Evolion®

Installation and operating instructions

1. Safety

Make sure to study and follow all instructions. Misusing the Evolion® may cause it to overheat or ignite.

- **Do not short-circuit the power terminals.**
- **Do not reverse connect the power cables.**
- **Do not disassemble the unit.**
- **Do not subject the unit to excessive vibrations or drop the unit.**
- **Do not immerse the unit.**
- **Do not expose the unit to fire or temperature higher than 100°C (+212°F). It may cause the cell safety vent to open which renders the unit inoperable.**
- **Use only in Telecom power systems with a maximum rated output of 60 V.**
- **Refer to the Battery Information Sheet (included) for emergency response procedures.**

2. Important recommendations

If smoke is emitted from a unit, stay clear of the smoke and evacuate the area until the smoke clears.

Refer to the Evolion® Technical Manual for functional details.

See Figure 1 for operator interface features.

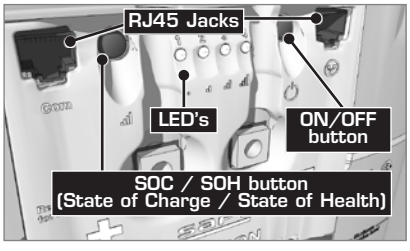


Figure 1 - Evolion® main front access

3. Unpacking and inspection

When shipped, the Evolion® is packaged in accordance with UN3480 Class 9 Group 2. Unpack and make sure all items were received. Table 1 summarizes the standard kit.

If items were not received or if anything is damaged contact your local Saft representative.

If a long storage is planned (more than 6 months), check and note the SOC (State of Charge) according to Figure 3 and Table 2. A hole in the packaging allows you to access the unit without removing it from the box. Refer to Figure 2.

This will help to plan the next refreshing charge.

Keep Evolion® in its original packaging for continued storage or for transportation.

Table 1 - Standard items in Evolion® kit (771473-XX)

Part N°		Qty
771492-XX	Evolion®	1
771285	Fuse, spare	1
780680	Power cable for positive terminal (1 meter length)	1
772517 (Note 1)	Power cable for negative terminal (1 meter length)	1
772518 (Note 1)	Communication cable (1 meter length)	1
773455	RJ45 resistor cap	1

-XX: refers to the parameter file variant
Note 1: The cable Part N° varies according to heat shrink color and cable color

Figure 2 - Accessing the unit

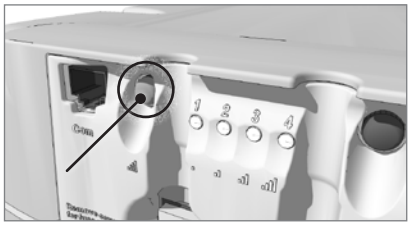


Figure 3 - Checking SOC (State of Charge)

- *For SOC, push and hold for 3 s or less and observe the LED's.*

4. Storage

Store the battery in its original packaging and in typical warehouse conditions. The temperature should be between 15°C to 30°C (59°F to 86°F).

In these conditions, the Evolion® can be stored for up to 1 year from the manufacturing date. Make sure the unit is switched OFF during storage. When OFF, the unit is in sleep mode. In sleep mode, no voltage is present on the terminals and the internal electronic consumption is very low.

NOTE: The Evolion® unit will periodically and automatically wake-up to record its state and to initiate cell balancing if necessary.

IMPORTANT: If the unit is left ON, it may over discharge in less than 3 weeks and render the unit inoperable. It is mandatory to check the SOC, every 6 months, while in a long storage period. See Figure 3 and Table 2.

If the Evolion® is stored at a low SOC for too long, it may eventually over discharge and render the unit inoperable.

To conduct a maintenance charge:

- Connect according to Section 6
- Make sure the set-point voltage on the rectifier is 56.0 V
- Charge for a total time according to the available charge current (see Table 3)

Table 3 - Maintenance charge time

Amps per unit	Charging time	Amps per unit	Charging time
3	15 h 20 min	12	3 h 50 min
4	11 h 30 min	15	3 h
5	9 h 10 min	18	2 h 30 min
6	7 h 40 min	20	2 h 10 min
8	5 h 40 min	25	1 h 50 min
10	4 h 30 min	CL mode*	see Note 1

*Note 1: CL = current limit mode, use a charge current less than IMR to avoid CL mode charge. See Evolion® Technical Manual for more details.

