REDISPOSE

Instruction manual, Stark CMR v2 (SCMR02)

Internet of Tings (IoT) communication, MOSFET and relay module

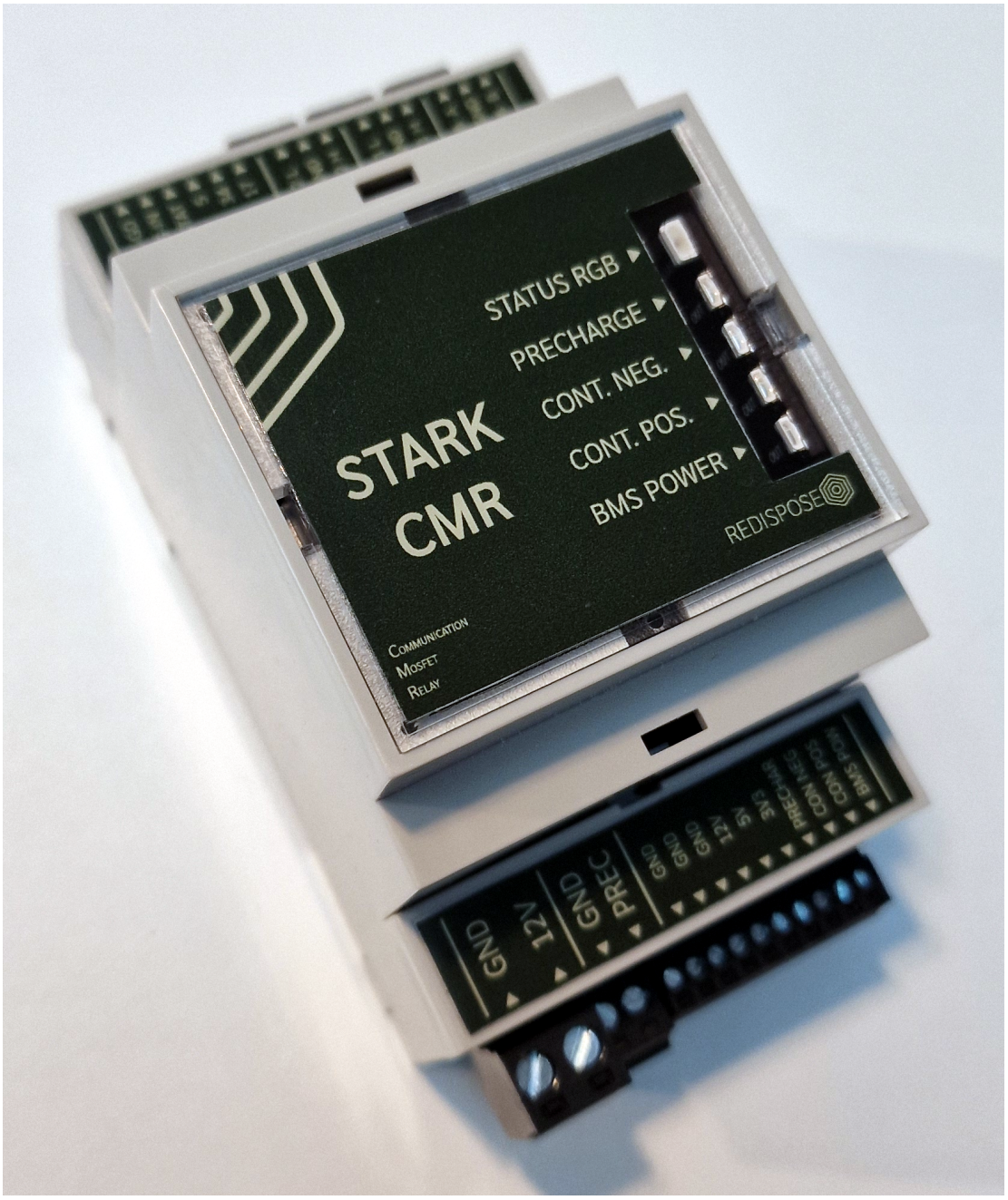

Figure 1

Redispose AB Vetevägen 24, 23169, Skegrie, Sweden | **Phone** +46-707-341695 | **E-mail** info@redispose.se | **VAT** SE559441816101

