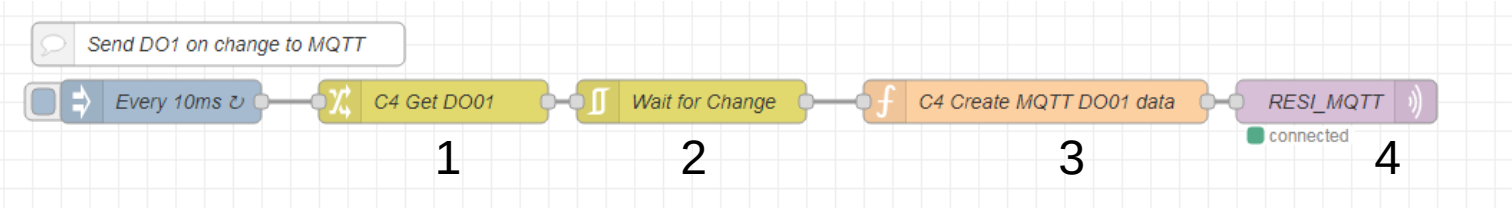
This command will show all entries in the MQTT server starting with RESI_C4, which is our root.

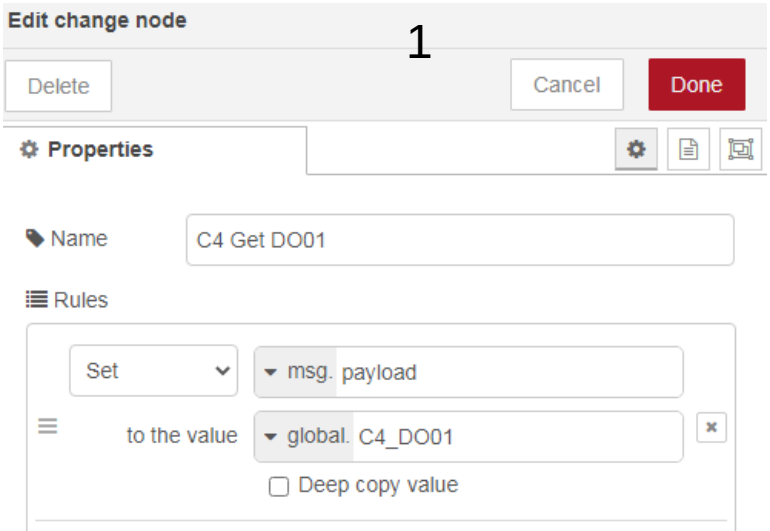


NodeRED® flow to read/write relay outputs to MQTT

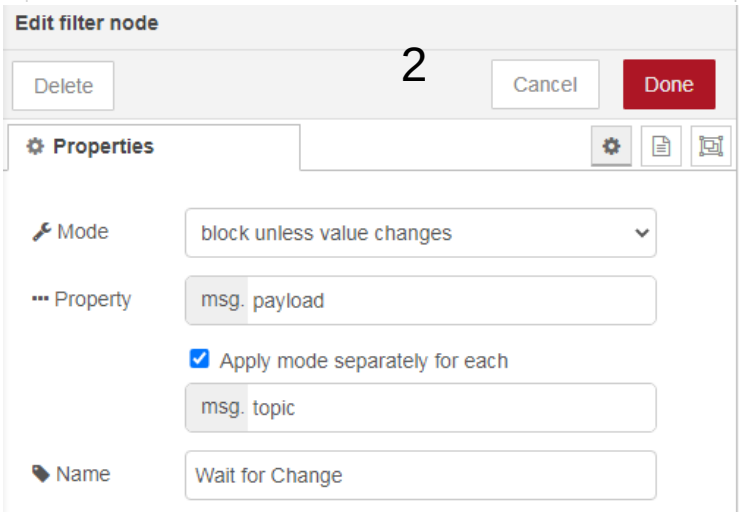
Set C4 relay outputs with Node-RED

The next flow will cyclically check the status of relay output DO1. If there is a change, a message is sent to MQTT server.





This node generates a message with the global variable C4_DO01.

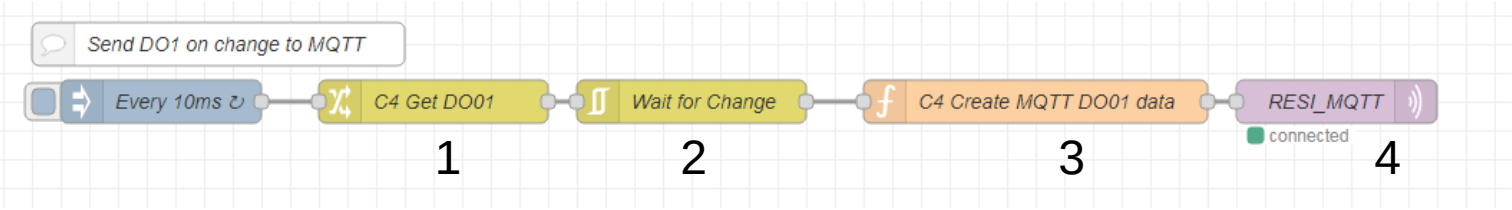


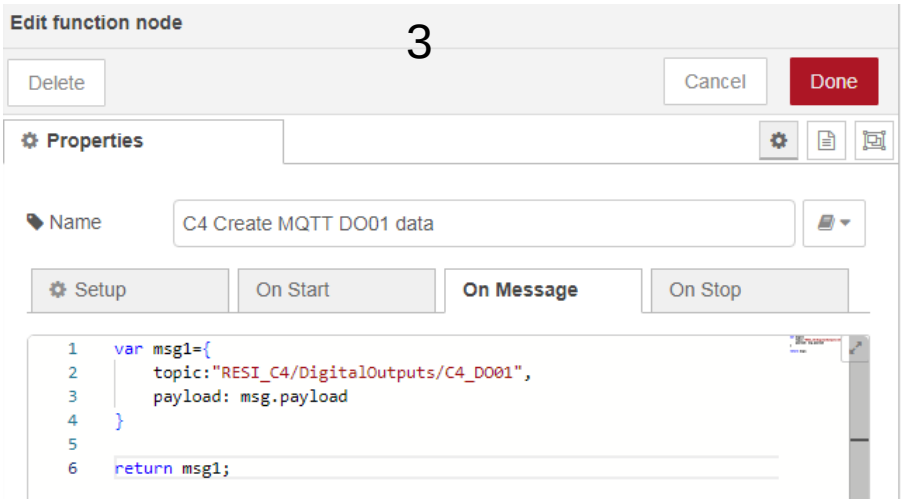
This node blocks the event to the next node as long as the content of the message has not changed.

NodeRED® flow to read/write relay outputs to MQTT

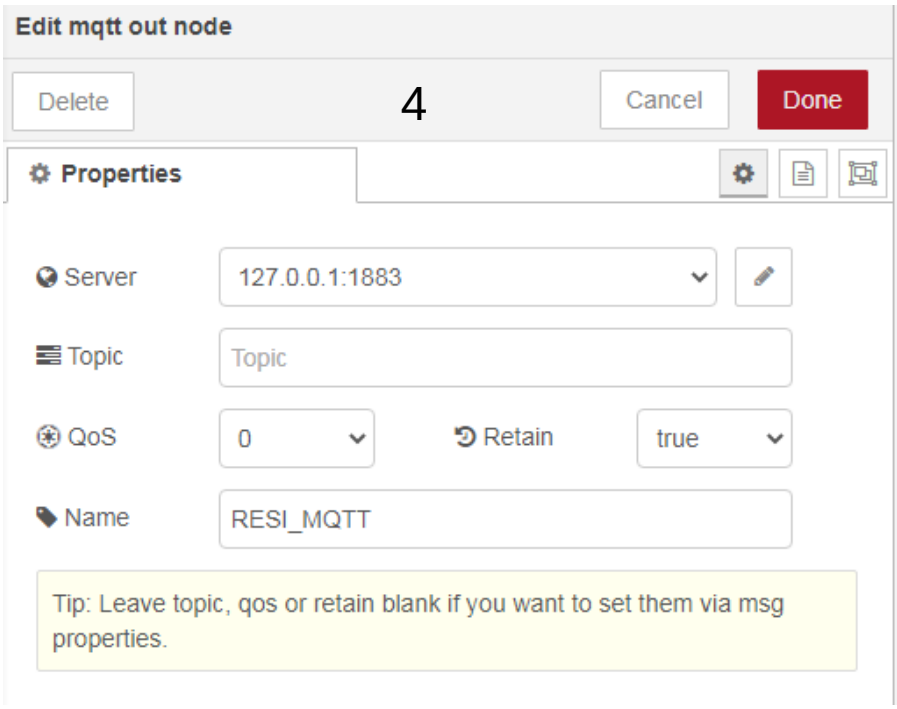
Set C4 relay outputs with Node-RED

The next flow will cyclically check the status of relay output DO1. If there is a change, a message is sent to MQTT server.





This node prepares the message to send to the MQTT server.

