

# **SWITCH MODE** **7<sup>STEP</sup>** **BATTERY CHARGER**

**For Lead acid batteries**

**14-230Ah (12V)**

**&**

**14-120Ah (24V)**



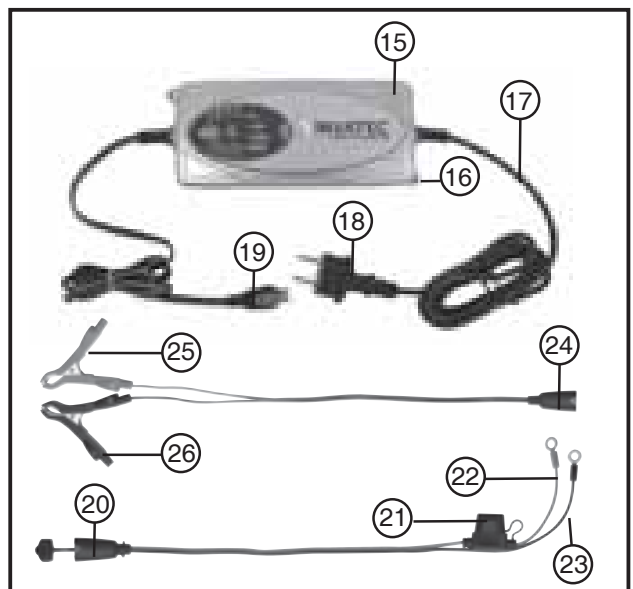
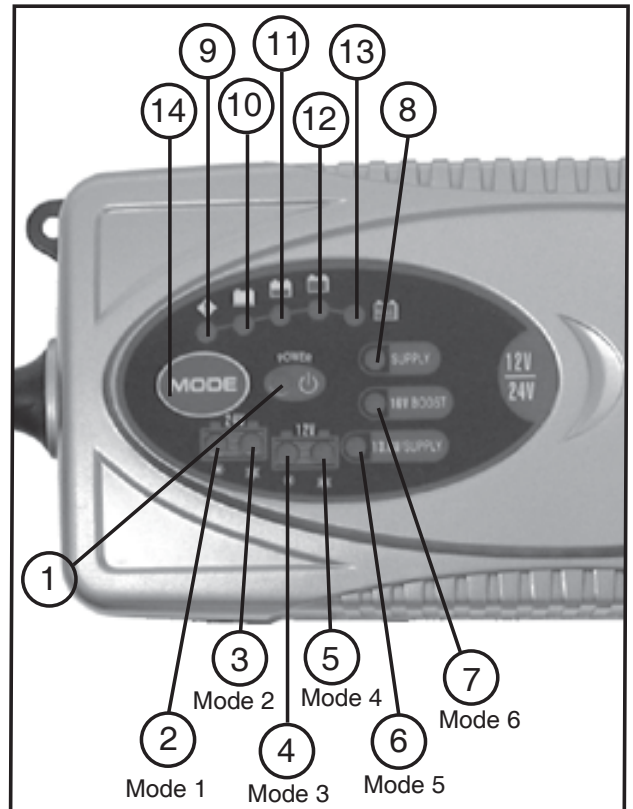
## **SC-7**

**User's Manual And  
Guide To  
Professional Battery Charging**

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## **For Your Safety**

This manual contains important safety and operating instructions. Read this manual carefully before using the charger for the first time and keep the manual in a safe place for future reference.

## **Product Feature**

Congratulations on your purchase of the **INVATEC SC-7** 7-Step fully automatic switch mode battery charger and maintainer, designed for charging a variety of 12V and 24V Lead-Acid rechargeable batteries, widely used in boats, cars, trucks and several other vehicles. The batteries may be of various types i.e. WET/Flooded (Liquid Electrolyte), GEL (Gelatin type Electrolyte, absorbed into the plates), AGM (Absorbed Glass Mat), MF, VRLA (Valve Regulated Lead Acid) batteries. Their capacity range from 12V/14Ah to 12V/230Ah and 24V/14Ah to 24V/120Ah. The **INVATEC SC-7** battery charger also charges batteries in cold conditions. Using state-of-the art technology, the charger enables the recharging of the batteries to almost 100% of their original capacity. It recovers slightly sulphated batteries. It diagnoses and rescues drained battery. It provides trickle charge and maintenance charging which increases battery life and gives superb performance. The **INVATEC SC-7** battery charger provides six output options to meet numerous requirements i.e. 14.4V, 14.7V, 28.8V, 29.4V, 13.6V/SUPPLY and 16V/BOOST. It has 10 Stage charging strategy i.e. Pulse charge, 7.0A, 5.0A, 3.5A, 3.0A, 1.5A, 200mA, Boost charge, Maintenance & Power Supply. It has memory function. The charger returns to last selected mode automatically when power is switched on (this feature is unavailable for 13.6V/SUPPLY and 16V/BOOST mode). For repetitive charging process, this is a very useful feature. However different charging mode could be selected by pressing the "MODE" button. It also features low back current drain and low ripple.

