User Manual

Interface Adapter IA 1

1 Table of Contents

2.1   Introduction

Thank you for choosing an EFOY product.

Please read this manual as well as the EFOY Pro Fuel Cell user manual before using the interface adapter.

Please note the instructions for installation and the warnings in both manuals.

Contact the EFOY hotline should you have any questions about installation or operation.

Headquarter Europe:	North America:
SFC Energy AG	SFC Energy, Inc.
Eugen-Saenger-Ring 7	7632 Standish Place
D-85649 Brunnthal-Nord	Rockville, MD 20855
Hotline: +49 89 - 673 5920	Phone: +1 240 – 328 6688
Toll-free: 00800 - 732 762 78*	Fax: +1 240 – 328 6694
Sales@sfc.com	Service-USA@sfc.com
www.efoy-pro.com	www.efoy-pro.com

* The toll-free number via landline is available in the following countries: Germany, Austria, Belgium, Denmark, France, Great Britain, Italy, the Netherlands, Norway, Spain, Sweden and Switzerland.

2.2 Safety Precautions

Read the user manual beforehand and keep the manual handy at all times. Follow all instructions in the manual.

⚠️ **CAUTION!**

Connect the EFOY fuel cell to a computer using an interface adapter only. Otherwise, damage to the EFOY fuel cell may result.

Damage may also result from improper use or improper connection to other electrical devices.

In addition to these safety precautions, please note any passages in bold type to avoid creating a hazard to yourself and others.

2.3 Intended Use

You can connect a computer to an EFOY Pro fuel cell with an IA1 interface adapter and a data line (Cat.5 patch cable) for the following functions:

- to retrieve information
- to modify operating parameters
- to operate the EFOY unit via a computer

2.4 Conformity Declaration

CE

SFC Energy AG, Eugen-Saenger-Ring 7, 85649 Brunnthal-Nord declares that the interface adapter IA1 conforms to EU guidelines for electromagnetic compatibility 2004/108/EWG. The following norms apply:
DIN EN 61000-6-1, DIN EN 61000-6-3

2.5   Disposal

Packaging

Packaging protected your interface adapter during shipping. All materials are environmentally friendly and recyclable. Please help protect our environment by disposing of packaging properly.

Your dealer or community authorities can inform you about proper disposal.

DANGER!

Risk of suffocation!

Keep packaging and parts out of children's reach. Plastic wrap or cardboard can cause suffocation.

Used devices

Used devices are valuable! They contain raw materials that can be recycled if disposed of properly. Proper disposal contributes to a cleaner environment.

The EFOY hotline can provide information about returning used devices.

Europe:	+49 89 - 673 5920
	or
	00800 732 762 78*
North America:	+1 240 - 328 6688

* The toll-free number via landline is available in the following countries: Germany, Austria, Belgium, Denmark, France, Great Britain, Italy, the Netherlands, Norway, Spain, Sweden and Switzerland.
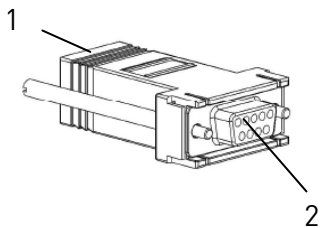
3.1   Parts Included

IA1 interface adapter

Parts included:

- IA1 Interface adapter
- User manual
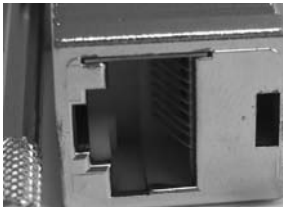
3.2   Interface Adapter

1   RJ45 port to connect either a data line or a Cat. 5 patch cable
2   9-prong D-Sub 9 (RS232) serial interface to connect to PC

3.3   Interface Adapter – Specifications

Dimensions (L x W x H):	53.0 x 33.0 x 16.0 mm / 2.1 x 1.3 x 0.6 in
Operating temperature:	-35 to +45 °C / -31 to +113 °F
Serial port:	D-Sub 9-pin, female
	Pin assignment (PC): 2 receive data RxD 3 transmit data TxD 5 ground GND
RJ45:	RJ45 8-pin port
	Pin assignment (EFOY): 2 receive data RxD 3 transmit data TxD 4 ground GND

4.1   PC System Requirements

In order to connect an EFOY Pro fuel cell to a computer with an interface adapter, the computer must meet the following requirements:

- Terminal program for transmitting and receiving serial data to a port
- D-Sub 9 serial plug, male (RS232)

4.2   Connection to the Computer

⚠️

CAUTION!

Improper use or connection to other electrical devices may result in damage.

Connect the EFOY Pro fuel cell to a computer only with an interface adapter. Otherwise, damage may result to the EFOY fuel cell.

Follow the directions for installation and operation contained in the EFOY Pro fuel cell user manual.

1. The EFOY Pro fuel cell must be in either the On, Off or Automatic mode and connected to a functional battery.

2. Connect the end of the data line to the interface adapter.

3. Connect the adapter to your computer with an RS232 type free serial plug.

Use only a Cat. 5 data line. Do not use any other kind of line such as ISDN.
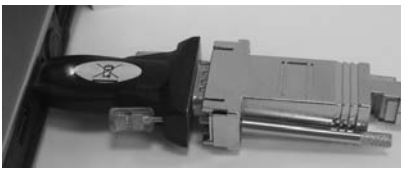
4. Configuring the Data Port

If you have a serial port, please follow the instructions contained in Point 4.