Table 2 - SOC (State of Charge) LED legend

SOC LED (LED steady for 5 s)	☀●●●●	☀●●●○	☀●●○○	☀○○○○
Minimum SOC	≥75%	≥50%	≥25%	<10%
Maximum storage time (at less than 30°C)	20 months	13 months	7 months	schedule maintenance charge immediately

5. Transportation

Use the original packaging or equivalent. Follow the necessary transportation rules for Li-ion batteries by consulting with your company's standard practice and your local transportation regulations.

Secure the Evolion® to prevent violent shock and other items from falling onto it. The Evolion® must be OFF during transportation.

6. Installation

See Figure 4 for Evolion® features.

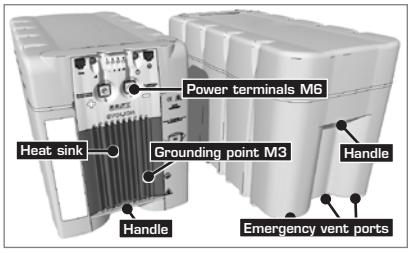


Figure 4 - Evolion® features (oriented upright with front and back view)

- Never block the heat sink.
- Do not obstruct the emergency vent ports.
- Install in environment with IP55 (NEMA3 outdoor) or higher protection index.
- 95% maximum humidity (non-condensing)
- Overall installation steps (details follow):
  1. Connect power
  2. Connect communication (optional)
  3. Startup
- Required tools

• 10 mm socket (for terminal)
• Multimeter (60 Vdc, ohms)
• Flat screwdriver (for cover removal)
• 7 mm socket (for fuse)
• Torque wrench (insulated)

Connect power

Always connect the Evolion® using the provided cables in order to balance the resistance in each branch. See Figures 5 and 6 for power connections schematics and options.

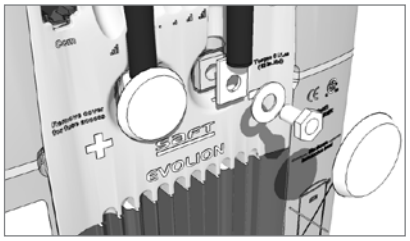
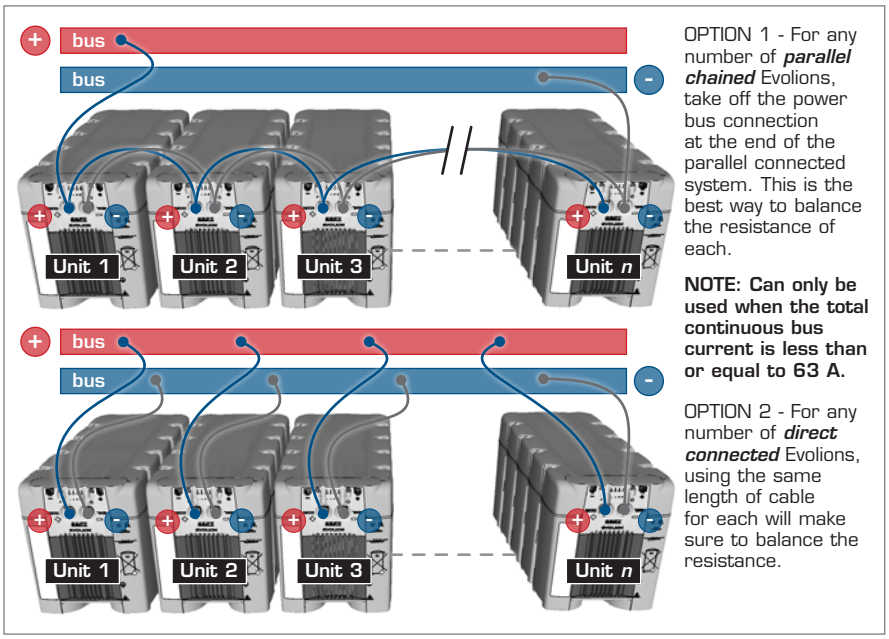


Figure 5 - Connecting to terminals

- *Only use the terminal bolts, washers, terminal protectors and cable lugs provided.*
- *Terminal bolt torque = 6 N.m (53 in.lbs)*



OPTION 1 - For any number of ***parallel chained*** Evolions, take off the power bus connection at the end of the parallel connected system. This is the best way to balance the resistance of each.

