

Device Control Board

The programmable universal device control board has been developed for managing various electrical appliances, according to preset parameters. It has four independent relays, which, depending on the connected sensor readings, positions of the switch and/or timers, connect or disconnect the power supply to selected electric devices. The device control board can be used alone or be integrated in to other devices.

All device control board settings can be sent to a computer and saved as separate files. This allows you to quickly change the board settings and application.

Applications

- Home automation
- Various electronic devices design and manufacturing
- Various automation equipment manufacturing
- Rotational speed, temperature, voltage 0-5V and 0-20mA (current loop) current measurement

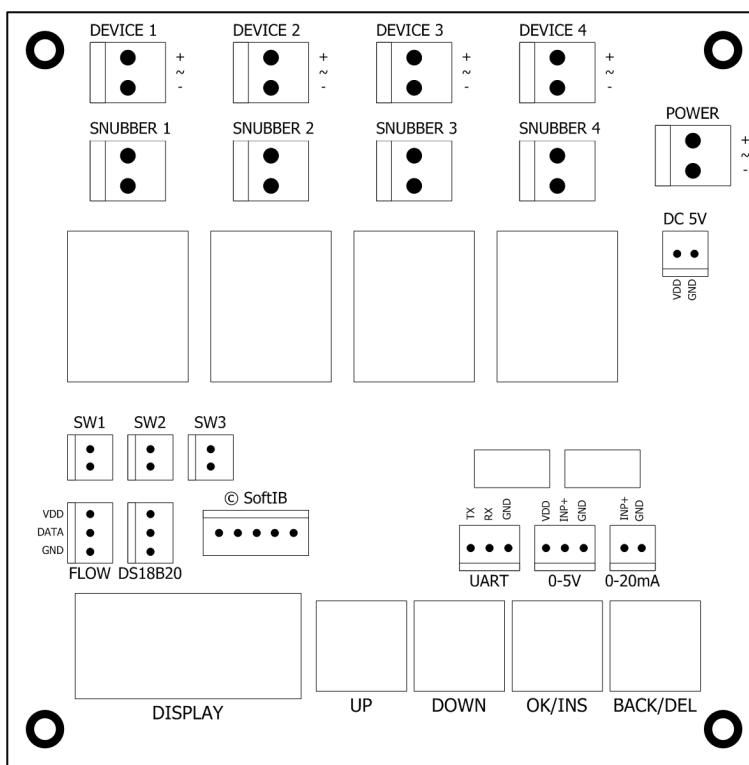
Features

- 3 switch connectors
- Rotation sensor connector with 5V power supply
- Temperature sensor DS18B20 connector
- 0-5V voltage meter connector with 5V power supply
- 0-20mA current (current loop) meter connector
- 4 independent timers with a day of the week indications
- 4 on/off sequences
- Serial connection to a computer
- 4-digit LED indicator and four menu buttons
- Execution mode continuation after power failure
- Inductive equipment control (each relay can be connected to the appropriate snubber circuit)
- A separate debounce time for each event from 10ms to 90s
- Heavy relay management to run high-power devices

Disclaimer

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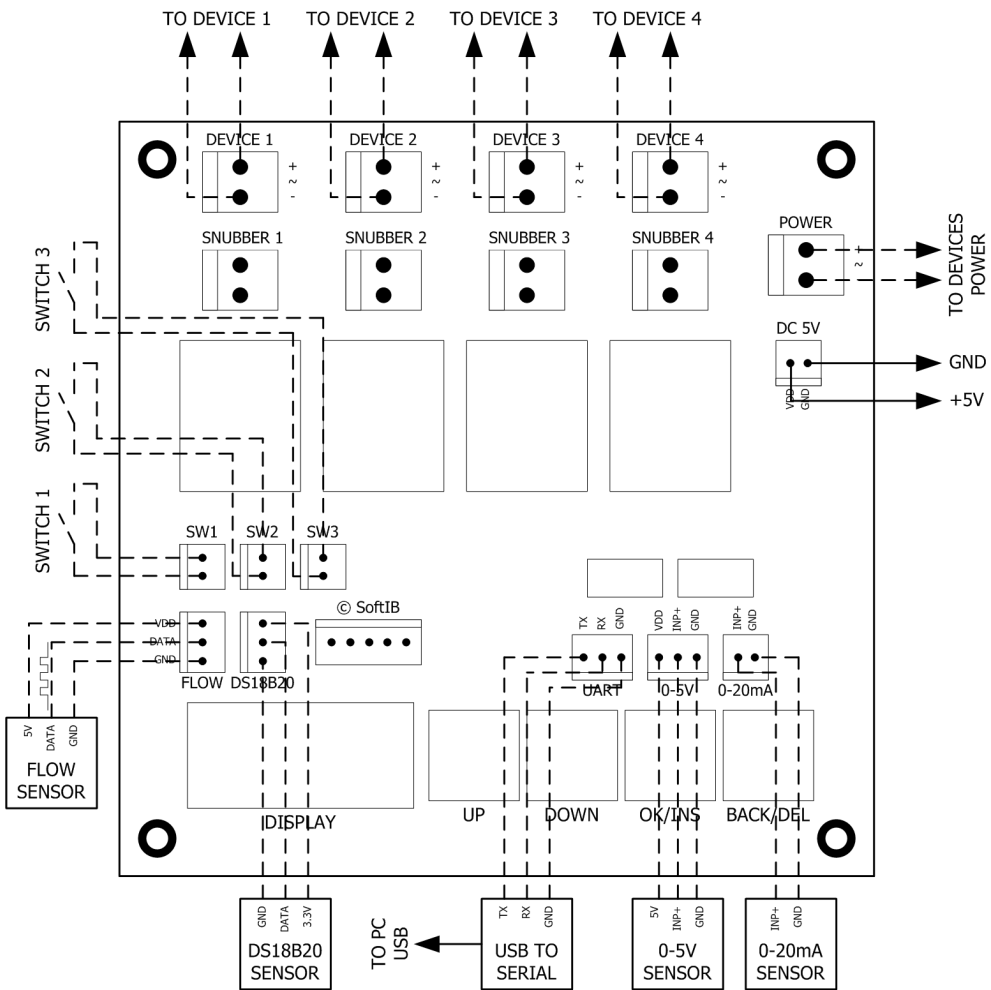
Pinouts



