

Monarco HAT driver for the REXYGEN system
(the MonarcoDrv module)

User guide

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Chapter 1

The MonarcoDrv driver and the REXYGEN system

1.1 Introduction

This manual describes the `MonarcoDrv` driver for direct access to inputs and outputs of the Monarco HAT [1] within the REXYGEN system. The driver was developed by the REX Controls company.

For a quick-start and step-by-step instructions see [2].

1.2 Installation of the driver on the host computer

The `MonarcoDrv` driver is included in the installation package of the Development tools of the REXYGEN system. It is necessary to select the corresponding package in the installer. The REXYGEN system typically installs to the `C:\Program Files\REX Controls\REX <version>` folder.

The following files are copied to the installation folder:

`Bin\MonarcoDrv_H.dll` – Configuration part of the `MonarcoDrv` driver.

`Doc\PDF\ENGLISH\MonarcoDrv_ENG.pdf` – This user manual.

1.3 Installation of the driver on the target device (Raspberry Pi)

If there is no `RexCore` runtime module installed on your Pi, install it first using the Getting started guide of REXYGEN [2]. The installation includes all necessary drivers including `MonarcoDrv`.

If you want to install `MonarcoDrv` separately, it can be done from the command line of Raspberry Pi using the command

```
sudo apt-get install rex-monarcodrvt
```

Chapter 2

Including the driver in the project

The driver is included in the project as soon as the driver is added to the project main file and the inputs and outputs are connected in the control algorithm(s).

2.1 Adding the MonarcoDrv driver

The project main file with the `MonarcoDrv` driver included is shown in Figure 2.1. There is one block which must be added to the project to include the driver. A block of type `IODRV` renamed to `MNR` and connected to the `Drivers` output of the main `EXEC` block. The name of this block (`MNR`, see Fig. 2.1), is the prefix of all input and output signals provided by this driver. The four most important parameters are:

`module` – name of the module linked to the driver, in this case `MonarcoDrv` – the name is CASE SENSITIVE!

`classname` – class of the driver, in this case `MonarcoHatDrv` – the name is CASE SENSITIVE!

`cfgname` – name of the driver configuration file, e.g. `monarcohat.rio`

`factor` – multiple of the `EXEC` block's tick parameter defining the driver's task execution period

The above mentioned parameters of the `IODRV` function block are configured in REXYGEN Studioprogram. The configuration dialog is shown also in Fig. 2.1.

The `Configure` button opens the configuration dialog of the `MonarcoDrv` driver, which is described in chapter 2.2.

2.2 Configuration dialog of the MonarcoDrv driver

The configuration dialog can be activated from REXYGEN Studio by pressing the `Configure` button in the parameters dialog of the `IODRV` block (see chapter 2.1).

The RS-485 section configures the properties of the RS-485 bus for connecting to external devices.

IMPORTANT: Note that the internal communication between the CPU and the MCU of the Monarco HAT uses UART communication (`/dev/ttyAMA0` on the Raspberry Pi) at 115200 baudrate, 8 bits per byte, no parity, 1 stop bit. These are the values you have to use in the Modbus driver configuration if you are willing to use it. For details about the internal structure of the Monarco HAT visit <http://www.monarco.io>.

The SPI configuration section defines the communication between the CPU and the Monarco HAT MCU (`/dev/spidev0.0` on the Raspberry Pi, maximum clock speed is 4 MHz).

