digital controlled devices

dicodes

dicodes E-Cigarette Control Unit “Dani Basic”: Technical Specification and Manual

1. Common

The electronic control unit from **dicodes** is equipped with an electronic, that incorporates a small 2-digit 7-segment display and a push-button to adjust several parameters by means of a menu structure and to show different measured values. The top M7x0.5 metric thread is compatible with most available types of vaporisers on the market today.

To use the different Li-Ion accumulators, namely 18650, 18500 and 18350, the electronic control unit is offered in three different lengths. The electronic is designed to work with a single Li-Ion cell and must not be supplied with voltages more than 4.5V.

The adjustments and handling is intuitive by pressing the button short term or for a longer interval. With the button actuated for more than 0.25 sec., power is applied to the heating winding, until the button is released or the maximum vapor time of 20 second is exceeded.

The **dicodes** electronic control unit is world-wide the only one, which works with a brand new technology enabling the device to handle high power in a very small volume. The power output is achieved by a true alternating current (+/- relative to housing or ground) and not with an adjusted voltage or a pulse-width –modulated constant voltage.

The selected power is – combined with the creation of the heater winding – decisive for the vaporising result. The device is designed to work within a resistance range of 0.7 to 3 Ohms. Most users judge the vapour as optimal with a heater resistance of about 1.5 Ohms and 10-12W. In general, the output power is independent of the heater resistance. The power chosen is always transferred to the load (power controller). Outside the suggested range of 0.7 to 3 Ohms vaporising is possible, but with certain power limitations.

The electronic control unit is powered up by consecutive fast pressing of the button 5 times. With continued pressing of the button the user steps through the programming menu and the error menu. When the button is released, the current value of that specific menu is displayed after a short time. The value can be changed by repeated pressing of the button or keeping the button pressed (auto repeat).

As soon as the display is off and the button is pressed for longer than 0.25 seconds, the heating winding is powered.

2. Menu Structure

The following is a list of the menu entries in the order they will be displayed on the device.

Pu => Power up increases the output power in steps of 0.5W or counts up during auto repeat. When reaching 15W the power adjustment jumps back to 5W (roll over). The half watt steps are indicated by the rightmost decimal point “on”.

Pd => Power down decreases the output power in steps of 0.5W or counts down during auto repeat. When reaching 5W the power adjustment jumps up to 15W (roll over). The half watt steps are indicated by the rightmost decimal point “on”.

Co => Check ohms performs a resistance measurement of the heating winding by means of an alternating current pulse. The measured value is used to calculate an equivalent DC-resistance by using a referencing and linearisation algorithm. This is based on a standard 0.16mm Kanthal winding (not micro coil).

Cb => Check battery measures the accumulator voltage under load, or displays the last voltage measurement, respectively.

Sb => Set battery defines the minimum battery discharge voltage and also the threshold for the power reduction slope. See below item 7 for further explanations.

So => Switch off. When this menu item is displayed and the button is kept pressed, first the decimal points are lid and then “- -“ and the electronic switches off completely. It can be switched on again by consecutive short term pressing of the button 5times.

F- => Fault indication. With no fault pending the display shows F-. The error codes are defined as:

- F1 => Resistance of heater winding open
- F2 => (not used, reserved)
- F3 => (not used, reserved)
- F4 => Short or loose winding or overload
- F5 => Battery (accu) voltage too low
- F6 => Temperature too high (PCB-temperature > 55°C)
- F7 => maximum vapor time exceeded

All but fault F1 have to be acknowledged, i.e. keeping the button pressed while in the fault menu until “F-“ is displayed.

F1 is displayed when the user tries to power an open or removed winding (no vaping head). It resets itself when the contact is re-established.

3. Power Controller

The electronic within the device is able to govern the output power in a range from 5 Watts to 15 Watts. The power control is independent from the wiring resistance. I.e. it does not matter whether the heater has 0.7 Ohm or 3 Ohms of resistance, the power will always be adjusted to the preset value.
Remark: Even when the wiring resistance is outside the nominal range of 0.7-3 Ohms, vaporising is possible in a certain range.
For resistances outside the recommended range, full power of 15W can not always be achieved. The maximum power of 15W at 0.7 Ohm is reduced to about 10W at 0.3 Ohm. These values were measured on a typical device, but cannot be guaranteed. In case that the requested power can not be transferred to the load, fault F4 indicates the overload condition. After reduction of power and fault acknowledgement, vaporising is possible.

4. Time limited power output

The maximum uninterrupted activation time for vaporising is limited to 20 seconds. So in case that the button is accidentally activated permanently, further power output is stopped after 20 seconds and the displays shows F7.