Connector	Pin Name	Function
DEVICE 1...4	+	Enabled equipment DC power supply "+" or AC
	-	Enabled equipment DC power supply "-" or AC
SNUBBER 1...4		Additional snubber circuit connectors
POWER	+	Attachable equipment DC power supply "+" or AC
	-	Attachable equipment DC power supply "-" or AC
DC 5V	+	Device control board 5V DC power supply "+"
	-	Device control board 5V DC power supply "-"
SW1...3		Switch connectors
FLOW	VDD	Rotation sensor power supply 5V DC "+"
	DATA	Rotation sensor data pulse
	GND	Rotation sensor ground
DS18B20	VDD	Temperature sensor DS18B20 power supply 3.3V DC "+"
	DATA	Temperature sensor DS18B20 data
	GND	Temperature sensor DS18B20 ground
UART	TX	Serial connection TX pin for data transmission
	RX	Serial connection RX pin for data receiving
	GND	Serial connection ground

0-5V	VDD	0-5V input 5V DC power supply "+"
	INP+	0-5V input voltage
	GND	0-5V input ground
0-20mA	Inp+	0-20mA input amperage
	GND	0-20mA input ground

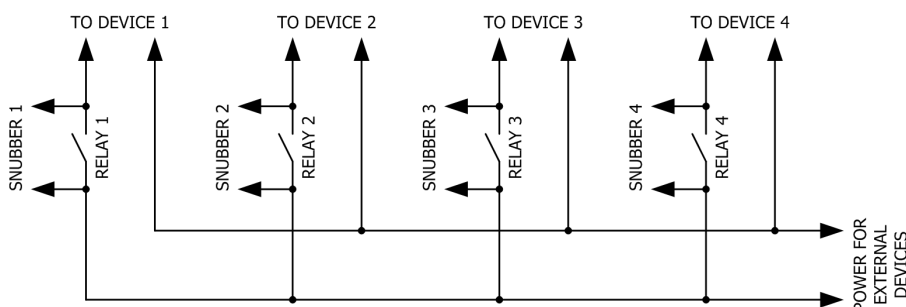
Typical Applications And Test Circuit



Warning!

Only appropriate voltage CMOS/TTL signals are allowed on the RX/TX pins.
Do not use RS-232 or similar voltage signals!

Controlled devices power circuitry



If the connected load is inductive (another relay, electromagnetic valve, etc.), it is necessary to use an additional snubber circuit to avoid device control board emergency shut-off or impairment of its operation. A simple snubber circuit consists of a carbon resistor (with a power of at least 2W) and an apolar capacitor (the voltage 400-1000V) connected in series. Their values can simply be calculated as followed:

- resistor impedance - 0.5...1 ohm per load volt
- capacitor - 0.5...1 micro farad per load ampere

Absolute Maximum Ratings

Operating temperature	-40°C...+85°C
Voltage on any pin with respect to ground	-0.5V...VDD+0.5V
Maximum operating voltage	5.5V
DC current per pin	20.0mA
External devices supply AC voltage	240V
External devices supply total AC current	10A
External devices supply DC voltage	24V
External devices supply total DC current	10A
Load current for a single external device to AC power connector	7A
Load current for a single external device to DC power connector	10A

Electrical Characteristics

Operating voltage*1	5V
Power consumption (all 4 relays in the off position)	0.2A
Power consumption (all 4 relays in the on position)	0.5A
UART settings	baud=9600 data=8 parity=none stop=1
Clock frequency tolerance	± 50ppm
0-5V input and 0-20mA input measurement error*1	± 3%

*1 The supply voltage accuracy is directly dependent on the 0-5V and 0-20mA input measurement accuracy. For example, if the supply voltage is less than 0.5V (10%), the measurement error is increased by 10%.

General Description

The equipment control board has two basic modes of operation. In configuration mode you can navigate through the menu and set all of the necessary parameters. In execution mode the menu is not available and instead, shown are the current relay positions that are changed depending on the switch and sensor events, according to the parameter values, as well as a timer control. Immediately after the power supply connection, the first menu item is shown (01) - execution mode activation. If there has been an active execution mode before and it is not suspended, then after the power supply connection, the execution mode is activated with the same relay state as it was before a power failure.

All set parameters are stored permanently in the EEPROM memory where they remain, even if the board is not connected to a power source for a long time. Date and time counting without an added power supply persists for 10 days. Similarly, the relay state remains the same for 10 days after there has been a power failure.

The device control board operation is based on events rather than on certain conditions or values. An event happens when there is a change in the position of a switch or the value of a sensor. For example, turning a switch on makes a switching event, or when the temperature drops and reaches the specified value, there is a reduction event.