Product description

The Stark CMR v2 is a DIN-rail mountable unit equipped with a small SoC (system on a chip). It allows the user to control three hardware communications buses as well as four independently controlled DC voltage outputs with clearly visible indicator lights on the front of the unit. The outputs can be used for example to control external DIN-mountable relays while the communications buses can be used to interact with other control systems or controllable hardware. It is equipped with WiFi and Bluetooth to allow remote control operation. It is a perfect fit where any combination of the above functions are desired. Basic knowledge of uploading ESP32 software over USB is needed to operate the unit successfully.

Important safety information

Read this manual before attempting to install the device

Failure to observe recommendations included in this manual may be dangerous or cause legal violations. The manufacturer, Redispose AB will not be held responsible for any loss or damage resulting from not following the instructions of this operating manual or using the Stark CMR in any other way than the ones described in this document.

Overcurrent protection

The Stark CMR is equipped with multiple overcurrent protection fuses to limit the current supplied to the power outputs. It is still strongly advised to limit the throughput current to the minimum needed in the intended application.

Absolute maximum momentary current loads

Main power output:	12 A
Secondary power outputs marked 1-4:	1,5 A
Tertiary power output +12VDC:	2 A
Tertiary power output +5VDC:	550 mA
Tertiary power output +3V3DC:	1,5 A
Each single GPIO pin:	20 mA

Exposed electronics

When the any part of the plastic casing is removed, the printed circuit board and the discrete components are exposed. **Do not touch or in any other way manipulate the components of the PCB or the PCB itself**, including the attached LED PCB, unless this manual explicitly and specifically mentions such manipulation.

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Environmental considerations

This product contains electrical or electronic components that should be correctly recycled. Submit the product for recycling at the designated facility in your local area. Local rules and regulations apply for recycling arrangements. Must not be discarded with generic household waste under any circumstances.

Physical properties

Scope of delivery

The module is delivered as a standard DIN-rail mountable unit. In addition to the module itself the delivery includes plugin screw terminal male connectors where applicable, a GPIO header connector housing with matching pins as well as a factory installed sticker pack.
Note that the included sticker set is presented with a randomly suggested naming scheme for the power outputs. Alternative naming schemes are subject to availability. Custom sticker sets are available upon request at an additional fee.

Dimensions

Standard DIN-rail form factor as depicted in figure 1.
Width 53,5 mm (similar to the width of three DIN modules)
Height 90,0 mm (95,0 mm including fastening clip)
Depth 53,5 mm

Range of safe and normal operation

Temperature: -20°C ~ +75°C

Power limitations

Respect the power throughput and output limitations as listed in the “Absolute maximum momentary current loads” and “Overview of features - Power” sections. **Failure to do so will void the warranty and may damage the unit.**

Mechanical limitations

Do not drop, shake or otherwise expose the SCMR02 to impact. Do not expose the unit to extreme humidity or moist environments. The SCMR02 must be installed in a dust protected DIN enclosure. If the unit has been compromised according to any of the specifications in this document, immediately disconnect the power supply or supplies and all other connections to external hardware. Then refer to the instructions in the “Getting started” section to verify normal operation.

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Overview of features

Power

Supply voltage (+5VDC - +16VDC) protected with reverse polarity circuitry
Operating current < 300mA @ 3,3VDC when all outputs are activated
Simultaneous USB connection and external power supply supported
All +3.3VDC logic with resettable over-current protection
Four individually controllable power outputs, equal to the DC input voltage consisting of:
1 relay channel, 7A continuous, 12A maximum with resettable over-current protection. Located on the main output 1 connector (figure 5).
3 MOSFET channels, 0,65A continuous, 1,4A maximum with resettable over-current protection. The MOSFET channels can be controlled by a PWM signal for more detailed control of the actual output power duty cycle. The outputs have a rise time of 2.3ns/6.5ns and a fall time of 1ns/7.5ns. The MOSFET outputs are located on the secondary output connector (figure 5).
Current specifications are valid at a surrounding temperature of 25°C or below.
+3.3VDC, max 500mA continuous load, output available. Protected by resettable fuse.
+5VDC, max 250mA continuous load, output available. Protected by resettable fuse.
Supply voltage output pin, max 1A continuous load. Protected by resettable fuse. Unregulated and equal to the supplied voltage.