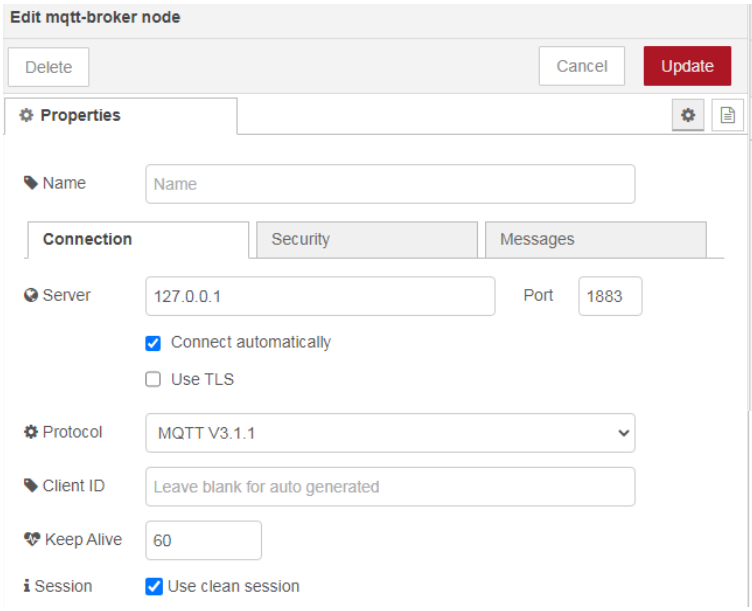


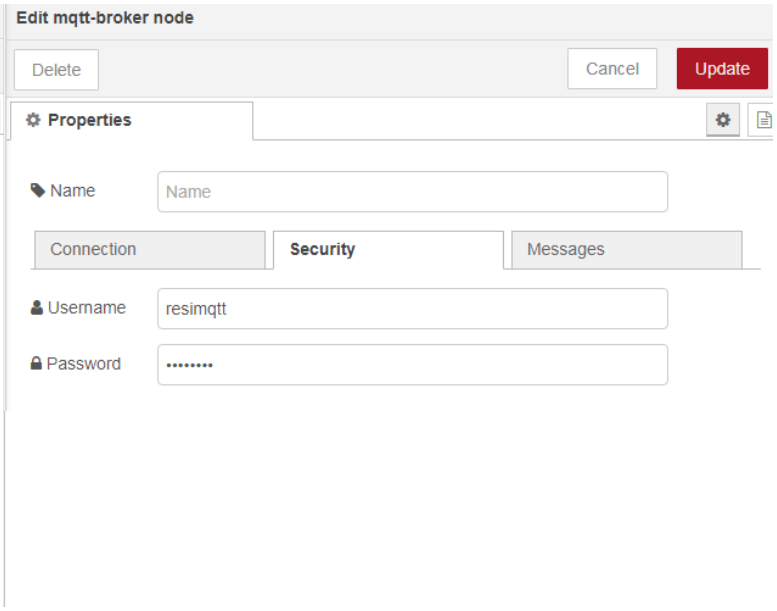
This node will send the received message with the topic to the MQTT Server.

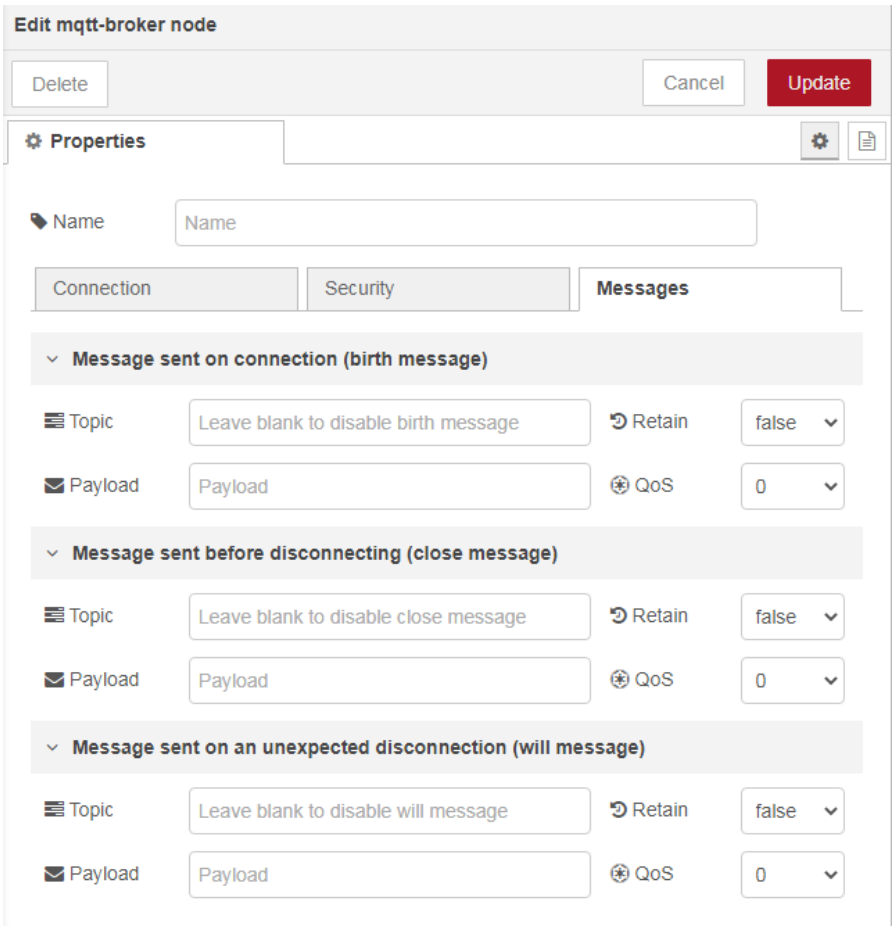
NodeRED® flow to read/write relay outputs to MQTT

Set C4 relay outputs with Node-RED

In the section of the configuration nodes you will find the MQTT broker node, which establishes the connection to your MQTT server and where you have to define your credentials. Also you can define messages in case of connection/disconnection.



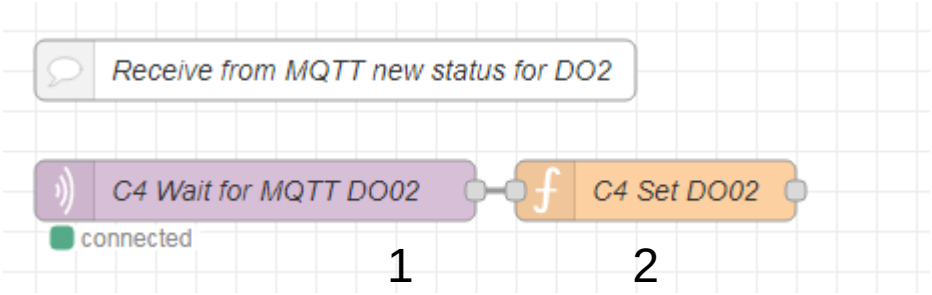


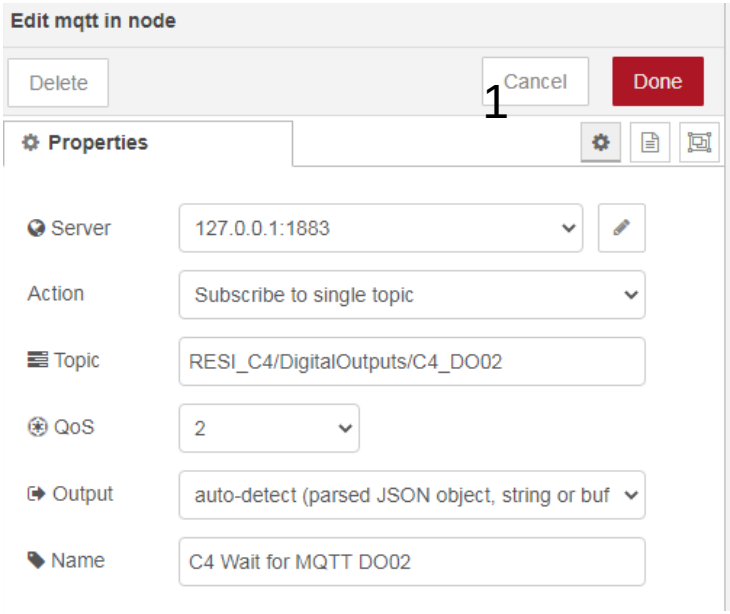


NodeRED® flow to read/write relay outputs to MQTT

Receive one specific message from MQTT to switch DO2

The next flow will wait for a specific message from MQTT broker to switch relay output DO2





This node triggers an event, whenever the MQTT broker will send the message RESI_C4/DigitalOutputs/C4_DO02

The contents of the message is 0 for OFF and 1 for ON.

This node receives the message and checks if the payload is 0 or 1.