NOTE: Can only be used when the total continuous bus current is less than or equal to 63 A.

OPTION 2 - For any number of ***direct connected*** Evolions, using the same length of cable for each will make sure to balance the resistance.

Figure 6 - Parallel connecting Evolions

IMPORTANT: Never connect the power terminals in series with other Evolion® units. The Evolion® may be damaged and rendered inoperable.

IMPORTANT: Parallel connecting can be done as long as the total system discharge current never exceeds 130 A (5 kW at 42 V) continuous. In this case paralleling any number of units is allowed.

Make sure to never parallel connect Evolions that have more than 2 V difference between the modules. Equalizing the voltage by charging or discharging modules separately may be necessary. To check the open circuit voltage when disconnected, press the ON/OFF button for at least 2 seconds and measure the voltage at the terminals. Make sure to turn the unit OFF by pressing the ON/OFF button for at least 4 seconds.

The Evolion® limits its own current with a built in charge regulated circuit. However, starting up the Evolion® to avoid the charge regulated mode is important to avoid a possible internal fuse fault.

Make sure to switch off the battery breaker(s) before connecting Evolion® power terminals to the power bus.

The Evolion® power terminals can be connected to systems with a positive ground, a negative ground or a floating ground system.

In order to prevent reverse connections, make sure to measure and note the polarity of the power bus cables.

IMPORTANT: A reverse connection on the power terminals may cause an internal fuse fault. See Section 10 if replacing the fuse is necessary.

Connect communication

See Table 4 for RJ45 jack pin assignments.

Table 4 - RJ45 pin assignments

Pin 1	RS485+
Pin 2	RS485-
Pin 3	Ground (isolated from power terminals)
Pin 4	Wake up (ground referenced)
Pin 5	Reserved
Pin 6	Reserved
Pin 7	Dry contact alarm output
Pin 8	Dry contact alarm output

Both RJ45 jacks are interchangeable and can be used to plug either the communication cable (772518) or the RJ45 resistor cap (773455).

To access the dry contact alarm signal, use pins 7 and 8. Both minor or major alarm signals are reported and the default state of the pin is as follows:
CLOSED = ALARM/power down
OPEN = NO ALARM

Use the communication cable provided. See Figures 7 and 8.

Make sure to conduct an Evolion® Installation and Commissioning (I&C) prior to startup. Setting a unique node ID (default = 1) for each parallel connected Evolion® is necessary in order to communicate using the Saft Evolion® Toolbox software during operation.

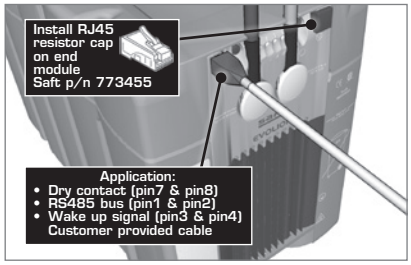


Figure 7 - Communication connecting with one module

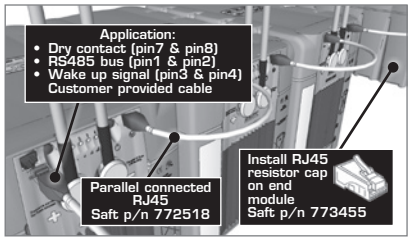


Figure 8 - Communication connecting with parallel modules

Startup

Table 5 - Rectifier output settings

#	Type	Setting
a.	Single level voltage	56.0 Vdc ± 0.5%
b.	Temperature compensated voltage control	Disabled or turned OFF.
c.	Maximum re-charge current	See Table 7 (to manage thermal behavior)
d.	Ramp in voltage/ current (soft start)	When the AC powers ON, output voltage/ current should ramp up to single level voltage over at least 1 minute.
e.	Default rectifier output voltage	When AC powers ON, if the rectifier controller is not available or working, make sure to set the default rectifier output voltage to 50 V maximum.
f.	Low voltage disconnect (if used)	45 Vdc ± 1%

To start up the Evolion® when connected to the application:

- Switch ON the rectifier/breaker output.

IMPORTANT: Do not use the ON/ OFF button to switch ON the Evolion® when it is connected the power bus. This may cause a fuse fault.

When the Evolion® is ON, the LED's are active indicating its operational status (see Table 6).

Table 6 - Operating LED legend

NORMAL	slow blink	Floating
	fast blink	Charging
	steady	Discharging
ABNORMAL	steady	Low health
	steady	Warning
	steady	Alarm

Note: Refer to 10. Troubleshooting if ABNORMAL LED is active.

