ALFA PROGETTI S.r.l. - Spilamberto (MO) Tel. +39 059 785 726 - Fax +39 059 785 737
www.alfaprogetti.com

Smart.IC2 V3 Installation and Use Manual

	Date	Notes
Version 1.1	21 Apr. 2010	Official Documentation
Version 1.2	26 Oct. 2011	Official Documentation
Version 1.41	29 Oct. 2012	Official Documentation

INDEX:

1 Description and operation

1.1 Features

Smart.IC2 V3 is a device designed for the monitoring and control of lead batteries. Its main features are:

- Measurement of the instantaneous battery data including voltage, current, available Ah and temperature. An indication of the amount of Ah available is provided by LEDs on the panel (§1.4 LED Signals)
- Built-in RTC (Real Time Clock) to build a log of the data collected with date and time
- Storage of historical data. The past activity of the battery can be accessed on a PC using the SmartViewII software application or through WEB. The data collected can be viewed grouped by working cycle or by day. For each working cycle the data is presented both in figures and graphics
- Data download to a PC. Through an IR connection all data can be sent to the SmartViewII PC program
- Statistical analysis. SmartViewII has numerous functions able to provide statistics to check the correct use of the battery and the charge reporting any anomaly
- Management of the Smart Energy family battery chargers (controlled charging system), which reduces the costs of charging
- Remote monitoring via the internet: SmartService is a software application which collects data from Smart.IC2 devices, processes it and sends an email report regarding the entire set of devices. The communication between the Smart.IC2 units and SmartService occurs through GPRS technology
- Possibility to use the SmartService functions which, like the SmartViewII program provide statistical data and report anomalies also enabling the visualisation of the list of anomalies and data grouped by cycle.
- Analysis of battery efficiency thanks to the SmartService monitoring.
- Ability to interface with SmartKey devices (system that controls access to the forklifts and stores events and collisions) and send data to SmartService via GPRS

NOTE: WEB/SmartService services are available only for the GPRS version.

Optional accessories:

- External temperature immersion sensor
- Electrolyte level sensor.

1.2 Working Cycle

A **working cycle** is intended as a sequence comprising a **discharge stage followed by charging stage**. Given that a change of cycle is forced in the case of a new association, power failure, or long period of inactivity after a charge, this definition should be understood as a guideline. Another exception of the definition occurs when the option Opportunity Charging is set (see §1.6 Opportunity Charging).

The transition from discharge to charge occurs after 2 minutes of charging to avoid misinterpretations due to the presence of a charge recovery device during braking (in this case it is intended as energy recovery and the input charge will be added to the "Recovered Capacity").

During the discharge stage the "Discharged Capacity" is counted. In addition, two situations which may arise in case of excessive discharge are highlighted: the "Underdischarge Time" which indicates the time when the voltage is below the "Underdischarge Voltage" configured (see §10.3 Programming of operating parameters and the "Discharged Capacity Under AhBS" (indicates the capacity used below the threshold of (100-AhBS)% of the nominal battery capacity)). During the discharge stage the "Self discharged Capacity" and the "Recovered Capacity" are also counted.

Within the charging stage there is a *First Stage* (the charge before reaching the configured "Voltage Threshold 2nd Stage"), the *Second Stage* (the charge following the attainment of the "Voltage Threshold 2nd Stage") and the "Capacity in Overcharging" (corresponding to any charge in excess over the hypothetical attainment of 109% of the nominal capacity). Only in the case of controlled Chargers (SmartEnergy) is the "Equalization" count displayed.

For a detailed list of the information provided by SmartViewII (Info TAB and OLD Data Info TAB) see the relevant manual.

SmartViewII: Old Data Info

1.3 Anomalies

The SmartViewII program provides information about anomalies found in the cycle.

Anomalies	**Description**	**LED Anom.**
Safety Timer 1st Stage	While charging the battery voltage did not reach the "Voltage Threshold 2nd Stage" by the "Safety Timer 1st Stage" (see §10.3 Programming of operating parameters)	X
Safety Timer 2nd Stage	While charging during the 2nd Stage, the battery charge did not reach the nominal capacity by the "Voltage Threshold 2nd Stage" (see §10.3 Programming of operating parameters)	X
Safety Ah	While charging, the battery reached 110% of the nominal capacity before reaching the 2nd Stage	
Battery Discharged Under AhBS	While discharging, the battery capacity dropped below the "Battery discharged threshold (AhBS)" (see §10.3 Programming of operating parameters)	
Low Battery Efficiency	The battery has been in an underdischarging state for a time ≥ "Under-Discharge" time when the remaining battery capacity is ≥ (Battery Ah – Battery discharged threshold (AhBS)) (see §10.3 Programming of operating parameters) (°)	
Low Level Of Battery Electrolyte	The electrolyte level sensor indicates the electrolyte under the minimum level (*)	X
Wrong Programming/Relay Failure	With SmartCB selected (see §10.3 Programming of operating parameters) there is a charging current even though "Charge Relay" is open	
EEPROM/RTC Failure	A failure in the memory of the SmartIC device or RTC was detected	

The "Xs" in the "LED Anom." column indicates that a LED warning is foreseen for the anomaly indicated.

(°) The "Low Battery Efficiency" anomaly must not be confused with the Battery Efficiency indication provided by SmartService which is evaluated over a long operational period of the battery and not on single cycles.
(*) The "Low Level Of Battery Electrolyte" anomaly is indicated by activating the LED anomaly and reported on SmartView Info TAB for the entire time and only the time it is active. Nonetheless, the anomaly is logged and can be viewed in the Old Data Info TAB.
NOTE: The "Low Level Of Battery Electrolyte" anomaly state appears after the sensor detects the anomaly for 3 consecutive minutes. The anomaly is deactivated when the sensor detects no anomalies for 10 consecutive seconds. Given that some sensors provide a delayed signal, the actual timing of activation and deactivation of the anomaly depends on the sensor used.

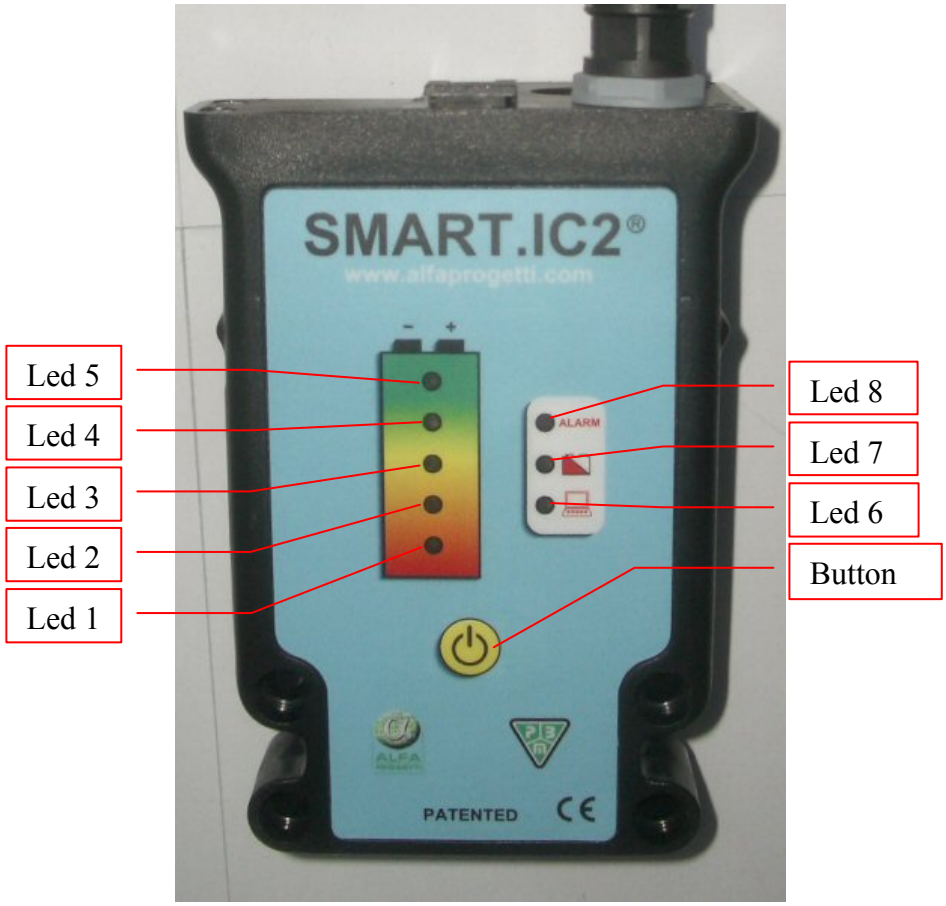
1.4 LED Signals

The LEDs on the unit provide useful information including an indication of the battery charge and possibly some anomalies. LEDs can signal the following situations:

LED 1 flashing	Battery charge not exceeding (100-AhBS)% of the nominal battery capacity
LED 1 ON	Battery charge over (100-AhBS)% and below 40% of the battery capacity
LED 1 and 2 ON	Battery charge over 40% and below 60% of the battery capacity
LEDs 1-3 ON	Battery charge over 60% and below 80% of the battery capacity
LEDs 1-4 ON	Battery charge over 80% and below 95% of the battery capacity
LEDs 1-5 ON	Battery capacity over 95% of the battery capacity

Periodic shut OFF of the LEDs from top-down (sequence from LED 5 to LED 1)	Discharge Stage
Periodic turning ON of the LEDs from bottom-up (sequence from LED 1 to LED 5)	Charging Stage
LED 3 Flashing	Forks Lock due to the Anti opportunity charging activated, see §1.7 Lock functions
LED 4 Flashing	Forklift Lock activated (due to scheduling), see §1.7 Lock functions
LED 5 Flashing	Forks Lock activated (due to low battery charge), §1.7 Lock functions
LED 6 (COMMUNICATION) flashing	Communication via IR or via GPRS
Led 7 (2nd STAGE THRESHOLD)	It turns ON when the battery voltage is greater than the "Voltage Threshold 2nd Stage", see §10.3 Programming of operating parameters
LED 8 (ALARM) flashing	Autostart stage (with SmartEnergy)
LED 8 (ALARM) ON	Anomaly detected in the current cycle

Note: AhBS is a programmable parameter through SmartView. If the value assigned is lower than 60%, the signalled events will differ from those reported in the table with regard to the first LED from the bottom that will flash with battery charge below (100-AhBS)%.