## **Product Safety Feature**

- Electronically safe against user errors. The charger will not damage vehicle electronics. It is totally safe for months-long connections and maintenance of irregularly or seasonally used batteries even while the charger is still connected to the vehicle. It provides optimal condition without damage. **No risk of over-charging!**
- Full protection against wrong connection and against short circuit ensures safe charging operation.
- Provided with Spark protection mechanism. This feature does not activate when the charger is in Supply mode. The charger will not begin operation upon connection to the battery unless charging mode has been selected. This embedded feature eliminates the possibility of a spark that often appears during connections.
- Fully controlled by internal MCU (Micro-Computer-Unit), which makes it faster, powerful, reliable and smarter. It detects the state of charge of the battery plugged into it and initiates charging.
- Dust and splash proof (IP65) approval. Approved for Outdoor use.
- Double insulated

## **Contents**

- 1) **INVATEC SC-7** Charger
- 2) Interchangeable quick contact battery leads with clamps
- 3) Interchangeable quick contact battery leads with eyelet terminals (Ø 6.3mm)
- 4) Plug-in fuse 10A
- 5) User Manual

## **Safety Information**

- **INVATEC SC-7** charger is designed for charging 12V 14-230Ah and 24V 14-120Ah Lead-Acid rechargeable batteries. Do not use it for any other purposes. It may cause an explosion.
- WARNING! DO NOT ATTEMPT TO CHARGE A NON-RECHARGEABLE BATTERY (PRIMARY CELLS).**
- Before charging make sure the input power is as per rated specifications, otherwise the charging performance may be seriously affected.
- Do not use battery charger for charging dry-cell batteries. They may burst and cause injury to persons and damage to property.
- Never charge a frozen battery.
- Never charge a damaged battery.
- Do not use the charger with a damaged cable (17). It must be replaced by the manufacturer, its service agent or similarly qualified technician in order to ensure safety.
- Do not operate charger if it appears to be damaged or malfunctioning. Take it to qualified person for inspection and repair.
- Do not disassemble charger, incorrect reassembly may result in electric shock or fire. Locate charger as far away from battery as DC cable permit.
- Never place charger above battery being charged, gases from battery will corrode and damage charger.
- While charging always use safety glasses, gloves, protective clothing and keep your face away from the battery.
- Remove metal items such as rings, bracelets, necklaces, and watches when working with a lead-acid battery. A lead-acid battery can produce a short-circuit current high enough to melt such metallic objects, causing a severe burn.
- **Explosion hazard!** A battery being charged could emit explosive gasses. Avoid smoking or open sparks or flames in the vicinity of the battery. Explosive and flammable substances such as fuel or solvents should not be kept in the vicinity of the charger or the battery.
- Disconnect the supply before making or breaking connections to the battery.
- While connecting the charger to the battery, maintain right polarity connection and avoid short-circuiting.
- Connect the appropriate DC clip to the battery post which is not connected to the automobile chassis. (The battery terminal not connected to the chassis has to be connected first.)
- Connect the other DC connector to the chassis, away from the battery and fuel line.
- The connector to be fixed to the positive pole shall be coloured red and that to be connected to the negative pole shall be coloured black.
- Then connect the battery charger to the supply mains.







- Do not cover the charger while charging.
- Do not touch the battery clips together when charger is connected with mains.
- After charging, disconnect the battery charger from supply mains. Remove the chassis connection and the battery connection, respectively. This will reduce back drain current.
- Charging must be ceased immediately if battery is found to be too hot or leaks out liquid during charging.
- In case of malfunction or damage, immediately disconnect the charger from the mains.
- Do not use vehicle when charging permanently installed batteries.
- During charging the battery must be placed in a well ventilated area.
- **Danger of chemical burns!** Battery acid is highly corrosive. If your skin or eyes come into contact with acid, immediately rinse the affected part of the body with excessive water and seek medical advice.
- This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.
- Children should be supervised to ensure that they do not play with the appliance.
- Ensure that charger switches to maintenance charge mode, before it is left unattended and connected for long time. If this stage does not arrive within 73 hours (max), the charger must be disconnected manually.

### Locate Charger

- Locate the charger as far away from battery as the DC cord permits.
- While charging do not place charger directly above or below the battery. Gases or fluids from the battery may corrode and damage the charger.
- Never allow battery acid to drip on the charger.
- Charging should be carried out in a well-ventilated, weather protected facility.

### Battery Type & Settings

The following recommendations should only be referred to as guidelines. For precise details, you must refer to battery manufacturer for instructions.









