General information

Congratulations on your choice of the **Robitronic Pro-2000**, a microprocessor-controlled, high-tech battery charger. This device delivers optimal user-friendliness and maximum reliability. Its built-in multifunction digital display provides you with sufficient information about the charging process and the state of the batteries.
This battery charger was designed especially for charging NiCad batteries.
A supply voltage of 13.8 VDC allows charging batteries with 6 to 7 cells.

Warning

Charging NiCad batteries with high current produces a large amount of gas and thus strong gas pressure within the cells. With old or defective batteries, this can cause an explosion of the battery cells. Therefore always maintain a safe distance from the charging and never charge batteries in the vicinity of small children.
Charging batteries with less than 6 cells or with higher supply voltage causes greater heating of the charger. Here you should reduce the charging current since it could cause overheating of or damage to the final stage of the device.
When charging from an automobile battery, avoid short circuiting the charging terminals with the automobile chassis. In the battery charger the positive terminal of the supply voltage is connected directly to the positive terminal of the charging terminal; on contact with the automobile chassis, this would cause a short circuit of the automobile battery.

Setup

The supply voltage requires either an automobile battery or a stabilized power supply. When using a power supply, assure that it can supply the necessary current. The output voltage of the power supply should be set to 12 V for charging 6 cells; excessive supply voltage causes greater heating of the charging device. When charging batteries with 4 or 5 cells, the charging current must not exceed 1 ampere!
The supply voltage is connected to the red cable (positive terminal) and the black cable (negative terminal) at the back of the charger. If the connections are reversed, the circuit is electronically broken within the charger. In this case you need not change a fuse, but only correct the connections.

Connecting the battery

The battery to be charged is connected to the red cable (positive terminal) and the black cable (negative terminal) at the front of the charger. If the battery connections are reversed, a warning signal sounds.

Starting charging

If the battery has been connected correctly, the multifunction digital display indicates the momentary battery voltage. Pressing the *Start* key begins charging. The LED signals that charging is in progress. The multifunction digital display indicates charging current, battery voltage, temperature and momentary charging time.

Ending the charging operation

Depending on the charging mode, the charging operation terminates when the peak voltage or the battery temperature is achieved; completion is reported by means of an acoustic signal. The multifunction digital display then indicates the charging time and the charged capacity.
The charging operation can also be terminated manually by pressing the *Start* key again.

Trickle charging on completing the charging operation

After the charging operation the battery continues to be charged with short current pulses (trickling).   The average trickle current is 10% of the charging current.
The charging operation can be resumed by pressing the *Start* key again.

Warning signal for supply voltage failure

If the supply voltage is interrupted while a battery is in the charger, a warning signal sounds. This proves especially helpful if a power supply is being used and the supply voltage is interrupted by a power failure. An already started charging procedure is continued automatically on restoration of the supply voltage.

SETUP - setting charging parameters

Pressing the *Mode* key switches the charger from charging mode to setup mode; thereupon the charger displays the current settings for the charging parameters (setup display). Each additional pressing of the *Mode* key advances the cursor (a line under the character) to the next parameter. The *Plus* and *Minus* keys allow modification of the parameter selected by the cursor.

To persistently save the charging parameters in the charger, keep the *Mode* pressed and simultaneously press the *Start* key. The charger reports successful storage of the parameters with a signal tone. Thereafter, each time the charger is turned on, it loads the stored charging parameters.

To avoid storing the charging parameters persistently, press only the *Start* key after setting the parameters.

Setting temperature charging mode

When the temperature charging mode *Temp* is shown at the bottom left of the setup display, the cut-off temperature and the maximum charged capacity can be set. This means that charging terminates either when the set battery temperature or the set charged capacity has been reached. The maximum charging capacity option largely protects batteries against overcharging when the temperature probe is missing. The charging capacity must be set to the type of battery used; several test charges can help determine this value, and the highest possible value is entered.

Values from experience for Sanyo batteries are ca. 2500-2800 mAh and for Panasonic batteries ca. 2600-3000 mAh.

4

Setting the delta-peak charging method

When the delta-peak charging mode *Peak* is shown at the bottom left of the setup display, the level of the voltage bend can be set (default value: 0,1V). In addition, the grace period can be set; here the battery voltage is first tested for voltage drop after the set time; this allows using the delta-peak method to charge even batteries with poor voltage characteristics. CAUTION: the grace period is not suited for repeaking batteries.

Setting the charging current

No general recommendations can be given for setting the charging current. This varies according to both the batteries used and their respective applications.
In general, however, it holds that higher charging current produces higher voltage (= pressure) in the battery and lower charging current produces greater charged capacity (= life of the charge, driving time). However, the charging current for rapid-charging driving batteries must not fall below 3.0 amperes and must not exceed 6.0 amperes.