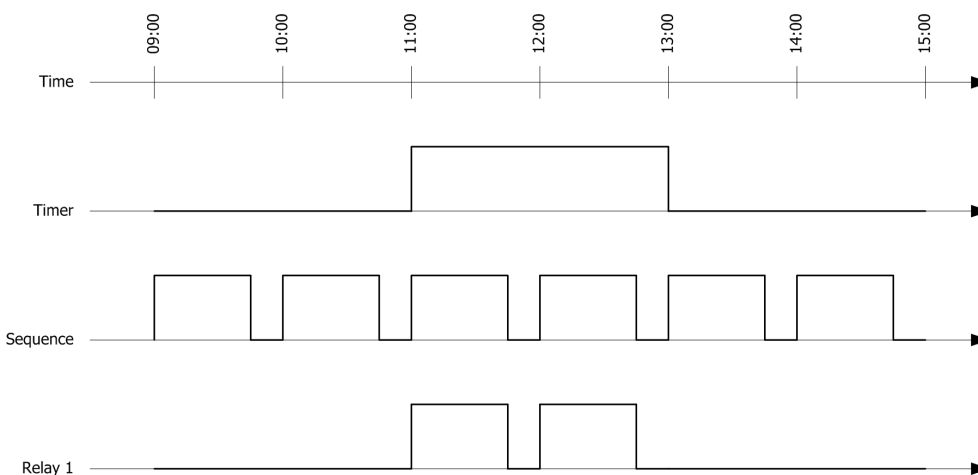
All four relay positions should be specified for each event. Possible relay positions are described in the table below. If an event is given to change a relay position and if a number of other events are affected by the same relay, then it is only switched on if all events indicate the relay switch on. If any one of the events indicate the relay off, then the relay is turned off. No sequence is also executed if any of the events indicate to turn off a relay. In addition, if one or more timers are set to turn off a relay during its duration, it will be turned off and no other events will affect the actual state of the relay. Similarly, if the timer indicates the relay to turn on, but one of the events to turn it off, the relay state will be turned off.

Timers and sequences

Equipment permitted (relay position on) and prohibited (relay position off) operations are shown by a timer that works in conjunction with the events (if the timer and events are affecting the same relays). The timers can also act alone without any of the events, if none of the events affect the relays specified by the timer.

The sequences execute a device or several devices turning on or off automatically over the specified periods and durations. If during the execution sequence, the power supply current is interrupted, the sequence is executed from the beginning once power is restored.

The result of a timer and a sequence interaction for one relay (Relay 1) is shown in the figure below. The timer off condition is set from 13:00 until 11:00, while the sequence is started at 09:00 and continues until 15:00. The total time period of the sequence is one hour. During that time, the relay status is switched on for 45 minutes and off for 15 minutes.



Menu

The current menu item is shown on the display as the first two digits from 01 to 12. Moving through the menu items can be done with the **UP** and **DOWN** buttons. The **OK** button performs the activation of the current menu item. If the menu item has a submenu, it is displayed as the last two digits of the display separated by a point. If a menu item performs an entry of parameters, the first data entry field is displayed. In other cases, the menu activation performs a certain task. For example, activating the menu 03 the first submenu (01.03) is displayed. To return from a submenu to the menu, press the **BACK** button.

All menu items with submenus and their detailed descriptions are presented in the table below. For data-fill fields, movement between them and filling them, see the description below the table.

Menu	Submenu	Description
01		Execution mode activation. The display shows the current 4 relay positions. Stop the execution mode by pressing and holding the BACK button for at least 3 seconds.
02		Date and time settings. The display shows the input field for the year, then the month, the day, the hour and the minutes. Format: YYYY> MM.DD> HH.MM.
03		Setting the parameters of the three switches. The display shows the input field of 4 relays, after that, the debounce time. Format: RRRR > BB.BB.
	01	1 switch on event parameters setting.
	02	1 switch off event parameters setting.
	03	2 switch on event parameters setting.
	04	2 switch off event parameters setting.
	05	3 switch on event parameters setting.
	06	3 switch off event parameters setting.
04		Setting the parameters of the rotation sensor. The display shows the input field of 4 relays, then the rotation speed (RPM) and the debounce time. Format: RRRR > SSSS > BB.BB. To display the current value of the rotation speed (field SSSS), press and hold the OK button for at least 3 seconds, but to delete the current value, press and hold the BACK button for at least 3 seconds.
	01	1 increase event parameters setting.
	02	1 decrease event parameters setting.
	03	2 increase event parameters setting.
	04	2 decrease event parameters setting.
05		Setting the parameters of the temperature sensor. The display shows the input field of 4 relays, then the temperature and the debounce time. Format: RRRR > TTT.T> BB.BB. To display the current value of the temperature (field TTT.T), press and hold the OK button for at least 3 seconds, but to delete the current value, press and hold the BACK button for at least 3 seconds.
	01	1 increase event parameters setting.
	02	1 decrease event parameters setting.
	03	2 increase event parameters setting.
	04	2 decrease event parameters setting.
06		Setting the parameters of the 0-5V voltage meter. The display shows the input field of 4 relays, then the voltage and the debounce time. Format: RRRR > VV.VV > BB.BB. To display the current value of a voltage (field VV.VV), press and hold the OK button for at least 3 seconds, but to delete the current value, press and hold the BACK button for at least 3 seconds.