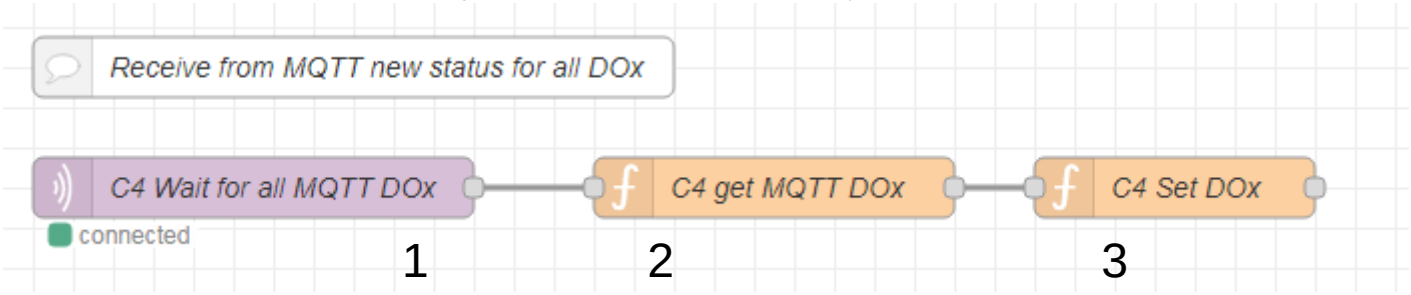
Then we set the global variable C4_DO02 to the new value.

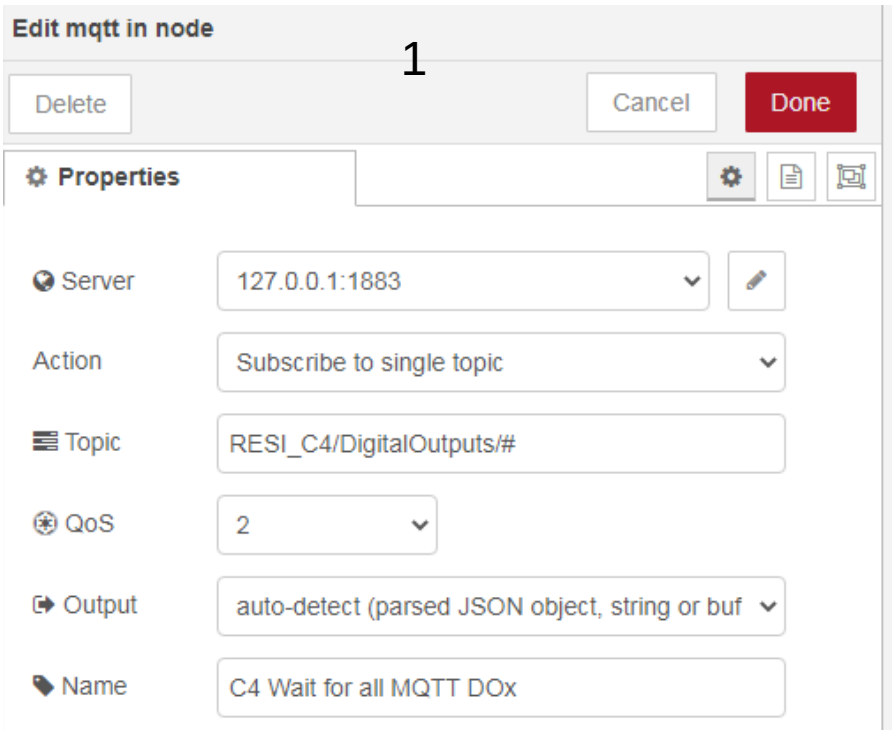
The flow C4 ROs will check the change in the set point and will write via MODBUS to the correct register to switch the digital output according to the new state.

NodeRED® flow to read/write relay outputs to MQTT

Receive more than one message from MQTT to switch all DOx

The next flow will wait for a specific message from MQTT broker to switch relay output DO2





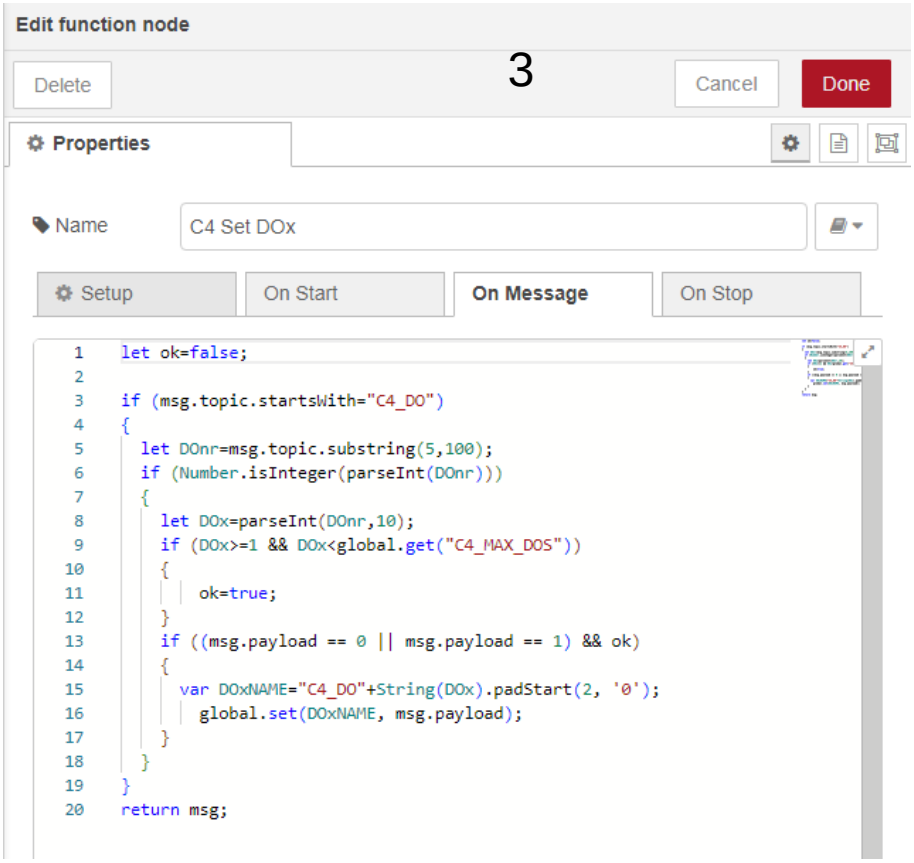
This node triggers an event, whenever the MQTT broker will send a message starting with RESI_C4/DigitalOutputs/

The # stands for everything

In this function node we check if the topic really starts with RESI_C4/DigitalOutputs/.

Only in this case we change the topic of the message to the digital output C4_DOxx

NodeRED® flow to read/write relay outputs to MQTT



This node checks if the topic has the name C4_DO01 to C4_DO08.

Only in this case the global variable C4_DOxx is updated with the new output state.

Again the flow on C4 ROs will then check the change and update the digital outputs via MODBUS.

NodeRED® flow to read/write relay outputs to MQTT

To test the MQTT broker use the command to view all incoming messages of your MQTT server:

```
mosquitto_sub -t RESI_C4/# -d -u resimqtt -P r4MQTT
```

To switch the digital output DO2 ON, use this command

```
mosquitto_pub -t RESI_C4/DigitalOutputs/Cx_DO2 -u resimqtt -P r4MQTT -m 1
```

To switch the digital output DO2 OFF, use this command

```
mosquitto_pub -t RESI_C4/DigitalOutputs/Cx_DO2 -u resimqtt -P r4MQTT -m 0
```

To switch the digital outputs DO1 to DO8 ON or OFF, use this command

```
mosquitto_pub -t RESI_C4/DigitalOutputs/Cx_DO1 -u resimqtt -P r4MQTT -m 1
mosquitto_pub -t RESI_C4/DigitalOutputs/Cx_DO1 -u resimqtt -P r4MQTT -m 0
...
mosquitto_pub -t RESI_C4/DigitalOutputs/Cx_DO8 -u resimqtt -P r4MQTT -m 1
mosquitto_pub -t RESI_C4/DigitalOutputs/Cx_DO8 -u resimqtt -P r4MQTT -m 0
```

