CANgineBerry Quickstart

for bootloader 1.03 or higher
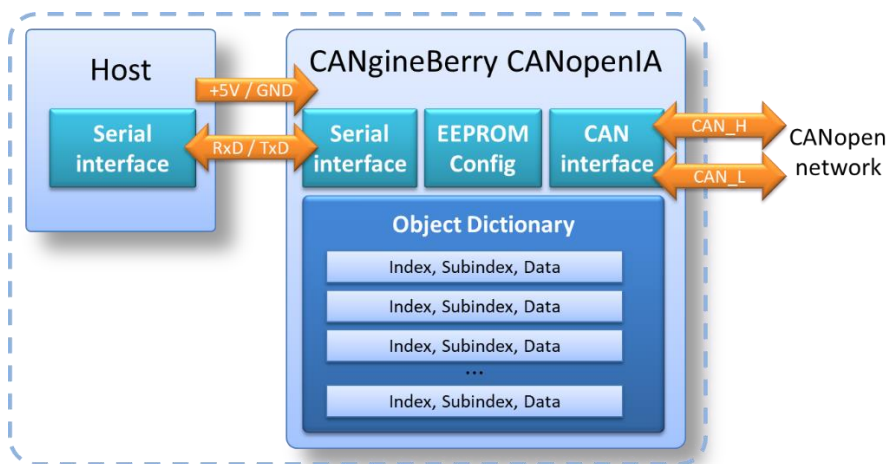
1   Raspberry Pi® setups

1.1   Connecting the CANgineBerry

Be careful when plugging the CANgineBerry onto the Pi to use the right pins. **Never plug or unplug the CANgineBerry while the Raspberry Pi® is connected to power!**
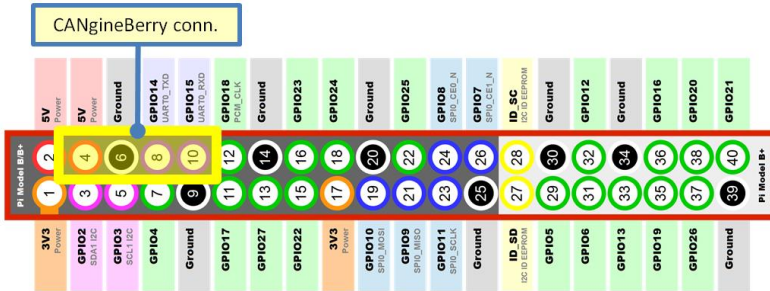
CANGINEBERRY CONNECTOR ON RASPBERRY PI® GPIO

The form factor of the module is designed to fit directly on top of the Raspberry Pi® (version 2 or higher), connecting directly to the UART in the GPIO header row.
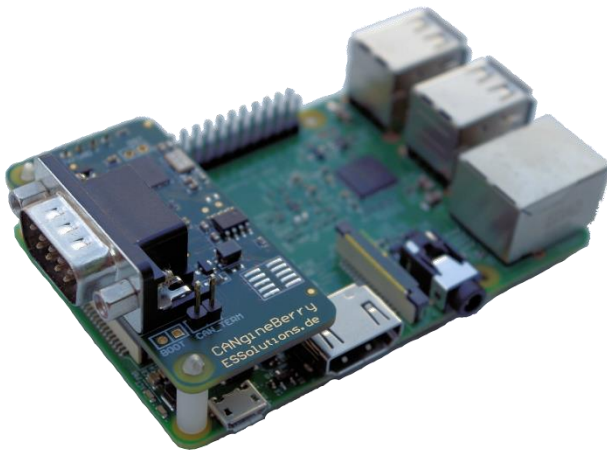
CANGINEBERRY ON RASPBERRY PI® 3

1.2   Raspberry Pi OS system settings

In the Raspberry PI® 3 and up, the UART at GPIO14 (pin 8) and GPIO15 (pin 10) is not available by default. It has to be enabled and the login shell via UART disabled in the raspi-config tool for it to be used with the CANgineBerry:

```
sudo raspi-config
```