If you do not have an RS232 serial port, please use a USB adapter on RS232.

USB adapters are usually installed on the computer. Follow the manufacturer's installation directions.

Then connect the interface adapter to the USB adapter.

Use a free USB port to connect the adapter to your computer.

4. Connect the RJ45 plug on the data line to the data interface of your EFOY Pro fuel cell.

5. Check the connection between computer and EFOY fuel cell by selecting the terminal program on your computer.

If the prompt

SFC›

appears after you press the Enter key ↵

then the connection to the EFOY fuel cell has been established.

If you have not yet set up the terminal program, follow the instructions in Chapter 4.3 Setting Up the Terminal Program, page 10.

4.3   Setting Up the Terminal Program

No additional software is necessary to operate an EFOY fuel cell with a computer. Terminal programs are an application on many operating systems and often come preinstalled.

The following illustrations will show you how to configure a terminal program such as Windows HyperTerminal so that you can operate your EFOY.

First, start the terminal program - in this illustration, Windows HyperTerminal.

Once the program is opened, the following window will appear:
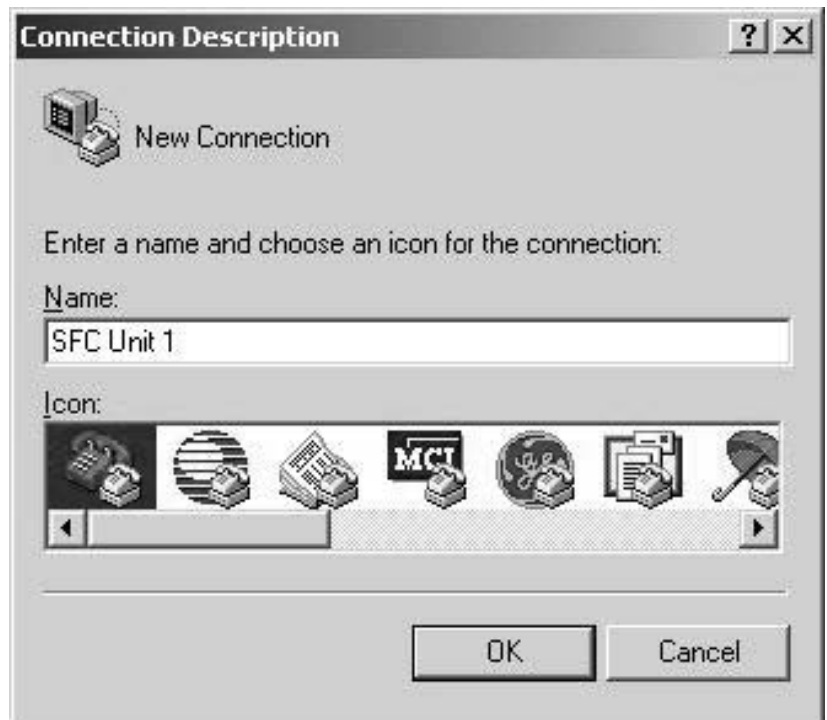
Enter a name (like SFC unit 1) into the name field. Confirm with OK.

The window that allows you to select a port will open automatically.

Select under "Connect using" the port to which you have connected the interface adapter, such as COM1.
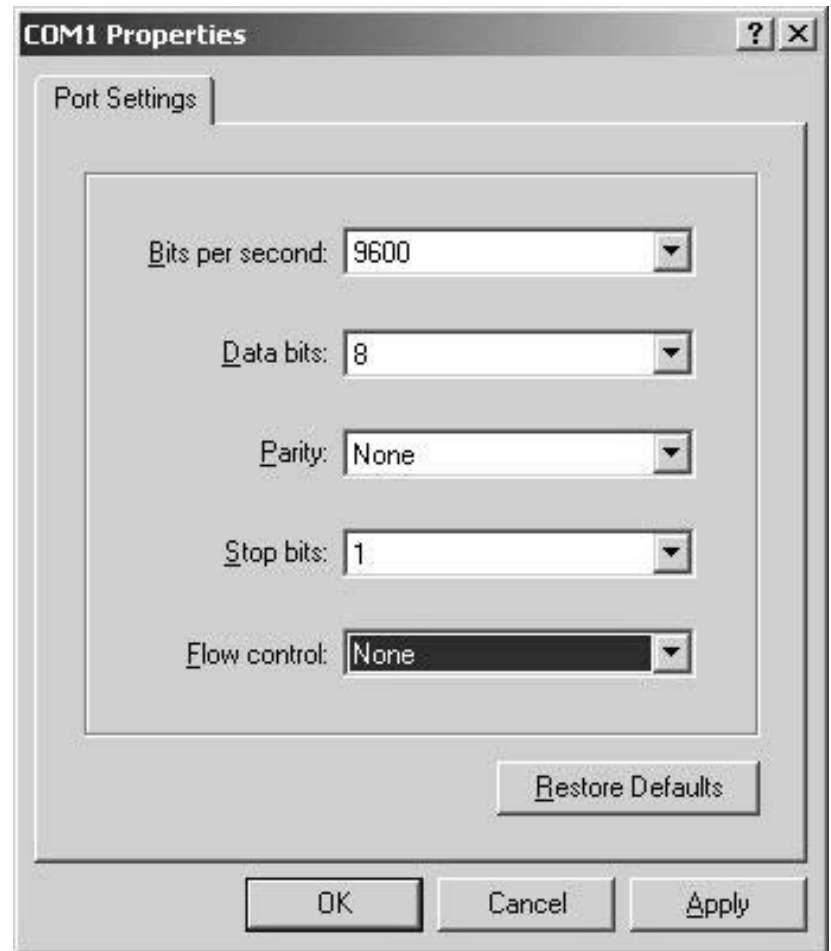
If you are not sure to which port the interface adapter is connected, you can change the setting later.