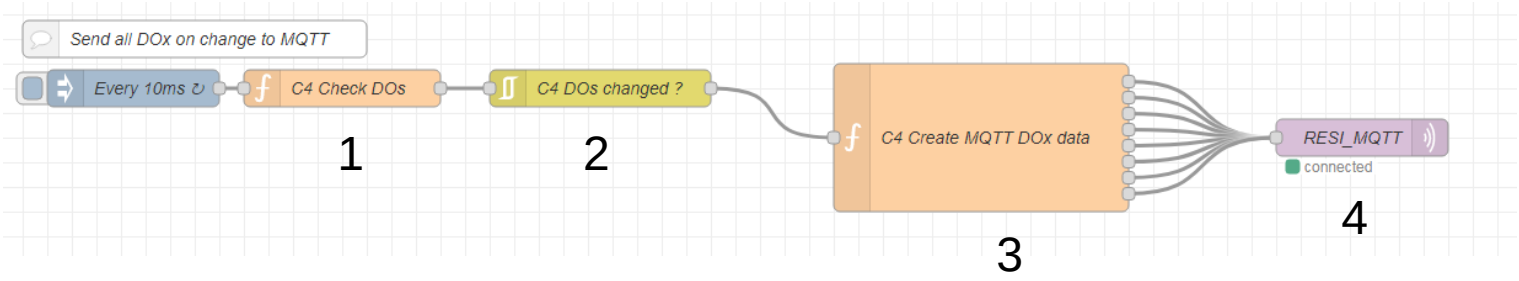
As soon as NodeRED sends a new MQTT status you will receive similar logging output:

```
0
Client (null) received PUBLISH (d0, q0, r0, m0, 'RESI_C4/DigitalOutputs/C4_DO04', ... (1 bytes))
0
Client (null) received PUBLISH (d0, q0, r0, m0, 'RESI_C4/DigitalOutputs/C4_DO05', ... (1 bytes))
1
Client (null) received PUBLISH (d0, q0, r0, m0, 'RESI_C4/DigitalOutputs/C4_DO06', ... (1 bytes))
0
Client (null) received PUBLISH (d0, q0, r0, m0, 'RESI_C4/DigitalOutputs/C4_DO07', ... (1 bytes))
0
Client (null) received PUBLISH (d0, q0, r0, m0, 'RESI_C4/DigitalOutputs/C4_DO08', ... (1 bytes))
0
Client (null) received PUBLISH (d0, q0, r0, m0, 'RESI_C4/DigitalOutputs/C4_DO01', ... (1 bytes))
1
Client (null) received PUBLISH (d0, q0, r0, m0, 'RESI_C4/DigitalOutputs/C4_DO02', ... (1 bytes))
0
Client (null) received PUBLISH (d0, q0, r0, m0, 'RESI_C4/DigitalOutputs/C4_DO03', ... (1 bytes))
0
Client (null) received PUBLISH (d0, q0, r0, m0, 'RESI_C4/DigitalOutputs/C4_DO04', ... (1 bytes))
0
Client (null) received PUBLISH (d0, q0, r0, m0, 'RESI_C4/DigitalOutputs/C4_DO05', ... (1 bytes))
1
Client (null) received PUBLISH (d0, q0, r0, m0, 'RESI_C4/DigitalOutputs/C4_DO06', ... (1 bytes))
0
Client (null) received PUBLISH (d0, q0, r0, m0, 'RESI_C4/DigitalOutputs/C4_DO07', ... (1 bytes))
0
Client (null) received PUBLISH (d0, q0, r0, m0, 'RESI_C4/DigitalOutputs/C4_DO08', ... (1 bytes))
1
```

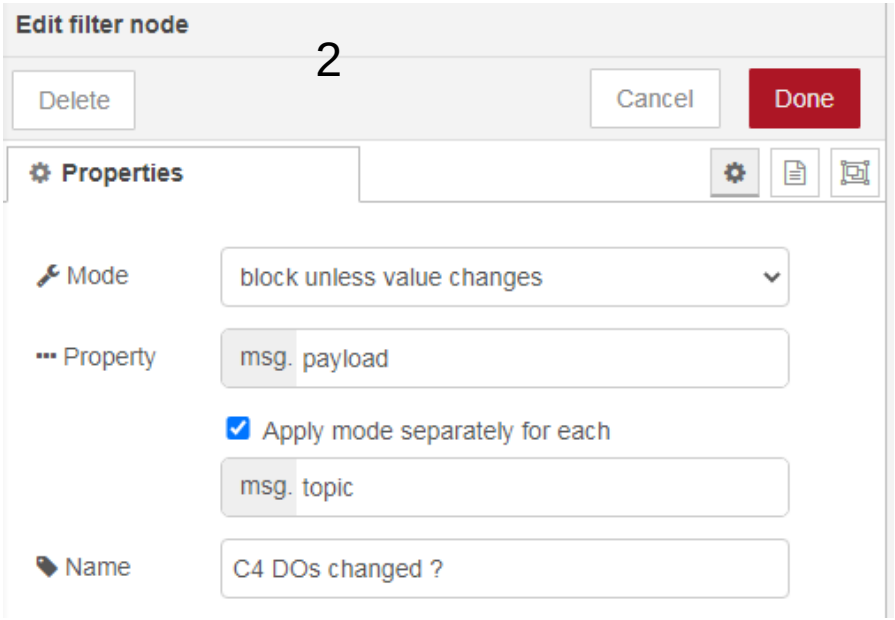
NodeRED® flow to read/write relay outputs to MQTT

If digital output changes send new state of all DOs to MQTT broker

The next flow will check cyclically, if the digital outputs have changed. If yes, a message for every digital output is send to the MQTT broker.

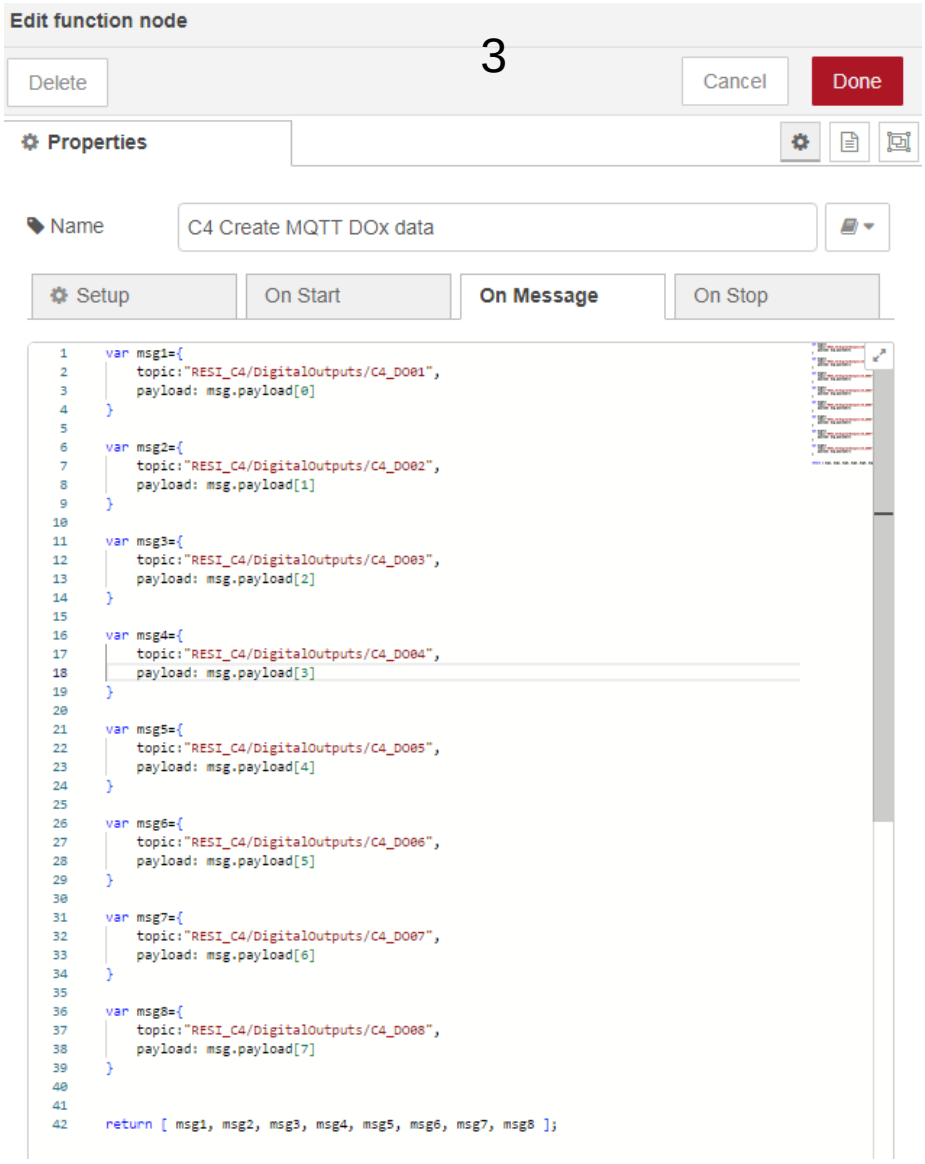


This node forms a message with an array of 8 elements. Each element in payload represents the actual state of a specific digital output.



This node waits until the message changes. This means unit one of the digital outputs has a new state

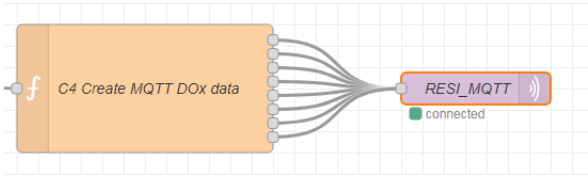
NodeRED® flow to read/write relay outputs to MQTT



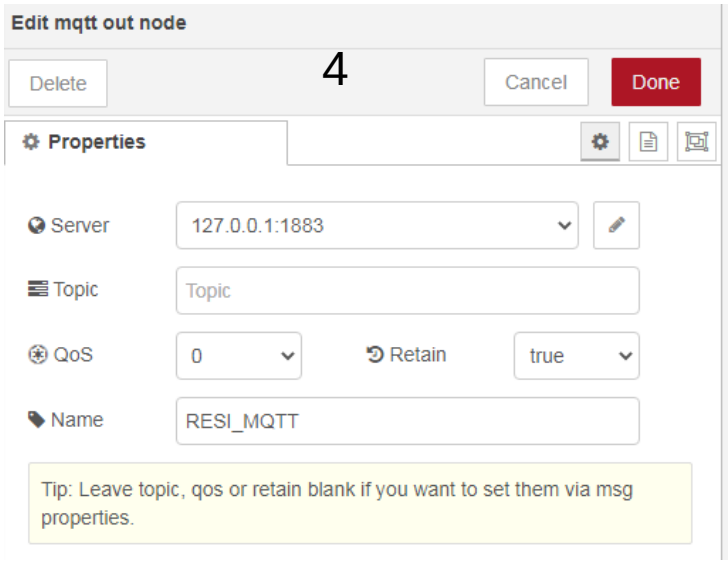
This node prepares 8 messages for the 8 digital outputs.

