



## GBCO Battery Management System



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## User Instructions

600010 J  
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# GBCO Battery Management System

The GBCO Battery Management System is used to store and maintain up to 28 SE400 batteries in optimum condition.

The Nickel Metal Hydride (NiMH) batteries used in the SE400 must be used and maintained correctly to achieve optimum lifetime. Ideally batteries should be fully discharged before recharging – known as “deep discharge-recharge” cycling – to prevent degradation over time. Because deep cycling is not always possible using the standard charger, the GBCO was developed to maintain batteries in optimum condition and to partially restore degraded batteries.

Batteries may also be permanently damaged if they remain fully discharged for a period of time. The GBCO prevents this by maintaining batteries in ready-to-use condition.

When batteries are placed in the GBCO they are first given a full charge, one at a time. When left in the GBCO, each battery receives a deep discharge-recharge conditioning cycle once per month. At all other times the batteries are maintained in ready-to-use condition.

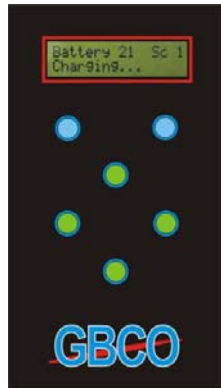
## CONTROL PANEL

The GBCO continuously scans all battery locations for a wide range of information. This information can be accessed via the control panel display using the five push-buttons.

Information may be displayed for each of the 28 battery locations.

The display consists of two levels:

1. The **default display** shows the battery locations being scanned in real time and a description of the most recent event that has occurred in the GBCO. The display reverts to the default display after 10 seconds of inactivity.
2. The **diagnostics display** shows a wide range of information about each battery location and the batteries installed.



### Display buttons (blue):

Left – selects default display

Right – selects or refreshes diagnostics display

### Navigation buttons (green) select diagnostics display, and:

Left-Right – selects a menu

Up-Down – selects a battery location

## WARNINGS

Do not use water when cleaning the GBCO. Doing so may result in ELECTRIC SHOCK and may cause damage to the GBCO.

Disassembly of the unit will void the product warranty.

The GBCO does not charge multiple batteries simultaneously – it charges sequentially.

Do not store batteries for any length of time in the GBCO while the unit is unpowered.

## TECHNICAL DATA

Power supply voltage	100–240 V, 50–60 Hz AC
Charging current	2 A
Discharging current	1 A
Discharging threshold (1A loaded)	10.5 V
Length of full cycle	1 month
Post-trickle current	150-200 mA
Charging + post-trickle duration	20 min to 5 hrs, depends on condition
Pre-trickle threshold	8 V
Pre-trickle current	0.75 A
Operational temperature range	0 to +55 °C
Operational humidity range	(non-condensing) 5–90%
Battery start charging temperature range	+5 to +35 °C
No of batteries	1–28
No of batteries processed simultaneously	1 charging or pre-trickle charging 2 post-trickle charging 1 discharging
Design	Double-insulated

## POWER INDICATORS

The GBCO has red and green power indicator LEDs located on the side of the unit near the power connector.

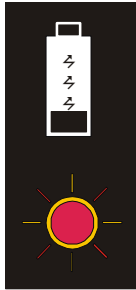
The GREEN LED lights when the GBCO is connected to the power and is functioning normally.

A flashing RED LED and audible alarm indicates that the GBCO requires IMMEDIATE ATTENTION. Attention may be required for any of the following reasons:

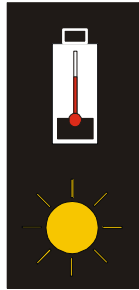
- The power has failed or become disconnected – Reconnect the power or remove all the batteries (batteries should not be stored for any length of time in an unpowered GBCO)
- A faulty battery has been detected – Identify the faulty battery using the control panel. Remove the battery and take it out of service.

## WARNING LEDs (located at each charging socket)

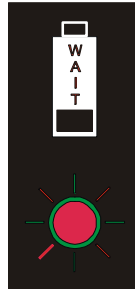
Note: Letters below refer to steps in the Instructions for Use on the following page.



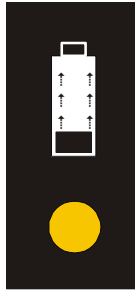
Red/orange flashing  
(a) Pre-trickle



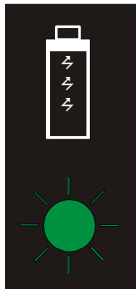
Orange flashing  
(b) Temperature



Red/green flashing  
(c) Waiting



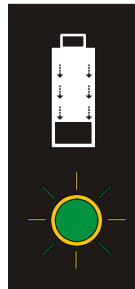
Orange steady  
(d) Charging



Green flashing  
(e) Post-trickle



Green steady  
(f) Ready for use



Green/orange flashing  
(g) Discharging



Red flashing  
(h) Faulty battery

## INSTRUCTIONS FOR USE

(Refer to “Warning LEDs” legend on previous page)

