Dye-sensitized Solar Cell
Power Module
User manual

● Please read this manual thoroughly before use.
● Please keep this manual handy for later reference.

1. The contents of this document are subject to change without notice
2. Please e-mail to ask-dsc@jp.fujikura.com when you need further assistance.
3. Fujikura assumes no responsibility for damage caused by misuse or careless handling.
4. The sample may differ slightly from the figures in this manual.

User manual

FDSC-EZFDDALL04
Revision 3E
April 2020
Fujikura Ltd.
For Your Safety

The safety precautions are ranked as “WARNING” and “CAUTION” in this instruction manual. The following symbols are used to indicate precautions:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Warning]</td>
<td>This symbol indicates the possibility of serious or fatal personal injury if the sample is handled improperly.</td>
</tr>
<tr>
<td>![Caution]</td>
<td>This symbol indicates the possibility of personal injury or property damage if the sample is handled improperly.</td>
</tr>
</tbody>
</table>

The following symbols indicate matters to be observed in handling the sample.

- This symbol indicates practices and conditions that must be prohibited.
- This symbol indicates instructions that must be followed without fail.

### Warnings

- ![Do not expose the sample to flammable gas / combustible liquid / organic solvent.](image)
  Failure to observe this could cause the sample to heat up, smoke, explode, or burst into flames.

- ![Do not expose the sample to acid gas / corrosive gas / corrosive liquid.](image)
  Failure to observe this could cause the sample to heat up, smoke, explode, or burst into flames.

- ![Do not apply any stress to the sample.](image)
  Failure to observe this could cause an electric shock, injury, or fire.

- ![Stop using the sample immediately when water enters or dew condensation occurs on the module.](image)
  Failure to do so could cause an electric shock or fire.

- ![Do not touch the sample with wet hand.](image)
  Failure to observe this could cause an electric shock or breakdown.

- ![Do not disassemble the sample.](image)
  Failure to observe this could cause an electric shock.

- ![Check polarity of lead wires carefully before using.](image)
  Failure to do so could cause breakdown or fire.

- ![Do not supply power in different ways from the charging method described in this document.](image)
  Failure to observe this could cause breakdown or fire.

- ![Stop using the sample immediately in case of breakdown, and discard it.](image)
  Failure to do so could cause an electric shock or fire.

- ![Discard the sample according to the instruction of each local government.](image)
Do not short-circuit the terminals in the port.  
Failure to observe this could cause an electric shock or fire.

Do not use the sample at any voltages other than 3 V.  
Improper use of the sample at any voltages other than the specified operating range could not only shorten the sample’s life, but also could cause the sample to leak, heat up, smoke, explode, or burst into flames.

Do not short-circuit the positive and negative electrode terminals of LIC.  
Failure to observe this could cause the sample to smoke, explode, or burst into flames.

Do not make a conductive material contact with the terminals of LIC and surface of circuit.  
Failure to observe this could cause an electric shock, burn, or injury, and the sample to leak, heat up, smoke, explode, or burst into flames.

Do not drop the sample or give excessive shock or vibration.  
Failure to observe this could cause an electric shock, burn, or injury, and the sample to leak, heat up, smoke, explode, or burst into flames.

Do not place the power management board on conductive objects.  
Failure to observe this could cause an electric shock, burn, or injury, and the sample to leak, heat up, smoke, explode, or burst into flames.

Cautions

Do not use the sample at temperatures out of the operating range.  
Improper use of the sample at temperatures out of the operating range could not only shorten its lifetime, but also could cause the sample to leak, heat up, smoke, explode, or burst into flames.  
Keep in mind that the surface temperature becomes higher than the ambient temperature because of radiation heat.

Do not use the sample in places exposed to condensation due to abrupt temperature changes.  
Failure to do so could cause a fault, an electric shock, or fire.

Use and keep the sample in place with little dust and low humidity.  
Failure to do so could cause a fault, an electric shock or fire.

Do not touch the ports directly.  
Failure to observe this could cause an electric shock.

Do not damage the lead wires.  
Failure to observe this could cause breakdown, an electric shock, or fire.

Do not touch the tip of the lead wires or solder joint.  
Failure to observe this could cause an electric shock.
Do not touch the sample with bare hands when it gets broken.
The sample uses a glass based substrate. Edge of fragments and broken pieces could cause injuries. Furthermore, electrolyte solution inside the sample could cause rough skin when it leaks out. In case that electrolyte solution enters your eyes or mouth, rinse with water or lukewarm water immediately and consult a doctor.

Do not put the sample on an unstable place.
Failure to observe this could cause an electric shock, an internal short circuit, leakage, or breakdown.

Do not put stress on the DSSC module panel.
Do not assemble the sample in a way of applying stress on it.
Failure to observe this could cause injury by the glass substrate.

Charge with the instruction described in this manual
Improper charge causes an electric shock or fire.

Do not overload the sample.
Please use the sample with electronic equipment sufficiently evaluated its safety. It is advisable for the user to add a protection circuit if need be.

Do not use the sample in a circuit where ripple current flows.
Failure to observe this could cause the breakdown of the IC.

Do not touch any terminals in the port.
Failure to observe this could cause an electric shock.