You will find information on the available ports in your computer's Device Manager.

Confirm with "OK". The window for configuring the port will then appear.

COM1 Properties

Port Settings

Bits per second: 9600

Data bits: 8

Parity: None

Stop bits: 1

Flow control: None

Restore Defaults

OK   Cancel   Apply

The following settings are necessary to establish the connection to the EFOY unit:

Bits per second: 9600
Data bits: 8
Parity: None
Stop bits: 1
Flow control: None

Use the settings as given above and confirm with "OK".

All settings must be entered correctly. Otherwise, a faulty connection may result or the terminal program will not be able to connect to the EFOY unit.

After confirming, you should now see a blank terminal screen.
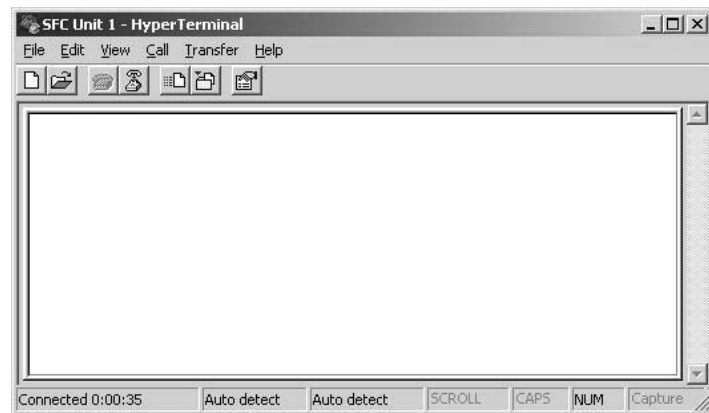
You will also need to perform the following settings for the HyperTerminal's line feed:

Open "File" and select "Properties"
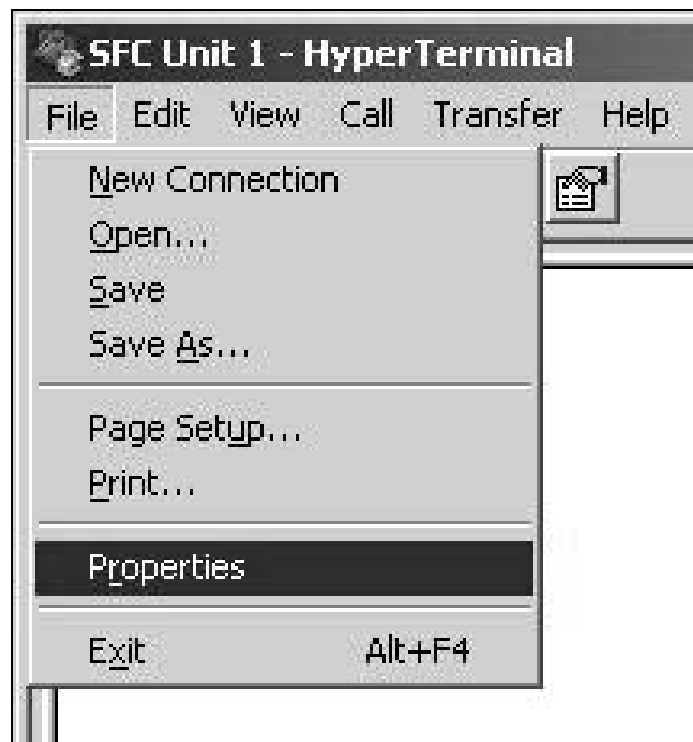
The following window will appear:

Select the tab "Settings"; then press the "ASCII Configuration" button.
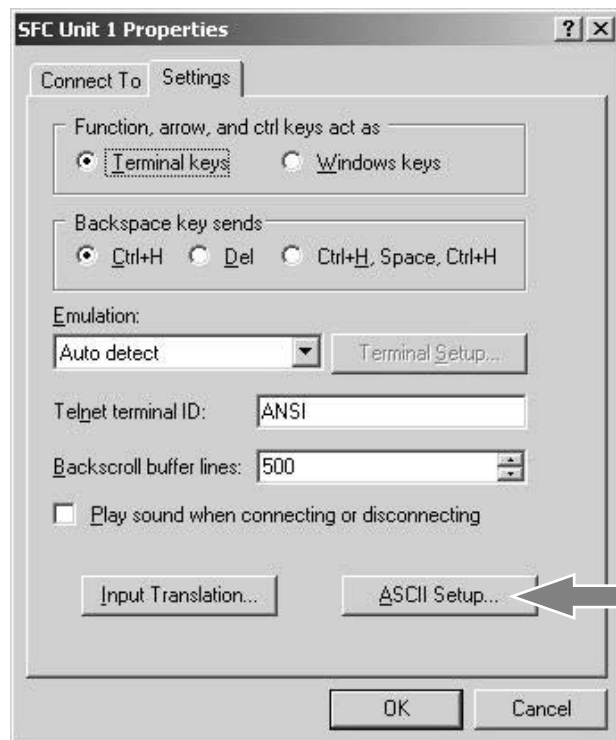
The following window will open. Please perform the settings as indicated:
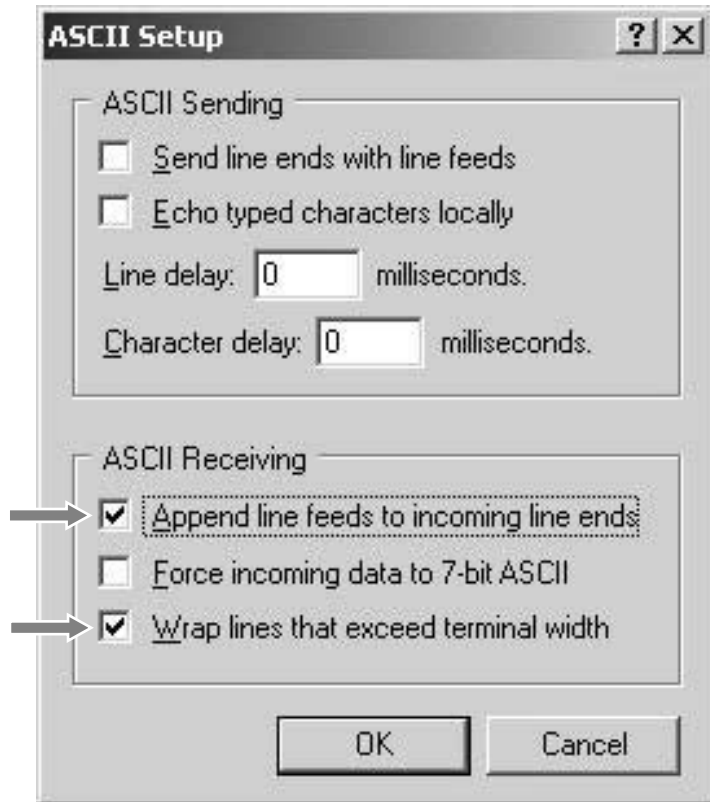
Close the window by clicking "OK" and confirm the "Properties" window with "OK".

The terminal is now configured and is ready to operate. You can connect or disconnect using the two telephone symbols in the upper left. The connection is automatically activated after the initial configuration. You can verify this by viewing the status bar at the lower left.
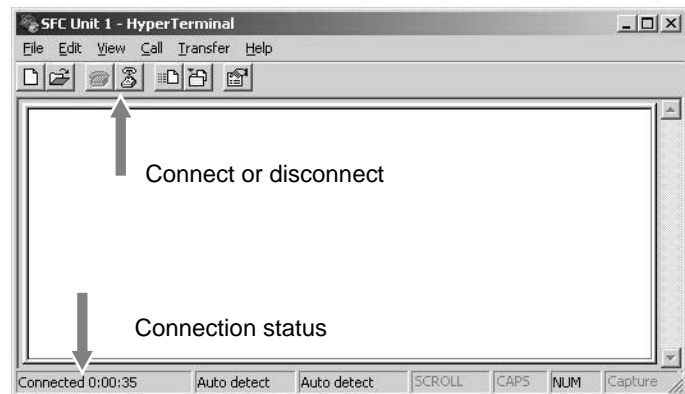
4. Configuring the Data Port

Test the EFOY connection by pressing the "Enter" key. The EFOY unit will respond with the prompt

SFC›

If there is no response, the connection is incorrect. Check to see whether the interface adapter is connected to the port (Com) and whether the connection is active. You can modify the settings in the menu "File\Properties" only after you close the connection.

If you change the port, you must reconfigure the settings as described above. You can open the appropriate menu by clicking the "Configure" button.

5.1 Commands

You can view the operating status, modify operating parameters or set up external control via the terminal interface.

There are various commands in the terminal interface. They are divided into three categories:

- commands for selecting operating parameters
  (see Chapter 5.2, page 19)

- commands for modifying preset operating parameters
  (see Chapter 5.3, page 25)

- commands for operating the EFOY unit
  (see Chapter 5.4, page 28)

The various chapters describe the function of all commands. The following is intended to provide a synopsis of the commands.

The description of the commands is based on Firmware Version 9.24 / 11.08

Enter commands only in upper case, i.e. SFC, and make sure that you have spelled them correctly.

Commands for selecting operating parameters

Command	Brief description	Chapter
?	Displays all available commands.	5.2
ERROR	Displays the most recent errors	5.2
GET	Displays the feasible values for operating parameters	5.2
LIMITS	Displays the permissible range for every operating parameter.	5.2
SFC	Displays the current operating status.	5.2
STDVALUE	Displays the default settings for operating parameters set by the command DEFAULT.	5.2
VALUE	Displays the current settings for the operating parameters. Use CONFIG to modify them.	5.2
VER	The firmware version installed on the EFOY unit.	5.2

Commands for modifying preset operating parameters

Commands	Brief description	Chapter
CONFIG	Permits modification of operating parameters such as forward transient voltage.	5.3
DEFAULT	Returns all operating parameters to the default settings.	5.3
SET	Allows variation of operation parameters	5.3

Commands for operating the EFOY unit

Commands	Brief description	Chapter
BATTERYPROTECTION	Permits to turn off the battery protection mode	5.4
BUTTON	Replaces pressing the On/Off and the Auto buttons on the remote control.	5.4
DUOCARTSWITCH	Permits operating the DuoCartSwitch	5.4
HYBRID	Turns the unit from the automatic mode into the hybrid mode for 15 seconds.	5.4
LANGUAGE	Verifies and modifies the language selection on the remote control.	5.4
LOCKED	Locks the software, thus preventing remote control of the EFOY unit via the Remote-On contact.	5.4
REMOTE	This control replaces the function of the Remote-On contact for remote control of the EFOY unit that is contained in the CC1 cluster controller.	5.4
RESET	Replaces pressing the Reset button on the remote control.	5.4

5.2 Commands for Selecting Operating Parameters

The following commands are purely for information purposes i.e., you can retrieve data without modifying the configuration.