1. Place the GBCO on a level surface. Ensure that the power indicator LEDs (located on the side of the unit near the power connector) are visible. The GBCO may be used with the lid open or closed.
2. Connect the GBCO to mains power using the appropriate power cord (supplied with the GBCO). The green “power” LED (on the side of the GBCO) lights and all LEDs will flash red/green for approximately 5 seconds. The GBCO is now ready for use.
3. Before installing a battery in the GBCO, check that the contacts on the battery and the GBCO charging socket are clean and intact.
4. Install up to 28 batteries into any of the charging sockets. The GBCO will detect the presence of each battery as it is installed. Each GBCO socket functions as follows:
  - a. If the battery voltage is too low for normal charging, a small “Pre-trickle” charging current is supplied for 1 hour. If the battery cannot be recovered, the “Faulty battery” condition is indicated – see (h).
  - b. If the battery temperature is too high or too low to commence charging, the GBCO waits until an acceptable temperature is reached.
  - c. The battery is now ready for charging. If another battery is being charged or discharged, the battery is automatically queued.
  - d. When the GBCO is ready the battery receives a “fast charge” to approximately 90% of full charge.
  - e. The fast charge is followed by a “post-trickle” charge which brings the battery to full charge. The whole charging cycle takes approximately 5 hours for each battery.
  - f. The battery is now fully charged and ready for use.
  - g. If the battery is left in the GBCO, it will undergo a discharge-recharge cycle after 30 days. As with charging, the GBCO queues batteries for discharging. The discharge is followed by a recharge, as per steps (b) to (f).
  - h. If a faulty battery is detected at any time, the LED flashes red. Remove the battery and take it out of service.

## CLEANING AND MAINTENANCE

If the GBCO becomes dusty, clean with a clean cloth or vacuum cleaner. Avoid touching the charging contacts with metal parts. Avoid dust entering under the top panel of the GBCO.

## ERRORS AND WARNINGS

The GBCO has extensive error monitoring and alarm features. In case of any errors the GBCO will produce visual and audio alarms.

### Error codes

Code	Description of fault and recommended actions
00	No error.
01 to 1D	GBCO internal warnings. GBCO continues to operate but may not function correctly. Consult S.E.A.
21	Pre-trickle charging cannot restore voltage above 0.8 V/cell. Probably bad battery. Repeat with good battery. If everything is OK, replace the bad battery.
22	Battery removed during charging.
23	Battery temperature exceeds +60°C (140°F) during charging. Possible fault in GBCO or an open or short circuit in the battery. Repeat with another battery – if problem persists, the GBCO may be faulty, consult S.E.A.; if problem disappears, replace the battery
24	Temperature sensor error detected during charging. Possible fault in GBCO or an open or short circuit in the battery. Repeat with another battery – if problem persists, the GBCO may be faulty, consult S.E.A.; if problem disappears, replace the battery.
25	Battery is charging more than maximum time. Possible fault in GBCO or an open or short circuit in the battery. Repeat with another battery – if problem persists, the GBCO may be faulty, consult S.E.A.; if problem disappears, replace the battery.
26	Negative temperature slope detected during charging. Possible fault in GBCO, or an open or short circuit in the battery, or the ambient temperature changed during charging. Repeat last action at a constant ambient temperature and with the internal battery temperature the same as the ambient temperature. If everything is OK, the failure was probably due to rapid changes in the ambient temperature. If fault persists, repeat with another battery. If problem still persists, the GBCO may be faulty, consult S.E.A.; if problem disappears, replace the old battery.
27	<b>Critical error.</b> High current detected. The GBCO will shut down automatically. Do not attempt to use the GBCO. Consult S.E.A.
29	GBCO jumps to an unexpected stage for an unknown reason. Carefully record the sequence of events (including any messages on the LCD display). Also record any information about the battery before and after the event, and consult S.E.A.
2A	Battery has very high internal resistance. Faulty battery. Replace it.
2E	Battery discharge time-out. Possible fault in discharging circuit.
2F	Battery does not reach normal temperature – WaitTemp time-out (5 days). Ambient conditions may be unsuitable (too hot or too cold).

### Default display

B23 TheSEAgrou  
B16 Charging

Line 1 – battery location number currently being scanned (real-time)

Line 2 – battery number of most recent event, and description of it status \*

\* Table 1 contains a full status list.

### Diagnostics display

B20 M2 ElapsTime  
00d 01h 13m 57s

Line 1 – selected battery location; selected menu number and name \*

Line 2 – information on the selected battery location and menu

\* Table 2 contains a full list of menu numbers, names and detailed descriptions.

**Table 1 – Default display – Status list**

Status	Description
Removed	Battery has just been removed; GBCO assessing status
Empty	No battery in battery location
Inserted	Battery has been inserted, processor assessing its condition
WaitTemp	Battery temperature too high or low for charging; processor waiting for temperature to change (up to 5 days).
WaitPreTrkl	Battery is in poor condition; in queue for conditioning cycle
PreTrickle	Attempting to recover battery (up to 1 hour)
WaitCharge	Battery in queue for charging
Charging	Charging in progress (5 minutes to 2 hours)
WaitPostTrkl	Charging completed, awaiting post-trickle charging
PostTrickle	Post-trickle charging in progress (30 minutes to 4 hours)
PostTrEnd	Post-trickle charging completed; GBCO assessing status
Ready	Battery is charged and ready for use (for up to 30 days)
WaitDisch	Battery in queue for discharging
Discharging	Discharging in progress (duration approx. 4 hours)
DischEnd	Discharge completed; in queue for charging
UndefStage	Intermediate stage. Try to request condition once more by pressing the right display (blue) button

**Table 2 – Diagnostics display – Menus**

Menu no.	Name	Display content	Description of information (relevant to selected battery location only)
M1	Status	(as per Table 1)	Most recent event (change of status)
M2	ElapsTime	DDd HHh MMm SSs	Elapsed time since last event (change of status)
M3	StandDays	Last=7 Next=23	Days since last conditioning; days to next conditioning
M4	S/W Vers	ICM=10 MCM=12	Software versions
M5-10			For SEA technical use only