5. Short Circuit Protection

When the heating winding is applied, unintentional shortages between housing and the wire can happen. If the button is pressed then, the electronics will not be damaged, but shows the error condition with “F4 short or wobbling contact or overload” in case of a low-ohmic short or intermitted contact. After acknowledgement of the error message – and removal of the shortage – vaporising is possible again.

Error message F4 is displayed in contrast to error F1 (open winding), when a short or opening happens during power output. So F1 is displayed as soon as the winding is removed or opened with no power applied, e.g. when the winding is applied or created.

6. Reverse Polarity Protection

Several accumulator manufacturers offer devices whose polarity is hard to identify compared to standard batteries. In the past it could happen that the heater-winding was powered permanently or the power switch was even damaged in case that the accumulator was insert with reversed polarity. The **dicodes** electronic control unit is equipped with a reverse polarity protection so that no current flows in this condition. Vaporing is impossible then, of course.

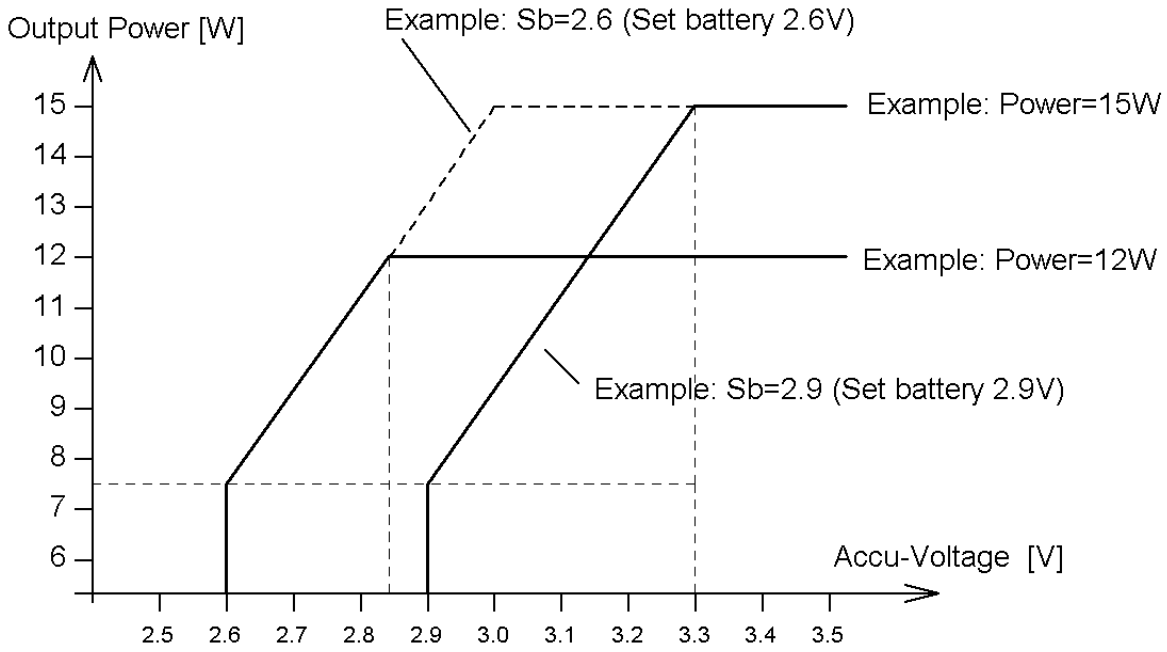
The battery should always be inserted slowly with the +pin first in the direction of the electronics and the device in an angular position.

7. Deep Discharge Protection and Power Limitation

Common Lithium-Ion accumulators have a voltage of about 4.2V when fully charged. During discharge the voltage reduces to 3.7V down the 3.3V and stays within this range while reducing slowly for a longer period of time. At the end of the capacity (about 70-80%) the voltage decreases somewhat faster until it's value reaches about 2.5 to 2.7V, below which the accumulator is irreversibly damaged or even destroyed due to chemical reactions inside.

Most electronic cigarettes in the market using a lithiuim-ion-accu abruptly disable further power output when the voltage under load drops to about 3.3V. This is somewhat unpleased for the user especially when no replacement accumulator is at hand.

In contrast to this, the electronic within **dicodes** device does not switch off all of a sudden. Beginning at an user adjustable voltage, a power reduction is activated, which enables further steaming at a reduced power, without changing any other adjustments. The output power is reduced proportional as the voltage under load of the accumulator decreases.



