VEC1093DBD

BLACK&DECKER®

Fully Automatic Electronic
Smart Battery Charger
40/20/10/4 Amp Charge Rates with 110 Amp Engine Start

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IMPORTANT SAFETY INSTRUCTIONS

WARNINGS

1. **RISK OF EXPLOSIVE GAS MIXTURES — WORKING IN VICINITY OF A LEAD-ACID BATTERY IS DANGEROUS. BATTERIES GENERATE EXPLOSIVE GASES DURING NORMAL BATTERY OPERATION. FOR THIS REASON, IT IS OF UTMOST IMPORTANCE THAT EACH TIME BEFORE USING YOUR CHARGER, YOU READ THIS MANUAL AND FOLLOW THE INSTRUCTIONS EXACTLY.**
2. **To reduce risk of battery explosion, follow these instructions and those published by the battery manufacturer and manufacturer of any equipment you intend to use in vicinity of battery. Review cautionary markings on these products and on engine.**
3. **This equipment employs parts (switches, relays, etc.) that produce arcs or sparks. Therefore, if used in a garage or enclosed area, the unit MUST be placed not less than 18 inches above the floor.**

Battery Safety

1. Use of an attachment not recommended or sold by the battery charger manufacturer may result in a risk of fire, electric shock, or injury to persons.
2. To reduce risk of damage to electric plug and cord, pull by plug rather than cord when disconnecting charger.
3. An extension cord should not be used unless absolutely necessary. Use of an improper extension cord could result in a risk of fire and electric shock, and will void warranty.

   If an extension cord must be used, make sure:

   a. that pins on plug of extension cord are the same number, size, and shape as those of plug on charger;

   b. that extension cord is properly wired and in good electrical condition; and

   c. that wire size is AWG#10 (10 gauge) for 100 feet and AWG#8 for distances over 100 feet.
4. Do not operate charger with damaged cord or plug — take to a qualified technician for replacement of the plug or cord immediately.
5. Do not operate charger if it has received a sharp blow, been dropped, or otherwise damaged in any way; take it to a qualified service technician.
6. Do not disassemble charger; take it to a qualified service technician when service or repair is required. Incorrect re-assembly may result in a risk of electric shock or fire, and will void warranty.
7. To reduce risk of electric shock, unplug charger from outlet before attempting any maintenance or cleaning. Turning off controls without unplugging will not reduce this risk.
8. Do not expose charger to rain, snow or use when wet.

Personal Safety

1. Another person should be within range of your voice or close enough to come to your aid when you work near a lead-acid battery.
2. Fresh water and soap should be nearby in case battery acid contacts skin, clothing, or eyes.
3. Wear complete eye protection and clothing protection. Avoid touching eyes while working with a battery. Acid, acid particles or corrosion may get into eyes. Immediately flood eye with cold water (Eye Wash Station) for at least 15 minutes and seek medical attention immediately.
4. If battery acid contacts skin or clothing, wash immediately with soap and water. If redness, pain or irritation occurs, seek immediate medical attention.
5. NEVER smoke or allow a spark or flame in vicinity of battery or engine.
6. Be extra cautious to reduce the risk of dropping a metal tool onto battery. This might cause sparks or short-circuit the battery or other electrical part, which can cause an explosion.
7. Remove personal 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 cause a severe burn.
8. Use charger for charging a LEAD-ACID battery only. It is not intended to supply power to a low-voltage electrical system other than in a starter-motor application. Do not use the battery charger for charging dry-cell batteries that are commonly used with home appliances. These batteries may burst and cause injury to persons and damage property.
9. NEVER ATTEMPT TO CHARGE A FROZEN BATTERY.

Power Cord Safety

Charger should be grounded to reduce risk of electric shock. Charger is equipped with an AC cord having equipment-grounding conductor and a grounding plug. The plug must be plugged into a properly installed and grounded 110/120 volt AC outlet in accordance with all local codes and ordinances (see Figure 1A).