Do not apply electrostatic charge.
Failure to observe this could cause the breakdown of the sample due to damage to the IC on the power supply board. Take anti–static measures to protect the sample from static damage. (e.g. with air conditioning, humidification, conductive floor coverings, non–synthetic clothing)
Features

This power module consists of a high efficiency DC/DC converter and a lithium ion capacitor (LIC) that are connected to a dye-sensitized solar cell (DSSC). Consequently, without light, the power module generates a constant voltage of 3 V.

This power module, thus, plays the role of a coin battery and does not need a complicated circuit.

Contents of package

- Power management board connected to DSSC and LIC x1
  - Standard DSSC module panel:
    - Two lead wires of red and black are connected to the terminals.
    - The dimensions and shapes differ depending on the type of a standard DSSC module panel.
  - Lithium Ion Capacitor connected to the board
- Lead wires with connector x1

Name of each part

- The power-generating section of DSSC is covered by protection film. Please remove the film before using the power module.
- Handle the device with care because its lead wires are breakable.

Lead wires
(AWG24: over 100 mm)
Only case of FDSC-DSA12FGC, AWG28 over 55 mm

Lithium Ion Capacitor (LIC)

Lead wires with connector
(AWG26: over 100 mm)

Power management board

DSSC module panel
- The dimensions and shapes differ depending on the standard DSSC module panel.

Figure 1: General view
Figure 2: Power management board

Table of parts

<table>
<thead>
<tr>
<th>No</th>
<th>Parts name</th>
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</tr>
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<tbody>
<tr>
<td>①</td>
<td>Power-generating section</td>
<td>Generates electric power under light and charge LIC</td>
</tr>
<tr>
<td>②</td>
<td>ON/OFF switch</td>
<td>Starts or stops the module</td>
</tr>
</tbody>
</table>
| ③ | Output port           | Is connected to a connector with three colored lead wires. The function of each wire is shown in the following:  
   The red wire in figure 2: Output of 3 V constant voltage  
   The black wire in figure 2: Ground wire  
   The orange wire in figure 2: Output of LIC voltage (for monitoring voltage)  
   When the LIC voltage drops to 3 V, overdischarge protection function is activated.  
   Warning  
   • The orange wire is connected to the positive electrode of the LIC via the circuit board. Be careful not to short-circuit the terminals or charge a heavy current through the wire. Use a voltmeter for high impedance when measuring the voltage of the LIC.  
   • If unnecessary wire exists, cover the head of the wire with insulating tape. |
How to use

"LIC1235RS3R8406" made by TAIYO YUDEN CO., LTD. is used as an energy storage device in this module. Before using this module, please download "Handling Precautions for use of Cylinder Type Lithium Ion Capacitors" from the following URL, Read the contents thoroughly before use.
https://ds.yuden.co.jp/TYCOMPAS/ut/sm/detail?pn=LIC1235RS3R8406&u=M

Assembly and connection of electronic components to output port

1. Insert a connector with lead wires to the output port by hand.
2. Turn on the ON/OFF switch
   Measure the red wire voltage without connecting electronic components. If the voltage is not about 3 V, the LIC may not enough be charged. In that case, charge the LIC by the charging method below.
   You can measure the LIC voltage by the orange wire on the lower figure.
3. After turn off the ON/OFF switch, connect electronic components to the red wire of output port.
4. Turn on the ON/OFF switch and make sure that generating section receives light.

The maximum output current is 100 mA (DC3.0±0.2 V) and the maximum rush current is 185 mA. If power supply does not start, measure the LIC voltage by the orange wire. If the LIC voltage is not high enough, charge the LIC according to the instruction shown below.

At the time of shipment, the power modules are fully charged. Do not short-circuit plus and minus terminals because this may cause an electric shock, burn or injury.
How to charge LIC

If the amount of LIC charge is insufficient, charge it with the DSSC module panel under high-light conditions.

1. Remove the connector with lead wires from the output port.
2. Make sure the ON/OFF switch is ON.
3. Shed light on the power-generating section to charge.

Information) The higher light intensity (e.g. directly under fluorescent light) DSSC receives, the shorter the charging time is.

![DSSC module panel]

- Dimensions and shapes differ depending on the standard DSSC module panel.

Information) The higher light intensity (e.g. directly under fluorescent light) DSSC receives, the shorter the charging time is.

Put the module on a place to receive light sufficiently on the whole surface of the power-generating section to efficiently charge the LIC.

Charge the LIC strictly subjecting to the above instructions. Other charging methods may cause injury or breakdown (e.g. electric shock, burn, liquid leakage, heat, smoke, burst, fire) due to overcharge.

⚠️ If LIC voltage is less than 3 V, charge the LIC by the above instructions. The following are the approximate required times from overdischarge to reboot.

- Under 200 lx : From 50 to 70 hour (Using FDSC-DSA4FGC)
- Under 2,000 lx : From 4 to 6 hour (Using FDSC-DSA4FGC)
- Under 5,000 lx : From 2 to 3 hour (Using FDSC-DSA4FGC)

Storage method

1. Make sure the ON/OFF switch is OFF.
2. Remove the connector with the lead wires from the output port and keep it separately.
3. Avoid locations exposed to high temperature and high humidity.
4. If the device is stored for a long time, charge LIC once every six months.

(LIC voltage drops because of leakage current may inhibit the power module from working immediately.)

⚠️ Always follow the storage method to avoid the degradation of characteristic (e.g. reduction in capacity).

⚠️ Store the device so as not to short the terminals together.