Go to Interface Options – Serial Port, then:
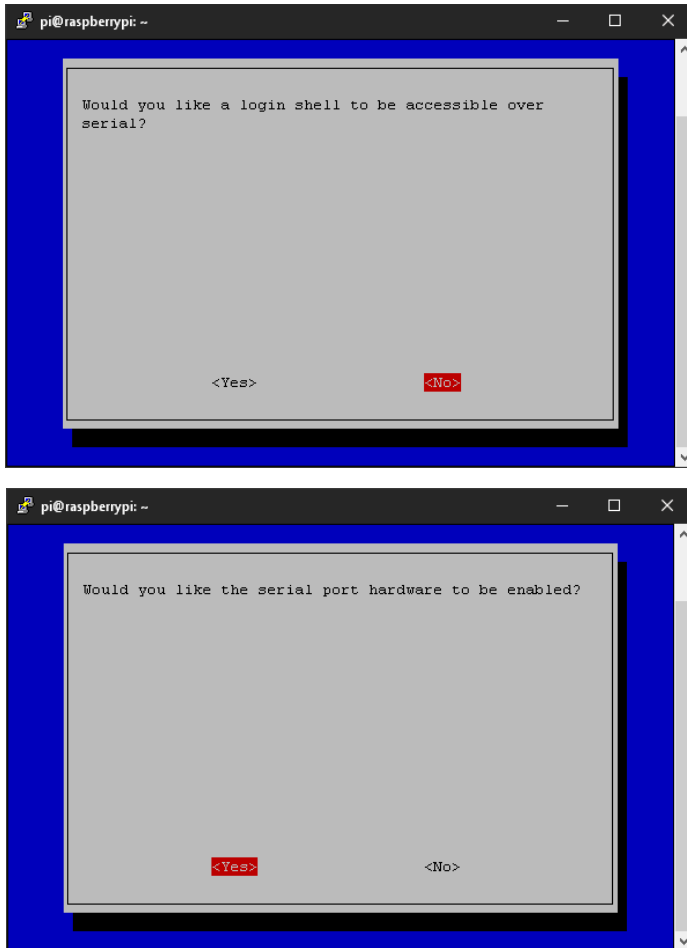
Confirm and select "Finish" to save, then reboot. Note that the serial port is accessible as (typically) /dev/ttyAMA0 or /dev/ttyS0 and Bluetooth may now be no longer available depending on the hardware version.

> **For performance and reliability reasons, don't try to use**
> **the mini UART in the Raspberry Pi® 3/4 with CANgineBerry!**

For details on the Raspberry Pi® UART configuration options, refer to

https://www.raspberrypi.com/documentation/computers/configuration.html#configuring-uarts

2   Software settings

2.1   Preparation

Download the latest Linux software archive from www.cangineberry.com to your Raspberry. Copy the executables from the UTIL directory to your working directory, for example the Public directory. Also copy the desired firmware version from the APPS directory to the working directory.

2.2   First commands

Open a terminal window and make the working directory your current directory:

```
cd Public
```

Use the COIAupdater utility (parameter -h gives you list of commands available) to check current version and application active:

```
./coiaupdater -p /dev/ttyAMA0 -i

COIAUpdater version 1.05.4265
(c) EmSA 2018, All Rights Reserved, www.em-sa.com
Connected to /dev/ttyS0 at 921600 bps
Show device info...
Waiting for bootloader to start...
Bootloader is running.
Bootloader version:    1.2
Hardware serial number: 0600100013434B5534353620
Stored configuration:
  Node ID:             125 (0x7D)
  CAN bitrate:         125 kbps
  LSS:                 disabled
Application found:
  Type:                0x02 (CANopen IA Manager)
  Version:             1.2
Disconnected from /dev/ttyAMA0
```

To reload or update the application running, use the -f command:

```
./coiaupdater -p /dev/ttyAMA0 -f CgB_COIA_MGR1.2_sec.bin

COIAUpdater version 1.05.4265
(c) EmSA 2018, All Rights Reserved, www.em-sa.com
Connected to /dev/ttyS0 at 921600 bps
Firmware file to write: /home/pi/Public/CgB_COIA_MGR1.2_sec.bin
Waiting for bootloader to start...
Bootloader is running.
Bootloader version:     1.2
Hardware serial number: 0600100013434B5534353620
Stored configuration:
  Node ID:              125 (0x7D)
  CAN bitrate:          125 kbps
  LSS:                  disabled
Application found:
  Type:                 0x02 (CANopen IA Manager)
  Version:              1.2
Erasing flash...done.
Programming............................done.
Update completed.
Disconnected from /dev/ttyAMA0
```

The default CAN bitrate can be set (here 125 kbps) with:

```
./coiaupdater -p /dev/ttyAMA0 -r 125
```

The default CANopen node ID used can be set (here 125) with:

```
./coiaupdater -p /dev/ttyAMA0 -n 125
```

Note: Numbers can be entered in both decimal or hexadecimal. When using hexadecimal, simply start the hexadecimal number with '0x'.

3 CAN Basics

A CAN interface cannot operate without a communication partner. Errors will occur, if nothing is connected to the CAN side or devices connected operate at a different bitrate.

