

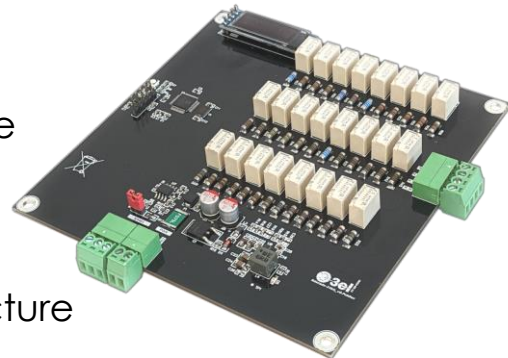
# Programmable Digital Resistance Decade V1.0 Rdecade V1.0



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## Features:

- Digitally controllable resistance setting in 0...1.666665 Ohm range with 1 Ohm resolution
- RS485 interface
- 115200 baud rate, RS485 ID
- Human readable message structure
- OLED display



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## Description:

The Rdecade V1.0 is a microcontroller-based circuit for industrial test and measurement environments featuring a configurable resistor chain covering a range of resistance value from 0 to 1.666665M $\Omega$ . The resulting resistor is 1W rated in the full range.

The Rdecade V1.0 can be controlled and monitored through RS485 bus connected to a 2x16 IO Card or to any other individual system having RS485 interface. There is no dedicated User Interface, the messages are sent and received either using a generic serial messaging tool (Hercules or similar), either from an integrated driver layer in a test and measurement system.

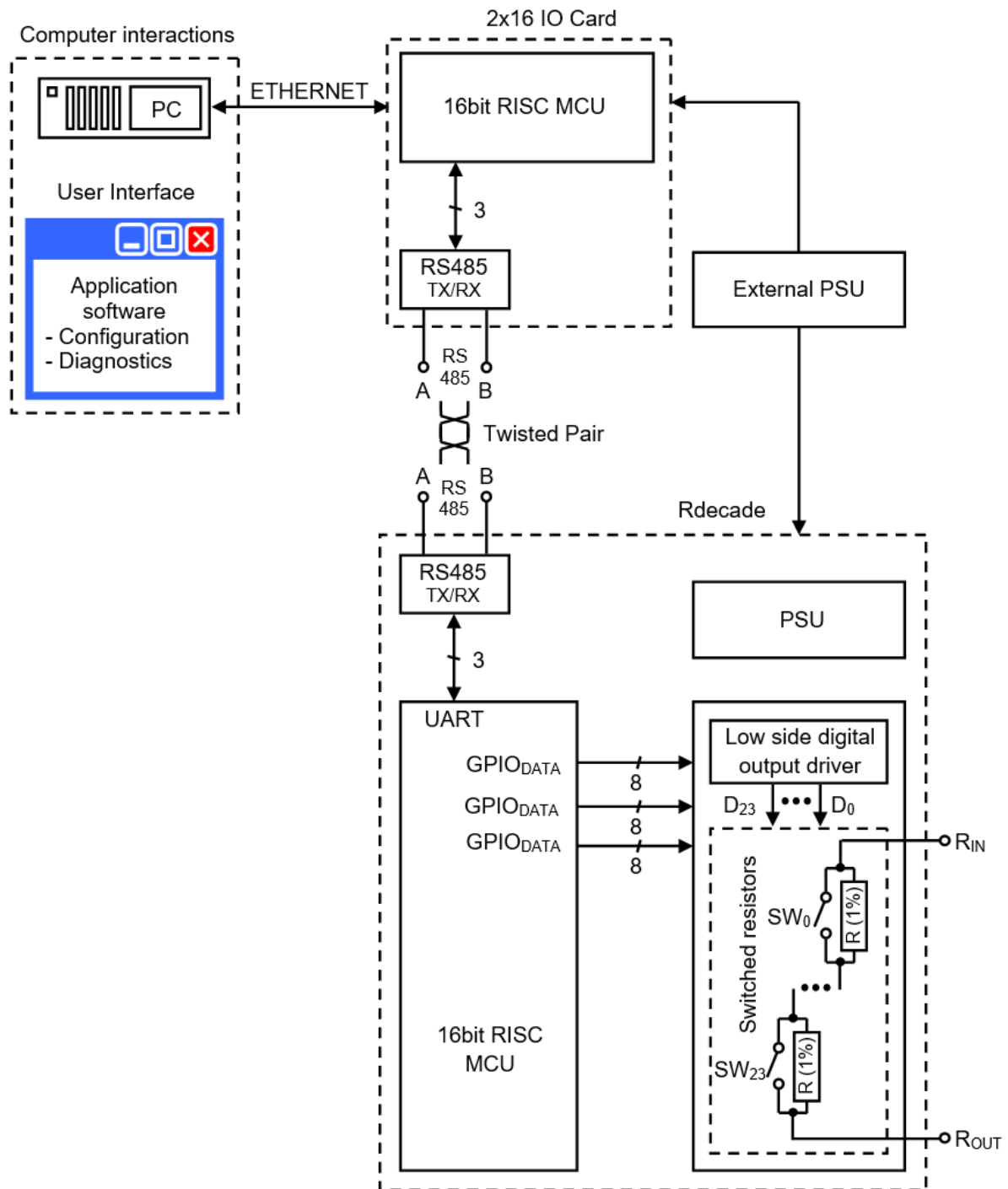
The message structure is human readable and the unit's RS485 ID is stored in the controller's FLASH memory. The unit also has a small display with two lines. The first line shows the resistance value connected to J1 connector, while the second line is scrolled back and forth displaying the last RS485 message and ID value of the unit.