Every message topic is the MQTT reference for the output and the payload represents the actual state of the digital oputput: 0 for OFF and 1 for ON.

At the end of the function we return an array of eight messages for the eight output knots.



We connect all eight output knots to the same MQTT out node. This will trigger the send of eight individual MQTT messages.



NodeRED® flow to build USER INTERFACE for DIP switch and LEDs

Read/Write the relay outputs from RESI-C4 controller to MQTT

Now we create a new flow C4 MQTT. Import this flow:


```
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{"p":"topic","vt":"str"}],"repeat":"0.01","crontab":"","once":false,"onceDelay":0.1,"topic":"","payload":"","payloadType":"date","x":130,"y":40,"wires":
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{"label":"FLASH","value":4,"type":"num"},
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{"label":"FLASH","value":4,"type":"num"},
{"label":"PULSE","value":5,"type":"num"}],"payload":"","topic":"topic","topicType":"msg","className":"","x":670,"y":240,"wires":[["01114f6e6fa4be51"]]},
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lue}}","min":0,"max":"255","step":1,"className":"","x":850,"y":40,"wires":[[]]},
{"id":"961c9a07323de1db","type":"ui_group","name":"LEDs","tab":"ce994ee19fec0ede","order":2,"disp":true,"width":"6","collapse":false,"className":""},
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{"id":"ce994ee19fec0ede","type":"ui_tab","name":"C4 DIP+LEDs","icon":"dashboard","order":2,"disabled":false,"hidden":false}]
```
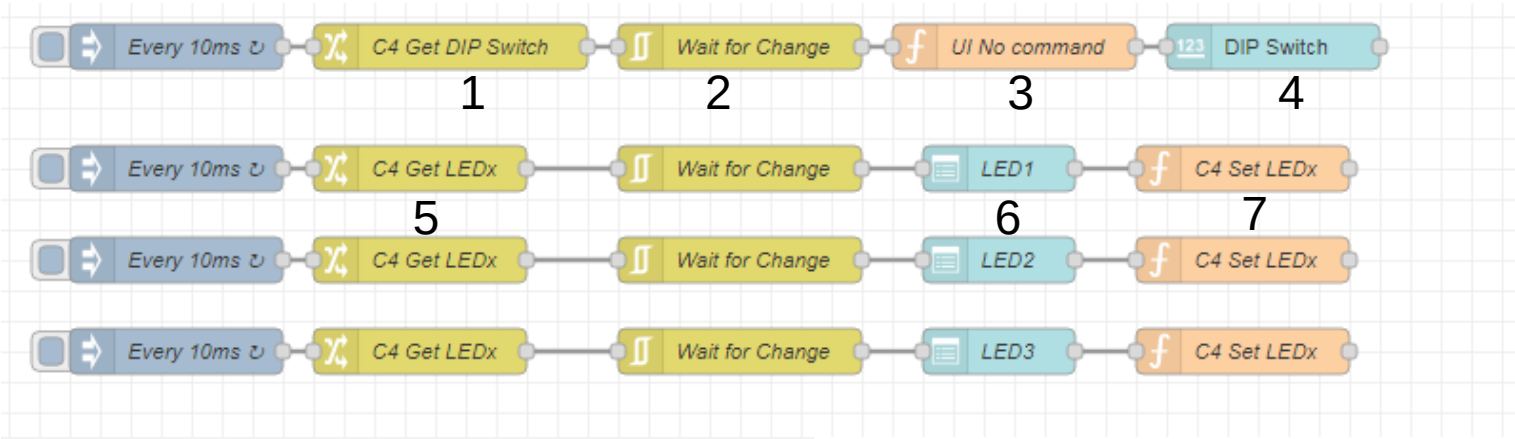
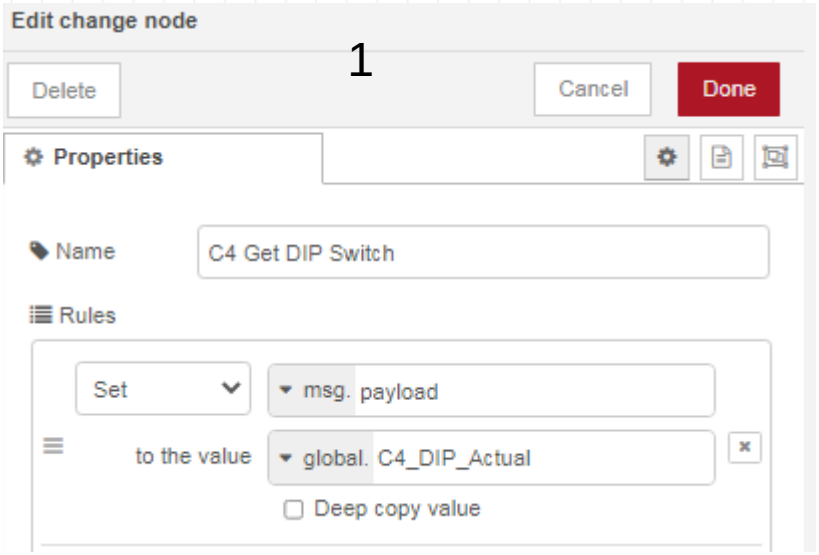

NodeRED® flow to build USER INTERFACE for DIP switch and LEDs

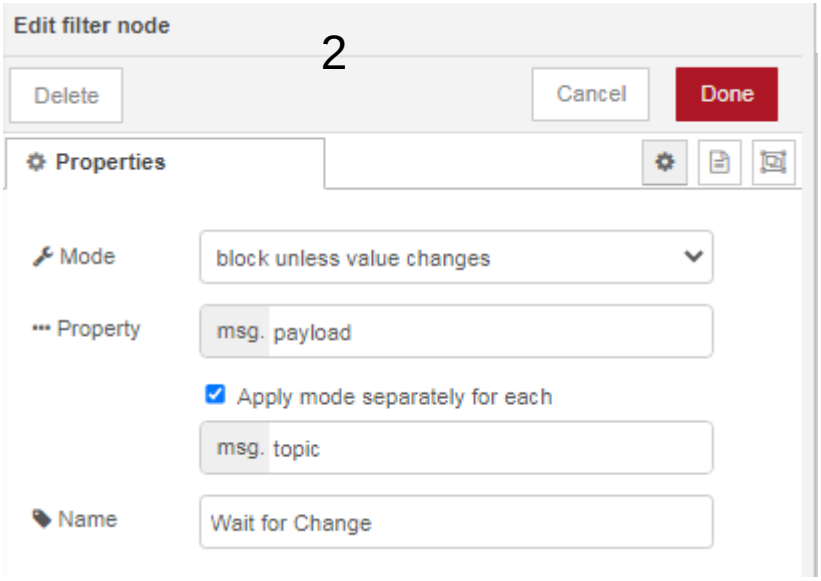
Create flow for UI DIP+LEDs

We create a new flow with the title C4 UI DIP+LEDs.





This node copies the contents of the global variable C4_DIP_Actual to the message for the next node



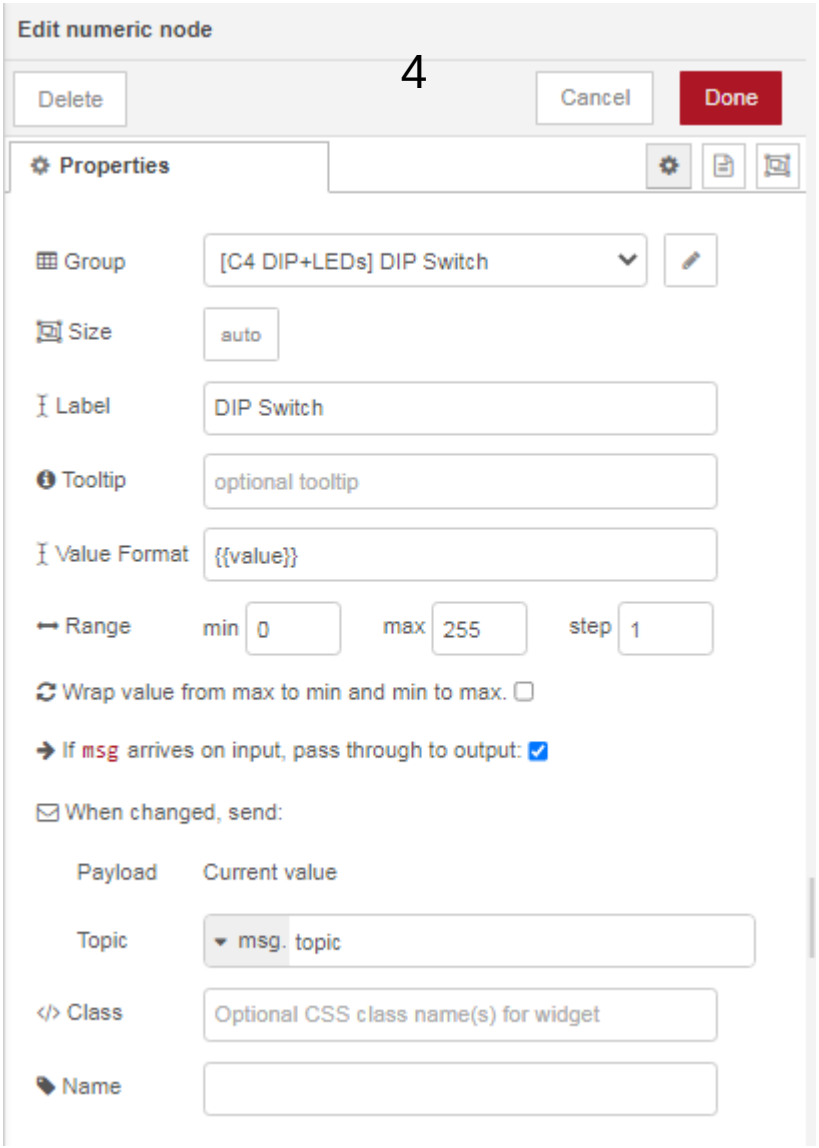
This node waits until the message changes. This means the next node is activated only, if the DIP switch has changed.