	01	1 increase event parameters setting.
	02	1 decrease event parameters setting.
	03	2 increase event parameters setting.
	04	2 decrease event parameters setting.
07		Setting the parameters of the 0-20mA current meter. The display shows the input field of 4 relays, then the current and the debounce time. Format: RRRR > AAA.A > BB.BB. To display the current value of a current (field AAA.A), press and hold the OK button for at least 3 seconds, but to delete the current value, press and hold the BACK button for at least 3 seconds.
	01	1 increase event parameters setting.
	02	1 decrease event parameters setting.
	03	2 increase event parameters setting.
	04	2 decrease event parameters setting.
08		Setting the timer parameters. The display shows the input field of 4 relays, then days of the week, then on and off times. Format: EEEE > DDDD > DDD > HH.MM > HH.MM.
	01	1 timer parameters setting.
	02	2 timer parameters setting.
	03	3 timer parameters setting.
	04	4 timer parameters setting.
09		Setting sequence parameters. The display shows the input field for the sequence phase duration and switched position, then the total length of the sequence and 4 relay positions. Format: SS.OO > LLLL > EEEE. The relay state field indicates the required relay states immediately after the sequences has been executed. This relay position is a priority and, if specified as on or off, it immediately switches the corresponding relay positions.
	01	1 sequence parameters setting.
	02	2 sequence parameters setting.
	03	3 sequence parameters setting.
	04	4 sequence parameters setting.
10		Display of the relays turned on position in hours. To delete the selected relays turned on time, press and hold the BACK button for at least 3 seconds.
	01	1 relay locked in the time in hours.
	02	2 relay locked in the time in hours.
	03	3 relay locked in the time in hours.
	04	4 relay locked in the time in hours.
11		Serial communication mode activation. Press the BACK button to stop the serial communication mode and return to the menu.
12		Erasing all parameters. To return to the menu, press the BACK button. To delete all the parameters, press and hold the BACK button for at least 3 seconds.

Data input field formats and setting ranges:

YYYY	Year (2015...2099)
MM.DD	Month (01...12) and day (01...28/29/30/31)
HH.MM	Hours (00...23) and minutes (00...59)

RRRR	4 relay positions: <ul style="list-style-type: none"> • - - do nothing • □ - turn on relay • ▣ - turn off relay • - start the first sequence • 2 - start the second sequence • 3 - start the third sequence • 4 - start the fourth sequence
BB.BB	Debounce time (00.01...90.00)
SSSS	Rotation speed RPM (0060...9000)
TTT.T	Temperature in degrees Celsius (-55.0...125.0)
VV.VV	Voltage in volts (00.00...05.00)
AAA.A	Current in milliamperes (000.0...020.0)
DDDD	Days of the week: Monday, Tuesday, Wednesday, Thursday; possible states: <ul style="list-style-type: none"> • - - relay settings inactive • □ - relay settings active
DDD	Days of the week: Friday, Saturday, Sunday; possible states: <ul style="list-style-type: none"> • - - relay settings inactive • □ - relay settings active
SS.OO	Sequence phase duration in minutes (15 ... 90) and on-state duration in minutes (01 ... 89)
LLLL	Total sequence execution duration in minutes (0015 ... 0720)
EEEE	4 relay positions for the timers and sequences end positions: <ul style="list-style-type: none"> • - - do nothing • □ - turn on relay • ▣ - turn off relay

The active value entry field is represented by blinking 1, 2 or 4 digits. Press **UP** to increase the current value and the **DOWN** button to decrease it. Holding one of these buttons down, the value is increased in increments of 1, 10 or 100, depending on the value of the field. Reaching the maximum or minimum value, the field value is changed to the opposite.

Press the **OK** button to move to the next input field. Reaching the end of the input field row, all field values are stored in memory. Press **BACK** to move to the previous field. By reaching the top row of the input fields, you will return to the menu or submenu without saving the field values in memory.

Device control board application examples

Several example applications, connection diagrams and the installation of the required parameters of the control board are explained below. All examples have been tested either under real conditions or simulating actual conditions. Power supply interruption simulations have also been carried out in the various stages of implementation.

1. Automatic store space lighting with additional lighting outside business hours

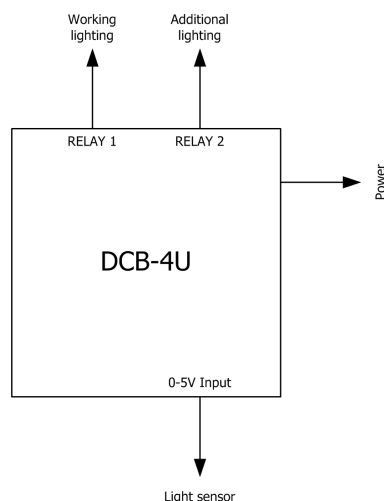
The store's business hours are from 10:00 to 20:00 on weekdays. Saturdays, Sundays are closed. Getting started takes place an hour before the store is opened, but completion - an hour after the store is closed. The store space lighting should take place from 09:00 to 21:00 with additional lighting being on for the rest of the time, from 21:00 to 09:00 on weekdays and during the whole weekend.

Required:

- the device control board

- a working lighting electrical circuit connected to the DEVICE 1 port (relay 1)
- additional lighting electrical circuit connected to the DEVICE 2 port (relay 2)
- a SoftIB DCB-LS light sensor, which is connected to a 0-5V voltage meter connector and placed outside the room to be lit

Wiring diagram:



Device control board configuration:

- set the **DCB-4U** to the configuration mode
- select the menu item 12 and hold the **BACK** button down for at least 3 seconds to clear all preset parameters
- **select the menu item 08 (timer) and the submenu 01**
- in the first relay input field set the value "r", while in the rest of the relay input fields set the value "L"
- in the Monday to Friday input fields set the value "□", and in the Saturday and Sunday input fields set the value "–"
- in the time from the hour and minute input field, enter the value 09:00
- in the time to the hour and minute input field, enter the value 21:00
- **select the menu item 08 (timer) and the submenu 02**
- in the second relay input field set the value "r", while in the rest of the relay input fields set the value "L"
- in the Monday to Friday input fields set the value "□", and in the Saturday and Sunday input fields set the value "–"
- in the time from the hour and minute input field, enter the value 21:00
- in the time to the hour and minute input field, enter the value 09:00
- **select the menu item 08 (timer) and the submenu 03**
- in the the second relay input field set the value "r", while in the rest of the relay input fields set the value "L"
- in the Monday to Friday input fields set the value "–", and in the Saturday and Sunday input fields set the value "□"
- in the time from the hour and minute input field, enter the value 00:00
- in the time to the hour and minute input field, enter the value 00:00
- **select the menu item 06 (0-5V voltage meter) and the submenu 01**
- in the first and second relay input fields set the value "L", while in the rest of the relay fields set the value "–"
- in the voltage input field, enter the value 02.10
- in the debounce input field, enter the value 90.00 (90 seconds is a long enough period to avoid accidental switching when the light sensor is temporarily exposed to extra lighting like passing cars)
- **select the menu item 06 (0-5V voltage meter) and the submenu 02**
- in the first and second relay input fields set the value "r", while in the rest of the relay fields set the value "–"
- in the voltage input field, enter the value 02.00 (the reduction event value should be selected slightly smaller than the increase event value; choosing the same values or a slightly higher reduction event value, there is a good chance that there will be uncontrolled re-switching)
- in the debounce input field, enter the value 90.00

