

# EFOY Pro Hybrid Solution User Manual – EFOY ProEnergyBox 4060P



sfc-energy.ca



# ! Warning !

### Protect Your EFOY Fuel Cell from Freezing



To avoid complications or potential damage, while doing preliminary work and setting up your EFOY system in cold temperatures, *please ensure any EFOY fuel cells are kept in a warm environment such as a vehicle or building until they are ready to be installed.* 

Install the EFOY fuel cell(s) last and then power up the system as soon as possible. Once an EFOY is connected to fuel cartridges and functioning batteries and set to automatic mode, it can protect itself from freezing temperatures.





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# Installation & Commissioning Checklist

Customer/End User	Site Location	Site ID
Installed By: Company Name	Installed By: Technician Name	Installation Date
EFOY Panel Serial #	EFDY Fuel Cell Serial #	Fuel Manager Serial #
Fuel Manager Type (FM2, FM4 or FM8)	Fuel Cartridge Type (M10, or M28)	Fuel Cartridge Quantity

EFOY Enclosure Check		lete
Heating Thermostat set point has not been adjusted, seal remains intact (found in main compartment)	Yes □	No 🗆
Cooling Thermostat set point has not been adjusted, seal remains intact (found in main compartment)	Yes □	No 🗆
Air Intake Exhaust Vent and Metal Screen Filter is clean and clear of obstructions	Yes 🗆	No 🗆
Air Exhaust Vent is unobstructed	Yes 🗆	No 🗆
ProEnergyBox Lid closes and seals properly	Yes 🗆	No 🗆
Batteries Installed – proper model # and quantity: See Step 5, below and refer to drawing BOM	Yes 🗆	No 🗆
Fuel Manager Installed: See Step 4, below	Yes □	No 🗆
Fuel Manager bracket tightened: See Step 4, below	Yes 🗆	No 🗆
EFOY is Installed: See Step 7, below	Yes 🗆	No 🗆
EFOY mounting strap tightened: See Step 7, below	Yes 🗆	No 🗆
EFOY Off-Heat Elbow Vent installed as per specified in system drawing package: See Step 13, below	Yes 🗆	No 🗆
EFOY water exhaust hose properly connected to EHT exhaust line assembly: See Step 11, below	Yes □	No 🗆



# Installation & Commissioning Checklist

	Value
EFOY System: Found using the Operating Panel (display)	
*Do not adjust these settings without first consulting the SFC Energy Service Team*	
EFOY Firmware Version	
Switch-On Voltage Setting	
Switch-Off Voltage Setting	
Absorption Time Setting	
Maximum Charge Time Setting	
Battery Bank Capacity	
Any Errors or Warnings?	
Recorded EFOY Runtime hours	
Battery Bank wired in proper voltage configuration as per system drawings (12/24/48 VDC)	
FEOV Remote Monitorian Method, if utilized	Complete / Value
	COMPLETE / VOIDE

EFOY Cloud Connection	Yes □	No 🗆
Modbus TCP Connection	Yes □	No 🗆
IP address/Gateway		

EFOY Fuel Cartridges		Complete	
EFOY Fuel Cartridges properly connected to Fuel Manager: See Step 10 below	Yes □	No 🗆	
M28 Adaptors secured hand/tight (where applicable): See Step 10, below	Yes □	No 🗆	
Methanol Volume set for each connected fuel cartridge: See Step 15a, below	Yes □	No 🗆	
EFOY Charge Now Test Cycle Complete: See Step 17, below	Yes □	No 🗆	
Pull test performed on each fuel cartridge: See Fuel Cartridge Replacement, p.17	Yes □	No □	



Complete

Complete / Value

# Installation & Commissioning Checklist

Solar Charge Controller	Complete / Value		
Solar Controller Programmed with proper settings	Yes 🗆	No 🗆	
DIP Switch Settings			
High Voltage Disconnect Setting			
Low Voltage Disconnect Setting			
Absorption Time Setting			

#### System Documentation

		-	
EFOY System Drawings w/ wiring diagram	Yes	□ No	
EFOY Quick Guide	Yes	🗆 No	
EFOY Fuel Cartridge Replacement Instructions	Yes	n No	