Command	Output in the terminal program

? ↵	This command (only a question mark) summons up the available set of commands with brief descriptions.
	
	Example:
	
	SFC›?↵
	 ? display command overview
	 BATTERYPROTECTION control battery protection
	 BUTTON software control of device
	 CONFIG set customized operation parameters
	 DEFAULT apply default operation parameters
	 DUOCARTSWITCH control DuoCartSwitch device
	 ERROR show five most recent errors
	 GET get customized operation parameter
	 HYBRID switch the device from automatic
	                          into hybrid mode for 15s
	 LANGUAGE set language for panel
	 LIMITS show limits of operation parameters
	 LOCKED lock control contacts
	 REMOTE remote control via software interface
	 RESET restart the device
	 SERIAL show the device's serial numbers
	 SET set customized operation parameter
	 SFC show current operation state
	 STDVALUE show default values of operation
	                          parameters
	 VALUE show current values of operation
	                          parameters
	 VER show version of firmware

5. Data Port Commands

Command	Output in the terminal program
	If you put a question mark ? after above-mentioned parameters, the available options will be shown Example: SFC›button? software control of device arguments: ON | OFF | AUTO
ERROR↵	Displays the most recent relevant errors.

GET [LIST / id: (VAL/MIN/MAX/STD)]↵	Displays details to feasible values. It is possible to get the same parameters as with the commands VALUES, LIMITS and STDVALUE. With GET LIST you can get the numbers of the single parameters:
	
	  SFC›GET LIST↵
	  ID: 018, 'switch on voltage @ 12 V', 'mV'
	  ID: 019, 'switch off voltage @ 12 V', 'mV'
	  ID: 020, 'switch off current @ 12 V', 'mA'
	  ID: 021, 'switch on voltage @ 24 V', 'mV'
	  ID: 022, 'switch off voltage @ 24 V', 'mV'
	  ID: 023, 'switch off current @ 24 V', 'mA'
	  ID: 017, 'reaction time', 's'
	  ID: 016, 'maximum output energy', 'Wh'
	  ID: 024, 'altitude up to', 'm'
	  ID: 045, 'full charge duration', 'min'
	  ID: 046, 'battery protection @ 12 V', 'mV'
	  ID: 047, 'battery protection @ 24 V', 'mV'
	
	SFC›GET "ID":(VAL/MIN/MAX/STD) ↵
	With the particular ID-number it is possible to get the current value, the minimum value, the maximum value and the standard value of a parameter.

	For example:
	SFC› GET 018:VAL↵ or GET 018↵
	12300
	Displays the current value of the parameter 'switch on voltage @ 12V' in mV.
	For example:
	SFC›GET 018:STD↵
	Displays the standard value of the parameter 'switch on voltage @ 12V' in mV.
	For example:
	SFC›GET 018:MIN↵
	Displays the minimum value of the parameter 'switch on voltage @ 12V' in mV.
	For example:
	SFC›GET 018:MAX↵
	Displays the maximum value of the parameter 'switch on voltage @ 12V' in mV.
LIMITS↵	Displays the permissible range for all operating parameters. You will find information about the parameters in Chapter 6.1. Explanation of Operating Parameters
	Example:
	SFC›LIMITS↵
	switch on voltage @ 12 V: min 11.0 V - max 13.0 V
	switch off voltage @ 12 V: min 13.5 V - max 14.7 V
	switch off current @ 12 V: min 1.0 A - max 10.0 A
	switch on voltage @ 24 V: min 22.0 V - max 26.0 V
	switch off voltage @ 24 V: min 27.0 V - max 29.4 V
	switch off current @ 24 V: min 0.5 A - max 5.0 A
	reaction time: min 2 s - max 300 s
	maximum output energy: min 180 Wh - max 10800 Wh
	altitude up to: min 0.0 m - max 2000.0 m (0.0 ft to 6561.7 ft)
	full charge duration: min 0 min - max 300 min
	battery protection @ 12 V: min 10500 mV - max 12000 mV
	battery protection @ 24 V: min 21000 mV - max 24000 mV

5. Data Port Commands

| SERIAL↵ | Displays the serial number of the EFOY unit.

Example:

  SFC›SERIAL↵
  efoy : 110601-1004-123456
  stack: 151010059- |
| --- | --- |

| SFC↵ | Permits monitoring of the current operating status by displaying the various parameters. The EFOY unit transmits a largely unformatted string with all available parameters and their current value.

The parameters are described in Chapter 6.1, page 32.