## Block schematic:

- 16bit RISC CPU running at 48MHz clock signal
- RS485 interface
- Internal PSU
- Low latency output control through low side output drivers
- Configurable RS485 ID
- 1% resistor value precision

# Programmable Digital Resistance Decade V1.0

## Rdecade V1.0



### Applications:

- various test and measurement circuits
- calibration system automation

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## Electrical characteristics:

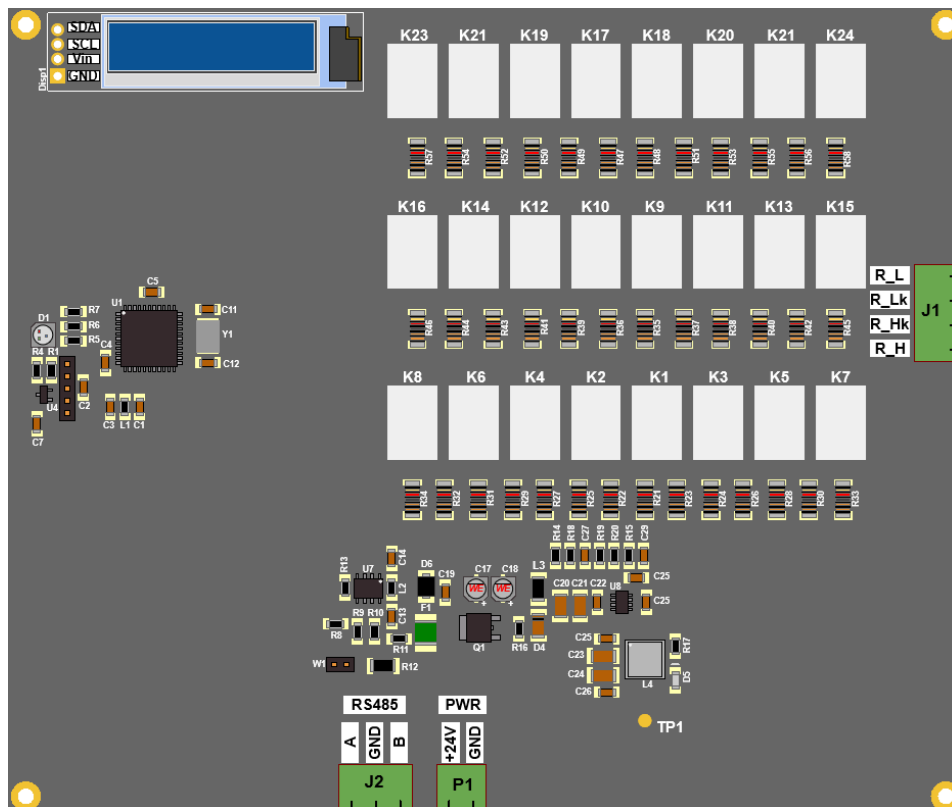
Nominal supply voltage:	24V
Overvoltage protection trigger point:	36V
Undervoltage protection trigger point:	20.6V
Operating temperature range:	15°C ... 45°C
Power consumption:	36mA

## Resistor output:

Resistance range:	0...16666650hm
Resistance value resolution:	10hm
Rated resistor power:	1W
Rated resistor voltage:	250V

## Board schematic symbol and pinout:

For CAD software integration the Rdecade V1.0 has a predefined schematic symbol containing the pinout following the physical connector arrangement of the real board. The inputs and outputs are grouped by functions. At the bottom edge next to the power input connector (P1) there are the communication line connections (J2), while the resistor connections (J1) are on the right edge of the PCB.