Figure 1A

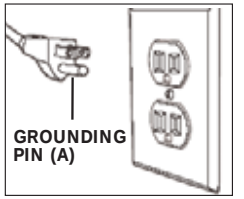
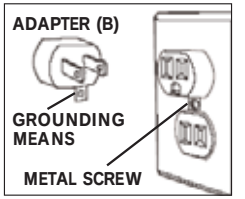


Figure 1B



If a properly grounded outlet is not available, a temporary adapter (like the adapter shown in Figure1B) may be used to connect this plug to a two-pole receptacle. The temporary adapter should be used ONLY until a properly grounded outlet can be installed by a qualified electrician.

DANGER — Before using an adapter as illustrated, make certain that the center screw of outlet plate is grounded.

The green-colored rigid ear or tab extending from adapter must be connected to a properly grounded outlet. MAKE CERTAIN IT IS GROUNDED. If necessary, replace original outlet cover plate screw with a longer screw that will secure adapter ground tab to outlet cover plate and connect to grounded outlet.

WARNING

NEVER alter AC cord or plug. If it will not fit, have a proper outlet installed by a qualified electrician. Improper connection may result in an electric shock.

Note: Use of an adapter is not allowed in Canada. If a grounding type receptacle is not available, do not use this appliance until the proper outlet has been installed by a qualified electrician.

Preparing to Charge

1. Determine voltage of battery to be charged by referring to the owner's manual.
2. If it is necessary to remove battery from vehicle to charge, or to clean terminals, always remove grounded terminal from battery first. Make sure all accessories in the vehicle are off, so as not to cause an arc.
3. Clean battery terminals. Do not allow corrosion to come in contact with eyes.
4. Add distilled water in each cell until battery acid reaches level specified by battery manufacturer. This helps purge excessive gas from cells. Do not overfill. For a battery without cell caps (maintenance free), carefully follow manufacturer's charging instructions.
5. Study all battery manufacturer's specific precautions, such as removing or not removing cell caps while charging, and recommended rates of charge.
6. Area around battery should be well ventilated while battery is being charged. Gas can be forcefully blown away by using a piece of cardboard or other nonmetallic material as a fan.
7. Make sure the initial charging rate does not exceed battery manufacturer's requirement.

Charger Location

1. Locate charger as far away from battery as cables permit.
2. NEVER place charger directly above battery being charged; gases from battery will corrode and damage charger.
3. NEVER allow battery acid to drip on charger when reading gravity or filling battery.
4. NEVER operate charger in a closed-in area or restrict ventilation in any way.
5. Marine batteries must be removed and charged on shore.
6. Do not set a battery on top of charger.

DC Connection Precautions

1. Connect and disconnect DC output clamps only after removing AC cord from electric outlet.
2. Never allow clamps to touch each other.
3. Attach clamps to battery chassis as indicated in "Battery Installed in Vehicle" steps 5 and 6, and in "Battery Outside of Vehicle" steps 2, 4 and 5.

Follow these steps when the battery is installed in a vehicle. A spark near the battery may cause an explosion. To reduce risk of a spark near the battery:

1. Position AC and DC cords to reduce risk of damage by hood, door, or moving engine part.
2. Stay clear of fan blades, belts, pulleys, and other parts that can cause injury to persons.
3. Check polarity of battery posts. POSITIVE (POS, P, +) battery post usually has larger diameter than NEGATIVE (NEG, N, –) post.
4. Determine which post of battery is grounded (connected) to the chassis. If NEGATIVE post is grounded to chassis (as in most vehicles), see 5. If POSITIVE post is grounded to the chassis, see 6.