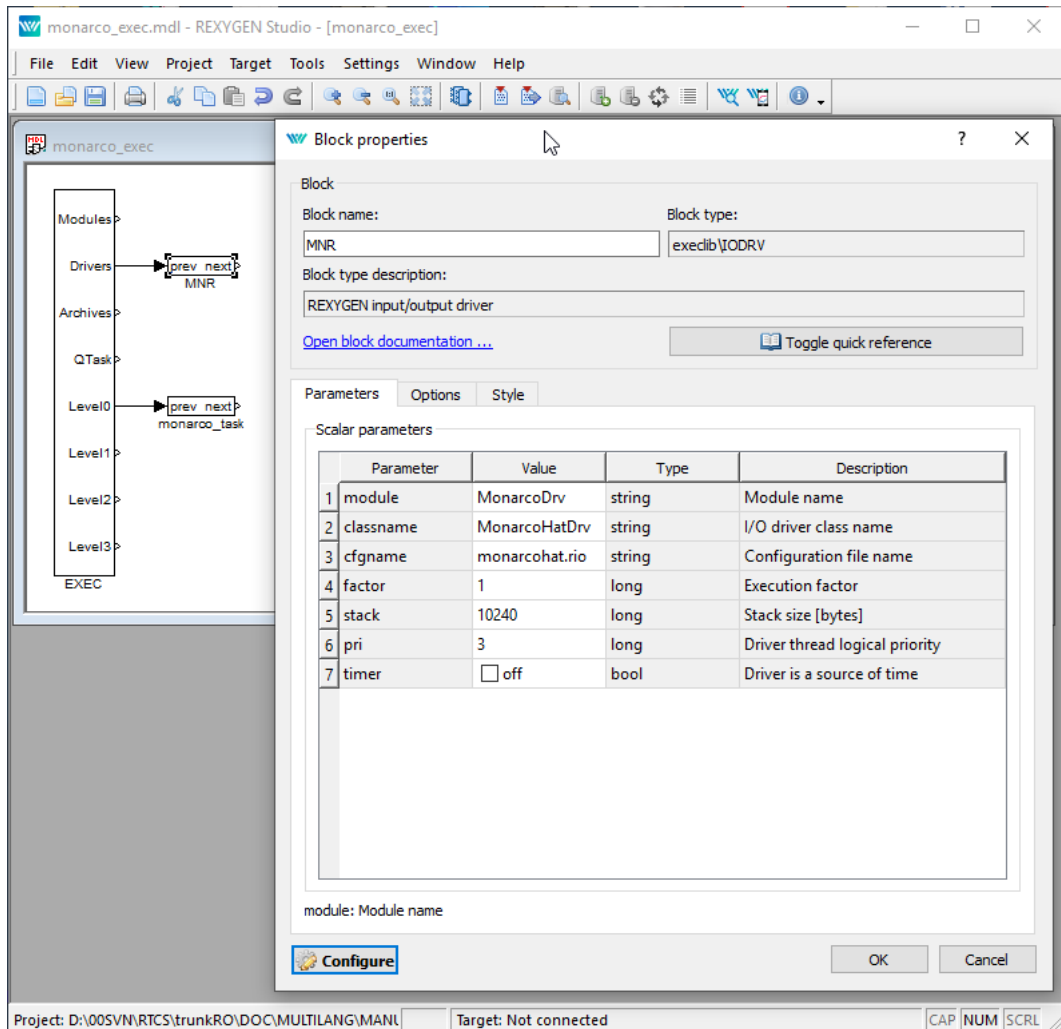


Figure 2.1: An example of project main file with the MonarcoDrv driver included

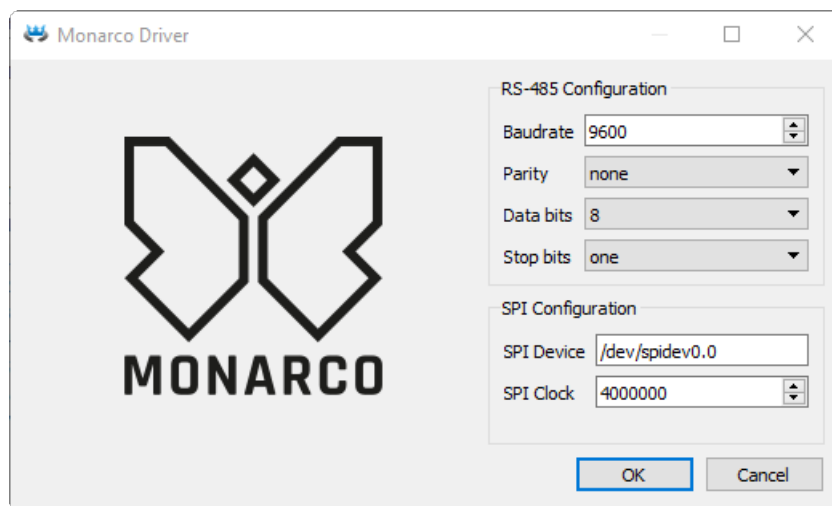


Figure 2.2: Monarco HAT configuration dialog

Chapter 3

Connecting the inputs and outputs in the control algorithm

The inputs and outputs of the driver must be interconnected with the individual tasks (.mdl files). The individual tasks (QTask or Task blocks) are connected to the QTask, Level0, . . . , Level3 outputs of the main EXEC block.