Example:

  SFC›SFC↵
  battery voltage 12.75 V
  output current 3.31 A
  operation time (charge mode) 166 h
  operating state: auto on
  operating mode: auto
  cumulative output energy 14807.4 Wh
  no error
  cartridge level above sensor or no sensor
  no warning* |
| --- | --- |

* Only for EFOY Pro 2200 XT

5. Data Port Commands

Command	Output in the terminal program
STDVALUE↵	Displays the standard default settings of all operating parameters on the terminal interface but does not set them for actual operation. If they are desired, use the DEFAULT command. Example: SFC›STDVALUE↵ switch on voltage @ 12 V: 12.3 V switch off voltage @ 12 V: 14.2 V switch off current @ 12 V: 2.0 A switch on voltage @ 24 V: 24.6 V switch off voltage @ 24 V: 28.4 V switch off current @ 24 V: 1.0 A reaction time: 10 s maximum output energy: 1560 Wh altitude up to: 1500.0 m (4921.3 ft) full charge duration: 180 min battery protection @ 12 V: 11200 mV battery protection @ 24 V: 22400 mV SFC›
VALUE↵	Displays the current set of operating parameters without modifying them. Example: SFC›VALUE↵ switch on voltage @ 12 V: 12.5 V switch off voltage @ 12 V: 14.2 V switch off current @ 12 V: 2.0 A switch on voltage @ 24 V: 24.6 V switch off voltage @ 24 V: 28.4 V switch off current @ 24 V: 1.0 A reaction time: 2 s maximum output energy: 1560 Wh altitude up to: 1500.0 m (4921.3 ft) full charge duration: 180 min battery protection @ 12 V: 11200 mV battery protection @ 24 V: 22400 mV SFC›

5. Data Port Commands

VER↵	Indicates the firmware version.
	Example:
	SFC›VER↵
	Firmwareversion A50-1 4.03L12V date 2005-08-31
	SFC›

5.3 Commands for Modifying Preset Operating Parameters

⚠ **CAUTION!**

Improper use or modification of operating parameters may lead to battery damage or compromise the EFOY unit's charging properties.

It is thus advisable to ask the manufacturer about the battery's charging properties before modifying the operating parameters.

Work on any electrical facilities should be performed only by qualified personnel in accordance with applicable codes.

Command	Output in the terminal program
CONFIG↵	Displays all operating parameters one after the other along with their current values and the range of possible settings. The system expects a new value. If none is entered, it is sufficient to send a return (ASCII-Code 13) to the EFOY unit.
	Information about operating parameters appears in Chapter 6.1. Explanation of Operating Parameters
	Example:
	SFC›CONFIG↵ switch on voltage @ 12 V (actual 12300 mV, min 11000 mV, max 13000 mV)? ↵ switch off voltage @ 12 V (actual 14200 mV, min 13500 mV, max 14700 mV)? ↵ switch off current @ 12 V (actual 2000 mA, min 1000 mA, max 10000 mA)? ↵ switch on voltage @ 24 V (actual 24600 mV, min 22000 mV, max 26000 mV)? ↵ switch off voltage @ 24 V (actual 28400 mV, min 27000 mV, max 29400 mV)? ↵ switch off current @ 24 V (actual 1000 mA, min 500 mA, max 5000 mA)? ↵ reaction time (actual 10 s, min 2 s, max 300 s)? 20↵ maximum output energy (actual 1560 Wh, min 133 Wh, max 7800 Wh)? ↵ altitude up to (actual 1500.0 m, min 0.0 m, max 2000.0 m)? ↵ (actual 4921.3 ft, min 0.0 ft, max 6561.7 ft) full charge duration (actual 180 min, min 0 min, max 300 min)? ↵ battery protection @ 12 V (act. 11200 mV, min 10500 mV, max 12000 mV)? ↵ battery protection @ 24 V (act. 22400 mV, min 21000 mV, max 24000 mV)? ↵

	switch on voltage: 12.3 V
	switch off voltage: 14.2 V
	switch off current: 4.0 A
	reaction time: 20 s
	maximal output energy: 2160 Wh
	altitude of site: 1500.0 m (4921.3 ft)
	full charge duration: 180 min
	battery protection: 11200 mV
	SFC›SFC
	In this example, the reaction time was changed from 10 seconds to 20 seconds. All other values remain unchanged.
⚠	**We recommend entering the command "VALUE" after modifying the settings and keeping a printout of the new settings with the EFOY unit.**
DEFAULT↵	Reverts all operating parameters to the factory settings and displays these values as well.
	Example:
	SFC›DEFAULT↵
	switch on voltage @ 12 V: 12.3 V
	switch off voltage @ 12 V: 14.2 V
	switch off current @ 12 V: 4.0A
	switch on voltage @ 24 V: 24.6 V
	switch off voltage @ 24 V: 28.4 V
	switch off current @ 24 V: 2.0 A
	reaction time: 10s
	maximal output energy: 2160 Wh (depending on the unit)
	altitude up to: 1500.0 m (4921.3 ft)
	full charge duration: 180.0 min
	battery protection @ 12 V: 11200.0 mV
	battery protection @ 24 V: 22400.0 mV
	SFC›
SET id:value (MIN/MAX/STD)]↵	The command 'SET id:value' changes the value of a parameters. With this command it is possible to set up the same values as with CONFIG and DEFAULT. The list of parameters (ID-number) can be requested with the command SFC›GET LIST↵.

5. Data Port Commands

For example:

SFC›SET 018:12000↵

Sets the parameter 'switch on voltage @ 12V' to 12000 mV.

For example:

SFC›SET 018:STD↵

Sets the parameter 'switch on voltage @ 12V' to the standard value 12300 mV.

For example:

SFC›SET 018:MIN↵

Sets the parameter 'switch on voltage @ 12V' to the feasible minimum value 11000 mV.

For example:

SFC›SET 018:MAX↵

Sets the parameter 'switch on voltage @ 12V' to the feasible maximum value 13000 mV.