Symbol	Mode	Settings	Details
	1	28.8V/3.5A	This mode is normally suitable for 24V WET, MF and GEL batteries.
	2	29.4V/3.5A	This mode is recommended for several 24V AGM batteries. It is also suitable for charging batteries in sub-zero temperatures.
	3	14.4V/7A	This mode is normally suitable for 12V WET, MF and GEL batteries.
	4	14.7V/7A	This mode is recommended for several 12V AGM batteries. It is also suitable for charging batteries in sub-zero temperatures.
	5	13.6V/5A SUPPLY	<p>a) Maintenance of 12V Lead-Acid rechargeable batteries: This mode is suitable for maintenance of 12V batteries with capacity range from 14-230Ah. The charger delivers a constant voltage of 13.6V. This is maintenance mode for applications where maximum capacity from the battery is required such as Golf Carts, Floor Sweepers etc.</p> <p>b) Power source: <b>INVATEC</b> SC-7 battery charger is also used as a power supply, without attaching a battery in this mode. The charger delivers 13.6V/5A. Spark free function is inactivated. However reverse polarity protection function still works.</p>
	6	16V/1.5A BOOST	This mode is mainly applied for recovering 12V batteries with capacity range from 14-230Ah in normal condition. To recover severely discharged batteries due to stratified acid, this mode is useful. High voltage (17V max) at 1.5A is applied for a maximum period of 3 hours. A fully charged battery gives faster result. High voltage may cause some water loss. For optimal efficiency and minimum risk to vehicle's / boat's electronics, battery must be disconnected.




















**Charging**

- 1) Charging of a permanently installed battery in a vehicle
  - a) Before connecting or disconnecting the battery leads, the power cord should be removed from the mains.
  - b) Check polarity of battery post. A positive (“+”) battery post usually has a larger diameter than a negative (“-”) post.
  - c) Identify the pole of battery which is connected to the chassis (earth). Normally the negative terminal is connected to the chassis.
  - d) Charging of negative earthed battery:
    - Make sure the black wire ⑫ (“-” pole connection) has not contact with the fuel line or the battery.
    - Connect the red wire ⑪ (“+”) to the positive (“+”) pole of the battery and the black wire ⑫ (“-”) to the vehicle chassis.
  - e) Charging of positive earthed battery:
    - Make sure the red wire ⑪ (“+” pole connection) has no contact with the fuel line or the battery.
    - Connect the black wire ⑫ (“-”) to the negative (“-”) pole of the battery and the red wire ⑪ (“+”) to the vehicle chassis.
- 2) Charging of a battery not connected to a vehicle
  - a) Before connecting or disconnecting the battery leads, the power cord should be removed from the mains.
  - b) Connect the red wire ⑪ (“+”) to the positive (“+”) pole of the battery and the black wire ⑫ (“-”) to the negative (“-”) pole.  
 In case of reverse polarity connection red LED ⑨ indicate error mode. This function would not work in Supply Mode. Error indication light ⑨ would be also shown if charge mode is initiated without connecting the battery to the battery leads.
- 3) Charging with eyelet terminals (Permanent connection to the vehicle battery)
  - a) Before connecting or disconnecting the battery leads, the power cord should be removed from the mains.
  - b) Connect the red wire ⑭ (“+”) to the positive (“+”) pole of the battery and the black wire ⑮ (“-”) to the negative (“-”) pole.

**Equipment Description**

**a) Indication:**


INDICATION	SYMBOL	Description
①		Yellow LED on for “POWER” In case of open circuit or short circuit or reverse connection, LED lights up
②		Red LED on for “Mode 1”(28.8V/3.5A) for 24V battery
③		Red LED on for “Mode 2”(29.4V/3.5A) for 24V battery
④		Red LED on for “Mode 3”(14.4V/7A ) for 12V battery
⑤		Red LED on for “Mode 4”(14.7V/7A ) for 12V battery
⑥		Red LED flashes “on-off” cycle in one second “Mode 5”( 13.6V/5.0A) “Battery Maintenance”.
⑥ & ⑧		Red LEDs display together “Mode 5” (13.6V/5.0A) “Power Supply”
⑦		Red LED displays “Mode 6” (16V/1.5A) “Boost”

INDICATION	SYMBOL	Description
⑦		Red LED flashes “on-off” cycle in one second “Mode 6” (16V/1.5A) “Boost begins”
⑦		Red LED flashes (Frequency “on” 0.5 second, “off” 1 second) “Boost finishes”
⑨		Red LED displays “Incorrect polarity/Fault”
⑩		Red LED flashes “on-off” cycle in 0.5 second “Diagnosis”
⑩		Red LED flashes “on-off” cycle in 1 second (below 25%) “Recovery”
⑩, ⑪	 on,  flashes	Red LED flashes “on-off” cycle in 1 second (below 50%) “Bulk”
⑩, ⑪, ⑫	  on,  flashes	Red LED flashes “on-off” cycle in 1 second (below 75%) “Bulk”
⑩, ⑪, ⑫, ⑬	   on,  flashes	Red LED flashes “on-off” cycle in 1 second (below 100%) “Absorption”
⑩, ⑪, ⑫, ⑬	    on	Green LED displays “Fully charged” “Maintenance”
⑭		“Mode” selection button