3.1 Direct input and output signals

The inputs and outputs of the `MonarcoDrv` driver can be accessed as shown in Fig. 3.1.

One block of the `From` type allowing the user to read one input has the `Goto tag` set to `MNR__DI1`, while the other has this tag set to `MNR__DI2`. The number in the flag corresponds with the terminal pinout. The block of `Goto` type allowing the user to set (write) one output has the `Goto tag` set to `MNR__DO3`, the other output is accessed via the `MNR__DO4` flag. The blocks always have the `MNR` prefix right at the beginning of the tag followed by two `_` characters (underscore).

Similarly for other pins we can use e.g. the flags:

- `Goto, MNR__DO4` – digital output 4
- `Goto, MNR__AO1` – analog output 1
- `From, MNR__AI1` – analog input (voltage mode 0..10V)
- `From, MNR__AI2C` – analog input (current mode 0..20mA)
- `Goto, MNR__LED5` – Onboard LED 5
- `Goto, MNR__LED5_Mask` – Only when `TRUE`, onboard LED5 can be controlled from algorithm

In general, the link to a particular signal consists of the driver name `MNR`, two underscore characters `__`, signal reference, signal number and an optional symbol defining the mode of the input. The terminal numbering of the Monarco HAT is shown in Fig. 3.2.

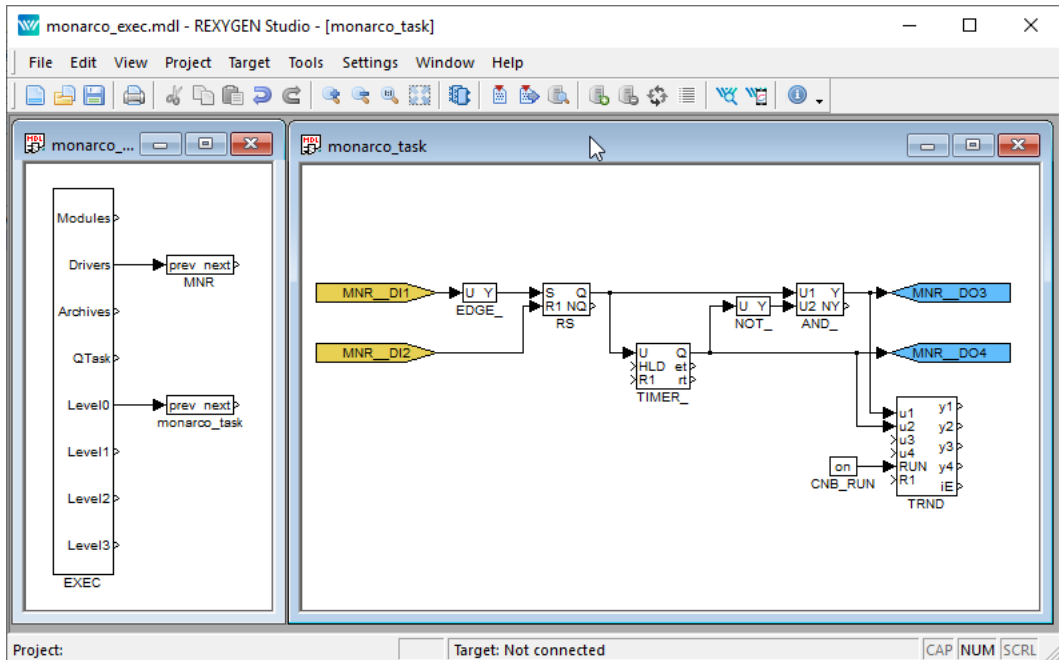


Figure 3.1: Example of input and output flags of the MonarcoDrv driver

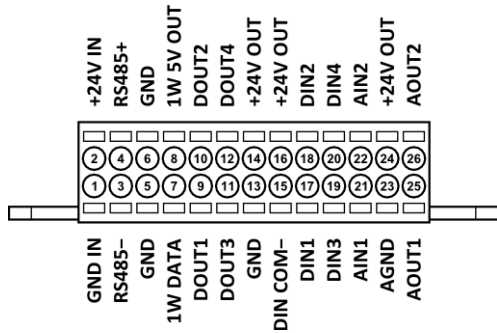


Figure 3.2: Terminal pinout for Monarco HAT.