5. For negative-grounded vehicle, connect POSITIVE (RED) clamp from battery charger to POSITIVE (POS, P, +) ungrounded post of battery. Connect NEGATIVE (BLACK) clamp to vehicle chassis or engine block away from battery. Do not connect clip to carburetor, fuel lines, or sheet-metal body parts. Connect to heavy gauge metal part of the frame or engine block.
6. For positive-grounded vehicle, connect NEGATIVE (BLACK) clamp from battery charger to NEGATIVE (NEG, N, –) ungrounded post of battery. Connect POSITIVE (RED) clamp to vehicle chassis or engine block away from battery. Do not connect clip to carburetor, fuel lines or sheet-metal body parts. Connect to a heavy gauge metal part of the frame or engine block.
7. When disconnecting charger, disconnect AC cord, remove clamp from vehicle chassis, and then remove clamp from battery terminal.
8. Do not charge the battery while the engine is operating.
9. See operating instructions for length of charge information.

Follow these steps when the battery has been removed from a vehicle. A spark near the battery may cause an explosion. To reduce risk of a spark near the battery:

1. Check polarity of battery posts. The POSITIVE post (marked POS,P, +) usually has a larger diameter than the NEGATIVE battery post (marked NEG, N, –).
2. Attach a 24-inch (minimum length) 6 AWG insulated battery cable to the NEGATIVE battery post (marked NEG, N, –).
3. Connect the POSITIVE (RED) battery clamp to the POSITIVE battery post (marked POS, P, + or red).
4. Stand as far back from the battery as possible, and do not face battery when making final connection.
5. Carefully connect the NEGATIVE (BLACK) charger clamp to the free end of the battery cable connected to the NEGATIVE terminal.
6. Set the charge rate to appropriate setting according to battery size.
7. When disconnecting charger, always do so in reverse sequence of connecting procedure and break first connection while as far away from battery as practical.

Note: ***A marine (boat) battery must be removed and charged on shore. To charge it on board requires equipment specially designed for marine use. This unit is NOT designed for such use.***

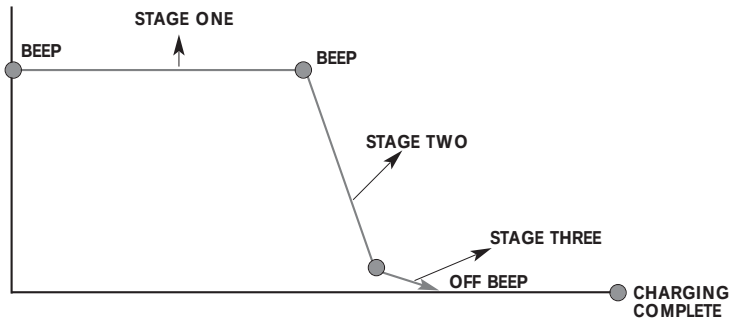
SAVE THESE INSTRUCTIONS

INTRODUCTION

Thank you for selecting the ***40/20/10/4 Amp Smart Battery Charger.*** With proper care and use, it will give you years of dependable service. This battery charger has a high charge rate of up to 40 amps, a low charge rate of 4 amps and 110 amps of engine starting power. It is designed for charging only 12 volt lead-acid batteries — conventional automotive, maintenance-free, marine deep cycle and gel — used in cars, trucks, farm equipment, boats, RVs and SUVs, lawn mowers/garden tractors, motorcycles, personal watercraft, snowmobiles, ATVs and various applications.

Smart Battery Chargers feature 3-stage high-efficiency charging technology built-in microprocessor control that ensures fast, safe and complete charging of serviceable batteries.

Charge Curve



Stage One — Rapid Start Charge at 40 amps delivers maximum charging amperage to “wake up” any serviceable 12 volt battery and allows for quick engine starting in just 1 minute (based on a midsize vehicle battery at 50% charge level). When battery reaches a maximum safe predetermined voltage, the charger will automatically signal a "beep" and move into Stage 2 of the charging process.