### b) Component Description

Indication	Description
⑮	Charger
⑯	Mounting Holes
⑰	Mains Cable
⑱	Power plug
⑲	Male connector
⑳	Female connector with protection cap
㉑	Fuse Holder with 10A plug-in fuse
㉒	“+” Pole connection cable (red) with ring terminal
㉓	“-” Pole connection cable (black) with ring terminal
㉔	Female connector
㉕	“+” Pole connection cable (red) with quick clamp (red)
㉖	“-” Pole connection cable (black) with quick clamp (black)


### Select Charging Mode

INVATEC SC-7 battery charger has unique memory function. The charger returns to last selected mode automatically when power is switched on. For repetitive charging process, this is a handy feature. However to charge various batteries at different ambient temperature a specific charging mode could be selected manually by pressing the  ⑭ selection button until the light for correct voltage is lit. Within 0.5 second, the charger activates the selected mode.

### Reset / Deleting Settings





In beginning of charging process after connection to the power supply, the charger automatically resets itself to “Power” basic settings and remains in  ① position unless further action is executed by the user. Yellow LED is lit.

### Identification of Overlap Voltage

To treat a 14.6-21V±0.25V battery if it may be a fully charged 12V battery or deep-discharged 24V battery. INVATEC SC-7 charger smartly identifies correct nature of battery and provides appropriate course of action. Once the selection button  ⑭ is pressed, charging LED shall flash “on-off” cycle in 0.5 second. Within 1-2 minutes the embedded MCU would detect change in battery voltage. If battery voltage remains at original value or rises to a higher level, system would treat it as a 24V battery, if voltage falls, it is treated as a 12V battery. After correct identification, system would initiate action as described in “a” or “b” under paragraph “Switching over between different Modes” until the battery is disconnected.








## Charging Status Indication

 ⑩	 ⑪	 ⑫	 ⑬	Charging Status	Charging Phases
FLASH	OFF	OFF	OFF	Below 25%	Diagnosis & Recovery
ON	FLASH	OFF	OFF	Below 50%	Bulk
ON	ON	FLASH	OFF	Below 75%	Bulk
ON	ON	ON	FLASH	Below 100%	Absorption
ON	ON	ON	ON	Full	Maintenance


## Switching over between different Modes

By repeatedly pressing the selection button  ⑭ displays the charging modes in the following order-  
a) for 12V battery:

 ① → “Mode 3”  (14.4V/7A) → “Mode 4”  (14.7V/7A) → “Mode 5”  
 (13.6V/5.0A) → “Mode 6”  (16V/1.5A) and repeats this cycle.











b) for 24V battery:

 ① → “Mode 1”  (28.8V/3.5A) → “Mode 2”  (29.4V/3.5A) and repeats this cycle.

If you press  ⑭, charging mode automatically switches to the next operation mode and begins functioning in that specific mode. However after a full charge, if battery is not disconnected from the charger, it remains in float charge mode, even if user switches it over to another mode. This protects battery from being damaged.











### MODE 1 (28.8V/3.5A)

This mode is suitable for charging 24V batteries with capacity range from 14-120Ah in normal conditions. Connect the output terminals of the charger to the battery with right polarity. Connect the power cord to the power outlet to begin charging.

Press the selection button  ⑭ to select Mode 1 (LED 2). After executing this operation the corresponding LED display  ② will light up. If no further process is activated, the electronic system will automatically start the charging with a current of 3.5A ±10%. Charging shall continue in several stages:  ⑩ →  ⑪ →  ⑫ →  ⑬ until battery is fully charged upto 28.8V±0.25V. At this stage all intermediate charging status LEDs display  ⑩,  ⑪,  ⑫ will turn on one by one until, LED display  ⑬ will turn on. The Trickle current is now available to battery for maintenance.











### MODE 2 (29.4V/3.5A)

This mode is suitable for charging 24V batteries with capacity range from 14-120Ah in cold conditions or charging several AGM batteries. Connect the output terminals of the charger to the battery with right polarity. Connect the power cord to the power outlet to begin charging.

Press the selection button  ⑭ to select Mode 2 (LED 3). After executing this operation the corresponding LED display  ③ will light up. If no further process is activated, the electronic system will automatically start the charging with a current of 3.5A ±10%. Charging shall continue in several stages:  ⑩ →  ⑪ →  ⑫ →  ⑬ until battery is fully charged upto 29.4V±0.25V. At this stage all intermediate charging status LEDs display  ⑩,  ⑪,  ⑫ will turn on one by one, until LED display  ⑬ will turn on. The Trickle current is now available to battery for maintenance.











### MODE 3 (14.4V/7A)

This mode is suitable for charging 12V batteries with capacity range from 14-230Ah in normal conditions. Connect the output terminals of the charger to the battery with right polarity. Connect the power cord to the power outlet to begin charging.