After completion of the configuration, activate the execution mode with the menu item 01, and make sure that the **DCB-**

4U is functioning properly.

Explanation:

- **menu item 08 (timer) submenu 01** - the relay will turn on the business hour lights from 9:00 to 21:00 on weekdays. The actual value of the relay will change the light sensor value
- **menu item 08 (timer) submenu 02** - the relay will turn on the additional lights from 9:00 to 21:00 weekdays. The actual value of the relay will change the light sensor value
- **menu item 08 (timer) submenu 03** - the relay will turn on additional lights from 0:00 to 00:00 on weekends. The actual value of the relay will change the light sensor value
- **menu item 06 (0-5V voltage meter) submenu 01** - two relays will turn off the lighting when the ambient lighting reaches and exceeds the specified level
- **menu item 06 (0-5V voltage meter) submenu 02** - two relays will turn on the lighting when the ambient light falls below the specified level

The most convenient way to read the lighting level sensor at which to switch the artificial lighting on is to go by senses. On the voltage value input field, press and hold the **OK** button for at least 3 seconds until the voltage value is displayed. The displayed voltage value is constantly changing as a response to changes in the ambient light.

The Business hour lighting and the addittonal lighting electric circuit MUST NOT exceed the voltage and power consumption levels that are shown above in the electrical parameters, otherwise, additional high-power relays, that are connected to the business hour and additional lighting circuits should be used instead.

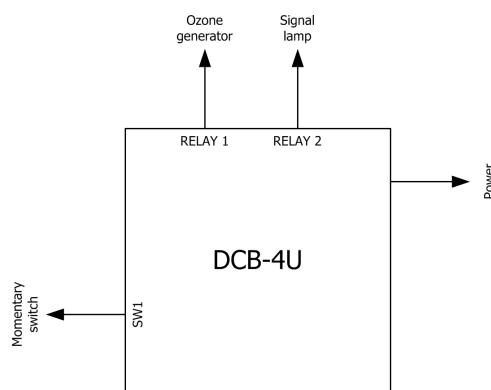
2. Workspace disinfection and air purification with ozone

Workspace disinfection and air purification with ozone must be carried out at a time when people are not present in the room. In addition, some time must be allowed after stopping the generation to fully decompose the ozone. In this case, the workspace ozonation is activated by an employe and it starts a short while after activation. During the period from 20:00 to 08:00 people are not indoors.

Required:

- the device control board
- an ozone generator connected to the DEVICE 1 port (relay 1)
- a signal light connected to the DEVICE 2 port (relay 2)
- a momentary switch that is connected to port SW1

Wiring diagram:



Device control board configuration:

- set the **DCB-4U** to the configuration mode
- select the menu item 12 and hold the **BACK** button for at least 3 seconds to clear all preset parameters
- **select the menu item 03 (switch SW1) and the submenu 01**
- in the first relay input field set the value to "1" and in the second relay input field set the value "1", while in the rest of the relays set the input value "-"
- in the debounce input field, enter the value 00:02 (20 milliseconds is a long enough period to avoid the effects of a switch "sparking")

- **select the menu item 09 (sequences) and the submenu 01**
- in the step length input field, enter the value 60
- in the state length input field, enter the value 30
- in the sequence length input field, enter the value 0720
- in the second relay input field set the value "1", while in the rest of the relay input fields set the value "-"
- **select the menu item 08 (timer) and the submenu 01**
- in the first relay input field set the value "1", while in the rest of the relay input fields set the value "-"
- in the Monday to Sunday input fields set the value "0"
- in the time from the hour and minute input field, enter the value 04:00
- in the time to the hour and minute input field, enter the value 20:00

After completion of the configuration, activate the execution mode with the menu item 01, and make sure that the **DCB-4U** is functioning properly.

Explanation:

- **menu item 03 (switch SW1) submenu 01** - the first relay switches on the operation sequence and the second relay signal lights up to indicate that the ozonation process is activated. Because we have set up the timer to forbid the activation of the first relay, the ozonation process can be activated at any time, but its actual start time will be at 20:00
- **menu item 09 (timer) submenu 01** – a sequence will be executed (execution duration of 12 hours) during which the ozone generation will be turned on for half an hour and then turned off for half an hour, then on again, then off again and so on. Additionally, after completion of the sequence the signal light will be turned off (second relay off position)
- **menu item 08 (timer) submenu 01** - the ozone generator operation will be prohibited during the period from 04:00 to 20:00. Such a solution would also work in the case of a power failure during the operation of the ozone generator, after which, the execution sequence is restarted from the beginning and, as it lasts for 12 hours, the ozone generator operation may take longer and happen at an inopportune time. In this situation, the signal light remains lit indicating a power failure.