Stage Two — Absorption Charge maintains the maximum possible charge at a constant, safe, predetermined voltage. During this phase, the charging voltage remains constant, while the actual charging current is reduced to allow for the maximum proper internal chemical energy transfer. At the end of Stage 2, the charger will automatically move into Stage 3 charge mode.

Stage Three — Top-Off Charge — voltage is automatically maintained and reduced to a predetermined level while current is adjusted for a safe, effective battery charge. At the conclusion of Stage 3, the unit will BEEP signaling the completion of the charging cycle.

The Automatic Float Charge feature is ideal for maintaining a battery. It automatically tops off battery as needed to keep battery fully charged all the time.

FEATURES

- This unit has four charge rate settings, accessed by the 4/10/20/40 AMP button:
  a) 4 amps: smaller batteries, as in lawn mowers, snowmobiles, motorcycles, etc.
  b) 10 amps: mid-sized batteries, as in small cars
  c) 20 amps: automobiles and light trucks
  d) 40 amps: large truck batteries, banks of RV batteries
- 110 amp engine start
- Automatic Temperature Compensation
- Battery type selection
- Digital diagnostics
- Alternator voltage and battery voltage check
- Digital display shows charge rate, operating mode, fault codes and FUL when charged
- 1-minute engine start
- 3-stage high-frequency switch mode automatic rapid charging
- Spark resistant reverse polarity and short circuit protection for user
- Built-in battery reconditioning (desulfate)
- Lightweight, high-efficiency design
- Internal short circuit protection
- Cables and clamps self-stored
- Reverse polarity indication
- Microprocessor control (Digital Smart Control) high frequency power
- Compensates for low AC from extension cord use
- Equalization function
- Battery recondition function

Controls and Indicators

CONTROL PANEL

DIGITAL READOUT CIRCULATING PATTERN

FUNCTION BUTTONS (FROM LEFT TO RIGHT):

Battery Type (Step 1) — allows the user to select Wet, Gel or AGM type of battery for efficient and safe charge. Most automotive batteries are Wet batteries. Refer to the battery manufacturer's specifications for battery type.

4/10/20/40 AMP (Charge Rate Selector) (Step 2) — allows the user to select the charge rate based on battery size. This selection and the actual battery charge rate are monitored by the microprocessor. The charger will stop charging if the rate is too fast or too slow for the battery size or condition.

110 AMP Engine Start — places the charger in an engine start sequence. This button will not be activated unless the charger is in the 40 amp charge mode; set the 4/10/20/40 AMP button to 40 amps first to activate this button.

Battery Recond. — is an automatic mode that, once started, continues for 24 hours and then stops. A series of electrical pulses breaks the crystalline form of lead sulfate to return these chemicals into useful battery electrolytes. More than 24 hours may be needed to restore. Periodic reconditioning is recommended to maintain a battery's optimum performance. However, if 5 cycles does not improve battery performance, discontinue and recycle the battery.

Battery Voltage (Alternator Voltage Check) — is a quick check that measures the battery voltage. This check is repeated at various electrical load levels and the tests allow the user to determine if the alternator can keep up with the loads.

INDICATOR:

Large (.375") 3-Character Digital Display in the upper left of the control panel indicates the various conditions and/or status codes:

Status Codes are described in the following chart and on the back of charger.

AC POWER INDICATOR - *When connected to an AC outlet, digital display shows circulating pattern to indicate power is on. Disconnect charger after use.*