The user adjusted value under Sb defines the point where the maximum output power will be reduced to 7.5Watts. If the voltage of the accumulator drops below this value, further power output is not permitted. In this case error message F5, voltage too low, is displayed. The reduction always starts 0.4V above the adjusted value when referenced to 15W. With a value of 2.9V , for example, the power reduction with 15W selected begins at 3.3V. If the power output was adjusted to 12 Watts, the power limitation only starts at about 2.85Volts, i.e. before the voltage reaches 2.85V there is no power reduction.

The reduction in power is displayed by flashing decimal points.

8. Temperature Check

The electronic checks for it's own temperature (temperature of printed circuit board). Any electronic has so called power losses, which increase the temperature in the end. To protect the electronics from over-heating, power output is stopped at temperatures above 55°C (approx.). Normally the value is never reached, even under persistent maximum power output.

9. Auto-Power-Off

When the device is not used, it switches off itself after 60 minutes. So if you forgot to actively switch off the device, using menu item So (Switch off), the battery is not discharged further.

10. Resistance Measurement

The resistance measurement supports the user during the application of the heating winding.

The measurement is done by applying a 50kHz signal to the winding. The measured values are standardised and linearised in order to display values near the DC-measurement. The deviation depends on the individual winding, though. Especially for MicroCoils and thicker wire (0.32mm) the specified accuracy of +/-10% might not be reached.

Typical heater windings have a resistance of 0.7 to 3 Ohms, assuming a Kanthal-wire of 0.16mm diameter is used. The device is optimised for this resistance range. Nevertheless the user is free to choose almost any other winding resistance and different materials like NiCr.

The appliance of a winding typically is as follows: Once you have created a winding, switch on the device by pressing the button 5 times. Pu for adjusting the power is displayed. Directly press the button again for two times to get to menu item Co (Check ohms) and wait shortly for the resistance being displayed.

11. Voltage measurement

The accumulator voltage is measured using menu item Cb (Ceck battery). The device measures the voltage in two ways. Either during the winding resistance measurement, which represents a light load, or when power is supplied to the winding. The most lately measured value is stored and displayed once you choose Cb.
When you have powered up the device, it instantly performs a resistance measurement. If you then choose Cb (Check battery) the voltage at light load is displayed, as this was measured at latest.
If you now apply power to the winding by keeping the button pressed for longer than 0.25 seconds and then shortly press the button again, that battery voltage during applied power is displayed. Thus you can also check the batteries inner voltage drop, which increases when the battery has reached its end of life.
If you like to measure the battery voltage at no-load condition, simply switch off the, remove the vaping head and switch it on again. As the device tries to check the resistance (with no heating-wire) you can read the no-load voltage at menu Cb (check battery).

Please note that the no-load voltage of an accumulator gives you no reliable information about it's quality nor it's charging level. A wear-out battery can show 4.1V, although the voltage will drop dramatically under load, and then goes back to 4.1V after some time.
If you get aware that an accumulator voltage, although fully charged, drops dramatically - depending on accumulator size and quality - under load condition, it has reached it's end of life.

12. Further technical data and specifications

Maximum ratings specify those values beyond which the operation of the device is not guaranteed and damage or even destruction can not be excluded.

Maximum input supply voltage 4.5 Volts
Maximum input current 8 Amps

As a protection against malfunctioning which could lead to high input currents and self heating, the battery holder is equipped with non-replaceable 8Amps melting fuse.

Parameter	Minimum	Typical	Maximum	Unit
Output Power (+/-10 %) @ resistance 0.7-3.1 Ohms	5		15	Watts (rms) at load (1)
Input voltage battery (operation range electronic)	2.5 (1.5)	3.4	4.2 (5.0)	Volt
Self-current consumption stand-by		22		mA (Vin=3.5V)
Self-current consumption display active		100		mA (Vin=3.5V)
Self-current consumption during power output		30		mA (Vin=3.5V)
Efficiency		95		% (@10 Watt)
Switching frequency		200		kHz
Resistance range, measurable	0.3		9.9	Ohm (3)
Switch off temperature limit (PCB temperature)	52	55	60	°C
Leakage current switched off		1	5	µA
Leakage current reverse polarity			10	µA
Temperature range	-20		40	°C

(1) Maximum output power within specified voltage range (Sb + 0.4V up to 4.2V) and specified resistance range (0.7 to 3.1 Ohms)

(2) Measurements in the range of 0.3 to 9.9 Ohms are possible, but outside the range of 0.7 to 3.1 Ohms the results might be less accurate.

- Subject to changes without further notice -