1.5 Estimation of the recharge

Thanks to the features described above, Smart.IC2 V3 is able to accurately estimate the charge in the battery.
There are two different ways to determine the attainment of a full charge. The first (traditional, by time) foresees that the battery is considered charged after the duration of the charge subsequent to the attainment of the "Threshold Voltage 2nd Stage" has reached the "Safety Timer 2nd Stage" (see §10.3 Programming of operating parameters). The second way (Ah), in contrast, foresees that the charge is considered sufficient when the restored capacity added to that present at the time the battery charge is initiated equals the nominal capacity.
The Default setting is the Ah method (see §10.3 Programming of operating parameters).

NOTES:
- With the Ah method, through the SmartEnergy family battery charger, the battery is supplied only with the power strictly necessary to achieve the full charge, thus saving energy and avoiding damage and waste of water.
- Alignment (see §11 Alignment) occurs only after a full recharge cycle is conducted.

1.6 Opportunity Charging

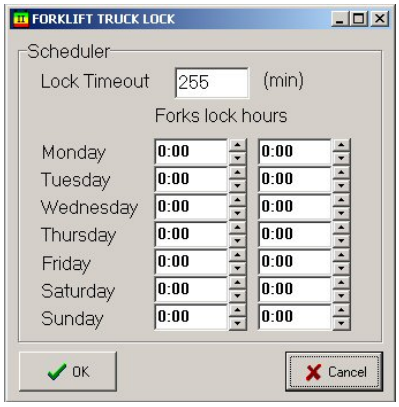
The term "Opportunity Charging" means the mode of use with which the battery is repeatedly charged and discharged for short periods and small capacity (as happens in the AGVs - Automatic Guided Vehicle). In this situation there would be a proliferation of working cycles that would lead to a rapid depletion of memory and substantially illegible data. In these cases, by setting the item "Opportunity Charging" in the programming (§10.3 Programming of operating parameters), it is possible to reduce the daily number of cycles: in fact, in this mode a new cycle is generated only if there is a discharge after the sum of cycle charge times has already exceeded the time.

1.7 Lock functions

The Smart.IC2 V3 device foresees two functions based on measurement of the battery capacity level to inhibit the operation of the forklift and/or lock the forks through the NO contact (Normally Open) of a relay.
These functions require that the relay contact is wired to a circuit of the forklift which can limit the functionalities (for example, the circuit that stops operation when the operator is not seated).
Anti opportunity Charging: After being charged, if the percentage of Ah in the battery is higher than that which is programmed in "Anti Opportunity Charging" (see §10.3 Programming of operating parameters), the forklift is enabled for normal use (the NO contact is closed). Conversely, if the battery capacity drops below the programmed percentage, use is prevented (the NO contact remains open). Setting the parameter to 0% (as a default) the function is disabled.
Forks Lock: When discharging, until the battery level drops below the (100-Forks Lock)%, normal operation is permitted (the NO contact is closed). In contrast, when the capacity drops below this threshold, normal use is prevented (the NO contact is left open).
NOTE: To avoid disrupting manoeuvres during a period of intensive use, the lock is executed 30 seconds after the last manoeuvre.
The default value of the programmable parameter "Forks Lock" is 80%.

The device also foresees the following lock function to prevent the use of the forklift outside working hours.

Forklift Lock: For each day of the week it is possible to set the time (start and end) with which to impose a lock on the forklift. If the two times coincide, the lock does not occur. The "Lock Timeout" parameter indicates the forklift downtime that must elapse before the lock is operational.



1.8 Use of the button

- If during discharge the "Forks Lock" situation is reached, the pressure on the button ensures an additional bonus of usable capacity equal to 4% of the nominal capacity
- If, during a working cycle the different power points are blocked for "Anti opportunity Charging", pressing the button disables the lock for that cycle
- Within 6 minutes of providing the power supply, repeatedly pressing the button forces the amount of Ah present in the battery with an increase of 20% of the nominal capacity each time (note: it does not perform the alignment). This feature is useful if the "Forks Lock" function is selected to allow normal use of the fork lift after the installation of Smart.IC2 V3 before the alignment charge is executed
- While charging with charger controlled by Smart.IC2 V3 (SmartEnergy), the button performs the ON and OFF functions of the charge.

2 Inserting/replacing the SIM card

The following is a description of the operations to insert, remove or replace the SIM card in the GPRS module of the device (only for GPRS versions).

WARNING: The DEVICE SHOULD NOT BE CONNECTED TO THE POWER SOURCE during the following activities.

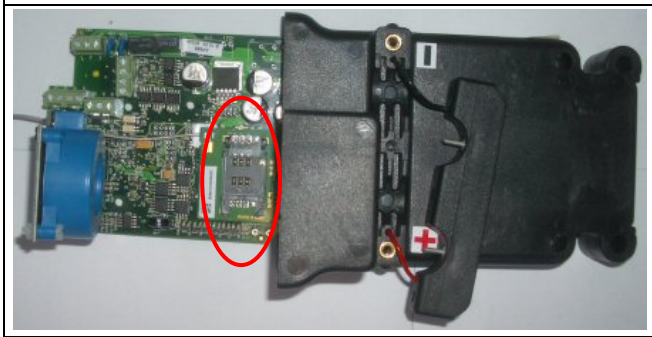
Required Supplies
No. 1 Phillips screwdriver (type PH1)

2.A	
	Remove the back cover by unscrewing the 6 screws (code **V1**).
2.B	
	Locate the connector with a flat cable.

2.C

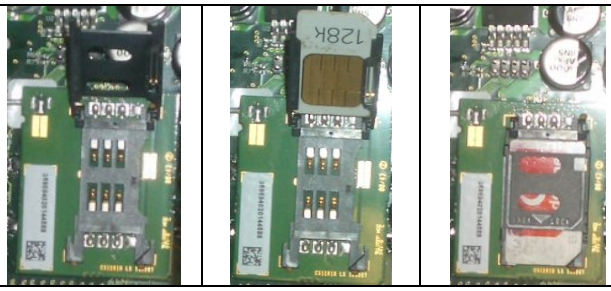
Disconnect the flat cable connector from the current sensor card.

2.D



Remove the electronic board from the container until the slot for the SIM card is accessible.

2.E



1. Unlock the slot for the SIM by sliding it up and open it
2. Insert the SIM card
3. Close the slot and lock it by sliding it down

2.F

Replace the electronic board in the container; connect the flat cable to the current sensor card. Close the back cover and tighten the 6 screws previously removed (code **V1**).

3 Mounting the Smart.IC2 V3 on the battery side of the DINxxx type connector

WARNING: The DEVICE AND THE BATTERY CABLES SHOULD NOT BE CONNECTED TO THE POWER SOURCE during the following activities.

Required materials:
No. 1 Phillips screwdriver (type PH1)
No. 1 Allen wrench 3mm
No. 1 Allen wrench 5mm

3.A

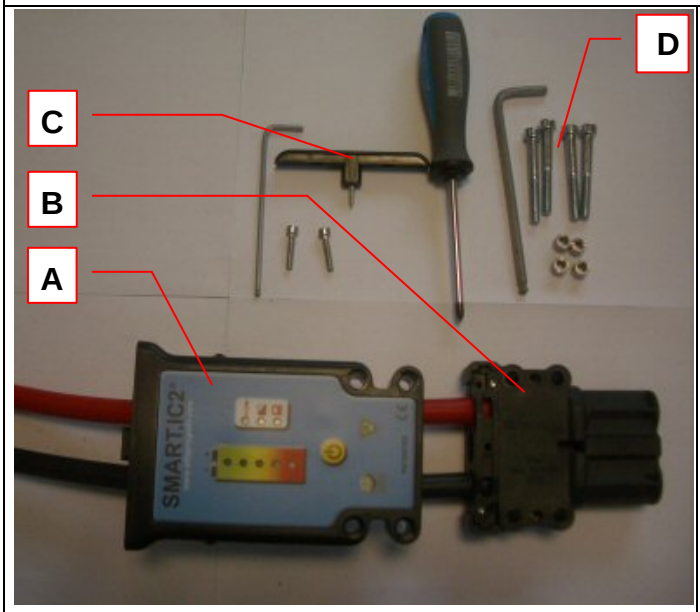
Locate the battery side and the connector side of the Smart.IC2 module.