Press the selection button  ⑭ to select Mode 3 (LED 3). After executing this operation the corresponding LED display  ④ will light up. If no further process is activated, the electronic system will automatically start the charging with a current of 7.0A ±10%. Charging shall continue in several stages:  ⑩ →  ⑪ →  ⑫ →  ⑬ until battery is fully charged upto 14.4V±0.25V. At this stage all intermediate charging status LEDs display  ⑩,  ⑪,  ⑫ will turn on one by one, until LED display  ⑬ will turn on. The Trickle current is now available to battery for maintenance.

## MODE 4 (14.7V/7A)





This mode is suitable for charging 12V batteries with capacity range from 14-230Ah in cold conditions or charging several AGM batteries. Connect the output terminals of the charger to the battery with right polarity. Connect the power cord to the power outlet to begin charging.

Press the selection button  ⑭ to select Mode 4 (LED 5). After executing this operation the corresponding LED display  ⑤ will light up. If no further process is activated, the electronic system will automatically start the charging with a current of  $7.0A \pm 10\%$ . Charging shall continue in several stages:  ⑩ →  ⑪ →  ⑫ →  FULL ⑬ until battery is fully charged upto  $14.7V \pm 0.25V$ . At this stage all intermediate charging status LEDs display  ⑩,  ⑪,  ⑫ will turn on one by one, until LED display  FULL ⑬ will turn on. The Trickle current is now available to battery for maintenance.




## MODE 5 (13.6V/5A)

**a) Maintenance of 12V batteries :** This mode is suitable for maintenance of 12V batteries with a capacity range from 14-230Ah. The charger delivers a constant voltage of 13.6V. This is maintenance mode for applications where maximum capacity from the battery is required such as Golf Carts, Floor Sweepers etc.

Connect the output terminals of the charger to the battery with right polarity. Connect the power cord to the power outlet to begin charging.

Press the selection button  ⑭ to select Mode 5 (LED 6). After executing this operation the corresponding LED display  ⑥ will light up. If no further process is activated, the electronic system will automatically start the maintenance charging at constant voltage  $13.6V \pm 0.25V$  with a output current of  $5.0A \pm 10\%$  by indicating  ⑥ flashing “on-off” cycle in one second. The charger has overload protection feature in this mode. If output voltage falls below 4.5V, the charger returns to  ⑨ mode.






**b) Power Supply :** INVATEC SC-7 battery charger is also used as a power supply, without attaching a battery in this mode. The charger delivers 13.6V/5A. In this mode Spark free function is inactivated. However reverse polarity protection still works.

Press the selection button  ⑭ continuously for 3 seconds to select Mode 5 (LED 6). After executing this operation the corresponding LED display  ⑥ and LED display  ⑧ will light up simultaneously. If no further process is activated, the electronic system will automatically begin as a “Power Supply” with output voltage of  $13.6V \pm 0.25V$  and output current of  $5.0A \pm 10\%$

## MODE 6 (16V/1.5A)

To recover severely discharged 12V batteries due to stratified acid with capacity range from 14-230Ah this mode is applied. A fully charged battery gives faster result. High voltage may cause some water loss. For optimal efficiency, battery must be disconnected.

Connect the output terminals of the charger to the battery with right polarity. Connect the power cord to the power outlet to begin charging.

Press the selection button  ⑭ to select Mode 6 (LED 7). After executing this operation the corresponding LED display  ⑦ will light up. If no further process is activated, the electronic system will automatically begin boost function by delivering voltage  $16.5V \pm 0.25V$  with a output current of  $1.5A \pm 20\%$ . This stage is indicated by flashing  ⑦ “on-off” cycle in one second. If battery is deep-discharged (4.5V),  ⑦ may continue indicate upto 3 hours (max). Recovery attempt is made at high voltage of 17V (max) at 1.5A. This process would terminate as soon as battery could accept normal charging and it would be indicated by flashing  ⑦ of with frequency of “on” 0.5 second, “off” 1 second.

## Rescuing Drained Battery

When charger is connected to a battery, before the start of charging process, the charger automatically detects the voltage of the battery. If voltage is below 4.5V (for 12V battery) and 16V (for 24V battery) the INVATEC SC-7 charger will not start due to its internal safety circuit. It initiates pulse charging mode if the voltage is in the range of  $4.5V \pm 0.25V$  to  $10.5V \pm 0.25V$  (for 12V battery) and  $16V \pm 0.25V$  to  $21V \pm 0.25V$  (for 24V battery). Once voltage of battery rises to  $10.5V \pm 0.25V$  (for 12V battery) or  $21V \pm 0.25V$  (for 24V battery) charger changes over to previously selected charging mode. Now the battery can be charged faster and safely. Most drained batteries can be charged and used again using this procedure.



### Abnormality Protection

In case of short-circuit, open circuit, reversed polarity connection or battery voltage below  $4.5V \pm 0.5V$  (for 12V battery) or  $16V \pm 0.25V$  (for 24V battery), the charger will turn-off the electronic system and will immediately reset the system back to basic position to avoid damage to battery and charger.