The sequence length, steps and on/off times can be freely adjusted according to your needs. In this case, the ozone generator is running for half an hour, and is turned off for the same period of time, allowing it to cool down and for the ozone to react with the surrounding organic and inorganic substances.

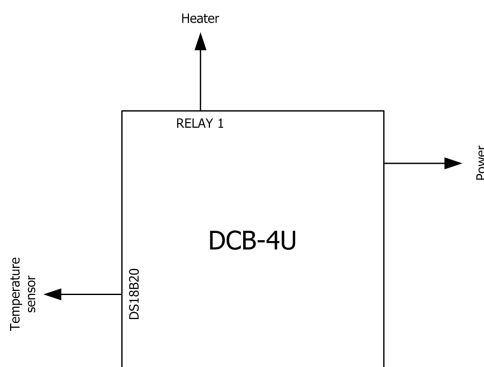
3. Automatic room temperature maintenance within certain limits (climate control)

In simple terms, it is assumed that the constant external air temperature is lower than the required temperature indoors and the room requires only to be heated. This simplified version may be supplemented by air humidification, cooling, etc., but this option is not discussed here. The required room temperature is between 23°C to 27°C.

Required:

- the device control board
- a heater which is connected to the DEVICE 1 port (relay 1)
- a DS18B20 temperature sensor, which is connected to the port DS18B20

Wiring diagram:



Device control board configuration:

- set the **DCB-4U** to the configuration mode
- select the menu item 12 and hold the **BACK** button down for at least 3 seconds to clear all preset parameters
- **select the menu item 05 (temperature) and the submenu 01**
- in the first relay input field set the value "L", while in the rest of the relay input fields set the value "-"
- in temperature input field, enter the value 027.0
- in the debounce input field, enter the value 60.00 (60 seconds to stabilize the temperature measurement)
- **select the menu item 05 (temperature) and the submenu 02**
- in the first relay input field set the value "r", while in the rest of the relay input fields set the value "-"
- in the temperature input field, enter the value 023.0
- in the debounce input field, enter the value 60.00 (60 seconds to stabilize the temperature measurement)

After completion of the configuration, activate the execution mode with the menu item 01, and make sure that the **DCB-4U** is functioning properly.

Explanation:

- **menu item 05 (temperature) submenu 01** - the first relay will be turned on when the temperature reaches and exceeds 27°C
- **menu item 05 (temperature) submenu 02** - the first relay will be turned off when the temperature reaches and falls below 23°C

The heater power consumption MUST NOT exceed the power consumption levels that are shown above in the electrical parameters, otherwise, high-power relays that are connected to the heater should be used instead.

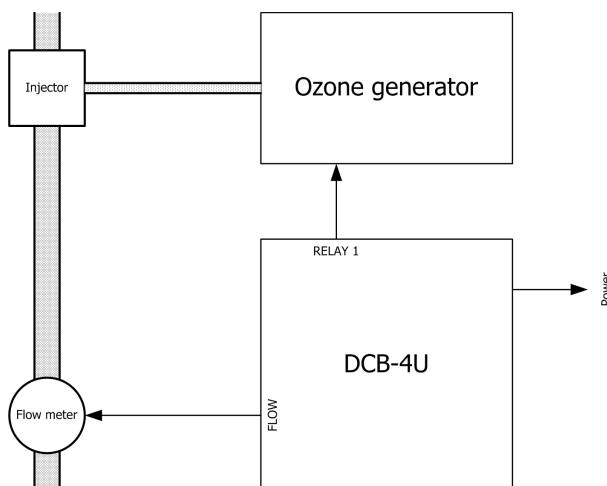
4. Water enrichment with ozone for disinfection

Here is a situation when the water enrichment with ozone is carried out with the help of an injector. An ozone generator where the ozone flows through tubes to the injector is needed. The injector and the water velocity meter should be placed directly in the water transfer pipe.

Required:

- the device control board
- an ozone generator which is connected to the DEVICE 1 port (relay 1)
- a water flow meter that is connected to the flow sensor FLOW port

Wiring diagram:



Device control board configuration:

- set the **DCB-4U** to the configuration mode
- select the menu item 12 and hold the **BACK** button down for at least 3 seconds to clear all preset parameters
- **select the menu item 04 (flow sensor) and the submenu 01**

- in the first relay input field set the value "1", while in the rest of the relay input fields set the value "--"
- in speed (RPM) input field, enter the value 0600
- in the debounce input field, enter the value 01.00 (1 second for the measurement stabilization)
- **select the menu item 04 (flow sensor) and the submenu 02**
- in the first relay input field set the value "1", while in the rest of the relay input fields set the value "--"
- in the speed (RPM) input field, enter the value 0480 (the reduction event value should be entered slightly smaller than increase event value; choosing the same values or setting the reduction event value a little higher, there is a good chance that there will be uncontrolled re-switching)
- in the debounce input field, enter the value 05.00 (5 seconds for the measurement stabilization)

After completion of the configuration, activate the execution mode with the menu item 01, and make sure that the **DCB-4U** is functioning properly.

Explanation:

- **menu item 04 (flow sensor) submenu 01** - the first relay will be switched on when the RPM reaches and exceeds 600
- **menu item 04 (flow sensor) submenu 02** - the first relay will be switched off when the RPM drops to 480

The turn off debounce time of 5 seconds is selected so that a fast-changing water flow does not end up constantly turning the ozone generator off and on. This may be applicable where fast flushing and other work is done.