NodeRED® flow to build USER INTERFACE for DIP switch and LEDs

With this function node, we instruct the next node, which is the UI node, that the control is only for viewing, but not for control.

Therefore we set msg.enable to false.

The payload of the message is the current value of the DIP switch.



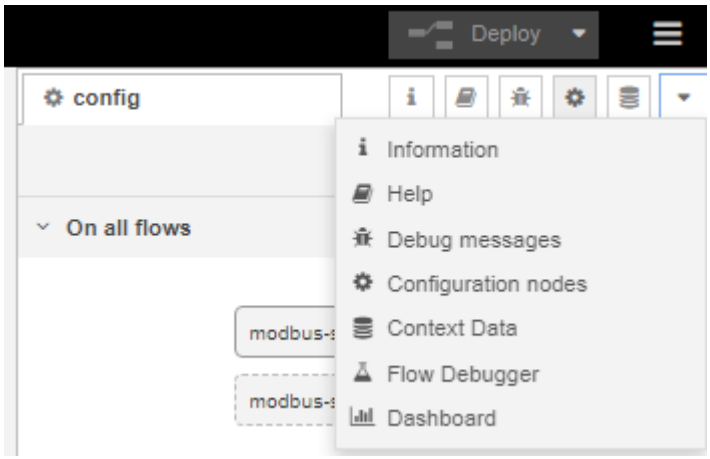
We choose the numeric node to display the current value of the DIP switch.

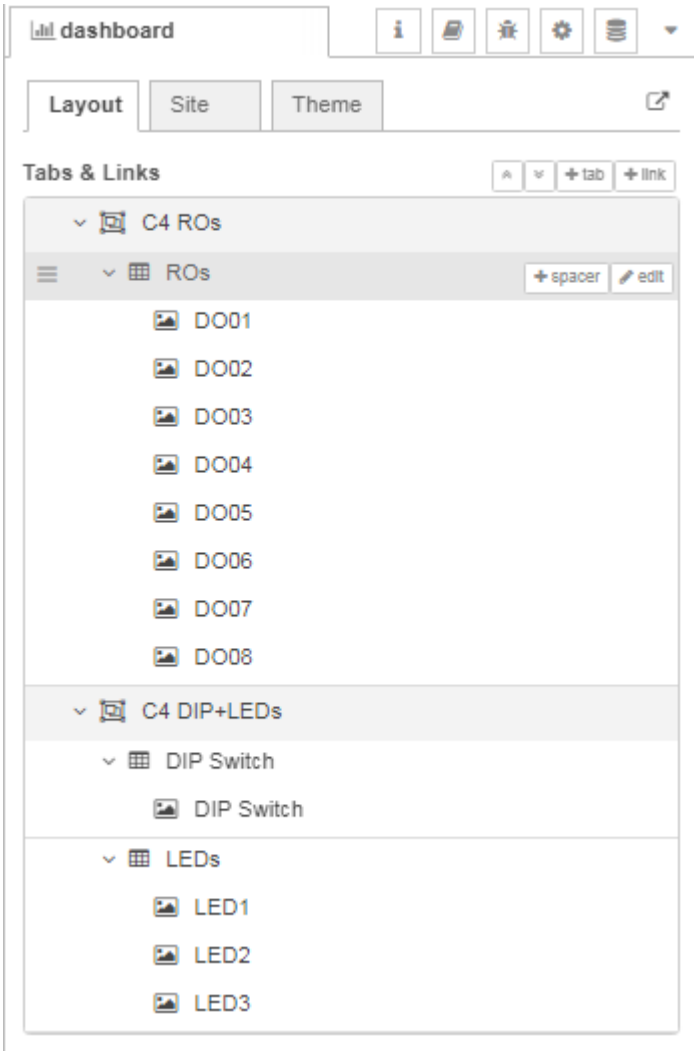
NodeRED® flow to build USER INTERFACE for DIP switch and LEDs

HOWTO build simple dashboard for DIP switches and LEDs

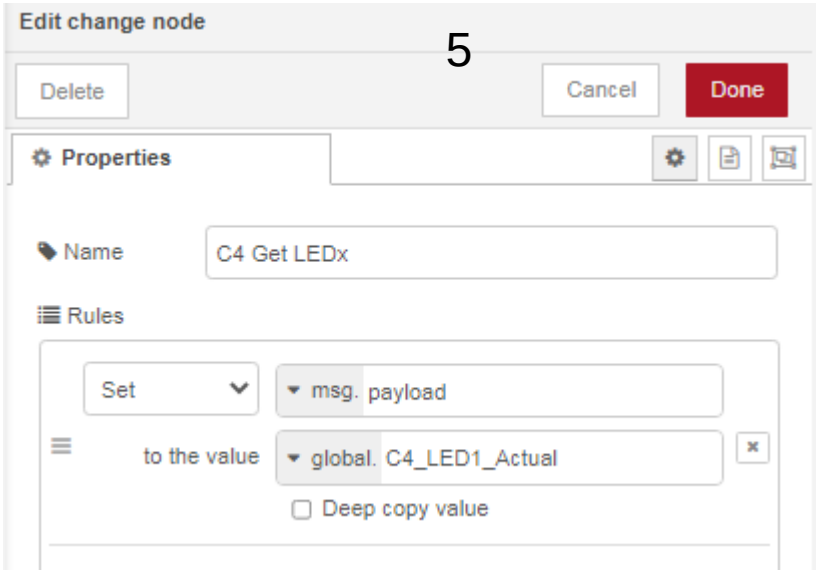
First you have to install the component node-red-dashboard.

Now open the new menu Dashboard. Create the tabs C4 ROs and C4 DIP+LEDs. Within the tab C4 ROs create the group node ROs. Within the tab C3 DIP+LEDs create the group node DIP Switch and the group node LEDs

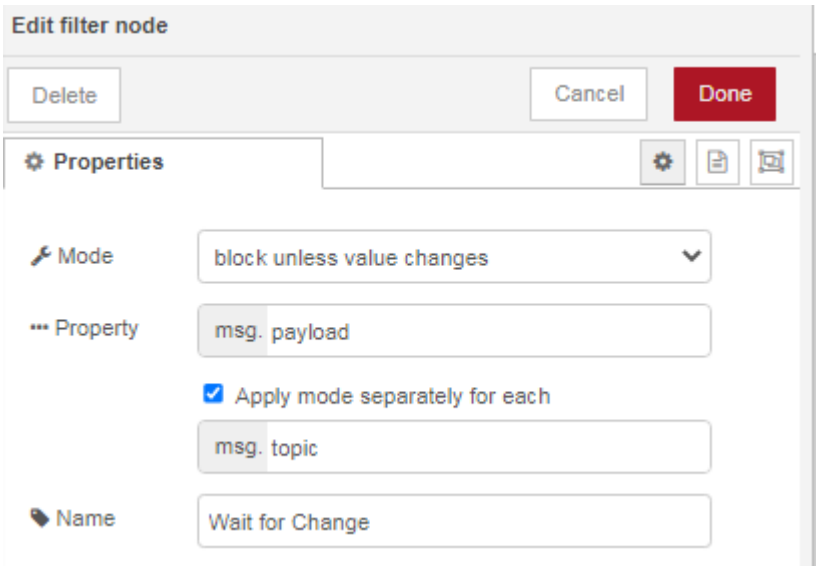




NodeRED® flow to build USER INTERFACE for DIP switch and LEDs



We copy with this node the contents of the global variable C4_LED1-Actual to the message payload.