### Overheating Protection

INVATEC SC-7 charger is protected by NTC control. During the charging process, if the charger becomes too hot, the power output is automatically reduced to protect itself from damage. The charger continues to work trickle charge. Charger increases power automatically when the ambient temperature drops.

### Bulk Charging Time

Battery Size (Ah)	For about 80% Charge (hours)	
	12V	24V
14	2.5	4.9
60	7.5	15
100	12	24
120	15	30
230	29	

### Technical Data




MODEL	SC-7
Input Voltage AC	220-240VAC, 50/60Hz
Output Voltage	12V & 24V (Auto-select)
Input Current	1.5A RMS max
Efficiency	>75%
Charging Voltage	28.8V $\pm$ 0.25V or 29.4V $\pm$ 0.25V or 14.4V $\pm$ 0.25V or 14.7V $\pm$ 0.25V or 13.6V $\pm$ 0.25V or 16.5V $\pm$ 0.25V
Charging Current	7.0A $\pm$ 10% or 5.0A $\pm$ 10% or 3.0A $\pm$ 10% or 1.5A $\pm$ 20%
Back Current Drain*	<5 mA
Ripple**	Max 150mV, 0.3A
Ambient Temperature	-20°C to +50°C/-4°F to +122°F, Reduced output power at higher temperature
Type of Charger	Seven step, fully automatic, switch mode with maintenance charging
Type of Batteries	12V & 24V Lead-acid batteries (WET, MF,AGM and GEL)
Battery Capacity	14-230 Ah (for 12V), 14-120Ah (for 24V)
Dimensions (LxWxH)	201 x 91 x 51 mm
Housing Protection	IP65 (Dust and Splash proof) Outdoor use
Weight	0.912 kg
Noise Level	<50 dB (Tested from a distance of 50cm)




\* = Back current drain is the amount of current drawn by the charger from battery, when the charger is connected to the battery, without power cord connected. INVATEC SC-7 has extremely low back current drain which corresponds to 0.7 Ah per month (1mA/hr)

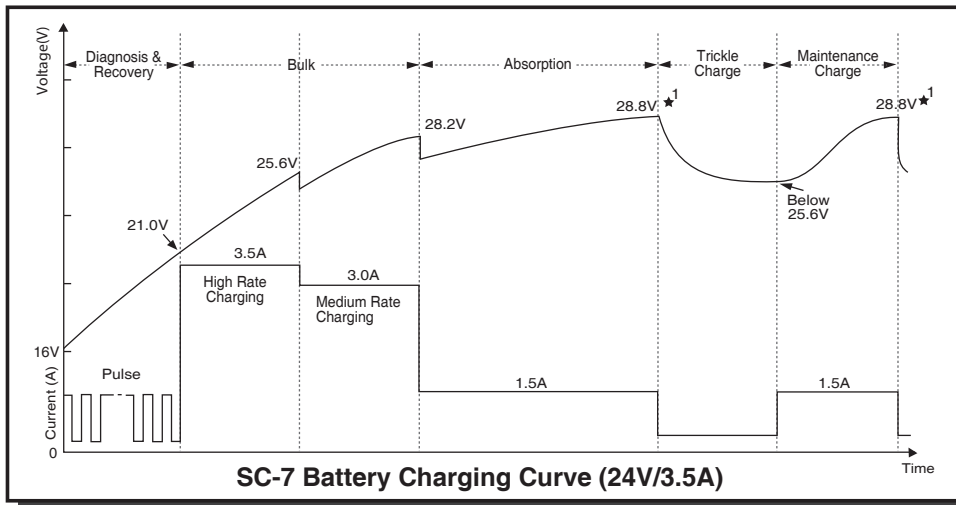
\*\* = Ripple refers to interference of current and voltage. A high current ripple heats up battery and reduces life of battery. Against a linear charger, which has a current ripple of upto 400%, INVATEC SC-7 charger's current ripple is below 2% (0.15/12V or 0.3/24V battery voltage), which is much lower than the max 5% for a sealed acid battery. Equipments connected to the battery could be damaged by high voltage ripple.