To shutdown the Evolion® when connected to the application:

- Turn OFF the battery output breaker.
- Push the Evolion's ON/OFF button for at least 4 s.

When the Evolion® is OFF, the LED's are inactive.

7. Operation

The Evolion® is a "smart battery" and will only allow safe operation. If a key operating parameter is exceeded, the Evolion® will automatically interrupt or restrict its operation until the key operating parameter is back within acceptable limits. In this case the alarm will be reset and operation will continue normally. Some alarms are only resettable by the BMST reset button or by sending a BMST reset command on the RS485/Modbus communication bus.

The Evolion® is an RS485/Modbus slave. Any user configured RS485/ Modbus master equipment can communicate with the Evolion®. See the Evolion® communication user manual for more details

The Evolion® is equipped with an internal heater. It operates as needed in charge and discharge mode of operation.

During operation, the LED's are active and indicate the Evolion's status. See Table 6.

Charging

Make sure that output of the rectifier is set as 56.0 V ± 0.5%. It must be set higher than 49.0 V to allow cell balancing during re-charge.

Temperature Compensated Voltage (TCV) should be disabled. The Evolion® is not harmed by TCV control but the available capacity will be decreased by 10% for every 1 V below 56.0 V.

- When Evolion® is used in "floating operation", for which re-charge time is not critical, the charge current can be limited to 16 A per Evolion® module.
- When Evolion® is used in "cycling operation" the maximum current will depend on the operating temperature. Refer to Table 7.
- If the maximum allowed charged current (IMR) is exceeded, the Evolion® will automatically regulate its own charge current by switching to regulated charge. In that case, the charge can last 24 h.

The Evolion® will accept charge current only when the temperature is above - 30°C and below +75°C (- 22°F and +167°F).

Table 7 - Maximum re-charge current to manage thermal behavior of Evolion®

Cycling Frequency	Maximum allowed Amps per Evolion® (Note 1)
More than 4x per day	16
3x to 4x per day	21
2x to 3x per day	24
1x to 2x per day	32
Less than 1x per day	Less than IMR

*Note 1: The re-charge current can never be above IMR to avoid charge regulated mode of operation. Make sure to use the lowest value.

Discharging

The Evolion® will discharge above - 30°C and below +75°C (- 22°F and +167°F). The maximum allowed discharge current is a function of temperature.

IMPORTANT: If an Evolion® is subjected to more than 130 A (5 kW @ 42 V) of continuous discharge current, a fuse fault will occur. See Section 10 for fuse replacement.

The Evolion® will continuously discharge until one of the following is encountered.

- The rectifier output power returns, or
- The battery reaches the minimum set SOC (0% by default), or
- No discharge current is present for a set time duration (default is 0), or
- The ON/OFF button is pushed for at least 4 s, or
- The maximum allowed discharge current is exceeded, or
- The low voltage disconnect is reached (default is 42.0 V).

When the end of discharge is encountered due to a low end voltage, the Evolion® will eventually go into sleep mode when the a low cell voltage is reached.

IMPORTANT: After the end of discharge to 42 V, the Evolion® can remain in sleep mode for a maximum of 14 days. If re-charge does not begin within this time, the Evolion® may be over discharged due to its internal self-discharge. If over discharged, it will not startup and will indicate a major alarm that is not resettable. The unit will need to be replaced.

8. Maintenance

The Evolion® requires no maintenance, but checking its state and taking necessary action during periodic site routines is recommended.

The SOC can be checked while in operation. Refer to Figure 3 and Table 2.

Check if the heat sink area is obstructed or accumulated with dirt and debris. As necessary, un-obstruct or clean using a non-metallic brush or a dry or damp cloth. Do not use any cleaning solvents or soaps. Do not immerse, dunk, bathe or hose off the Evolion®.

Check the rectifier output. It should be set at 56.0 V ± 0.5%.

Check the LED and verify that the operating status is normal. Refer to Table 6.

If an abnormal operation (see Table 6) is noticed, see Section 10.

9. Resetting the software

If an alarm that is not automatically resettable or software trap is encountered then push the reset button using a pointed object. After the unit can be restarted normally. See Figure 9 below.

IMPORTANT: Only push the reset button when the Evolion® is disconnected from the application. The Evolion® must be ON to reset.