Then we wait for an change in the value to update the UI node

NodeRED® flow to build USER INTERFACE for DIP switch and LEDs

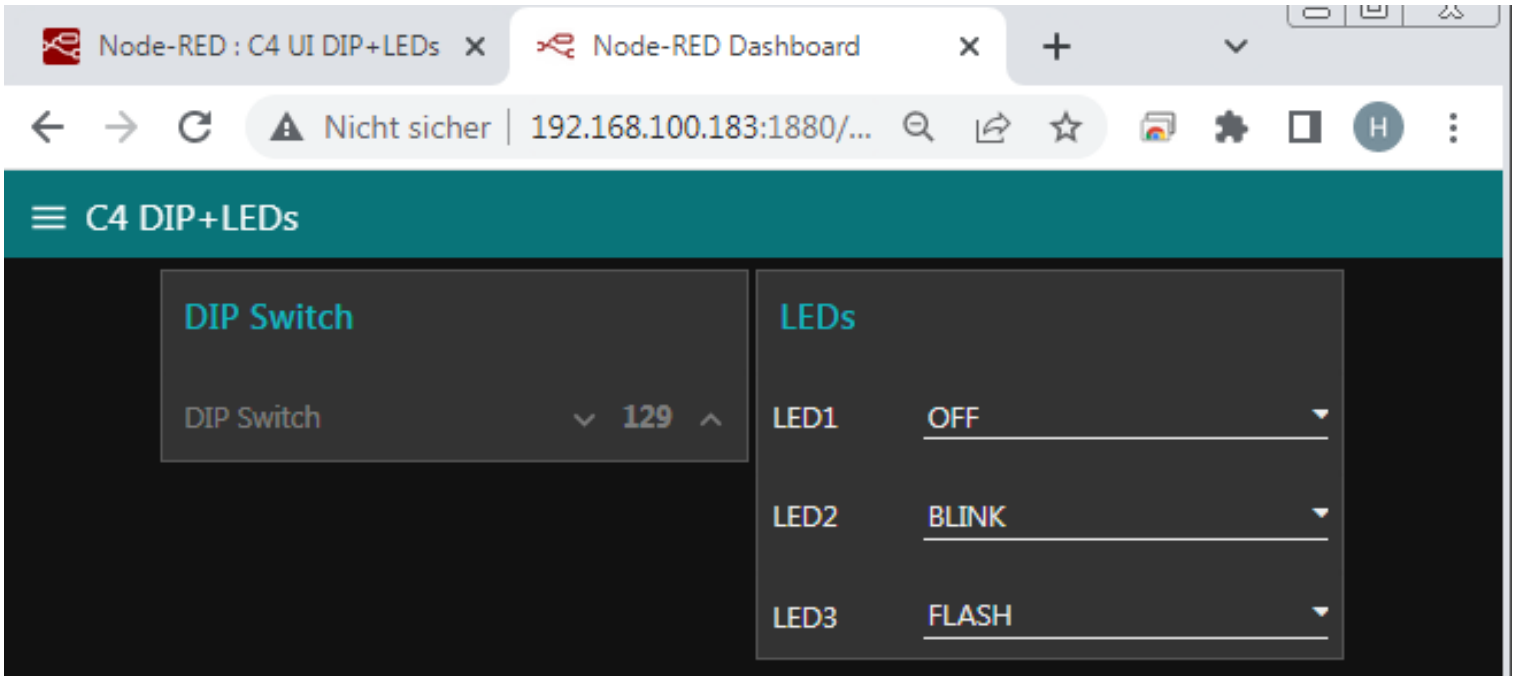
We choose a drop down UI interface element to show the actual status of the LED and to select a new command for the LED. The other two LEDs operate in the same way.

When the user selects a new mode from the drop down list, this node will check, if the value is correct and updates the global variable C4_LED1_State.

The flow C4 DIP Switch+LEDs will react on the change an write via MODBUS the new mode value to the affected LED.

NodeRED® flow to build USER INTERFACE for DIP switch and LEDs

Open your browser and enter the correct URL for your UI. You can now select a new mode for the three LEDs and if you change the DIP switch, the shown value will change too. Select from the Drop Down Menu the correct page.