FAULT CODES

F01	**INTERNAL SHORTED CELL BATTERY -** *Cannot be charged. Have battery checked by certified auto service center.* **EXCESSIVE LOAD ON BATTERY WHILE CHARGING -** *Check load.*
F02	**BAD BATTERY CONNECTION -** *Check battery connection.* **BATTERY VOLTAGE TOO LOW TO ACCEPT CHARGE -** *Have battery checked by certified auto service center.*
F03	**INTERNAL OPEN CELL -** *Have battery checked by certified auto service center.* **SULFATED CONDITION -** *Battery needs to be reconditioned. See manual.*
F04	**OVERTIME CONDITION -** *Battery will not accept a charge after 18 hours of continuous charging. Battery may have internal damage. Have battery checked by certified auto center.* **BATTERY CHARGE RATE IS SET TOO LOW -** *Set charger to higher charge rate. See manual.*
F05	**OVERHEATED CONDITION -** *Disconnect charger and allow to cool for 30 min., check for ample ventilation.*
F06	**REVERSE POLARITY**
F07	**ALTERNATOR OUTPUT IS OUT OF TYPICAL OPERATION RANGE**

OPERATION CODES

≡≡≡	**BATTERY RECONDITIONING -** *(The letters **DES** will display for the first 3 seconds.)*
---	**ALTERNATOR VOLTAGE CHECK**
000	**CHARGER STANDBY**
FUL	**BATTERY FULLY CHARGED**

CONTROL PANEL LED INDICATORS:

WET — lights when battery type selector is on WET battery type

GEL — lights when battery type selector is on GEL battery type

AGM — lights when battery type selector is on AGM battery type.

Float Charge — lights when automatic charge monitoring is active. This feature allows a battery to maintain its charge over long periods of non-use. If there is any loss of power to the charger once power is restored charger will automatically return to the default settings. Battery selector type would be "GEL".

Battery Voltage — lights when battery voltage is displayed.

Alternator Good — lights when load or not load checks show the alternator is keeping up with the electrical load.

BUTTON (TO THE RIGHT OF LEDS):

Equalize — a recessed button used to start the equalization process.

OPERATING INSTRUCTIONS

Ensure that all installation and operating instructions and safety precautions are understood and carefully followed by anyone installing or using the charger. Follow the steps outlined in "Important Safety Instructions" at the front of this manual.

Charge Rate Selection

After charger clamps are correctly connected, plug in the charger to a 120 volt AC outlet and the charger will show a circulating pattern on the Digital Display, indicating power has been applied. Select the proper charge current rate based on battery size. Press the 4/10/20/40 AMP button and the charger will begin charging at 4 amps. Pressing the 4/10/20/40 AMP button again will advance the charge rate to 10 amps, again to 20 amps, and again to 40 amps. Pressing the switch again will turn OFF the charger output and the display will show "000."

Note: ***The only time the selected charge rate does not display at the full selected rate is when the battery is nearly full and charging at either step two or three. The display will be showing a reduced charge rate. To return to 2A, press the 2/20/40 AMP button. When the battery is fully charged, the charging complete and "FUL" is displayed on the Digital Display.***

⚠ WARNING

If Digital Display shows "F02", the connection to the battery terminals is bad. Follow the steps outlined in "Important Safety Instructions" at the front of this manual to disconnect, clean battery terminals, then reconnect.

If Digital Display shows "F06", the Red (POSITIVE) and Black (NEGATIVE) clamps are incorrectly connected to battery terminals. Follow the steps outlined in "Important Safety Instructions" at the front of this manual to disconnect, then reconnect in correct polarity.

Charging the Battery

1. Press Battery Type selector until desired battery type LED lights.

   Note: ***The default selection is "GEL" type battery.***

2. Press 4/10/20/40 AMP button to begin charging at the 4 amp rate; the unit sounds a beep and the charging current LED lights. The charger starts charging at 4 amp rate automatically if 4/10/20/40 AMP button is not pressed within 3 minutes after applying AC power.

   If the Display on the charger varies between "F03" and the amp rate, the battery is sulfated and the charger is trying to give it some charge. If after approximately 2 hours the display just shows "F03", then the battery will not charge.

   Charger occasionally sounds a beep and displays "0.0" during self-test or charging stage changes.