Pass the positive pole cable (red wire) inside the hole of the **Smart.IC2 S2** or **S2GPRS** Module.

Note: If the cable is so small as not to allow the punches to pierce the insulating sheath, use the supports (B) provided and position them in the special location as shown in the sequence.

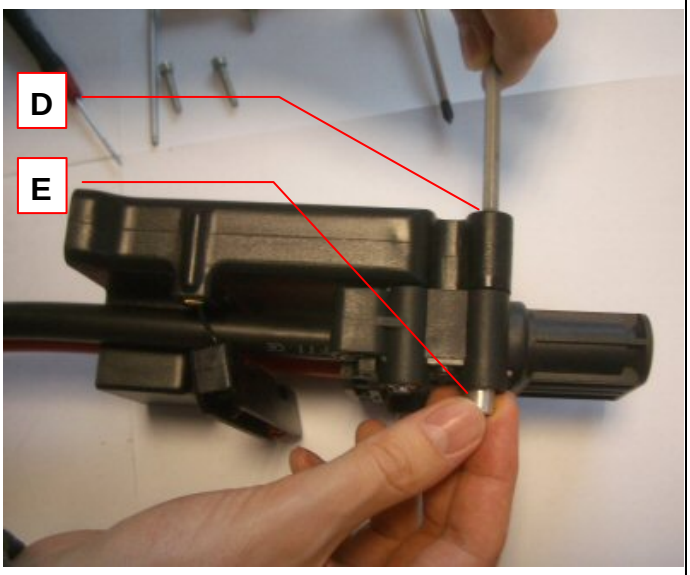
A) **Smart.IC2 S2** or **S2GPRS Module**
B) Thickness P882C

3.B



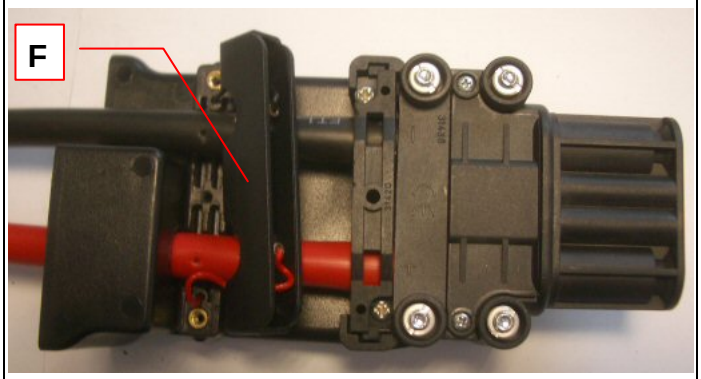
Press the clamp until the punches completely pierce the cable sheath.
Make sure the insulation has been pierced by the two tips at the bottom

A) **Smart.IC2 S2** or **S2GPRS Module**
B) DINxxx type connector
C) Clamp cover P882B



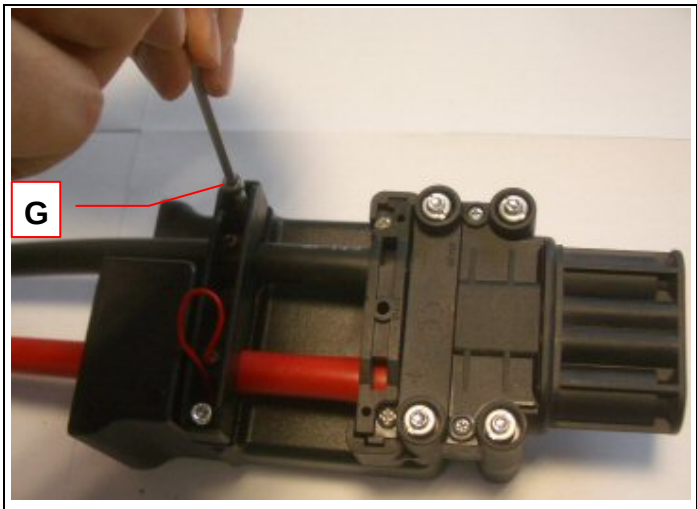
Secure the Smart.IC2 **(A)** to the DINxxx type connector **(B)** with the screws supplied

D) 4 Allen screws M6x50 (code **V8**)
E) Cylindrical nut 6MA (code **D2**)



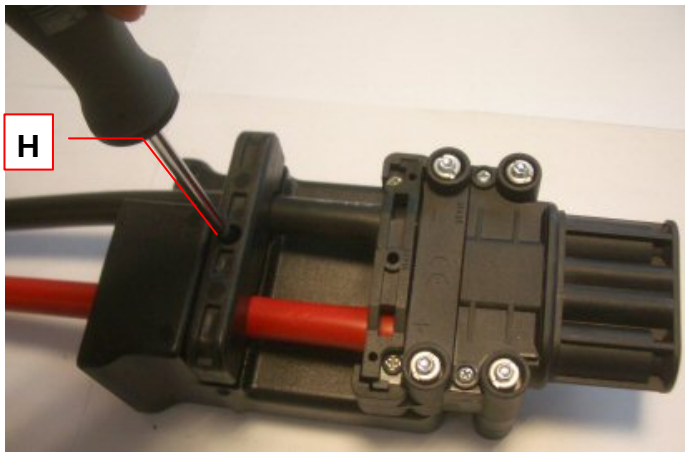
Place the power supply wires inside the cable clamp compartment (P882A) so that they are not damaged during closure.

F) Clamp P882A



Secure the clamp **(F)** with the Allen screws **(G)** supplied 4x20mm (code **V10**).

G) Allen screws 4x20 mm (code **V10**)



Close the clamp with the special cover **(C)**, and secure it with the screw **(H)** supplied 3.5x16 mm (code **V4**).

H) Screw 3.5x16 mm (code **V4**)

3.C

Wiring complete and connector ready for use.

A) USA type connector **160A** or **320A**
B) **Smart.IC2 S2** or **S2GPRS** Module

4 Mounting on battery side of connector, USA type

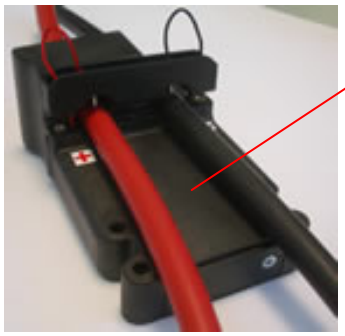
WARNING: The DEVICE AND THE BATTERY CABLES SHOULD NOT BE CONNECTED TO THE POWER SOURCE during the following activities.

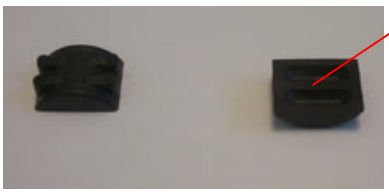
Required materials:
No. 1 Phillips screwdriver (type PH1)
No. 1 Allen wrench 3 mm

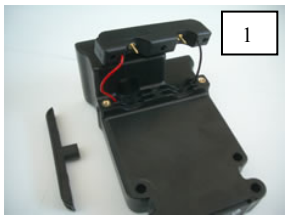
4.A

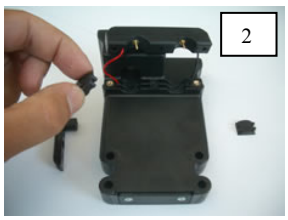
Connector side

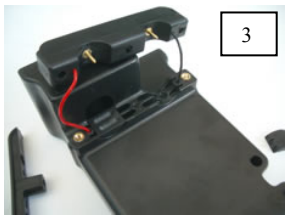
Battery side

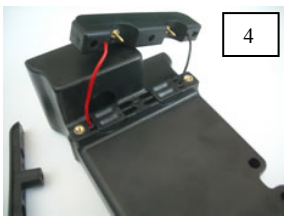












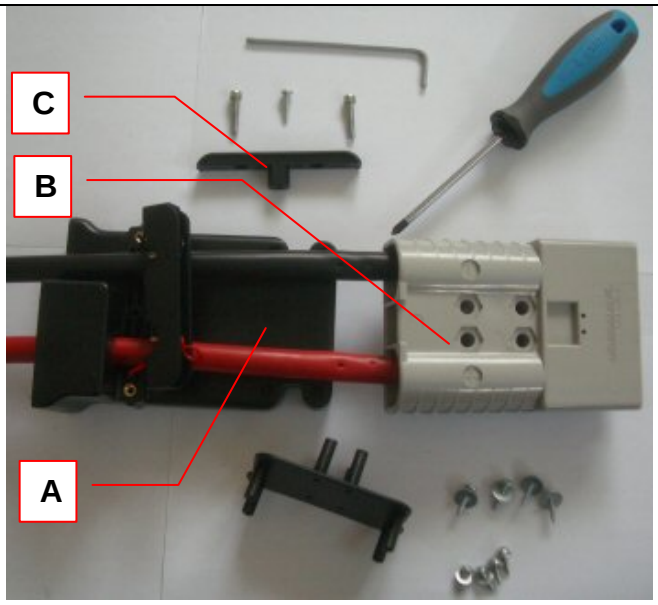
Locate the battery side and the connector side of the Smart.IC2 module.