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**Basic requirements before use:**

- the Rdecade V1.0 should be mounted on four, 6mm (minimum) tall standoffs ensuring optimal distance from any conductive or electrically sensitive surface and the circuit PCB.
- the Rdecade V1.0 should be powered from an external, primary 24VDC power supply

**Protocol description:**

**ASCII** protocol with line feed termination character ('\n'). Parameters are separated with space.

Requests are sent with the format:

**Command + parameters**

Response is given with format:

**OK + Command + details** if successful

**ERR + Command + details** if failed

**BUSY + Command + details** if device is busy

Multi-line messages are started with the “<” character, this signals that there are more lines to be processed. The last row must start with the “>” character.

Request messages can specify a target, if multiple devices are used. In this case the “@” character is used to represent the **ID** (serial number) of the device. The response is sent back with the received **ID**.

Request messages can also be sent with a checksum, to ensure data integrity. The checksum should be sent at the beginning of messages, after the “^” character. The checksum is calculated from the message data. If the request is sent with checksum, the response will have a checksum value appended. Both **ID** and **CRC** are optional. Commands can also be sent without any data.



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## **Message frame examples**

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### **Example request:**

#Checksum @ID Command Data1 Data2 ... \n

### **Example response (successful):**

#Checksum @ID OK Command Data \n

### **Example response (multi-line):**

#Checksum @ID < Command Data \n

#Checksum @ID Command Data \n

...

...

# Checksum @ID > Command Data \n

### **Example when only ID is used:**

@1 getbaud

@1 OK getbaud 115200

### **Example when no ID is used:**

getbaud

OK getbaud 115200

### **Example response (error):**

#CRC @ID ERR details \n

### **Example with error:**

@1 getbauds

@1 ERR getbauds UNKNOWN COMMAND



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## Measurement functions

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### **Set resistance**

Format:

TX: setresistance <value>

RX: *OK setresistance <value>*

Note1: value: 0...1666665 ohm

Example: set resistance value to 10kOhm

Setresistance 10000

*OK setresistance 10000*

### **Get resistance**

Format:

TX: getresistance

RX: *OK getresistance <value>*

Note1: value: 0...1666665 ohm

Example: get resistance value

getresistance

*OK getresistance 10000*

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## SETUP functions

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### **Set RS485 device ID**

Format:

TX: setdeviceID <ID>

RX: *OK setdeviceID*

Note: ID: 0...65535; default is 0

Example: set device with ID=56

setdeviceID 56

*OK setdeviceID*

### **Get RS485 device ID**

Format:

TX: getdeviceID

RX: *OK getdeviceID <ID>*

Note: ID: 0...65535; default is 0

Example: get device ID

getdeviceID

*OK getdeviceID 56*



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**Get firmware version**

Format:

TX: getfwver

RX: OK *getfwver <value>*

Example:

getfwver

OK *getfwver 1.0*

**Get device name**

Format:

TX: getboardname

RX: OK *getboardname <value>*

Example:

getboardname

OK *getboardname RDECADE24BIT*

**FLASH (EEPROM) memory functions**

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***Initialize the ID value in the FLASH memory with default value (0)***

Format:

TX: FLASHinitcal

RX: OK *FLASHinitcal*

***Write the ID value stored in RAM to the FLASH memory***

TX: FLASHwritecal

RX: OK *FLASHwritecal*

***Read the ID value from FLASH memory and store as RAM value***

TX: FLASHreadcal

RX: OK *FLASHreadcal*



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## **ERROR messages**

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### ***Unknown command***

TX: measurexyz 1 2

RX: *ERR measurexyz UNKNOWN COMMAND*

### ***Bad data format***

missing parameter or less than required parameters (measure command requires 2 parameters, missing second input)