Before actively using the CANgineBerry, ensure that it is properly connected to a CAN system with one or multiple nodes (all configured to same bitrate) and that the termination resistors are in place.

If needed, the CANgineBerry can provide one termination by setting the CAN_TERM jumper.

See https://en.wikipedia.org/wiki/CAN_bus#Architecture for the architecture layout.

See https://en.wikipedia.org/wiki/CAN_bus#Layers for the pinout. Note that typically GND is also connected via the network, but not V+ as the voltage for that is not standardized.

4   Application CANopenIA-MGR

This application implements a CANopen controller (minimal manager), that can handle up to 32 CANopen devices. Before connecting a CANopen device, ensure that it is configured to use the same CAN bitrate and has a unique node ID in the range of 1 to 32 (double node ID assignments will result in errors).
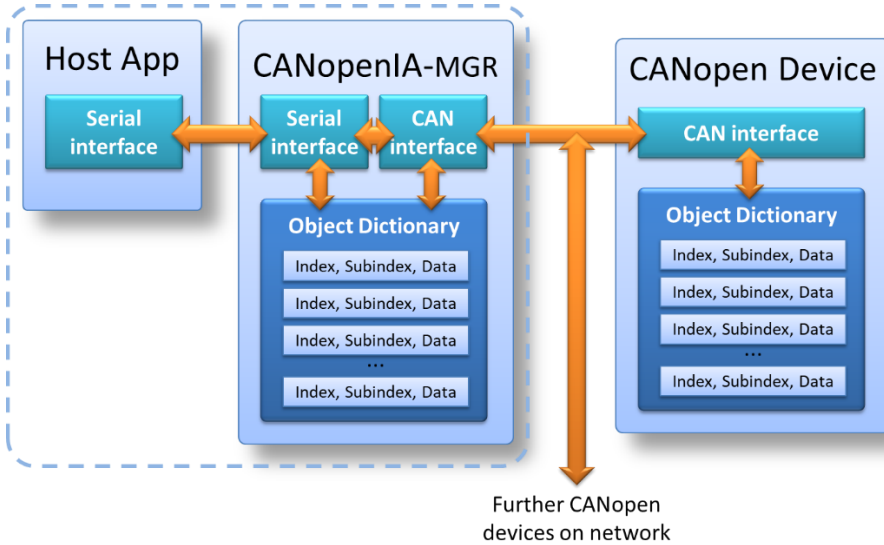
CANopenIA-MGR AND CANopen Object Dictionaries

4.1   Using the COIA utility

The COIA utility offers first access to the network connected. To get a common starting point, send a reset command (CANopen NMT reset message) to all connected devices:

```
./coia -p /dev/ttyS0 -n all,reset
```

This ensures that all devices re-boot and the controller re-scans the devices that produced a boot-up message.

For this test case, we connected a CANopenIA-M0 (node ID 10) evaluation board and a Schneider Advantys® I/O system to our network (node ID 16 and 17).

CANgineBerry with CANopenIA-M0 and Schneider Advantys® system

The –net-info parameter shows us a list of devices found:

```
./coia -p /dev/ttyAMA0 --net-info

COIA version 1.73.4265
(c) EmSA 2018, All Rights Reserved, www.em-sa.com
Connected to /dev/ttyS0 at 921600 bps
No information available for node 0x01 - not yet seen on network?
No information available for node 0x02 - not yet seen on network?
No information available for node 0x03 - not yet seen on network?
No information available for node 0x04 - not yet seen on network?
No information available for node 0x05 - not yet seen on network?
No information available for node 0x06 - not yet seen on network?
No information available for node 0x07 - not yet seen on network?
No information available for node 0x08 - not yet seen on network?
No information available for node 0x09 - not yet seen on network?
Node 0x0A: Device type 0x00030191
           Vendor ESAcademy - USA (0x01455341)
           Product code 0x11223344
           Revision number 0x53521B2C
           Serial number 0x1212EE39
No information available for node 0x0B - not yet seen on network?
No information available for node 0x0C - not yet seen on network?
No information available for node 0x0D - not yet seen on network?
No information available for node 0x0E - not yet seen on network?
No information available for node 0x0F - not yet seen on network?
Node 0x10: Device type 0x00030191
           Vendor Schneider Electric - American Global Products
(0x0400005A)
           Product code 0x0000000C
           Revision number 0x00013800
ERROR: Unable to get node 0x10 identity information (4): 0x00001000
ERROR: Node error: 0x0040
Node 0x11: Device type 0x00010191
           Vendor Schneider Electric - American Global Products
(0x0400005A)
           Product code 0x00000003
           Revision number 0x00013800
ERROR: Unable to get node 0x11 identity information (4): 0x00001000
ERROR: Node error: 0x0040
No information available for node 0x12 - not yet seen on network?
No information available for node 0x13 - not yet seen on network?
No information available for node 0x14 - not yet seen on network?
No information available for node 0x15 - not yet seen on network?
No information available for node 0x16 - not yet seen on network?
No information available for node 0x17 - not yet seen on network?
No information available for node 0x18 - not yet seen on network?
No information available for node 0x19 - not yet seen on network?
No information available for node 0x1A - not yet seen on network?
No information available for node 0x1B - not yet seen on network?
No information available for node 0x1C - not yet seen on network?
No information available for node 0x1D - not yet seen on network?
No information available for node 0x1E - not yet seen on network?
No information available for node 0x1F - not yet seen on network?
No information available for node 0x20 - not yet seen on network?
Disconnected from /dev/ttyAMA0
```