Communication

1 x RS485 channel using Texas Instruments transceiver
1 x CAN channel using Texas Instruments transceiver
1 x CAN/CAN-FD channel using Microchip technology MCP2518FD controller and Texas Instruments transceiver
All of the above protected using GDT/ESD/TVS discrete components
Easily accessible DIP switches for termination on all three lines

SoC

ESP32-WROOM-32E using ESP32-D0WDR2-V3
Xtensa® dual-core 32-bit LX6 microprocessor, up to 240 MHz
448 KB ROM, 520 KB SRAM, 16 KB SRAM in RTC
Equipped with 8MB Flash and 2MB PSRAM

Status LEDs

1 x 3.3V logic power indicator (Blue)
4 x output status indicators (Green: GPIO 25, Yellow: GPIO 33, Orange: GPIO 32, Red: GPIO 23)
1 x programmable RGB WS2812B (GPIO 4). *Data out from this LED is available on the GPIO header (STATUS pin). This data line can be used to control additional WS2812B LEDs in series.*
All except power and status indicators found only on perpendicular plug-in PCB for better visibility.

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Extra headers

8 available GPIOs (5 freely usable, 2 bootstrapped, 1 input only)
HSPI/JTAG pins available as part of the GPIO header
Maximum current per GPIO must not exceed 20mA

Isolated signal input

An isolated signal input pair (Signal IN + Signal GND) linked to GPIO 2 is available via the GPIO connector (Figure 4). The input accepts a LOW 0V or HIGH +3.3VDC – +16VDC signal resulting in an equal logic signal on the attached GPIO which can be read by the esp32.

Physical control / Interaction

1 x USB-C power and data connector
3 x DIP-switches toggling individual termination resistors for RS585, CAN and CAN/CAN-FD
2 x Momentary switches for SoC manual reset and flash (GPIO-0 to GND) functions
1 x JTAG header

WiFi

802.11b/g/n, 802.11n up to 150 Mbps bit rate
A-MPDU and A-MSDU aggregation
0.4 µs guard interval support
Center frequency range of operating channel: 2412 ~ 2484 MHz
On-board PCB antenna

Bluetooth

Bluetooth V4.2 BR/EDR and Bluetooth LE specification
Class-1, class-2 and class-3 transmitter. AFH, CVSD and SBC.

Conformity

The publicly released Stark CMR v2 / SCMR02 units complies with the European directives for CE-marking as stated below:

Radio Equipment Directive 2014/53/EU (RED)
Articles 3.1.a, 3.1.b, 3.2
EN/ETSI 301 489-1 – V2.2.3
EN/ETSI 301 489-3 – V2.3.2
EN/ETSI 301 489-17 – V3.2.4
EN/ETSI 300 328 – V2.2.2
EN/IEC 62368-1
RoHS Directive 2011/65/EU (EN/IEC 62321)

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Accessing the protected features

Removing the front cover

To access the USB-C connector, the momentary buttons (flash and reset) and the DIP-switches, please remove the front cover. To remove it, insert a flat and blunt tool like a flat head screwdriver into the slot as illustrated in figure 2. Gently pry the front towards you by bending the tool sideways and away from the unit. To open using the rightmost slot as shown in figure 2, bend the tool to your right. For the left slot, the opposite bending direction is used.
The location of the USB-C connector, the reset button, the flash button and the DIP-switches are highlighted in figure 6.

Reattaching the front cover

To reattach the front cover, align the posterior tabs of the cover with the slots of the gray plastic casing and push gently until it snaps into place. Please note that the perpendicularly mounted LED PCB can be moved out of its original position when accessing the PCB this way. **Make sure that the right front cover tab is not interfering with the LED PCB when pushing on the cover.** Should this be the case, gently move the LED PCB slightly to the left before repositioning the front cover. A small gap should be visible between the LED PCB and the right edge of the gray plastic cover as can be seen in figure 2.

