**Wagon controller**

# Software

## PCF8575 replacement

The PCF8575 is a 16Bit port expander for the I2C-Bus. A maximum of 8 devices can be used per I2C bus. More devices requires the use of an I2C multiplexer.

Because of the lack of internal configuration registers (like MCP23016), the device is quite simple. After the initial write sequence transporting the device address, every subsequent byte written will be placed in the output latch A bevor B. The operation is module 2. Writing 6 bytes will have the same result then writing only the last 2 bytes.

The firmware to emulate the PCF8575 is based on the WIRE library, which comes with Arduino. The idea is to be able to replace a PCF8575 without making any changes to the I2C-Master. Just setting the correct address at the slave. The address must be set in the source code and cannot be changed by external settings like the PCF8575 can.

The controller board used here comes with real push-pull-outputs, where the PCF8575 uses only low-side switches.

The Controller used is an Arduino Nano Every. It is cheap, has a small footprint and supports 2 serial ports by hardware, so one can be used for serial monitor and the other is used for RS485 device transceiver.

The Arduino-Pins are assigned to the bits of the PCF8575 and the PCB connectors as follows:



|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| PCF8575  Register A | Arduino Pin-Nr | Connector @ PCB | Connector @ PCB | Arduino Pin-Nr | PCF8575  Register B |
|  |  | J15 (TX1) | J17(/Reset) |  |  |
|  |  | J14 (RX1) |  |  |  |
|  |  | J16(/Reset) |  |  |  |
|  |  |  |  |  |  |
| Bit 0 | 2 | J3 (D2) | J26 (A7) | 10 | Bit 0 |
| Bit 1 | 3 | J4 (D3) | J25 (A6) | 11 | Bit 1 |
| Bit 2 | 4 | J5 (D4) | J24 (A5/SCL) | 12 | Bit 2 |
| Bit 3 | 5 | J6 (D5) | J23 (A4/SDA) | 13 | Bit 3 |
| Bit 4 | 6 | J2 (D6) | J22 (A3) | A0 | Bit 4 |
| Bit 5 | 7 | J7 (D7) | J21 (A2) | A1 | Bit 5 |
| Bit 6 | 8 | J8 (D8) | J20 (A1) | A3 | Bit 6 |
| Bit 7 | 9 | J9 (D9) | J19 (A0) | A3 | Bit 7 |
|  |  | J10 (D10) | J18 (AREF) |  |  |
|  |  | J11 (MOSI) | J27 (+3V3) |  |  |
|  |  | J12 (MISO) | J13 (SCK) |  |  |
|  |  |  |  |  |  |

The assignment is important for wiring the device. It can be easily changed  
in the firmware. The Pin numbers are collected in two arrays, named portA and portB

uint8\_t portA[] = {2, 3, 4, 5, 6, 7, 8, 9};

uint8\_t portB[] = {10, 11, 12, 13, A0, A1, A2, A3};

see 🡪 Test\_PCF8575\_Emu

## RS485-Node

RS485 is a differential 2-wire bus system widly used in industrie. It is

# Sources

Verwendete Bibliothek für den PCF8575

https://github.com/xreef/PCF8575\_library

Arduino-Client for MQTT

https://github.com/knolleary/pubsubclient

JSON-Library for Arduino

https://github.com/bblanchon/ArduinoJson