Note that the Schneider devices do not have a serial number, therefore an error is reported when the CANopenIA-MGR app tries to read this entry.

For more details about an individual node, use the --node-info parameter:

```
./coia -p /dev/ttyAMA0 --node-info 0x0A

COIA version 1.73.4265
(c) EmSA 2018, All Rights Reserved, www.em-sa.com
Connected to /dev/ttyS0 at 921600 bps
Node 0x0A: Device type 0x00030191
           Vendor ESAcademy - USA (0x01455341)
           Product code 0x11223344
           Revision number 0x53521B2C
           Serial number 0x1212EE39
Disconnected from /dev/ttyAMA0
```

For any CANopen I/O system that follows the CiA 401 specification for generic I/O, we know the CANopen Object Dictionary entry location for inputs and outputs. Index 0x6000 with Subindex 1 to 8 address up to 8 input bytes. Index 0x6000 with Subindex 1 to 8 address up to 8 output bytes.
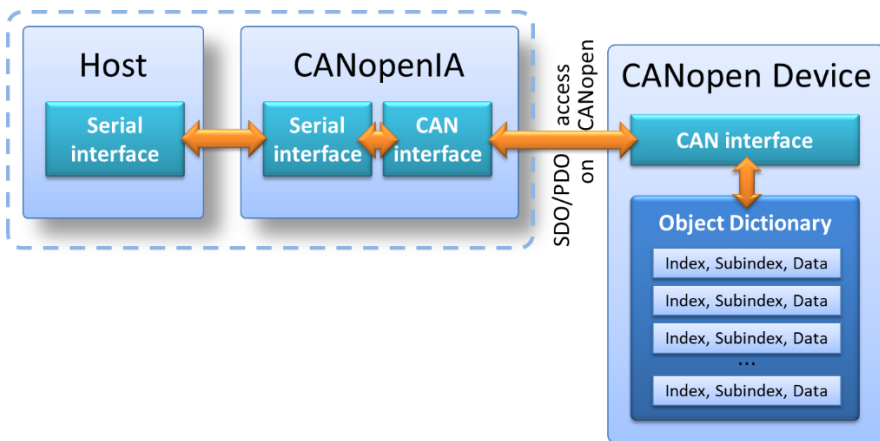
Read or write request to a remote Object Dictionary of a node on the network

To read the first input byte from node 16, type:

```
./coia -p /dev/ttyAMA0 --node-read 0x0A,0x6000,0x01

COIA version 1.73.4265
(c) EmSA 2018, All Rights Reserved, www.em-sa.com
Connected to /dev/ttyS0 at 921600 bps
Read from node 0x0A object dictionary [0x6000,0x01]: 0x0F
Disconnected from /dev/ttyAMA0
```

Here the current value reported is 0x0F.

To write to the first output byte of node 16 (here writing 1 byte, 0x55), type:

```
./coia -p /dev/ttyAMA0 --node-write 0x0A,0x6200,0x01,1,0x55

COIA version 1.73.4265
(c) EmSA 2018, All Rights Reserved, www.em-sa.com
Connected to /dev/ttyS0 at 921600 bps
Wrote 0x00000055 to node 0x0A object dictionary [0x6200,0x01]
Disconnected from /dev/ttyAMA0
```

On the CANopenIA-M0 evaluation board, this switches the outputs accordingly.

4.2   Programming your own controller application

The CODE directory contains the RemoteAccessApp project including all sources. This is a basic C++ program that communicates with the CANgineBerry. Use this as a base for your own applications.