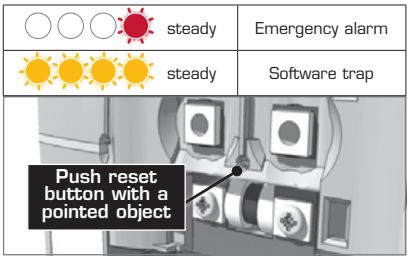


Figure 9 - Reset button

10. Troubleshooting

The Evolion® Toolbox software is the best way to interrogate an Evolion® during troubleshooting. Refer to the Evolion® Technical Manual Appendix E for troubleshooting alarm details.

If an abnormal operation status is noticed, conduct the following procedure (Table 8):

Table 8

steady	Schedule a replacement of the Evolion® module. Contact your local Saft representative for further details.
steady	The Evolion® can continue to operate normally. Use the Evolion® Toolbox software to view the active alarms. Troubleshoot the active alarms according to the Evolion® Technical Manual Appendix E. Contact your local Saft representative for further assistance.
steady	The Evolion® is currently disconnected by its own internal switch. Disconnect and remove the Evolion® from the application to prevent inadvertent waking up and reconnecting with too much voltage difference (2V maximum). Use the Evolion® Toolbox software to view the active alarms. Troubleshoot the active alarms according to the Evolion® Technical Manual Appendix E. Put Evolion® back into service if alarms are successfully cleared. Make sure to reconnect with less than 2V difference between modules. Contact your local Saft representative for further assistance.
Evolion® is **OFF** on a live bus	The Evolion® is likely deep discharged. Disconnect and remove the Evolion® from the application. Contact your local Saft representative for further assistance.

If the Evolion® emits an unusual smell, feels hot, changes shape or appears abnormal in any other way, conduct the following procedure:

1. Disconnect the Evolion® from power.
2. Shut-down the Evolion® by pushing the ON/OFF button for at least 4 s.
3. Leave the Evolion® in place.
4. Call your local Saft representative for further assistance.

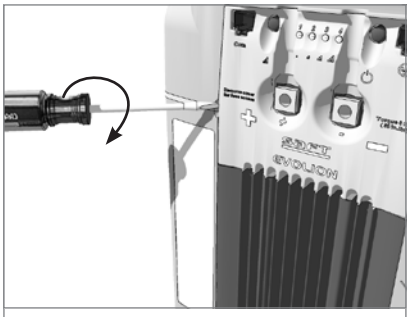
To check and replace the fuse, conduct the following procedure:

1. Shut-down the Evolion® by pushing the ON/OFF button for at least 4 s.
2. Disconnect and un-install the Evolion®.
3. Check and replace the fuse according to Figure 10.
4. The Evolion® is now ready for service.

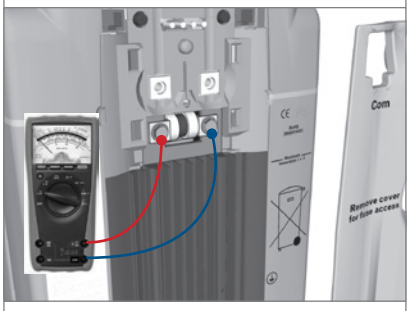
11. Removal and recycling

Make sure to turn OFF the battery breaker.

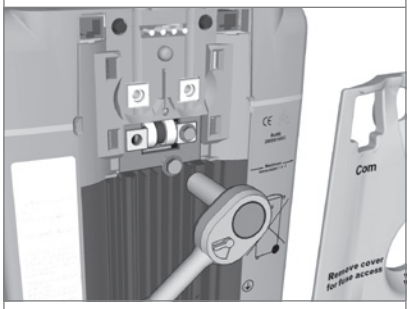
1. Shut-down the Evolion® by pushing the ON/OFF button for at least 4 s.
2. Disconnect the power terminals.
3. Disconnect alarm/communication cables.
4. Remove the Evolion® and stage for recycling.
5. Call your local Saft representative for further assistance.



- *Remove fuse cover by inserting, on either side, a flat head screwdriver and twisting.*



- *Measure continuity. If good continuity, the fuse is good. Re-install the cover.*



- *If no continuity, remove and replace the fuse using a 7 mm socket and torque wrench with a torque of 3 N.m (26.5 in.lbs). Re-install the cover.*

Figure 10 - Replacing a fuse

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