Removing the connector covers

To remove the upper and lower connector covers, insert a flat and blunt tool like a flat head screwdriver into the slot as illustrated in figure 3. By slightly prying or twisting the tool the cover should snap loose moving the inner side where to tool is inserted outwards (or upwards when referring the viewpoint of figure 3). Pulling the cover slightly might be needed to move it outwards.

The pinout of the GPIO header can be seen in figure 4.
GPIOs 17, 34 and 5 is part of the SPI bus connected to the CAN-FD interface.

Reattaching the connector covers

The cover is reattached by aligning the posterior tabs of the cover with the inner sides of the gray plastic casing and pressing it gently until it snaps back into place as the centrally placed tab of the cover engages with the casing.

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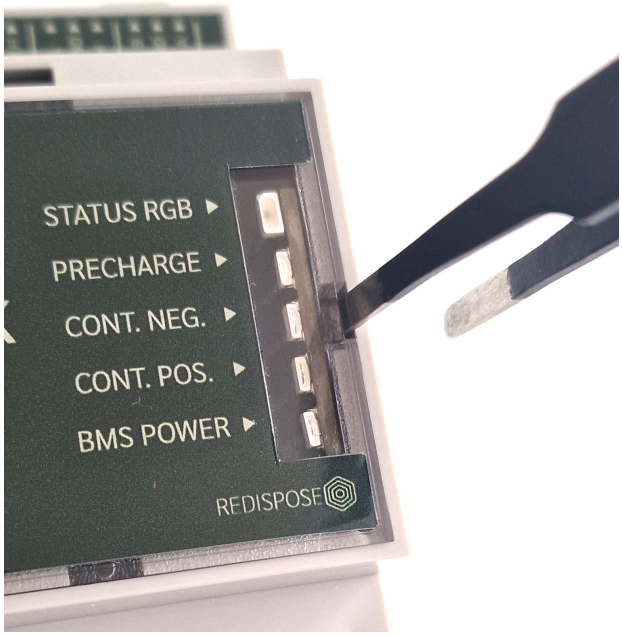


Figure 2: Opening the front cover

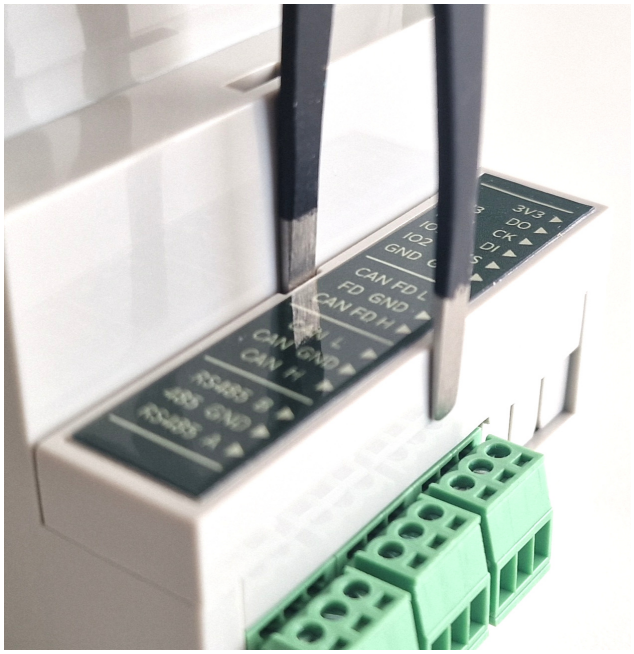
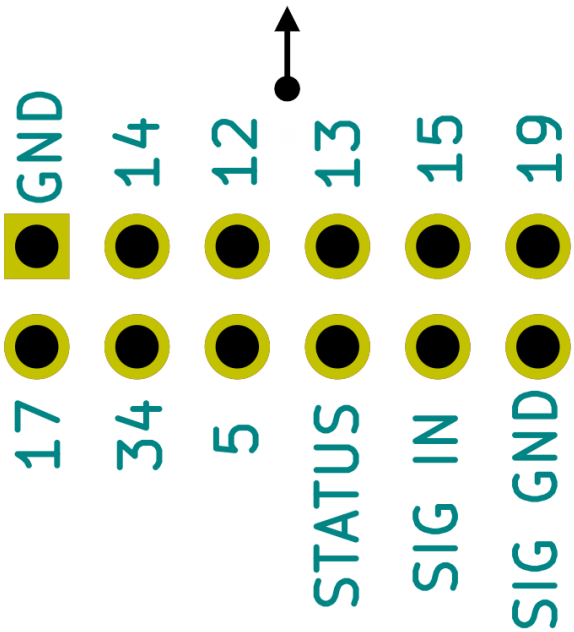