#### Before Leaving Site: System Checklist

Solar Breaker ON	Yes 🗆	No 🗆
Power Distribution Breaker ON	Yes 🗆	No 🗆
Battery Breaker ON	Yes 🗆	No 🗆
Loads Breaker ON	Yes 🗆	No 🗆
EFOY Breaker ON	Yes 🗆	No 🗆
EFOY Mode: Automatic	Yes □	No □
ProEnergyBox Lid is Closed and Latched	Yes 🗆	No □



# Installation & Commissioning Checklist

#### Additional Notes

EFOY Commissioning Su	ccessful:		
Yes No D		Customer Representative:	
 Date	Signature	Date	Signature

#### **Submission**

Upon successful completion of system commissioning please submit this signed and completed form to the SFC Energy Service department at <u>service-support@sfc.com</u> for record keeping.

If you require assistance, please contact the SFC Energy Canada Service Department at 1 800 565 74 31 or <a href="mailto:service-support@sfc.com">service-support@sfc.com</a>



### System Start-up Instructions

1. Verify PV array wiring configuration is correct according to the specific site design. (An example diagram is included in the drawing package).



3. Verify all field wiring according to drawing package and turn all breakers into the <u>OFF</u> position.



2. Check PV array for proper voltage and Polarity.



4. Examine the Fuel Manager in the middle of the enclosure and ensure it is secured on the mounting bracket. Verify that the Fuel Manager data cable(s) are connected on the right and the red power cable is connected on the left as shown below.



# EF<sub>O</sub>Y

5. In the front left open space, lower the batteries into place. Connect the batteries as per the designated system voltage using the cables provided.



7. Put the EFOY Fuel Cell on the mounting platform and secure it into place by running the strap though the mounting brackets on either side.



6. Place the M28 methanol fuel cartridges into the ProEnergyBox.



8. Connect the EFOY fuel cartridge connector to the top of the Fuel Manager.



Find more information on efoy-pro.com



# **EF**<sup>O</sup>Y

9. Connect the Power and Communication cables to the EFOY Fuel Cell. They can be found hanging loose near the EFOY mounting platform. The black or grey data cable connects to the lower right SFC Bus port.



11. Remove the protective cap from the EFOY fuel cell exhaust spout and connect the exhaust hose. Perform a quick visual check to ensure there is no pinching or kinking in the hose, and it is positioned at a downward angle.



10. Connect the fuel manager hoses to the cartridges (or M28

adapters, if required) hand tight (avoid overtightening as this

can lead to issues). Take care not to cross thread as the fuel

12. If you're utilizing any network communications with your EFOY Fuel Cell, you can connect to the EFOY LAN port on the left as shown below.









### System Start-up Instructions

13. Attach the Off-Heat Elbow Vent to the EFOY warm air exhaust port at a 45 degree angle, pointed down, towards the exhaust hose and batteries. This is essential to direct the warm air from the fuel cell in the most beneficial direction, ensuring proper air circulation and minimizing any required exhaust fan runtime.



14. Switch ON the breakers for the EFOY, and the Batteries which are both clearly labelled. There are two breakers for the EFOY, one for the charging line and the other for the voltage sensing line. Refer to the drawings for more information.



- 15. Wake up the Operating Panel (LED Display) on the door by touching the screen. Follow the prompts to complete the initial configuration. See detailed configuration steps below.
- 15a. Complete the Initial Setup by going through these steps on the Operating Panel.

Battery Type		Bat	tery Capa	city	Fuel Cartrid	ge Type	Fuel Le	evel in Carl	ridge
1100	12	10.8	*1	17.4		#102278#	1018		1114
Print Set	Nd.		1993950			nup.		In the Server	
Behrylge .		Belleyce	and y		Dense Nationte	W.	Select Aud	and.	
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100000000000000	Ċ.	-0.5	0 .a. m	- ¥	***	۲	1	100	
(AVPORTON) (AV)	0		and other	1	M/H.	6	-		12
(41010-1244)	0				anse -	0			
	_				Dation	8			
-	~	-			( Beel	-	-		



### System Start-up Instructions Visual Step by Step Guide

15b. The unit will be in Transportation Mode when you first unbox it. This will need to be deactivated before use by following the steps below.