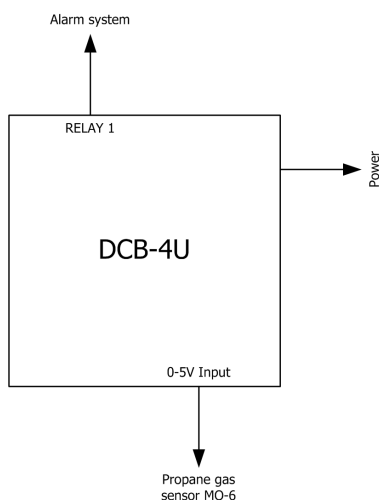
5. Propane gas leak alarm

The propane gas leak alarm timely warns about an extinguished gas flame in the kitchen or any other leakage from the gas cylinder to the stove. It can also be used where rooms are heated with gas or somewhere else.

Required:

- the device control board
- an alarm system connected to the DEVICE 1 port (relay 1)
- a SoftIB DCB-MQ sensor socket with an inserted MQ-6 sensor, which is connected to a 0-5V voltage meter port

Wiring diagram:



Device control board configuration:

- set the **DCB-4U** to the configuration mode
- select the menu item 12 and hold the **BACK** button down for at least 3 seconds to clear all preset parameters
- **select the menu item 06 (0-5V voltage meter) and the submenu 01**
- in the first relay input field set the value "1", while in the rest of the relay input fields set the value "--"
- in the voltage input field, enter the value 03.50
- in the debounce input field, enter the value 05.00 (5 seconds for the measurement stabilization)
- **select the menu item 06 (0-5V voltage meter) and the submenu 02**

- in the first relay input field set the value "1", while in the rest of the relay input fields set the value "-"
- in the voltage input field, enter the value 03.00 (the reduction event value should be entered slightly smaller than increase event value; choosing the same values or setting the reduction event value a little higher, there is a good chance that there will be uncontrolled re-switching)
- in the debounce input field, enter the value 05.00 (5 seconds for the measurement stabilization)

After completion of the configuration, activate the execution mode with the menu item 01, and make sure that the **DCB-4U** is functioning properly.

Explanation:

- **menu item 06 (0-5V voltage meter) submenu 01** – the first relay will be switched on when the sensed value reaches and exceeds 3.5V
- **menu item 06 (0-5V voltage meter) submenu 02** - the first relay will be turned off if the sensed value decreases and drops below 3V

The voltage value at which to turn the alarm on and off must be determined experimentally. They may differ significantly from the values specified here, as it is dependent on the set of the sensor load resistance (sensitivity) for the DCB-MQ sensor socket.

6. Water treatment plant using ozone

Here a water treatment plant based on two water tanks, placed on top of each other, is discussed. The crude water is injected in the top tank (directly from the well or a drill hole) where the water treatment (ozonation) takes place, while the bottom tank stores the purified, ready to use, water. The entire process runs fully automatic, continuing its operation even after a power failure.

Required:

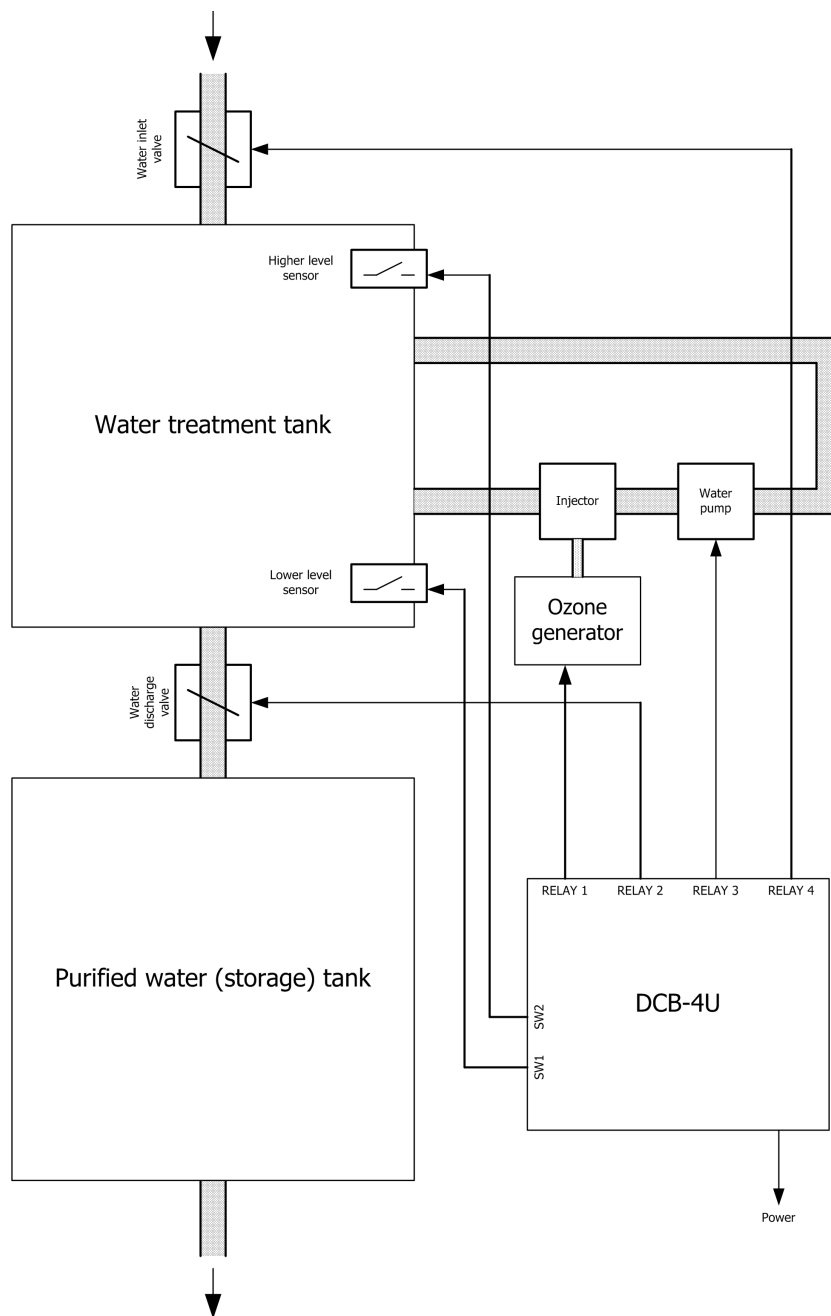
- the device control board
- a ozone generator with an ozone tube, which is connected to the DEVICE 1 port (relay 1)
- a water discharge valve (between the two water tanks), which is connected to the DEVICE 2 port (relay 2)
- a water pump for circulating the ozonation process, which is connected to the DEVICE 3 port (relay 3)
- a water inlet valve before the elevated tank, which is connected to the DEVICE 4 port (relay 4)
- a low water level sensor, which is connected to the SW1 port
- a high water level sensor, which is connected to the SW2 port