Sanyo battery: charging current 4.5A - 5.5A (default 5.0 A)
Panasonic battery: charging current 4.0A - 5.0A (default 4.5 A)

Setting for amateur drivers:
    charging current: 3.5 amperes
    cut-off method: peak 0.10V 10 min

Setting for competition:
    charging current: 5.0 amperes
    cut-off method: peak 0.10V 5 min
           or temperature 40°C 2800mAh

Timer

A timer can be activated in the setup display (top left of display). The timer value defines the time interval until the automatic start of a charge. Particularly for competitions, this allows charging batteries precisely to the minute; you will never again have to begin a race with a half-charged battery.
Pressing the *Start* key begins the countdown for the timer. The display signals countdown mode with a blinking colon on the time display.
The timer value is reset to zero when charging begins; the timer value cannot be stored persistently.
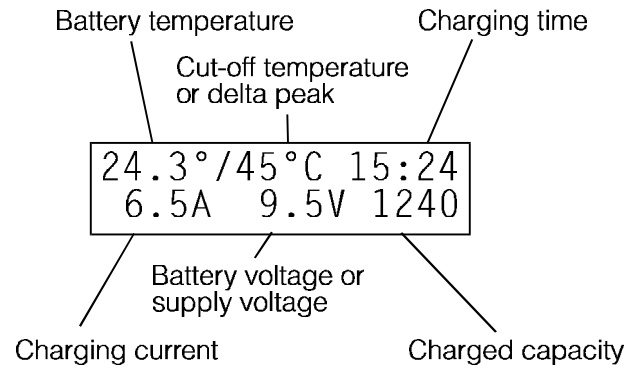
Quick instructions

Key functions in charging mode

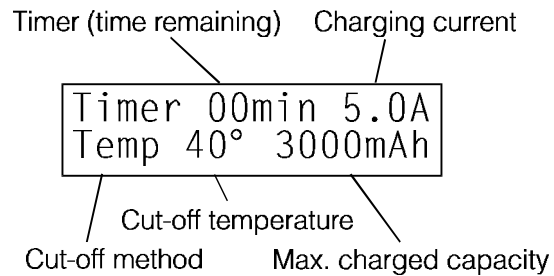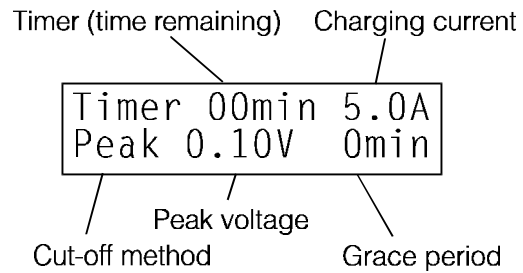|	
Start key	start or stop charging; start the timer countdown
Mode key	toggle between charging mode and setup mode
Plus key	(disabled in charging mode)
Minus key	(disabled in charging mode)

Key functions in setup mode

Mode key	select charging parameter; cursor indicates selected parameter
Plus key	increase value of selected parameter
Minus key	reduce value of selected parameter
Start key	toggle between charging mode and setup mode; modified charging parameters are not stored persistently
Start key	with simultaneously pressed *Mode* key: toggle between charging mode and setup mode; modified charging parameters are stored persistently (short signal emitted)

Display in charging mode

Battery temperature   Charging time

Cut-off temperature
or delta peak

```
24.3°/45°C 15:24
 6.5A  9.5V 1240
```

Battery voltage or
supply voltage

Charging current   Charged capacity

Display in setup mode

Timer (time remaining)   Charging current

```
Timer 00min 5.0A
Peak 0.10V   0min
```

Peak voltage

Cut-off method   Grace period

Timer (time remaining)   Charging current

```
Timer 00min 5.0A
Temp 40°  3000mAh
```

Cut-off temperature

Cut-off method   Max. charged capacity

Basics of charging nickel-cadmium batteries:

During charging, the energy delivered to the battery as charging current is stored. Toward the end of the charging process the battery can no longer completely store the charging current, but transforms it into heat. In addition to raising the temperature of the battery, this also begins to reduce the battery voltage. This yields two possibilities for detecting the charged state of a battery.

1. Monitor the battery temperature and terminate charging when a set temperature value is reached, normally between 35°C and 45°C.
2. Monitor the battery voltage and terminate charging when battery voltage drops (known as the delta-peak method). Here settings define how much the battery voltage must drop below the peak voltage in order to terminate charging.

The delta-peak cut-off method is the most common and reliable method; however, for older or defective batteries there can be a voltage bend at the beginning of the charging process. A battery charger could misinterpret this and terminate charging prematurely. However, the Pro-2000 battery charger allows setting a grace period at the start of charging that prevents premature termination of charging.

Specifications:

Input voltage   12-13,8 volts
Charging current   0 - 10 amperes
Trickle current   0 - 10 amperes current pulse
Number of NiCad cells   6 - 7 cells (4-5 cells max 1A)
Temperature probe range   0 - 50°C
Charging mode   linear
Cut-off   delta peak, battery temperature
Multifunction digital display   charging current, battery voltage,
                                       capacity, charging time, temperature
Additional features   timer function;
                                       alarm for power failure
Pole reversal/short-circuit protection
Dimensions (WxDxH)   135 x 90 x 58mm

Features: Multifunction digital display (LCD 32 characters)
            Persistent storage of charging parameters
            Alarm for power failure
            Automatic resumption of charging after power failure
            Automatic start of charging via timer
            Timer functions even in power failure
            Acoustical pole reversal alarm protects battery
            Trickle current via pulses