5.4 Commands for operating the EFOY Unit

Command	Output in the terminal program
BATTERYPROTECTION	**Allows you to deactivate/activate the battery protection mode.** SFC›BATTERYPROTECTION OFF OFF SFC›BATTERYPROTECTION ON ON

BUTTON [ON/ OFF / AUTO]	This allows you to reproduce the functions governed by buttons on the remote control. You must always indicate a parameter corresponding to the button to be "pushed".
	
	<table><tr><td>**Button**</td><td>**Parameter**</td></tr><tr><td>auto</td><td>AUTO</td></tr><tr><td>⏻ On</td><td>ON</td></tr><tr><td>⏻ Off</td><td>OFF</td></tr></table>
	Example:
	
	  SFC›BUTTON AUTO↵
	  OK
	  SFC›BUTTON↵
	  no valid parameter
	  SFC›BUTTON ON↵
	  OK
	  SFC›
	
	In this example, the EFOY unit began in the automatic mode. No parameter was indicated with the second command. The response was therefore an error message. The third command switches the EFOY unit on.

DUOCARTSWITCH [ON / OFF / SWITCH 1 / SWITCH 2]	This function must be activated while using the DuoCartSwitch for the first time. Remains active untill it will be deactivated. A fuel cartridge change to another cartrigde can be set by a parameter:

	Example: SFC›DUOCARTSWITCH on battery voltage 12.64 V output current 0.00 A operation time (charge mode) 166.1 h operating state: auto off operating mode: auto cumulative output energy 14809.9 Wh no error cartridge level above sensor or no sensor (cartridge 1 consumed 0.00 l) SFC›DUOCARTSWITCH SWITCH 2 Switches from fuel cartridge 1 to fuel cartridge 2 If the command is output without the parameter, the EFOY unit output is "SFC". The last line „cartridge level above sensor or no sensor (cartridge 1 consumed 0.00l)" shows, that the DuoCartSwitch is activated.

LANGUAGE [SHOW / language]	Changes the language on the remote control or displays the language currently selected.
	
	If the command is transmitted without parameters, the EFOY unit replies with the language currently selected. If a new language is transmitted as a parameter, it registers as a new language. In order to display all available languages, it is necessary to add the parameter SHOW to the command.
	
	Example:
	
	  SFC›LANGUAGE↵
	  english
	  SFC›LANGUAGE deutsch↵
	  OK
	  SFC›LANGUAGE↵
	  deutsch
	  SFC›LANGUAGE SHOW↵
	  English
	  Deutsch
	  Français
	  Italiano
	  Nederlands
	  SFC›

LOCKED [ON / OFF]	Prevents control of the EFOY unit by the Remote-On contact and prevents remote control of the EFOY unit during servicing, for example. If the command is entered without parameters, the EFOY unit will indicate the current status of the software lock.
	If you have set the software lock, a lock symbol 🔒 will appear on the remote control.
	Example:
	SFC›LOCKED↵ OFF SFC›LOCKED ON↵ OK SFC›LOCKED↵ ON SFC›LOCKED OFF↵ OK SFC›

Command	Output in the terminal program

REMOTE [ON / OFF]	This command replaces the Remote-On contact contained in the CC1 cluster controller for external control of the EFOY unit.
	
	If the command is used without parameters, it will be possible to check the current status of the "software contact".
	
	If you have imposed a software lock, a lock symbol 🔒 will appear on the remote control.
	
	Example:
	
	  SFC›REMOTE↵
	  OFF
	  SFC›REMOTE ON↵
	  OK
	  SFC›REMOTE↵
	  ON
	  SFC›
	
	The "remote" command is the only way of controlling the EFOY when the Hybrid mode is used.

RESET↵	This command replaces pressing the Reset button on the operating panel. Example: SFC›RESET↵ Note: This is the only command that provokes no response because it immediately triggers a reset of the EFOY unit.

6.1 Explanation of the Operating Parameters

Switch-on parameters

Operating Parameter	Function	Note
Switch-on voltage	The EFOY Pro unit switches on and charges the battery when a predetermined voltage level is reached.	A setting that is too high will cause the EFOY unit to switch on frequently.

Switch-off Parameters

The EFOY fuel cell switches off fully automatically. Controlling the shut-off are the two operating parameters, battery voltage and charging current. In order for EFOY fuel cells to shut off, the switch-off voltage must be exceeded and the current must be lower than the shut-off point. The factory settings are 14.2 V and 2.0 A (4.0 A for EFOY Pro 2200) respectively, meaning that the EFOY fuel cell shuts off as soon as battery voltage exceeds 14.2 V and charging current is lower than 2.0 A (4.0 A).

Operating parameter	Function	Note
Switch-off voltage	Once the battery reaches a predetermined voltage, the EFOY unit will switch off, provided that the "switch-off current" parameter is also met.	Please note your battery's end-of-charge voltage. Follow the manufacturer's recommendations.

6. Additional Information

Switch-off current	The EFOY Pro unit will shut off once current dips below this level.	If you wish to use battery voltage as the sole switch-off parameter, set for the maximum switch off current since EFOY fuel cells will always produce a lower value. If you want to charge the battery the best way we advise following calculation: Current consumption (A) + 0.012 x Battery capacity Example: with a constant consumption of 2.0 A and a battery capacity of 80 Ah the swtich of current is 2.96 A [2 A + 0.012*80]
Full charge duration	This function is an additional switch-off criteria for the EFOY unit when the switch-off current won't be achieved in adjusted time.	Factory setting is 3 hours, it can be changed from 0 to 5 hours.