Figure 3: Opening the connector covers

Figure 4: GPIO header location and pinout



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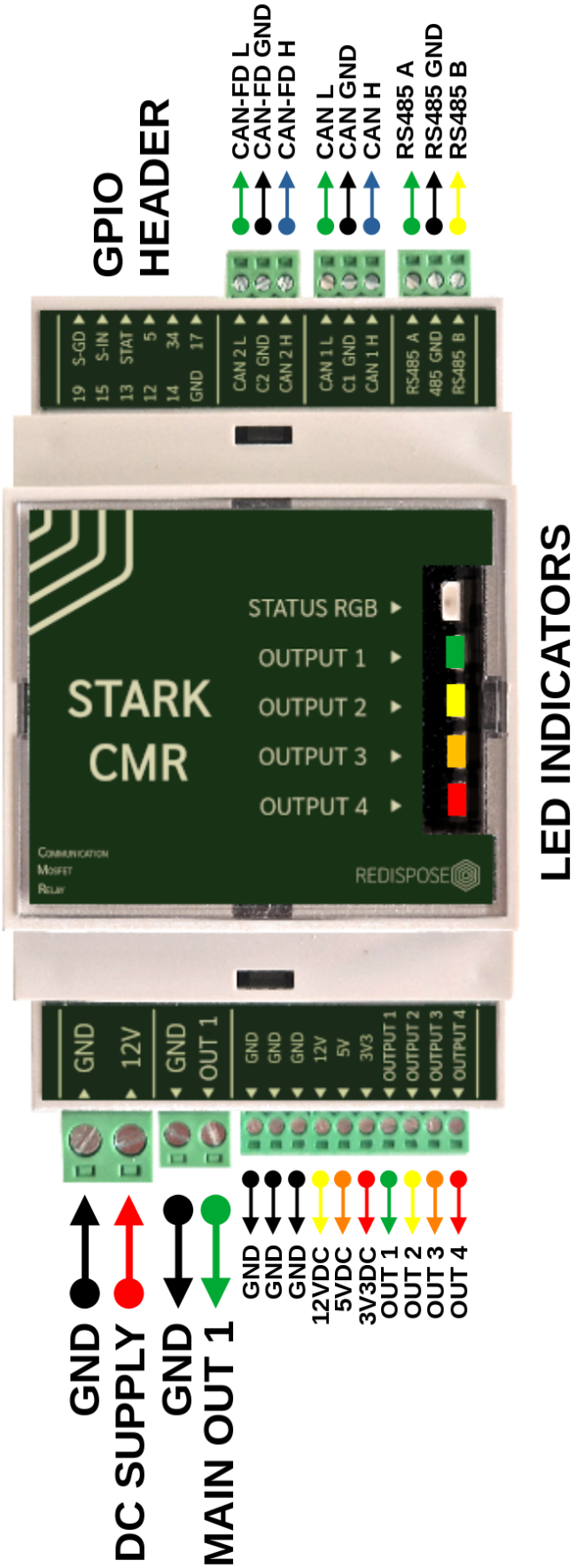