15c. Put the EFOY into 'Automatic' operating mode. The EFOY will sense when the voltage in the batteries is drawn down to the switch-on voltage threshold and automatically switch on to begin a charging cycle whenever required.



Find more information on efoy-pro.com

### System Start-up Instructions



16. Inside the EFOY is a mixing tank containing a methanol and water mixture which is used in the chemical reaction to create power. Over long periods of time if the EFOY isn't operating, the water can evaporate. When starting up an EFOY, it MAY prompt you to add 'Service Fluid'. If your EFOY does prompt you to add fluid, you can remove the exhaust hose, and add it straight into the exhaust port. Each new EFOY comes with a small bottle of service fluid. Ensure you re-attach the exhaust hose afterwards. If the EFOY does not prompt you to add fluid, it is not necessary.

17. To ensure the EFOY has been installed successfully, select 'Mode' to return to the 'Charge Mode' screen and initiate a 'Charge Now' cycle. This will test that the EFOY is correctly connected to fuel. The EFOY will attempt to pull fuel from the active cartridge. If unable to do so, it will switch over to the other cartridge, and the previous connection will have to be examined and reconnected. If there are any other issues, the Operating Panel will display the relative error messages. Once the EFOY completes its charging cycle, it will automatically switch itself back into 'Automatic' mode.

<u>Note</u>: The EFOY will not allow you to perform a 'Charge Now' cycle if the batteries are fully charged (above 13.2V in a 12V system and 26.4V in a 24V system). In order to facilitate this test, turn OFF the solar input breakers, and turn ON the load breakers to draw down the batteries. You can monitor the battery voltage level on the EFOY display and initiate the 'Charge Now' cycle when the battery voltage is below 13.2V or 26.4V.

18. Once you've verified that the EFOY has run a successful charge cycle, you can energize the rest of the system and prepare to close it up. Turn on all the applicable load breakers, and ensure the solar breakers are turned on. Verify there are no errors on the operating panel, close the box and secure the latches.







### Solar Array Setup Guidelines and Example

# ! WARNING ! Have your solar installation done by certified electricians. The following is an example and meant to serve as a guideline. Ensure local codes and regulations are always followed, otherwise injury and/or damage to property could occur!

#### Accounting for Solar Components

If your order included a solar package from SFC Energy, there are several items to account for. Solar Panels, pairs of PV cables, a Panel Mounting System, a Solar Combiner box with Disconnect, Breakers, a GFCI breaker, and a Lightening Arrestor are all items we often provide. The items you receive may vary depending on the package purchased. We design our 12 and 24VDC systems to arrange solar panels in a series-parallel configuration whenever possible. If your system has just 1 or 3 solar panels, these will come with an equal number of breakers and sets of PV cables, and enter the Combiner Box separately. If your system comes with an even number of solar panels, these will enter the box in pairs (series-parallel or sets of 2) and have one set of PV cables and one breaker per pair.

#### Wiring the Solar Combiner Box/Disconnect

If purchased, your Combiner Box/Disconnect should have come pre assembled. To verify, ensure the breakers are installed on the rail, connecting to the positive bus at the top. The GFCI breaker should also be installed on the rail, but not connected to the positive bus like the other breakers.

Wire the positive bus to the bottom of the power side of the GFCI breaker. Then, connect it's white lead to the negative bus, and it's green lead to the ground bar. The lightening arrestor should be installed directly onto the combiner box (side or bottom is recommended) and the red lead connected to the positive bus, the black lead to the negative bus, and the green lead to the ground bar.

#### Wiring the Solar Panels and Connecting to EFOY Cabinet

Begin by entering the PV cables from your solar panels into the combiner box. These will be wired as per the comments above. For example, if you have a 4 solar panel system, you will require 2 breakers and 2 sets of PV cables. Connect 2 Solar panels together, then connect them to the combiner box using one set of PV cables. Wire the positive lead to one breaker, and the negative lead to the negative bus. Do this for each pair of solar panels.

The outgoing power cable to connect the combiner box to the EFOY cabinet will connect to the (+24V) lead top of the power side of the GFCI breaker, and the (-) lead to the negative bus. The cable ground can connect to the ground bar.