6. Additional Information

Miscellaneous Criteria

Reaction time	The reaction time must elapse before the EFOY unit reacts. For example, switch-on voltage must fall below 12.3 volts for at least ten seconds before the EFOY unit switches on (factory settings).	If you are going to briefly use high voltage appliances, coordinate this value with the times of operation.
Energy (maximal output energy)	If the switch-off criteria, voltage and current, have not been satisfied, the EFOY unit will shut off after generating the number of watt-hours for which it is set. (Example: 1200 watt-hours for the EFOY 1200. Once the switch-on criterion has been satisfied, the EFOY unit will go back on, which can be immediately afterwards.	This switch-off criterion prevents unlimited charge cycles caused by things like defective batteries.
Altitude of site	Standard value "up to 1500.0 m"(4921.3 ft). For stationary application above 1500.0 m (4921.3 ft), we recommend to set "2000.0 m" (6561.7 ft) as altitude via the CONFIG command.	

6.2 Permissible Ranges of Operating Parameters

Operating parameter 12 V	ID	Factory setting	Min.	Max.	Actual value
Switch-on voltage	018	12300 mV	11000 mV	13000 mV	
Switch-off voltage	019	14200 mV	13500 mV	14600 mV	
Switch-off current	020	2000 mA (4000 mA EFOY Pro 2200)	1000 mA (4000 mA EFOY Pro 2200)	10000 mA	
Reaction time	017	10 s	2 s	300 s	
Maximum output energy	016	Depends on EFOY Pro type	Depends on EFOY Pro type	Depends on EFOY Pro type	
Full charge duration	045	180 min	0 min	300 min	
Battery protection	046	11200 mV	10500 mV	12000 mV	

Operating parameter 24 V	ID	Factory setting	Min.	Max.	Actual value
Switch-on voltage	021	24600 mV	22000 mV	26000 mV	
Switch-off voltage	022	28200 mV	27000 mV	29400 mV	
Switch-off current	023	1000 mA (2000 mA EFOY Pro 2200)	1000 mA (2000 mA EFOY Pro 2200)	5000 mA	
Reaction time	017	10 s	2 s	300 s	
Energy maximum output energy	016	Depends on EFOY Pro type	Depends on EFOY Pro type	Depends on EFOY Pro type	
Full charge duration	045	180 min	0 min	300 min	
Battery protection	047	22400 mV	21000 mV	24000 mV	

6.3   Explanation of Measured Values

Use the "SFC" command to retrieve these values. See Chapter **Fehler! Verweisquelle konnte nicht gefunden werden.** Commands for Selecting Operating Parameters, page 19.

Measured values	Example	Explanation
Battery voltage	12.1 V	Voltage measured at the battery
Output current	0.0 A	Charging current measured at the fuel cell
Operating time	5.8 h	Hours the EFOY Pro fuel cell has been in operation
Operating state		Operating status of the EFOY Pro fuel cell
	Auto on	The fuel cell is working in automatic mode and is on.
	Auto off	The fuel cell is working in automatic mode and is off.
	error	error: There is an error or malfunction. Please follow the instructions in the EFOY Fuel Cell user manual.
	remote on	The fuel cell is switched on via the remote contact
	remote off	The fuel cell is switched off via the remote contact. Used for Hybrid operation.
	Slave on	If several products are combined via a cluster controller, the following status is indicated for the non-leading units.
	Battery protection	when the battery protection is acitvated.
	Freeze protection	the fuel cell is being used in the freeze protection mode.

6. Additional Information

Operating mode	auto	Displays current operating mode auto: Automatic On Off Hybrid
Error messages	change cartridge	In addition to indicating the operating mode, the system also displays other text and error messages. Please refer to the user manual for detailed failure codes.
Fuel-cartridge sensor	cartridge level above sensor	If a fuel-cartridge sensor is used, this will indicate whether the level is below or above the sensor level. cartridge level above sensor or no sensor cartridge level below sensor
DuoCartSwitch	(cartridge 1 consumed 1.00 l)	DuoCartSwitch is active. Since last fuel cartridge switch, 1 litre of methanol has been used.
Warning*	Warning No warning	An information is displayed and an action is required. No action is required.

* Only for EFOY Pro 2200 XT

Description	Solution
It is not possible to establish a connection between the EFOY fuel cell and the computer.	Connect the EFOY unit to a functional battery. Configuration is possible only if power is flowing to the EFOY unit.
	Check to see whether the data line and the interface adapters are connected (see 4.2, Connection to the Computer, page 8)
	Check the configurations in terminal program (see Chapter 4.3 Setting Up the Terminal Program, page 10).
	Make sure the interface adapter is connected to the allocated port (such as COM 1).
	Check whether a connection has been established by the terminal program.
	If using a USB-RS232 adapter:
	Make sure you have the correct COM port allocation (it generally isn't a COM1 port). You can check the port in your PC's Device Manager.
	Check whether the USB adapter has been properly installed and the PC recognizes it.
Commands are not accepted.	Enter commands only in upper case, i.e. SFC, and make sure that you have spelled them correctly (see Chapter 6.2 Permissible Ranges of Operating Parameters, page 35).
Operating parameters cannot be modified.	Make sure that the desired value is within the permissible range (see Chapter 6.2 Permissible Ranges of Operating Parameters, page 35).
Hyperterminal cannot be found	Windows 7 and Vista don't have the hyperterminal program anymore.

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