Figure 5: Connector overview and pinout

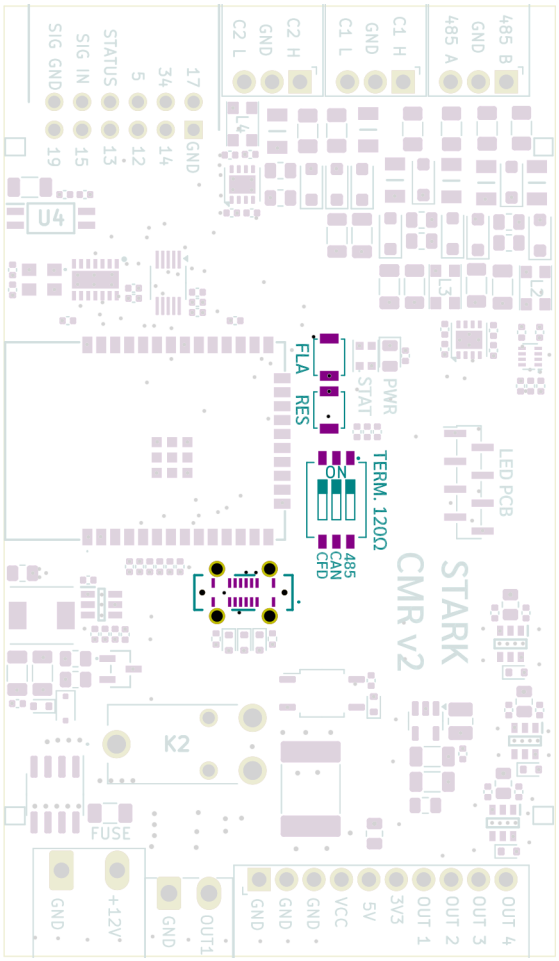

Figure 6: Location of USB-C connector, buttons and DIP-switches

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Getting started

Verify USB connection and basic function

The Stark CMR v2 (SCMR02) is loaded with a simple RGB LED demonstration code when delivered. This software deactivates all power outputs by default for safety reasons.
Note that if not explicitly controlled by the active software, output 4 is on by default.

To get started remove the front cover of the SCMR02 and connect the unit to a computer using the USB-C connector. **Do not connect any other wires at this point.**
This should power the SCMR02 on. The blue on board LED indicating the +3.3VDC status should light up and the RGB status LED should show a rolling animation. The status LED is represented on board as well as on the connected LED PCB.

The SCMR02 is equipped with a CH340X USB to serial port IC. While drivers for this line of ICs are included in newer Linux and MacOS versions, Windows users will need to add appropriate drivers manually if they have not been previously installed.

Verify that a working USB connection has been established between the computer and the SCMR02 by listing the USB devices of the computer. Refer to the instructions of the OS used to find the correct procedure. When the connection is correctly set up the SCMR02 will output informational data over USB when rebooted using the reset button. The baud rate for these messages is 115200.

Uploading software

To upload code to the SCMR02 use any software compatible with the ESP32 line of SoCs. These include but are not limited to “Espressif ESP IDF” extensions, “Arduino IDE” and “Visual Studio Code” with extensions. Out of these three options the Arduino IDE arguably has the most gentle learning curve. See the online documentation for the chosen software for details on how to use eps32 board definitions and uploading software to esp32 SoCs.

As the SCMR02 is equipped with 8MB flash and 2MB PSRAM, the suggested settings for uploading software is as stated below:

Use the full 8MB of flash
Use a partition scheme that supports 8MB
Activate the PSRAM

The SCMR02 supports auto upload and will accept software upload over USB without any button presses. This is dependent on a DTR signal being sent from the computer when uploading well as a reset signal after upload is completed. Should the computer not support these signals a manual process is available. To set the unit in upload mode, press and hold the flash button and press the reset button while still holding the flash button.

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Verifying power outputs and GPIOs

Before connecting any external power sources, please verify that the outputs are activated when the proper GPIOs are given a HIGH signal. Successful activation will light the corresponding output indicator LEDs. Figure 5 shows the indication LEDs placement and color.

The data line of the WS2812B status LED is connected to GPIO 4.