Sequence of Operation:

- the low water level sensors switch off event is triggered in the empty water purification tank, which opens the inlet and closes the water outlet valve
- the high water level sensors switch on event is triggered in the full water purification tank, which closes the water inlet valve and starts the water treatment sequence
- the water treatment sequence intermittently powers the water circulation pump and the ozone generator that performs the water purification process
- the water discharge valve is opened after executing the sequence to let the purified water flow to the purified water tank
- the water level in the tank drops to the lowest level, which again triggers the low water level sensor to start the sequence all over

If the water from the purified water tank is not fully expelled, the discharge valve remains open until all the water moves to the treatment tank. Depending on the tank, and water consumption, it may take several days. Thereby a water valve that does not consume electricity, after switching from one position to the other, must be chosen. A regular electromagnetic valve, that is switched to the open position, consumes power and heats up, so it is not very suitable for this water treatment equipment version.

Wiring diagram:



Device control board configuration:

- set the **DCB-4U** to the configuration mode
- select the menu item 12 and hold the **BACK** button down for at least 3 seconds to clear all preset parameters
- **select the menu item 03 (switch SW1) and the submenu 02**
- in the second relay input field set the value "L", in the fourth relay input field set the value "H", while in the rest of the relay fields set the value "-"
- in the debounce input field, enter the value 10.00 (10 seconds to stabilize the water level)
- **select the menu item 03 (switch SW2) submenu 03**
- in the second and fourth relay input fields set the value "L", while in the first and third relay input fields set the value "H"
- in the debounce input field, enter the value 10.00 (10 seconds to stabilize the water level)

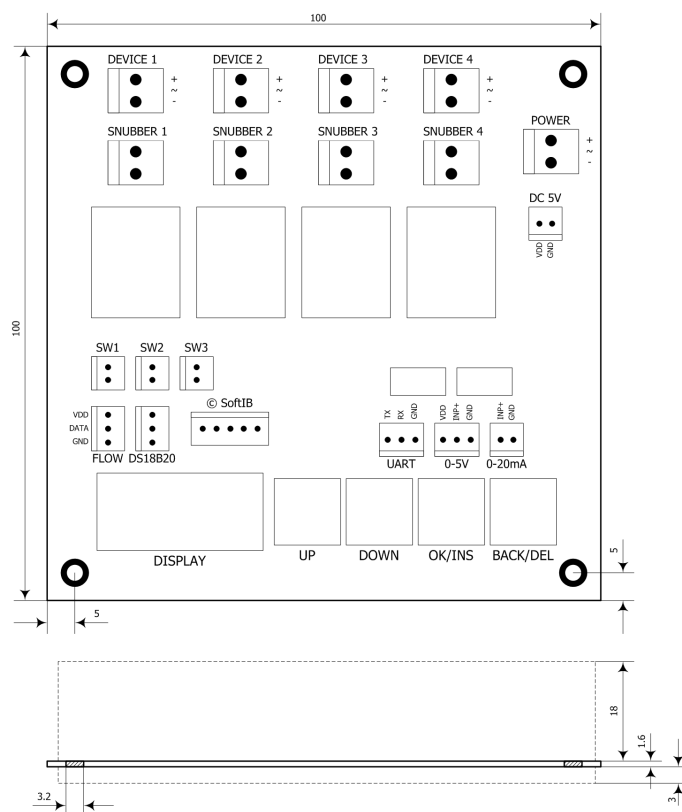
- **select the menu item 09 (sequences) and the submenu 01**
- in the step length input field, enter the value 60
- in the state length input field, enter the value 30
- in the sequence length input field, enter the value 0720
- in the second relay input field set the value "1", while in the rest of the relay fields set the value "--"

After completion of the configuration, activate the execution mode with the menu item 01, and make sure that the **DCB-4U** is functioning properly.

Explanations:

- **menu item 03 (switch SW1) submenu 02** - the second relay will be turned off (closing the drain valve) when the water level falls below the lower level, while the fourth relay will be turned on, which opens the inlet valve and allow the treatment tank to be filled with water
- **menu item 03 (switch SW3) submenu 03** - the second relay will be turned off (closing the drain valve) when the water level reaches the highest level, while the fourth relay will be switched off, which closes the inlet valve
- **menu item 09 (sequences) submenu 01** - the sequence executes (with a full running time of 12 hours) the ozone generator to be turned on for 30 minutes, then off for 30 minutes, then on again and off again and so on. At the end of the sequence, the second relay position will be switched to on to open the drain valve, allowing the purified water to flow to the storage tank

Dimensions



All dimensions are in millimeters.

The program SoftIB DCB Data Manager

All DCB-4U parameters can be read and saved as a file using the SoftIB DCB Data Manager. The stored files can be opened and transferred to the DCB-4U at any time. For more detailed information, go to the software help section.