### Charging Phases

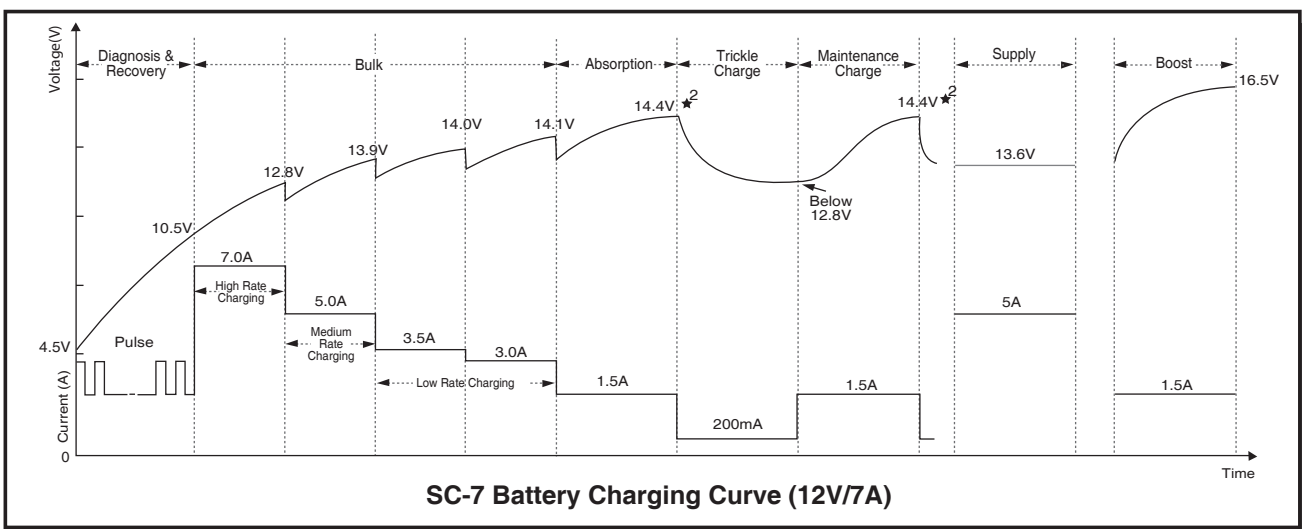
INVATEC SC-7 charger performs 7-step fully automatic charging cycle.

MODE	SETTINGS	SYMBOL
1	28.8V/3.5A	
2	29.4V/3.5A	
3	14.4V/7A	

MODE	SETTINGS	SYMBOL
4	14.7V/7A	
5	13.6V/5A SUPPLY	
6	16V/1.5A BOOST	



\* In case of cold weather charging, ★<sup>1</sup> voltage refers to 29.4V, instead of 28.8V



\* In case of cold weather charging, ★<sup>2</sup> voltage refers to 14.7V, instead of 14.4V

**1) Diagnosis & Recovery:** As soon charging instruction is given to the charger, the unique diagnostic function automatically checks status of battery (detects voltage). If a deeply discharged battery's voltage is over  $4.5V \pm 0.5V$  (for 12V battery) or  $16V \pm 0.25V$  (for 24V battery), charger begins pulse charging with 3A high current and 1.5A low current to recover it, which terminates when voltage reaches to  $10.5V \pm 0.25V$  (for 12V battery) or  $21V \pm 0.25V$  (for 24V battery). At this stage or if voltage of a battery is over  $10.5V \pm 0.25V$  (for 12V battery) or  $21V \pm 0.25V$  (for 24V battery) at the beginning of the process, the charger skips pulse charging and it switches over to pre-selected charging mode.

**2) Bulk :** 80% of energy is returned in this phase of charging. Here charger performs in multi-stages:

#### For 24V battery

- High Rate Charging: Charger delivers constant current of 3.5A until the voltage reaches to 25.6V
- Medium Rate Charging: Charger delivers constant current of 3.0A until the voltage reaches to 28.2V at which point the charger switches to Absorption phase.

#### For 12V battery

- High Rate Charging: Charger delivers constant current of 7.0A until the voltage reaches to 12.8V
- Medium Rate Charging: Charger delivers constant current of 5.0A until the voltage reaches to 13.9V, at this level constant current is 3.5A until voltage reaches to 14.0V. Finally charger delivers 3.0A current until voltage reaches to 14.1V at which point the charger switches to Absorption phase. Since current is not delivered at highest constant level, **INVATEC** SC-7 charger will minimize the heating up of the battery, and hence will eliminate the build up of gases. This ensures more efficient and safer performance.

**3) Absorption:** Use of a constant high current for extended periods of time risks gassing the battery. Therefore a constant low charging current is given at 1.5A to raise voltage from 28.2V to 28.8V (for 24V battery) and 14.1V to 14.4V (for 12V battery). In this phase complete charging up to almost 100% is achieved. Charger switches to trickle charge phase after sensing that the battery is truly fully charged.


**4) Trickle Charge :** Battery is fully charged and ready to use. The battery will signal to the charger and will only take enough current to sustain small loads such as alarms etc or current leaks in the vehicle wiring circuit. Very low current of 200mA is given to the battery. When voltage drops below 25.6V (for 24V battery) or 12.8V (for 12V battery), monitoring circuit senses that battery needs more current to maintain its charge than available in trickle charge phase. The charger switches to maintenance Charge phase.

**Standby feature :** When battery remains connected with vehicle's wiring system, during the trickle mode, circuits continuously monitor the current drawn by the battery.

**INVATEC SC-7** is fully interactive charger which adjusts itself to changing current and voltage requirement to charge and maintain the battery.

**5) Maintenance Charge :** As charger continuously monitors the terminal voltage in order to determine if a maintenance charging should be initiated. If the battery is loaded and/or terminal voltage falls below 25.6V (for 24V battery) or 12.8V (for 12V battery), the charger starts maintenance charging pulse at constant 1.5A until voltage reaches to 28.8V (for 24V battery) or 14.4V (for 12V battery). Now maintenance charging is discontinued. Cycle of trickle charging and maintenance charging is repeated indefinitely to keep battery in good condition when it is not in use and enables charger to be left connected indefinitely.