NodeRED® flow to build USER INTERFACE for relay outputs

Read/Write the relay outputs from RESI-C4 controller to MQTT

Now we create a new flow C4 MQTT. Import this flow:


```
[{"id":"eb35aa3e56e41af4","type":"tab","label":"C4 UI ROs","disabled":false,"info":"","env":[]},
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{"p":"topic","vt":"str"}],"repeat":"0.01","crontab":"","once":false,"onceDelay":0.1,"topic":"","payload":"","payloadType":"date","x":130,"y":40,"wires":
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global.set(\"C4_DO01\", msg.payload);\n}\n\nreturn msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":830,"y":40,"wires":
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global.set(\"C4_DO02\", msg.payload);\n}\n\nreturn msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":830,"y":100,"wires":
[[]]},{"id":"a81f554348694777","type":"function","z":"eb35aa3e56e41af4","name":"C4 Set DO03","func":"if (msg.payload == 0 || msg.payload == 1) {\n
global.set(\"C4_DO03\", msg.payload);\n}\n\nreturn msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":830,"y":160,"wires":
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global.set(\"C4_DO04\", msg.payload);\n}\n\nreturn msg;","outputs":1,"timeout":0,"noerr":0,"initialize":"","finalize":"","libs":[],"x":830,"y":220,"wires":
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```
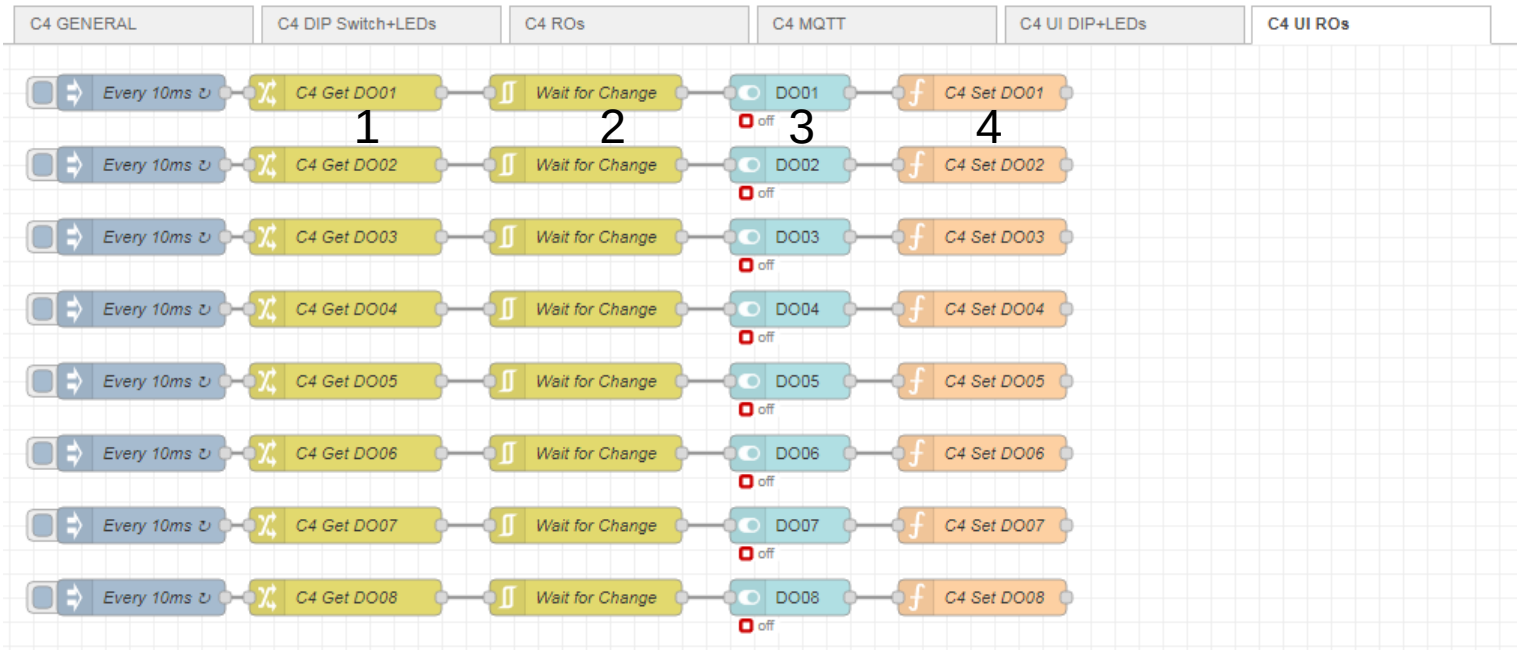
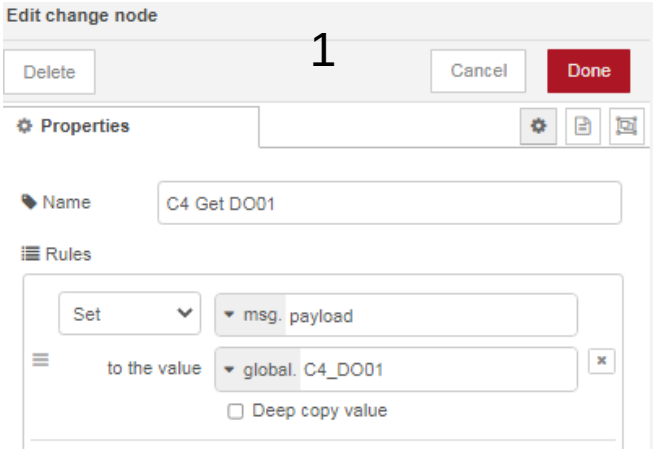

NodeRED® flow to build USER INTERFACE for relay outputs

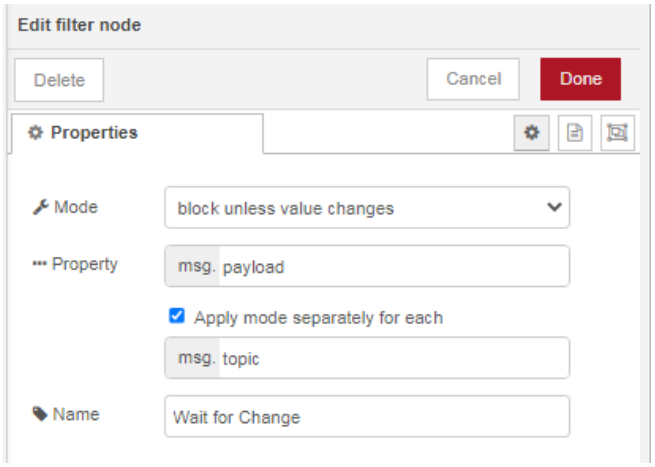
Create flow for UI ROs

We create a new flow with the title C4 UI ROs



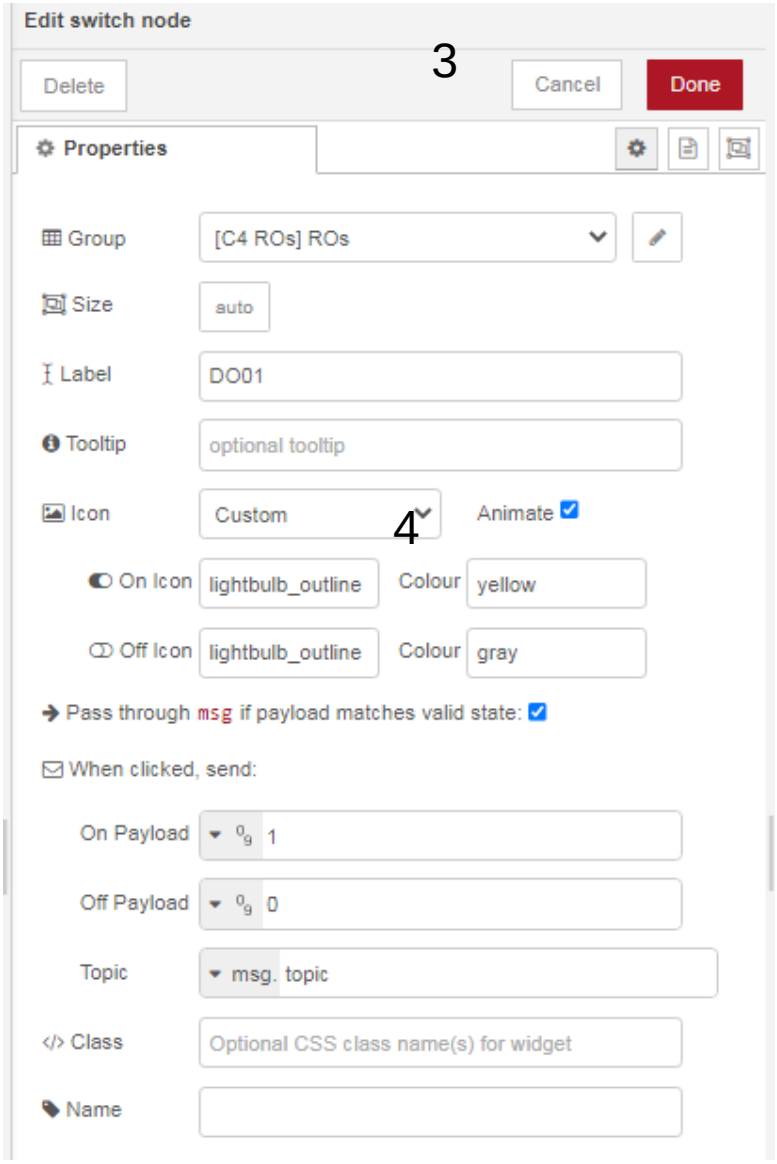


This node copies the contents of the global variable C4_DO01 to the message for the next node



This node waits until the message changes. This means the next node is activated only, if the DIP switch has changed.

NodeRED® flow to build USER INTERFACE for relay outputs



With this UI node we display a switch. We use a light bulb as symbol. It will be yellow, if DO is ON and gray if DO is OFF.

Also we allow switching the state to 0 or 1.

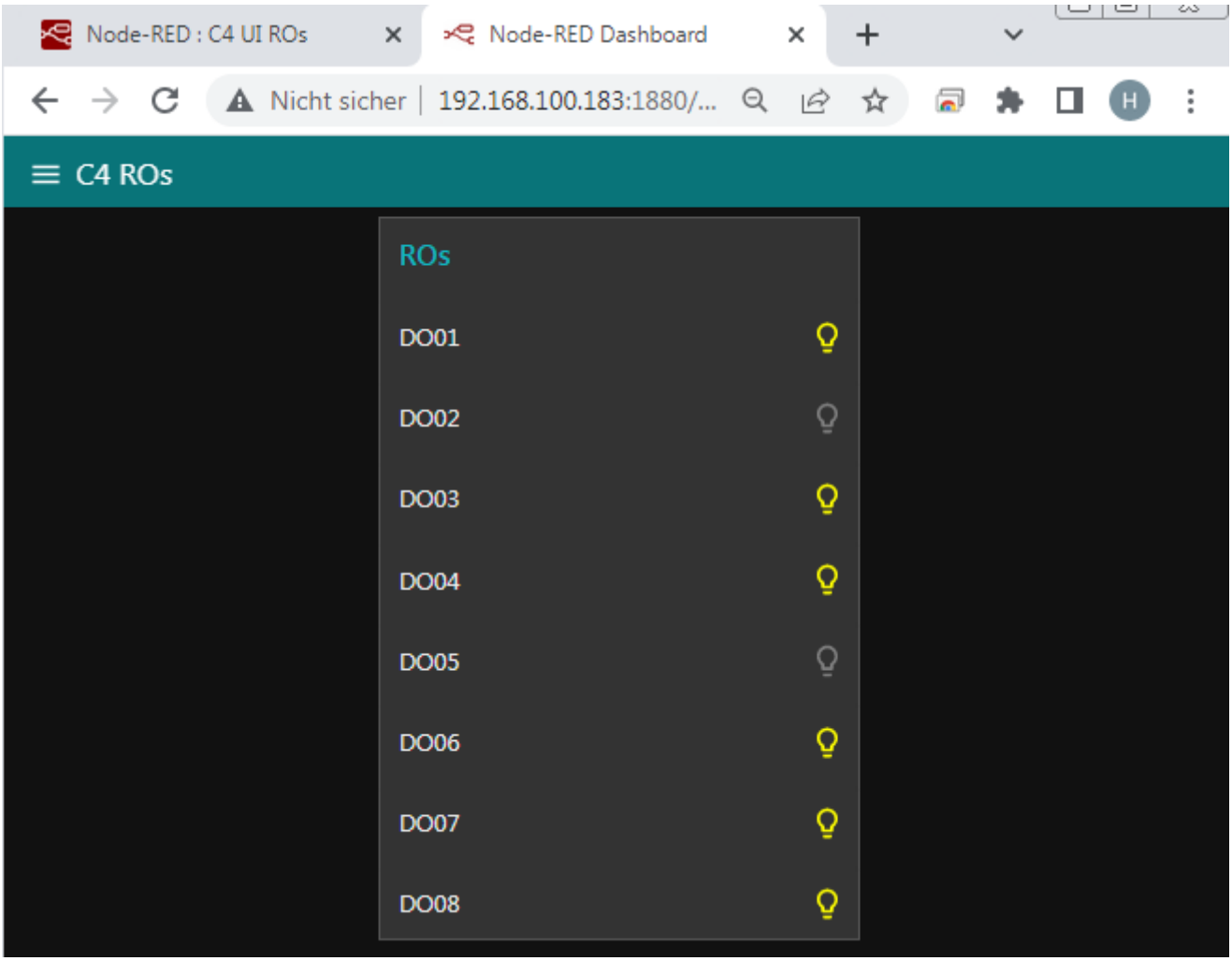
When the user clicks onto the light bulb, this node will be activated with the new state (0 or 1).

This node sets the corresponding global variable C4_DOxx to the new value.

The flow C4 ROs will then update the digital outputs via MODBUS.

NodeRED® flow to build USER INTERFACE for relay outputs

Open your browser and enter the correct URL for your UI. You can now switch the digital outputs by clicking on the light bulb. But if you send a MQTT message to switch the digital output the new status will be shown also. Select from the Drop Down Menu the correct page.



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