The four power outputs are connected to the following GPIOs:

Output 1:	*GPIO 25*	*Main high power connector **and** secondary output connector*
Output 2:	*GPIO 33*	*Secondary output connector*
Output 3:	*GPIO 32*	*Secondary output connector*
Output 4:	*GPIO 23*	*Secondary output connector*

Externally available GPIOs are easily located by using figure 4.
Detailed info on these GPIOs is listed below.

GPIO 5:	*Available as INPUT and OUTPUT. Outputs PWM signal at boot. Strapping pin.*
GPIO 12:	*Available as INPUT and OUTPUT. Must not be pulled HIGH at boot. Strapping pin.*
GPIO 13:	*Available as INPUT and OUTPUT.*
GPIO 14:	*Available as INPUT and OUTPUT. Outputs PWM signal at boot.*
GPIO 15:	*Available as INPUT and OUTPUT. Outputs PWM signal at boot. Strapping pin.*
GPIO 17:	*Available as INPUT and OUTPUT.*
GPIO 19:	*Available as INPUT and OUTPUT.*

Connecting the external power supply

If the unit operates as expected during the previous steps of the setup, the external DC power supply may be connected at this point. Only use the DC supply connector shown on the bottom right of figure 5 to connect the supply voltage.
Applying the DC supply voltage to any other connector than the specified input connector will void the warranty and may damage the unit.
The accepted input voltage range as well as the output current limits are specified in the “Overview of features - Power” section.
Failure to follow this specification will void the warranty. Over voltage on the input connector will damage the unit. Current output overload on any output, including the GPIO pins, may damage the unit.
External supply voltage and USB power may be simultaneously used. The SoC will be powered when one or both of the above are connected.
When the external DC supply voltage is present, the power output connectors will relay this voltage when activated using the dedicated GPIOs as listed above. As no filtering of the passed through voltage occurs it is of upmost importance to supply a stable voltage to the input.

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Using the hardware communication buses

The hardware communication buses can be utilized using the following GPIOs.

RS485 TX: *GPIO 22*
RS485 RX: *GPIO 21*

The RS485/RS422 half-duplex transceiver on board is hardwired for auto-direction control using the data input pin.

CAN 1 TX *GPIO 27*
CAN 1 RX *GPIO 26*

CAN 1 uses the built in ESP32 controller.

CAN-FD (CAN 2)	*SCK:*	*GPIO 17*
CAN-FD (CAN 2)	*SDI:*	*GPIO 5*
CAN-FD (CAN 2)	*SDO:*	*GPIO 34*
CAN-FD (CAN 2)	*CS:*	*GPIO 18*
CAN-FD (CAN 2)	*INT:*	*GPIO 35*

CAN-FD (CAN 2) uses the MCP2518FD controller connected to the VSPI bus which needs to be defined by the ESP32 software according to the list above. The CAN-FD bus is backwards compatible with classic CAN.

The DIP switch bank controls the termination resistors for each of the three communication buses. The default state of the DIP switches is OFF. The OFF state equals to 0 Ohm while the ON state introduces 120 Ohm termination on the respective bus.

Maintenance

Keep the outside of the unit clean by wiping it with a slightly damp, soft cloth when all connectors are **fully disconnected** from the unit. Do not use strong or corrosive detergents. The inside of the unit and the female connectors may be cleaned with low pressure compressed air from a safe distance, no less than 30 cm.

Troubleshooting

This section will be populated as user feedback is received and common issues that might appear are resolved.

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Non operational or otherwise faulty unit

Should the SCMR02 in any way not operate as expected or described in this document, please contact Redispose AB. Do not attempt to repair or perform any other form of hardware alterations unless this manual explicitly allows it. Interfering with the hardware in any other way, shape or form will void the warranty. Redispose AB reserves the right to deny any service or repairs to units subjected to such interference.

Document revision history

2024-10-06, v0.1, Pre-release version
2024-10-21, v1.0, Initial publication

Redispose AB

Redispose AB is a small company located in the south of Sweden. We focus on small scale development and production of IoT hardware, general software development and consultancy services including educational efforts mainly in the mentioned areas.

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Final notes

This document is subject to changes and updates. The user is obligated to adhere to the latest documentation available at all times. The latest version will always be available to all users upon request or via the product web page.
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