Pass the positive pole cable (red wire) inside the hole of the **Smart.IC2 S2** or **S2GPRS** Module.

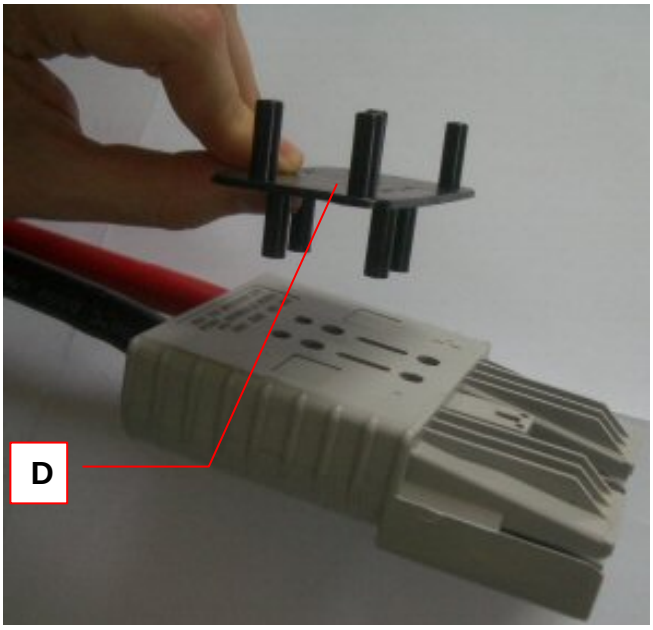
Note: If the cable is so small as not to allow the punches to pierce the insulating sheath, use the supports (B) provided and position them in the special location as shown in the sequence.

A) **Smart.IC2 S2** or **S2GPRS** Module
B) Thickness P882C

4.B

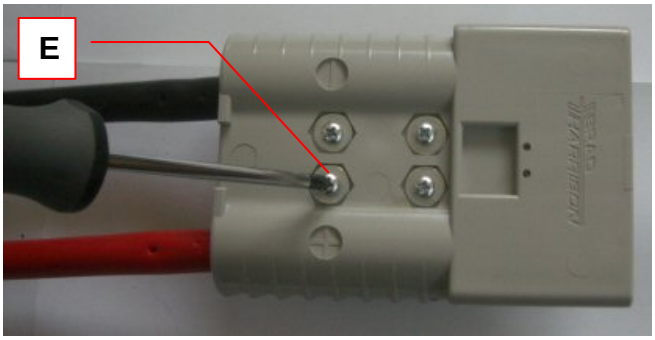


A) **Smart.IC2 S2** or **S2GPRS** Module
B) USA-type connector **160A** or **320A**
C) Clamp cover P882B



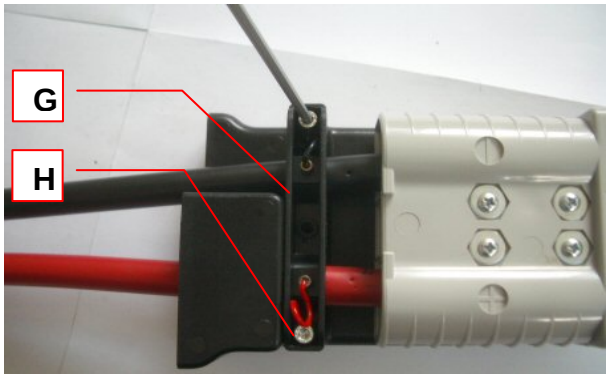
Connect the battery connector **(B)** by fastening the + and - wires to the PINs.
Fasten the adapter block **(D)** **(code P882EU)** to the USA-type connector with the 4 screws **(E)** and washers.

D) Adapter (code **P882EU**)
E) 4 screws 3.5x16 (code **V4**), 4 washers 4x12 (code **R2**)



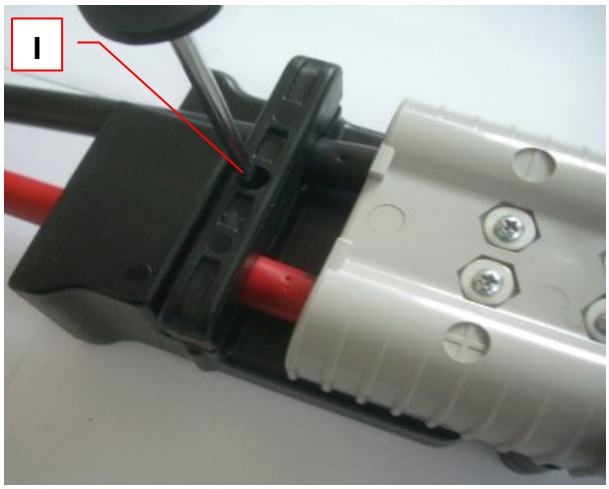
Fasten the adapter block **(D)** **(code P882EU)** to the SMART.IC2 with the 4 screws **(F)** and washers.

F) 4 screws 3.5x13 (code **V3**), 4 washers 4x9 (code **R1**)



Fasten the clamp **(G)** with the Allen screws **(H)** supplied 4x20mm (code **V10**).

G) Clamp (code **P882A**)
H) Allen screws 4x20 mm (code **V10**)



Close the clamp with the special cover **(C)**, and secure it with the screw **(I)** supplied 3.5x16 mm (code **V4**).

I) Screws 3.5x16 mm (code **V4**)

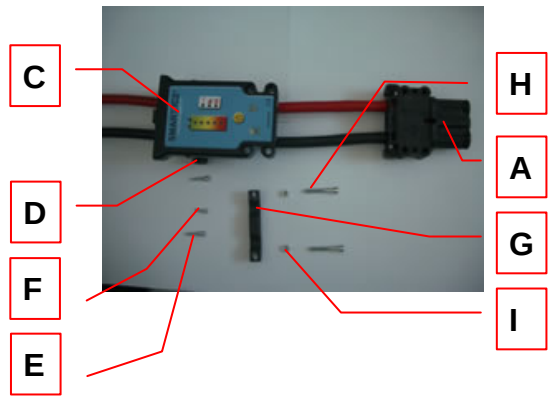
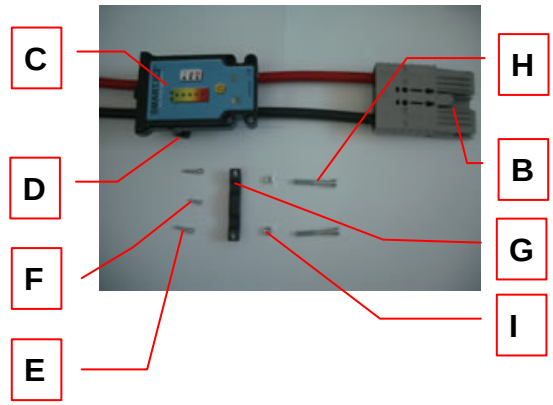
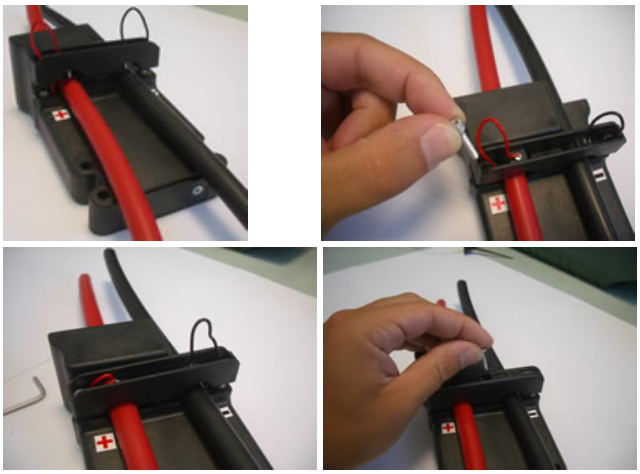
4.C

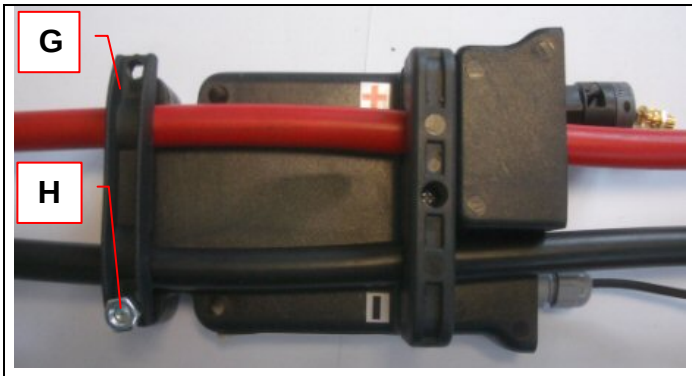
Wiring complete and connector ready for use.