<u>Note</u>: Please refer to "A1 - Annex 1 Typical PV Array Interconnection" of the system drawing package for a reference guide detailing typical PV array interconnections.



### Solar Array Selup Guidelines and Example

#### Typical 24VDC Combiner Box Wiring





### **EFOY IP Address Assignment**

#### Assigning an IP Address to an EFOY Pro Fuel Cell

In some communication scenarios, you may wish to manually assign an EFOY a specific IP Address. Please see the following steps for doing so.

1. On the EFOY Operating Panel (LED touchscreen) select the icon with 3 lines in the top left corner to access the Menu, and then click on 'Settings'.

	Dyer	des.	CO-EFO
Tour device EFOY 80	<b>.</b>	FM4 Port 1 active	1
		Battery EFOY LI 70	2%
FFOV state		State of Charge	10.R.0.

2. In the settings menu, click 'EFOY Fuel Cell' and then 'Ethernet configuration / Modbus'.

¢	Settings	DUEFOY		
EFOYFuel Cell	$\leftarrow$	>		
Battery		>		
Fuel centridge		>		
Display		<	EFOY Fuel Cel	<b>ENEFOY</b>
		Mode		>
		Ethernat config	paration / Modbus	- >
		Cluster		×
		Factory default	5	>



### EFOY IP Address Assignment

3. From here, you can see the DHCP client setting. To be able to manually input an IP Address, this switch needs to be set to the off position, as seen here.

<	Ethernet configuration	<u>MU</u> EFOY
EFOY Internet connection	n	no connection
Ethernet cable		connected
Modbus TCP		
Modbus TCP port		502 >
DHCP client		$\rightarrow$ $\bigcirc$
IP address	19	92.168.123.123 >

4. Then, you can select 'IP address' and continue to manually input the desired IP address and hit Confirm. This will conclude the process.

<	Ethernet configuration	<b>MUEFOY</b>
EFOY Internet connection	n	no connection
Ethernet cable		connected
Modbus TCP		
Modbus TCP port		502 >
DHCP client		
IP address		

Note: The DNS Setting are unchangeable on the EFOY.



### EFOY Transport Mode

The EFOY Pro 2800 has a protective mode we can enable if its to either be transported or stored for long periods of time.

Activate Transport Mode by following the below steps. This may take a few minutes, depending on the state of your EFOY.



### **Recommended System Settings**

It's important to remember that set points will be pre-set with our recommended system settings by the team at SFC Energy. While these settings are adjustable, before modifying any on your own we advise having a discussion with an SFC Energy Service Team member about what you'd like to change and why. Adjusting set points incorrectly could result in less efficient EFOY operation resulting in more fuel consumption and unnecessary runtime hours.

	EFOY 80 / 150	Pro 900/1800/2800	Pro 1200
Switch-on Voltage	12.0V / 24.0V	12.0V / 24.0V	24.0V / 48.0V
Switch-off Voltage	14.0V/28.0V	14.0V/28.0V	28.0V / 56.0V
Max Battery Voltage	15.0V / 29.5V	15.0V / 29.5V	29.5V / 59.5V
Max Charge Time	6 - 12 hrs	6 - 12 hrs	6 - 12 hrs
Heat Trade Thermostat	5° C	5° C	5° C
Exhaust Fan Thermostat	30° C	30° C	30° C

#### Tips:

- **O** The default system settings are fine for most applications.
- **b** Longer charge cycles are better than shorter more frequent cycles as the start-up phase is the hardest on the power stack.
- You can adjust the switch on/off voltage and max charge time settings to conserve fuel but this may shorten battery bank lifespan.
- An EFOY can mask an end of life battery bank but this will show up clearly in the data if you look at charge cycles as the battery voltage will drop as soon as a charge cycle is completed and the EFOY will quickly turn back on again.
- 🖕 Do not ever adjust the Heat Trace or Exhaust Fan Thermostats.



### Fuel Cartridge Replacement

#### EFOY Fuel Cartridge Replacement Process

Please review the following basic steps to ensure your fuel cartridges are replaced and reconnected correctly.