TX: measure 1

RX: *ERR measure data format*

### ***One or more parameters are out of range***

for example, input=6 is out of range

TX: measure 1 6

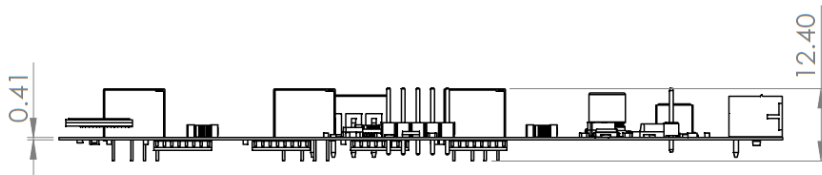
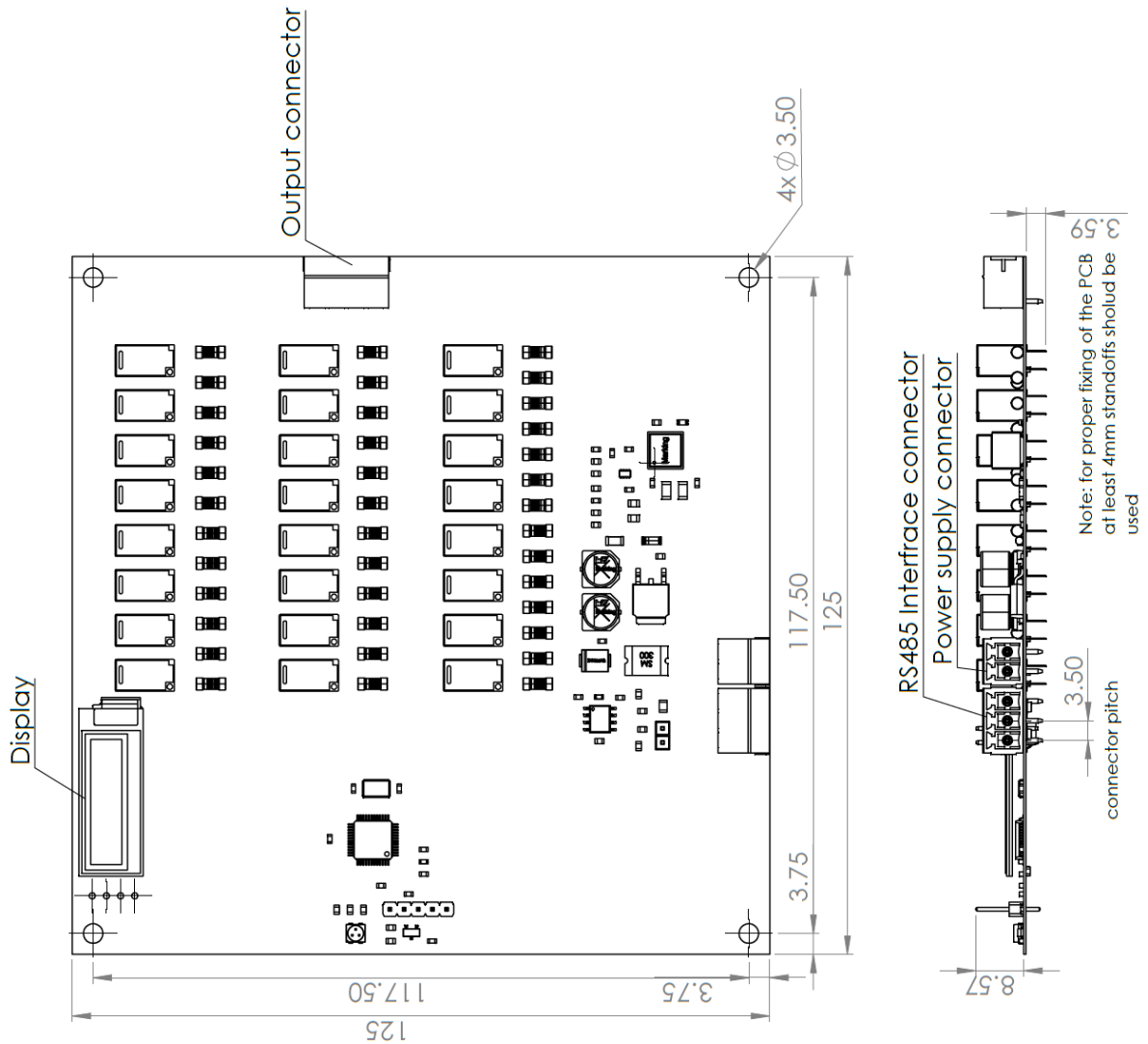
RX: *ERR measure data range*



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## Mechanical drawings:



3d view