A) **Smart.IC2 S2** or **S2GPRS** Module
B) USA-type connector **160A** or **320A**

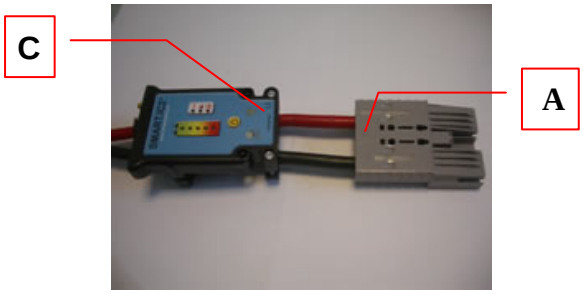
5 Mounting outside the connector (battery side)

Required materials:
No. 1 Phillips screwdriver (type PH1)
No. 1 Allen wrench 3mm
No. 1 Allen wrench 4mm

5.A	
  	Pass the positive pole cable (red wire) inside the hole of the **Smart.IC2 S2** or **S2GPRS** Module. A) **DINxxx type** connector B) **U.S.A. type** connector C) **Smart.IC2 S2** or **S2GPRS** Module D) Clamp (code **P882A**) E) 2 screws 4x20 for clamp (code **V10**) F) Screw 3.5x16 for clamp cover (code **V4**) G) Clamp for 25 mm cable (code **P882C25**) or 70 mm cable (code **P882C70**) H) 2 screws 5x30 for clamp (code **V5**) I) 2 nuts 5MA (code **D1**) Secure the clamp collar **(D)** to the module **(C)** using the screws **(E, F)**. Make sure the insulation has been pierced by the two tips in the lower part.

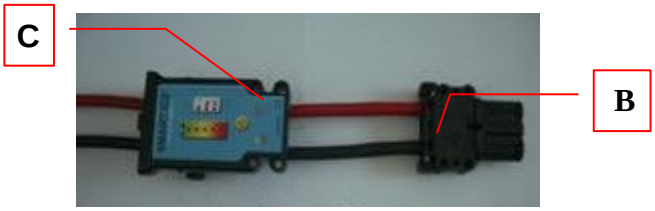


Also fasten the battery cables to the module **(C)** through the clamp collar **(G)** using screws **(H)** and fastening nuts **(I)**.



Wiring complete and connector ready for use.

A) **DINxxx type** connector
C) **Smart.IC2 S2** or **S2GPRS** Module



Wiring complete and connector ready for use.

B) **USA type** Connector
C) **Smart.IC2 S2** or **S2GPRS** Module

6 Forklift Control Mode

Locking or limiting the activities of all powered devices requires wiring the contact of the relay on the device. The operations are indicated below.

WARNING: The DEVICE SHOULD NOT BE CONNECTED TO THE POWER SOURCE during the following activities.
NOTE: It is assumed that an appropriately sized cable gland is already installed on the back cover.

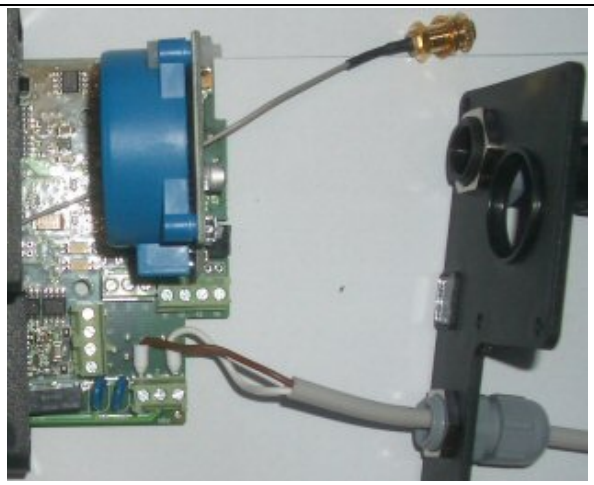
Required materials:
No. 1 Phillips screwdriver (type PH1)
No. 1 flat screwdriver (type SL2.5)

6.A	
	Remove the back cover by unscrewing the 6 screws (code **V1**).
6.B	
	Locate the connector with flat cable.
6.C	
	Disconnect the flat cable connector from the current sensor card.

6.D

Remove the electronic board from the container until the green terminals next to the Hall sensor are accessible.

6.E



Connect the wires to the terminal in poles 1 and 3 (see screen-printed numbers next to the terminals). The wiring connections to the terminal must be made according to the following diagram (see screen-printed numbers next to the terminals).

Connections	
Pole 1	white wire*
Pole 3	brown wire*

*Colours refer to the wire supplied by Alfa Progetti.

6.F

Reposition the electronic board in the container; connect the flat cable to the current sensor card. Close the back cover by tightening the 6 screws previously removed (code **V1**).
Tighten the cable gland.

7 Connection of accessories

The operations for installing the following external accessories are described below:
- Immersion temperature sensor, two wire type PT1000
- Electrolyte level sensor.

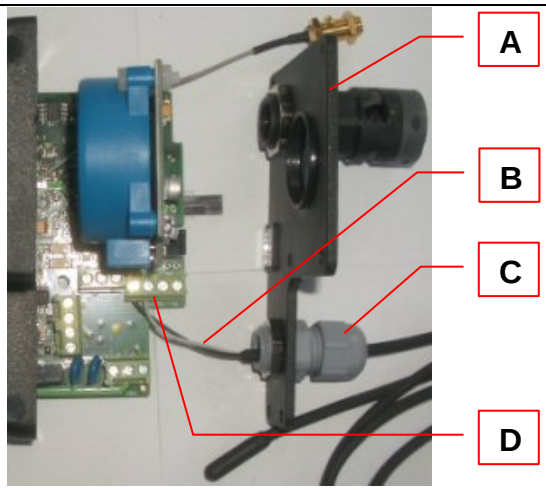
The two operations are optional and independent of each other. For simplicity in the following images only the mounting of the accessory discussed in the corresponding paragraph will be shown. If both accessories are mounted, it will be necessary to ensure that a cable gland is used which is large enough to hold all the cables to be used.

WARNING: The DEVICE SHOULD NOT BE CONNECTED TO THE POWER SOURCE during the following activities.

NOTE: It is assumed that an appropriately sized cable gland is already installed on the back cover.

7.1 External temperature probe

7.A



Remove the cover **(A)**, remove the electronic board from the container until the terminal is accessible. Insert the wires **(B)** through the cable gland **(C)** and connect the wires to the terminal **(D).** The wiring connections to the terminal must be made according to the following diagram (see screen-printed numbers next to the terminals).

Connections	
Pole 11	black wire
Pole 12	gray/white wire

A) Cover (code **P882CU**)
B) Wires for temperature sensor (**PT1000**)
C) Cable gland
D) Connection terminal for external temperature probe (**J3**)

7.B

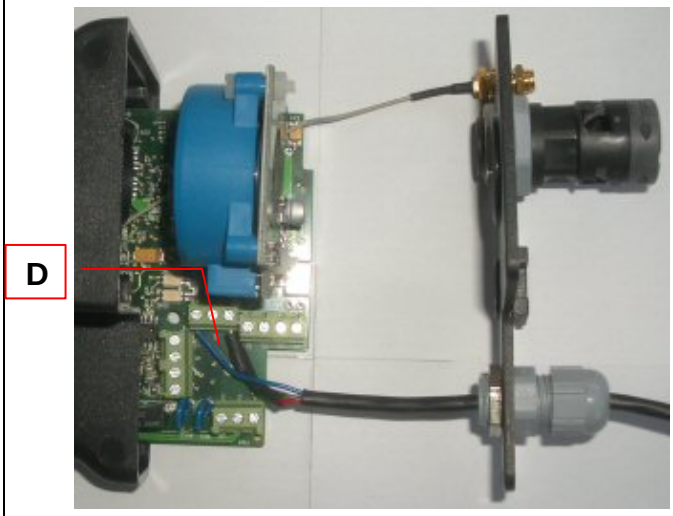
Replace the cover and tighten it with the screws.
Tighten the cable gland.

7.2 Electrolyte level sensor

Smart.IC2 V3 supports the electrolyte level sensors that provide a LED indication of the status "Level OK" or "Low Level" via remote cable.
To be used with Smart.IC2 V3 the sensor must be adapted: contact the SmartIC vendor.

IMPORTANT: This SmartIC2 V3 device, unlike the prior model, has a galvanically isolated input for the electrolyte level sensor.
The following instructions apply only to the V3 series.
For the prior series, refer to the relevant Installation Manual.

7.C



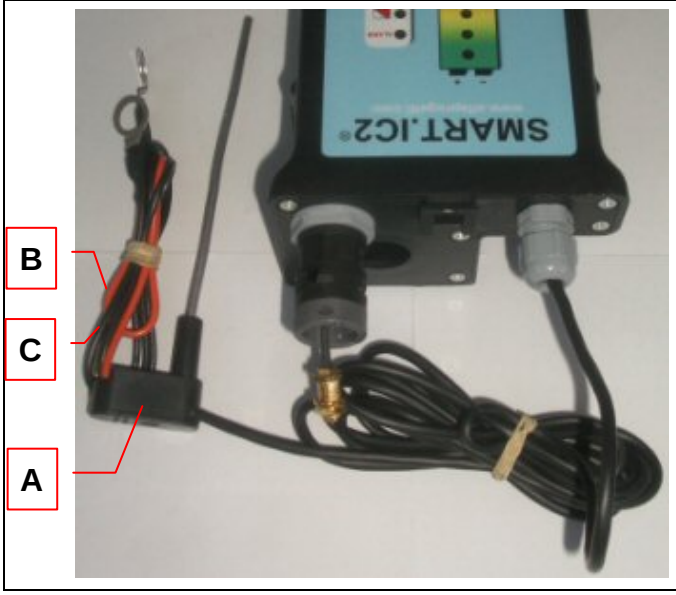
Remove the cover, remove the electronic board from the container until the terminal is accessible. Connect the level sensor (**SL**) to terminals 8 and 10 - input ISO1 or 9 and 10 - ISO2 input.
The wiring connections to the terminal must be made according to the following diagram (see screen-printed numbers next to the terminals).