The installation of the REXYGEN system includes a library of examples, where among other things, the section 0121_Monarco_HAT is dedicated to the use of MonarcoDrv. The example 0121-00_IO_Flags contains a library of usable inputs and outputs.

3.2 Modbus communication via RS-485

The RS-485 bus provides a standard interface to communicate with external devices (servo drives, energy meters, etc.) or to expand the I/O capabilities of the Monarco HAT

itself. Modbus communication is typically used. There is a separate driver for Modbus communication in the REXYGEN system, see [3].

IMPORTANT: Note that the internal communication between the CPU and the MCU of the Monarco HAT uses UART communication (`/dev/ttyAMA0` on the Raspberry Pi) at 115200 baudrate, 8 bits per byte, no parity, 1 stop bit. These are the values you have to use in the Modbus driver configuration if you are willing to use it. For details about the internal structure of the Monarco HAT visit <http://www.monarco.io>.

Figure 3.3 shows an example project main file with multiple I/O drivers.

3.3 1-Wire sensors and expansion modules

The 1-Wire bus provides additional interface to expand the I/O capabilities of the Monarco HAT itself (e.g. using 1-Wire temperature sensors, relative humidity sensors, relay modules etc.). There is a separate driver for 1-Wire communication in the REXYGEN system, see [4].

Figure 3.3 shows an example project main file with multiple I/O drivers.

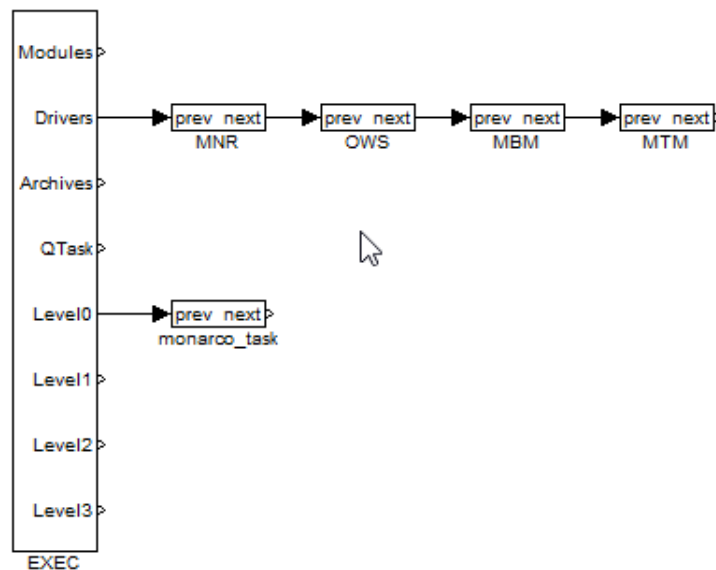


Figure 3.3: A project with MonarcoDrv, 1-Wire, Modbus RTU and Modbus TCP drivers

Chapter 4

Troubleshooting

First and foremost, it's advisable to explore the library of examples, especially the section `0121_Monarco_HAT`, which pertains to the usage of `MonarcoDrv`.

In the case that the diagnostic tools of the REXYGEN system (e.g. REXYGEN Studio@) report unexpected or incorrect values of inputs or outputs, it is desirable to test the functionality outside the REXYGEN system (command line tools, simple scripts, etc.). Also double check the configuration – the most common problems include:

Hardware problem – incorrect wiring.

Internal communication problem – SPI bus, I2C bus or UART is occupied by another service or program.

In the case that the given input or output works with other software tools and does not work in the REXYGEN system, report the problem to us, please. E-mail is preferred, reach us at support@rexygen.com. Please include the following information in your description to help us process your request as soon as possible:

- Identification of the REXYGEN system you are using. Simply export it to a file using the REXYGEN Studio program (Target → Licensing → Export).
- Short and accurate description of your problem.
- The configuration files of the REXYGEN system (`.mdl` and `.rio` files) reduced to the simplest case which still demonstrates the problematic behavior.

Bibliography

- [1] REX Controls s.r.o.. Internet webpage www.monarco.io, 2020.
- [2] REX Controls s.r.o.. *Getting started with REXYGEN and Monarco HAT*, 2020. →.
- [3] REX Controls s.r.o.. *Modbus driver of REXYGEN – User guide*, 2020. →.
- [4] REX Controls s.r.o.. *OwsDrv driver of REXYGEN for 1-Wire devices – user guide*, 2020. →.