1. Disconnect the empty cartridge and remove it.

Place the new cartridge in position and reconnect the fuel hose connector hand tight – avoid overtightening as this can cause connection issues. Ensure the connector is not cross threaded as a seal is required to successfully pump fuel.
\*If an M28 cartridge with PN: 150 905 100 is being used then an M28 adapter will need to be utilized. First connect the M28 adapter to the fuel cartridge, then the fuel hose connector to the adapter.

- 3. Using the operating panel, we can re-set the new cartridge value to 100% by following these steps:
  - Enter the main menu by selecting the three lines icon in the top left corner.
  - **O** Select Settings, and then Fuel Cartridge.
  - Choose which port you are replacing (1 or 2, the numbers are on the fuel hose connector)
  - **O** Input the correct fuel cartridge type, and adjust the new fuel level to 100%
  - **O** Save your changes.
- 4. Confirm the new fuel levels are correctly displayed on the Fuel Cartridge menu.

To ensure a proper connection has been made to each cartridge please complete the following steps:

- 1. In the Fuel Cartridge menu, click on the cartridge port you have just replaced.
- 2. Click 'Enable' in the lower left of the screen.
- 3. Run a manual charge cycle to start the EFOY. From the home screen, select 'Mode' and then click 'Charge Now'.
- 4. This will initiate the start-up phase on the EFOY, and it will begin to pull fuel from the enabled cartridge. This may take up to 30 minutes.
- 5. Once the start-up phase is complete, it will enter 'Charging' phase. Seeing this transition means the EFOY has successfully pulled fuel from the enabled cartridge. After the unit has competed a 'Chage Now' cycle, it will revert to 'Automatic Mode' on its own.
- 6. Repeat the above steps to check any additional cartridges that have been changed out.
- 7 Before leaving the system, be sure to set any partially full cartridges to the active cartridge by enabling it via the Fuel Cartridge menu.

If the EFOY was not able to pull fuel from the newly replaced cartridge, it will attempt to switch to the other cartridge to pull fuel. Try reconnecting the fuel hose on the cartridge it was having difficulty with, enable it, and run another charge now cycle to verify a secure connection has been made.

Note: As mentioned in the Start Up Instructions, the EFOY will not allow you to perform a 'Charge Now' cycle if the batteries are fully charged (above 13.2V in a 12V system, and 26.4V in a 24V system). In order to facilitate this test, turn OFF the solar input breakers, and turn ON the load breakers to draw down the batteries. You can monitor the battery voltage level on the EFOY display and initiate the 'Charge Now' cycle when the battery voltage is below 13.2V or 26.4V.



### Do's and Don'ls

#### Do's

- **b** Set a partially full fuel cartridge as the active cartridge when refuelling.
- Ensure fuel cartridges are connected hand tight only. Avoid overtightening as this can lead to issues.
- Install the Off Heat Elbow to the EFOY warm air exhaust to direct warm air away from the thermostats.
- **O** Maintain proper spacing around the EFOY for airflow.
- 🗅 Inspect the water exhaust line and exhaust spout to ensure they are free of obstructions.
- **O** Clean any dirt/dust/snow off solar panels whenever possible.
- **b** Health test your battery bank on a yearly basis, as an EFOY can mask dead batteries.
- Add service fluid to the EFOY only if the system prompts you to do so.
- If an EFOY has been exposed to freezing temperatures while powered down, bring it to room temperature before reinstallation and energization.
- **O** Ensure the solar array is positioned facing south and is free from shading as much as possible.

#### Donl's

- **b** Let the EFOY run out of fuel during sub-zero temperatures.
- **O** Let the EFOY freeze during transportation or prior to installation.
- U Install and Energize an EFOY the has been exposed to freezing temperatures without first warming it back up to room temperature for approximately 24 hours.
- **O** Allow the system to operate with dead batteries.
- Adjust the Thermostats controlling the heat trace or exhaust fans.
- Add additional solar panels or batteries to the system without first consulting the SFC Service team.
- **b** Store Service Fluid in the ProCabinet, it will freeze.

#### Resources

Our Technical Services Team is available 24/7/365 by calling 1-800-565-7431 and you can also visit https://sfcenergy.freshdesk.com/support/solutions/folders/13000010811 to find additional information on EFOY Firmware Updates, Modbus TCP Registers, EFOY Cloud Overview and more.