Connections	
Pole 8/9	blue wire*
Pole 10	black wire*

*Colors refer to the electrolyte level sensor supplied by Alfa Progetti.

WARNING: The two inputs are not isolated from each other; **do not install two probes on two different battery cells.**

7.D



Replace the cover and tighten it with the screws.
Tighten the cable gland.

7.E	
	Place the level sensor within a cell of the battery (in the figure the automatic refilling cap was used; alternatively a hole can be made on the cell cap). For the power supply, positioning and setting the threshold level, refer to the probe manufacturer's instructions.

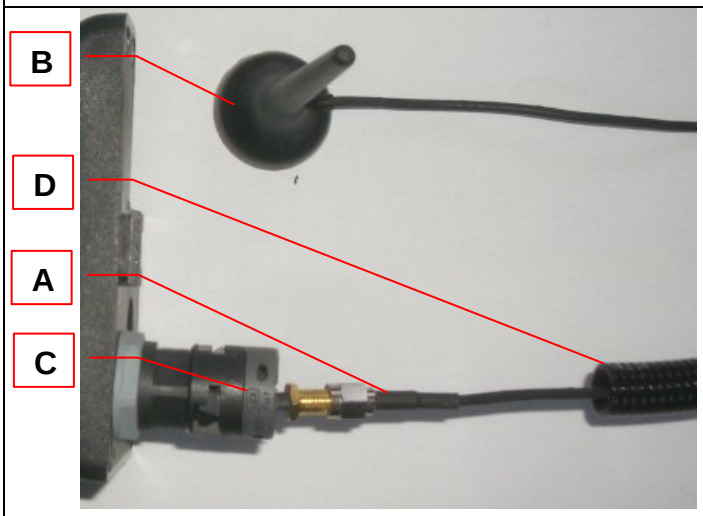
Depending on the type of probe used and to which input it is connected, it is necessary to programme the "Electrolyte Sensor" parameter via the SmartView Programming TAB (see §10.3 Programming of operating parameters).
The table shows the selectable options in the dropdown menu.

Off	Probe is not installed.
Presence of water ISO1	Select whether the probe generates a signal if the electrolyte level is above the threshold (electrolyte level OK). Probe wired to terminals 8 (signal) and 10 (common).
No water ISO1	Select whether the probe generates a signal if the electrolyte level is below the threshold (electrolyte level low). Probe wired to terminals 8 (signal) and 10 (common).
Presence of water ISO2	Select whether the probe generates a signal if the electrolyte level is above the threshold (electrolyte level OK). Probe wired to terminals 9 (signal) and 10 (common).
No water ISO2	Select whether the probe generates a signal if the electrolyte level is below the threshold (electrolyte level low). Probe wired to terminals 9 (signal) and 10 (common).

8 Antenna installation

Required materials:
Wrench no. 8
Cable bands

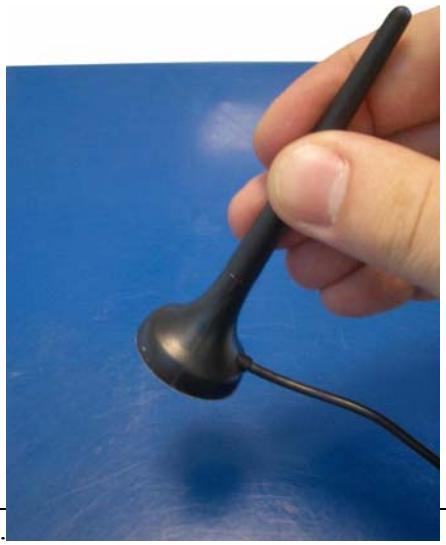
8.A



Identify the connection for the corrugated conduit on the back of the Smart.IC2 plug.
On the side of the Smart.IC2 screw the antenna cable on the connector.
Tighten the connector slightly with a no. 8 wrench.
Insert the corrugated conduit into the connection.

A) GPRS antenna cable, side of Smart.IC2
B) GPRS antenna
C) Connector for corrugated conduit
D) Corrugated conduit

8.B



Place the antenna on top of a ferrous part of the forklift, preferably in an area not shielded by other metal parts.

The antenna base is composed of a magnet, thereby favouring its positioning.

8.

Lay the corrugated conduit along the battery cables.

Fasten the corrugated conduit with bands without putting it under tensile stress.

Sometimes it may be useful to wrap the corrugated conduit of the antenna to a battery cable with insulating tape.

Note: Make sure that the corrugated conduit of the antenna and the cable inside it are not damaged when closing the hood or by any other mechanical part of the forklift.

9 Communication with other devices

Smart.IC2 V3 has the following serial interfaces to communicate with external devices:

- Galvanically isolated RS485
- Galvanically isolated CAN bus

NOTES:

- RS485 and CAN bus are on the same galvanic area
- both the CAN line and the RS485 line terminate in the SMART.IC2 unit with a 120Ω resistor

The signals are available on terminals in the Smart.IC2 V3 unit.
The signals and relative terminals are presented in the table.

Other Devices		
CAN+	Pole 4	
CAN-	Pole 5	
RS485_A (+)	Pole 6	brown wire*
RS485_B (-)	Pole 7	Blue/white wire*

*Colors refer to SmartKey – SmartEnergy provided by Alfa Progetti.

Some connections are described below.

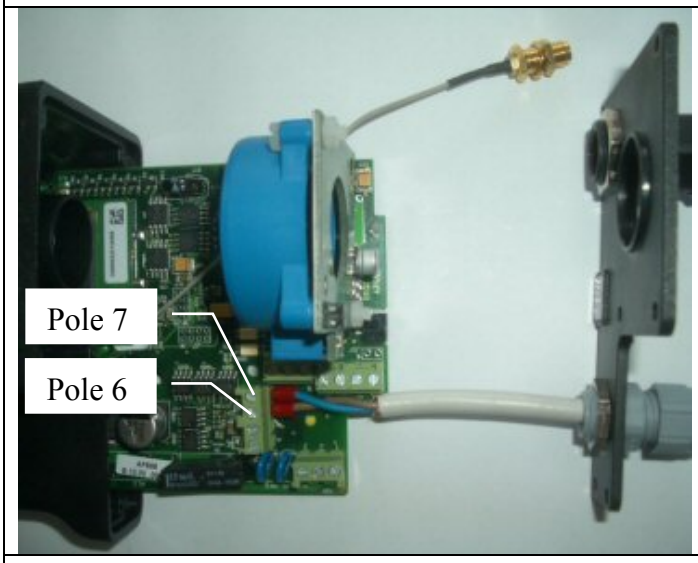
WARNING: The DEVICE SHOULD NOT BE CONNECTED TO THE POWER SOURCE during the following activities.

NOTE: It is assumed that an appropriately sized cable gland is already installed on the back cover.

9.1 Communication with SmartKey and SmartEnergy

Communication with the SmartKey display and the SmartEnergy family battery chargers occurs by means of the RS485 serial port.
The connection is made by means of a two-wire cable. One end of the cable is connected to the Smart.IC2 V3, the other to the battery connector's auxiliary contacts.
The connection with Smart.IC2 V3 is shown below. For the connection to the external devices end, refer to the relative manuals, making sure that on both ends the couplings are between corresponding signal pairs (RS485_A with RS485_A, RS485_B with RS485_B).

9.A



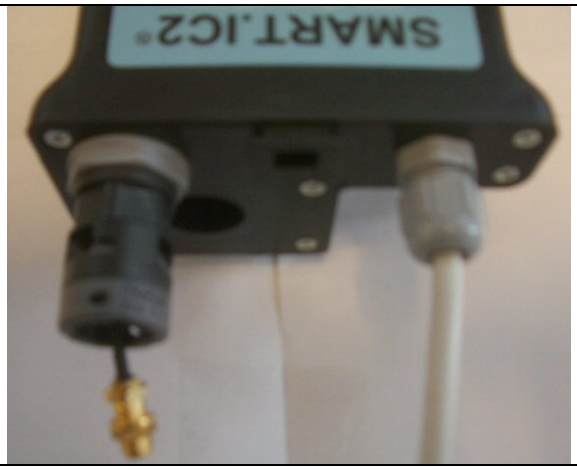
Remove the lid, remove the electronic board from its plastic casing until the terminal is accessible.

The wiring connections to the terminal must be made according to the following diagram (see screen-printed numbers next to the terminals).

SmartKey - SmartEnergy Connections		
Pole 6	brown wire*	RS485_A (+)
Pole 7	blue/white wire*	RS485_B (-)

*Colors refer to SmartKey – SmartEnergy provided by Alfa Progetti.