**NOTE:** If the charger is left connected indefinitely, check water levels every four weeks or as recommended by battery manufacturer to ensure battery remains at proper level.

**6) Supply 13.6V :** **INVATEC SC-7** charger provides a constant voltage at 13.6V and current upto 5.0A. This is suitable for maintenance of 12V battery using Float charge approach at 100% of charge. **INVATEC SC-7** battery charger is also used as a power supply with maximum capacity of 13.6V/5A. In this mode spark free function is inactivated. However reverse polarity protection function still works. It has electronic overload protection, which activates if output voltage from the charger falls below 4.5V and current to around 6A (max). In this situation charger returns to  "Power" mode.

**7) Boost 16V :** To recover severely discharged 12V batteries this mode is useful. High voltage (17V max) at 1.5A is applied for a maximum period of 3 hours. At finish of this stage it would switch to normal charging setting (14.4V).

#### **Error Mode** ⑨

The charger goes to Error mode  ⑨ in following situation-

a) The battery is connected with reverse polarity poles

#### **Power Mode** ①

The charger goes to Power mode  ① in following situations-

- Charger's terminals are short circuited or open circuited when charging is initiated
- Over-loaded charging
- Attempt to charge a defective battery
- Charging is initiated without any battery connected to the battery leads
- Attempt to charge a battery whose voltage is below  $4.5V \pm 0.5V$  (for 12V battery) or  $16V \pm 0.25V$  (for 24V battery)
- The charger is in recovery mode for over 7 hours
- The charger is in bulk and absorption mode for over 41 hours

#### **Trouble Shooting**

##### **Charger light does not turn on:**

- Remove the charger from the AC outlet and recheck the charger clamps are connected to the correct terminals and are making a clean connection
- Check to make sure AC outlet is supplying power
- A bad connection of the battery to ground

##### **Charger light is on but battery does not charge properly**

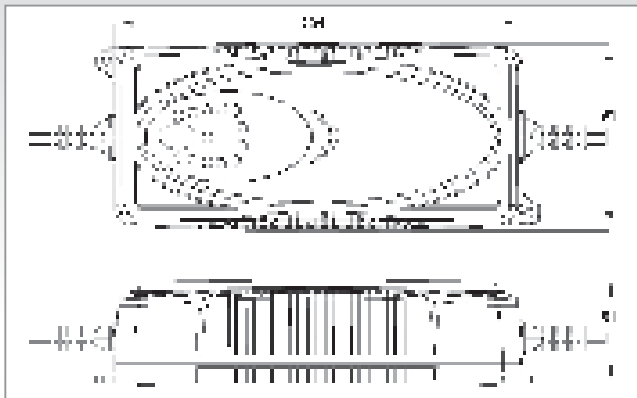
- The battery may be defective or of oversize
- The battery has a excessive current draw, battery must be replaced

## Maintenance

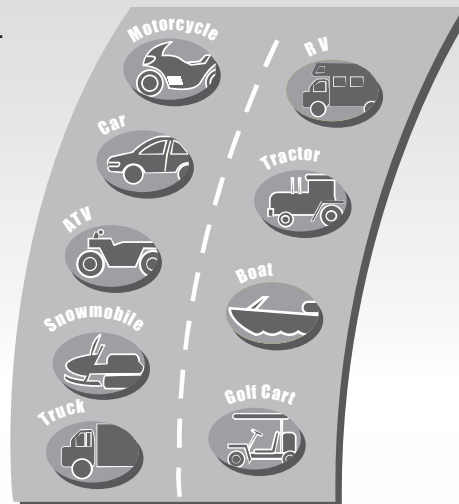
INVATEC SC-7 charger does not need any specific maintenance. Only install, maintain or service this charger when it is disconnected from the mains. It may be cleaned with a dry cloth or soft tissue. Under any circumstances, do not use any solvents or other cleaning agents.

## Mounting & Product dimensions

The charger is easy to fix using two screws. Please refer to product drawing.



## Application



## Equipment

INVATEC SC-7 charger is supplied with two detachable and interchangeable colour coded lead sets- one with clamps for bench charging and other with eyelet terminals (Ø6.3mm) with in-line battery protection plug-in fuse (10A) for permanent attachment to the battery posts to allow quick connection/disconnection through snap-connector.

### Connectors



Interchangeable Quick Contact Battery Leads with Clamps




Interchangeable Quick Contact Battery Leads with Eyelet Terminals



Snap Connector

## Declaration of Compliance

Tested and approved by  and conforms to EN 60335-1, EN 60335-2-29, EN 55014-1, EN 55014-2, EN 61000-3-2, EN 61000-3-3, EN 50366

Note: We reserve right to carry out technical modifications for improvement of SC-7 charger without notice.



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