9.B



Replace the lid and tighten it with the screws.
Tighten the cable gland.

10 Programming

Once installed, Smart.ON needs to get some information to work correctly.
For this purpose it is necessary to connect it to a PC equipped with the SmartViewII program for Windows. This can be done through an infrared port.

10.1 Making it ready

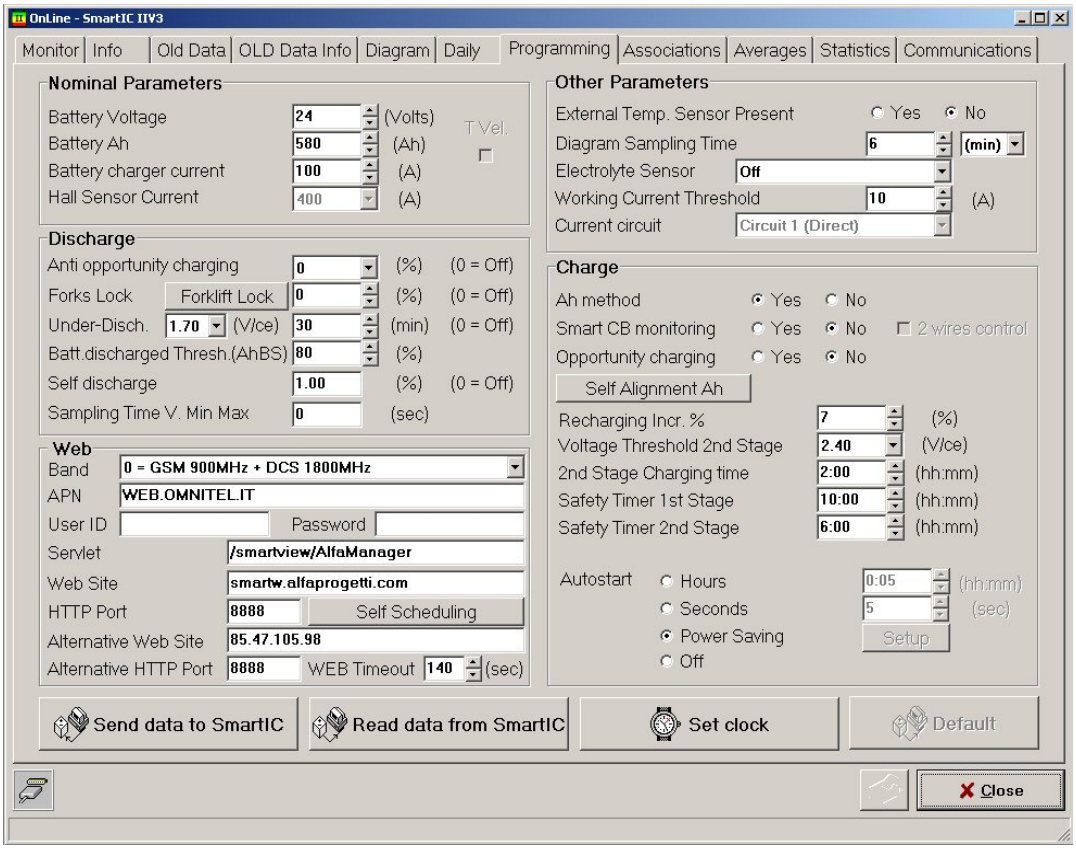
- Connect the infrared adapter to the PC (AP160 adapter to a RS232 port, or AP160UIR adapter to an USB[1] port)
- Trigger the SmartViewII program
- Insert the Password for level 2
- Press the "Connect" pushbutton

10.2 Setting of date / time

- Select the "Programming" TAB
- Press the "Set clock"[2] push-button
- Select the "Monitor" TAB and check data in the box showing date and time

10.3 Programming of operating parameters

The operating parameters allow Smart.ON to collect data correctly during the normal operation. Therefore they have to be compiled very carefully.
For more details, please see the user manual of the SmartViewII program.



SmartViewII: programming of the operating parameters

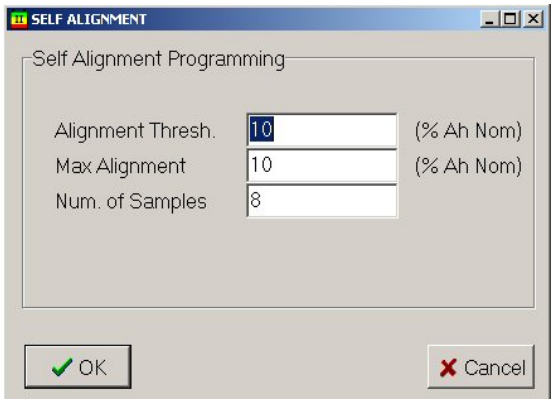
[1] The AP160UIR device needs to be previously installed through a driver for Windows
[2] The process transfers date and time on PC to Smart.ON: check that the PC dater is correctly set

- Select the "Programming" TAB
- Fill in the following fields:

Battery Voltage	Nominal voltage of the battery
Battery Ah	Nominal capacity of the battery
Battery charging current	Nominal current of the battery charger
Hall Sensor Current	Nominal value of the current sensor
Diagram sampling time	Voltage and current log sampling times for graphs (1, .., 127 min / 1, .., 127 sec); (default: 6 min) NOTE: If expressed in seconds, the duration of cycles will be one hour at most
External Temp. Sensor Present	External temperature sensor selection
Electrolyte Sensor	Input and operation of electrolyte level sensor selection
Working current threshold by contract	See manual SmartViewII (default: 10A)
Anti opportunity charging	Forks lock setting for anti opportunity charging. See §1.7 Lock functions
Forks Lock	Forks lock setting for low battery charge. See §1.7 Lock functions
Forklift Lock	Forklift Lock schedule setup button. See §1.7 Lock functions
Under-Discharge	If the voltage is below the specified value (V/el) for the specified time (minutes), the capacity is forced to (100-AhBS)% of the nominal capacity Ah Battery if greater than said value (default: 1.70 V/el, 30 minutes)
Battery discharged threshold (AhBS)	Discharging below (100-AhBS)% of the nominal capacity the battery is considered discharged (default 80%)
Self discharge	Self-discharged capacity every 24 hours (default: 1%)
Ah method	Charging mode selection: capacity (Yes) or time (No) (default: YES)
Smart CB monitoring	Battery charger selection: SmartCB/SmartEnergy
Opportunity charging	Selection of scheduled counting of working cycles (opportunity charging mode) (default: No)
Self Alignment Ah	Access button to set the Self alignment parameters
Recharging Incr. %	Percentage of energy dissipated during charging stage (default: 7%)
Voltage Threshold 2nd Stage	Gas production voltage threshold. Determines the transition from the first to the second charging stage and related counts (default: 2.40 V/el)
2nd Stage Charging time	Time after exceeding the Voltage Threshold 2nd Stage to end the charge for timed recharges and in the alignment cycle (default: 2:00 hours)
Safety timer 1st Stage	If the voltage has not reached the Voltage Threshold 2nd Stage within this time period, an alarm is generated (default: 10:00 hours)
Safety timer 2nd Stage	If the capacity has not reached the nominal value within this time period starting from the achievement of the Voltage Threshold 2nd Stage, an alarm is generated (default: 6:00 hours)
Autostart	Autostart time selection (only available when SmartCB is selected)
Setup	Button to select the daily autostart schedule if the energy savings function is enabled (only available when SmartCB is selected)
Band	GPRS module operating band
APN	APN Code of the GPRS network chosen
User ID	User ID of the GPRS network chosen
Password	Password of the GPRS network chosen
Servlet	WEB application
Web Site	WEB application address
HTTP Port	GPRS Gateway
Self Scheduling	Access button to set the Auto Scheduling parameters
Alternative Web Site	WEB application alternative address
Alternative HTTP Port	Alternative GPRS Gateway
WEB Timeout	Auto disconnect time on no GPRS link

The Self alignment function automatically corrects the indication representing the charge available in the battery (Ah). The configurable parameters indicate the threshold beyond which the correction is performed, the maximum possible alignment and the number of samples on which the "Self Alignment" is based. The "Self Alignment" is allowed only if the alignment has already been done (see §**Errore. L'origine riferimento non è stata trovata.**).
Default parameters:

Alignment Threshold	10%
Max Alignment	10%
Num. of Samples	8



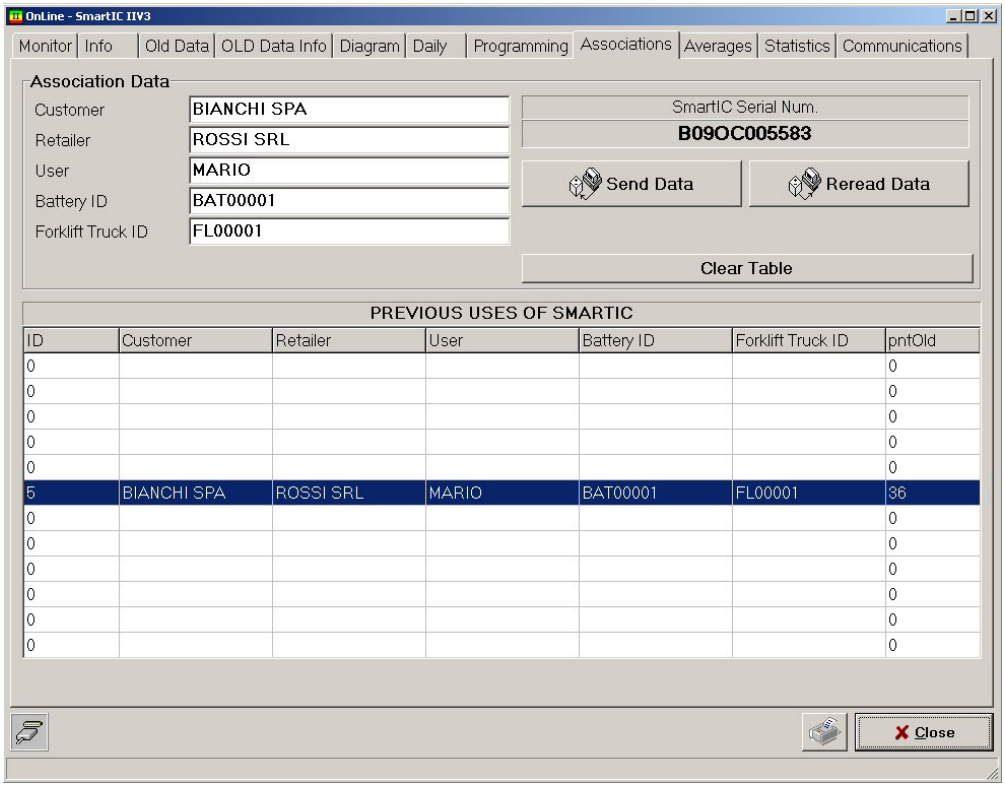
- Press the button "Send data to SmartIC" for the changes to take effect (for greater security check the operation by pressing the button "Read data from SmartIC" and verify that the parameters read are those entered)

NOTE: The work parameters can also be set in advance, before installing the device on the battery.

NOTE: To configure an S2 GPRS device it is possible to execute all the operations above through WEB after enabling the GPRS connection via SmartService.
In this case, instead of an IR adapter and the SmartView software program, the user needs a PC with internet access. The S2 GPRS device must have a SIM card installed, and the GPRS connection parameters (Web section of the Programming TAB) already set.

10.4 Programming of associations

Associations are memory parameters which working cycles and diagrams, collected by Smart.ON during normal operation, refer to. Every time cycles and diagrams will be downloaded onto a PC, they will be identifiable and selectable thanks to the above mentioned parameters.
Therefore, these parameters too need to be compiled very carefully.
NOTE: filling in the association parameters is not binding. If you do it, choose carefully names and codes, avoiding to fill in the same parameters for different Smart.ON's.
For more details refer to the user manual of the SmartViewII program.



SmartViewII: programming of the associations

- Select the "Associations" TAB
- Fill in the following fields:

Customer	Text identifying customer
Retailer	Text identifying dealer
User	Text identifying user
Battery ID	Text identifying battery serial number
Forklift Truck ID	Text identifying forklift truck serial number

- Press the "Send data" pushbutton and check if a string with the parameters put in appears in the table underneath.

NOTE: The programming of the associations can also be executed in advance in the workshop if all parameters are known.
NOTE: To configure an S2 GPRS device it is possible to execute all the operations above through WEB after enabling the GPRS connection via SmartService.
In this case, instead of an IR adapter and the SmartView software program, the user needs a PC with internet access. The S2 GPRS device must have a SIM card installed, and the GPRS connection parameters already set.

11 Alignment

To make Smart.IC2 V3 fully operational and therefore collect and subsequently supply all the data, it must acquire the real state of the battery. This is called ALIGNMENT and must be performed only once after connecting the device to the battery. During normal operation, the Smart.IC2 V3 device stays aligned by measuring and counting the inbound and outbound charge of the battery.
The alignment procedure involves the execution of a traditional full charge, that is:

- The battery voltage reaches the value indicated in the configured "Voltage Threshold 2nd Stage" parameter (default: 2.4V/el)
- The charge continues after reaching this voltage for a period not shorter than that established with the configured "2nd Stage Charging Time" parameter (default: 2 hours).

After the alignment procedure, all LEDs are lit in the Battery mimic panel, indicating that the battery is fully charged.
It is recommended that the alignment procedure be run with the battery not fully charged.

IMPORTANT: Normally, the alignment is very easy to execute. It is enough to recharge the battery with a conventional battery charger. Nonetheless, it is not always possible to recharge a battery in the aforementioned conditions. This may be due to various reasons, including:

- The battery is already charged and the battery charger performs a charge that is too short
- The battery voltage does not reach the "Voltage Threshold 2nd Stage" configured (this happens, for instance, for gel battery chargers)
- The battery charger has a particular kind of charging curve.

In these cases it is possible to change the "Voltage Threshold 2nd Stage" and/or "2nd Stage Charging Time" parameters by reducing their values to facilitate the achievement of the alignment. However, it is good practice not to deviate much from the default values to avoid providing the Smart.IC2 V3 unit incorrect information about the real state of the battery.

NOTE: <u>As long as the Smart.IC2 V3 is misaligned</u>

- The red low battery LED flashes on the Mimic panel (unless the battery charge was forced using the procedure described in §1.8)
- With SmartView:
    - In the Monitor TAB the battery charge status is replaced by the message "Ah Alignment not performed!!!"
    - In the OLD Data info TAB the graphic representation of the cycle is replaced by the message "Ah Alignment not performed!!!"
    - Elsewhere no battery charge reference values are displayed.

Even when Smart.IC2 V3 is not aligned, all parameters measured during the cycle (voltages, currents, temperatures, date and time) and the graphs are logged.

NOTE: The alignment procedure must be repeated each time the Smart.IC2 V3 is disconnected from the power supply.

12 TA1 - Codes for fastening components (screws and accessories)

PHOTO	REF.	COMPONENT	SIZE
	V1	P882F	2.9x6.5 countersunk
	V2	P882CU / P882CO	3.5x13 countersunk
	V3	P882EU	3.5x13
	V4	P882C25 / P882C70 / P882EU	3.5x16
	V5	P882B	M5x30
	V7	P882	M6x45
		P883E	M6x45
	V8	P882	M6x50
	V9	P883U160 / P883U320	M6x50 countersunk
	V10		M4x20

	D1	P882B	5MA
	D2	P883E	6MA cylindrical
	D3	Dado P883U	6MA

	R1	P882EU	M4 D9
	R2	P882EU	M4 D12
	R3	P883U160 / P883U320	M6 D12

13 TV2 - KIT components (materials lists)

Unit	Code	Description	Q.ty
	**S2**	**SMARTIC II**	
	AP882	ELECTRONIC CARD FOR SMART.IC II	1
	P882	PLASTICS CASE OF SMART.IC II	1
	P882CU	SMARTIC CLAMP WITHOUT CONNECTOR FOR SMART CB	1
	P882C25	SMARTIC ADAPTER FOR 25MM² CABLE	1
	P882C70	SMARTIC ADAPTER FOR 70MM² CABLE	1
	P882EU	SMARTIC BRACKET ADAPTER FOR USA-TYPE BATTERY CONNECTOR	1
	P882B	CABLE CLAMP FOR INSTALLATION OUTSIDE THE CONNECTOR	1
	**S2GPRS**	**SMARTIC II WITH GPRS**	
	AP882GPRS	ELECTRONIC CARD FOR SMART.IC WITH GPRS	1
	ANT882	GPRS ANTENNA	1
	P882	PLASTICS CASE OF SMART.IC II	1
	P882CU	SMART.IC CLAMP WITHOUT CONNECTOR FOR SMART CB	1
	P882C25	SMART.IC ADAPTER FOR 25MM² CABLE	1
	P882C70	SMART.IC ADAPTER FOR 70MM² CABLE	1
	P882EU	SMART.IC BRACKET ADAPTER FOR USA-TYPE BATTERY CONNECTOR	1
	P882B	CABLE CLAMP FOR INSTALLATION OUTSIDE THE CONNECTOR	1

14 Specifications

Some useful technical information is reported below.

STORABLE DATA:

Storable working cycles	400
Storable graph data	12,000 samples (equal to 50 days with sampling every 6 minutes)
Storable daily data	The unit stores the work data of the previous 30 days

FIELD OF OPERATION:

Cut-off switch T200	batteries from 100 to 340Ah
Cut-off switch T400	batteries from 350Ah to 740Ah
Cut-off switch T800	batteries from 750 to 1500Ah

ELECTRICAL/PHYSICAL SPECIFICATIONS

Supply Min/max	18V - 144V
Average power consumption	S2 < 1.5W; S2GPRS < 2W
Protection from internal breakdown	Fuse on the power input
Contact Relay	2A @ 30Vdc (Vmax = 50Vdc/Vac)
Operating temperature	-20°C to +50°C

PHYSICAL SPECIFICATIONS

Size (external dimensions)	100mm x 60mm x 142mm
Overall antenna connector (min)	60mm
Weight	350g
Degree of protection	IP 42