3. Pressing the 4/10/20/40 AMP button again advances charging rate to 10 amps, pressing once more advances charging rate to 20 amps, and again to 40 amps. (Pressing the button again will turn OFF the charger output and the Display will show "000".) This selection and actual battery charge rate are monitored by the microprocessor, and the unit will stop charging if the selected rate is too fast or too slow for battery size or condition.

   As the battery nears full charge capacity, the unit's output will automatically drop to a lower charge rate.

Pressing the 4/10/20/40 AMP button repeatedly advances to standby mode; the unit sounds a beep, displays "000" and stops charging.

4. The battery charger displays the charge current. To view the battery voltage, press BATTERY VOLTAGE button. The charger will sound a beep and display the battery voltage for 3 seconds, then returns to displaying the charge current.
5. The display shows "FUL" when the battery is fully charged.
6. Follow the steps outlined in "Important Safety Instructions" at the front of this manual to disconnect.

Automatic Float Charging

Automatic Float Charging is ideal for maintaining a fully charged battery.

1. Keep the AC power and battery connected after battery is fully charged.
2. The charger monitors the battery and tops it off as needed.
3. The Float Charge indicator lights; the display shows charge current when topping off the battery and returns to "FUL" when completed.
4. To view battery voltage, press the Battery Voltage button.

Note: ***Charging can be terminated by pressing the charge rate selector button at any time when unit is charging. After AC power interruption, charging restarts at 4 amp rate automatically and the battery type will default to "GEL".***

⚠ WARNING

If battery size is not known, charge at the 4 amp rate. DO NOT overcharge batteries.

Equalizing

Equalizing is the process by which the fluid in each of a battery's cells is equalized. This process occurs after charging is complete.

⚠ WARNINGS

- **NEVER TRY TO EQUALIZE A GEL OR AGM CELL. THE RESULTING EXPLOSION COULD CAUSE PROPERTY DAMAGE, SERIOUS INJURY AND/OR DEATH.**
- **Remove or disconnect the vehicle's battery when equalizing.**

The frequency which the equalization process needs to be run depends on the use of the battery. The more the battery is used, the more undercharged it becomes; thus the more frequently the battery should be equalized.

1. Do not use this mode on sealed or valve regulated batteries. This mode is only meant for wet (unsealed/vented) batteries.
2. Make sure there are no flammable sources near the recharging sight.
3. Wear safety glasses, gloves and protective clothing.
4. Remove battery from vehicle. MAKE SURE THAT THE BATTERY HAS GOOD VENTILATION. The process causes the release of hydrogen and oxygen. An accumulation of these gases presents a real danger of explosion.
5. Open the battery cap, if removable.
6. Fill the battery with distilled water according to the manufacturer's instructions. Since batteries may rapidly bubble while being charged, remember to refill (only with distilled water) after the equalization process is complete and the voltage is back to normal.
7. Follow the steps in the "Charging the Battery" section on page 5 of this manual.
8. Push the Battery Type Selector Switch until "WET" is displayed. (This mode will only work if a WET battery is selected.)
9. Choose the correct charge rate and start charging. You can check the battery voltage by pushing the Battery Voltage button. This will trigger the Battery Voltage indicator button.
10. Push the Equalize button at any time and the battery will automatically begin to equalize in 4 amp limited current. Note that in order to push the recessed button you will need a small pin or ballpoint pen.
11. Every hour, the temperature should be checked by touching the battery. If the battery is hot to the touch, stop the charging and allow the battery to cool.
12. The voltage rises, but does not go over 15.3v to 16.2v (2.55-2.7v per cell) depending on ambient temperature; it will automatically adjust.
13. The "WET" LED flashes while the charger is in equalize mode.
14. The digital readout will show "FUL" when the equalization process is complete.

Engine Start

The Engine Start function can supply 110 amps for engine starting.

1. Set the 4/10/20/40 AMP button to 40 amp mode and immediately press the 110A button switch to activate the Engine Start mode.
2. The digital display will countdown from "999" to "000."
3. When the "000" count is reached and begins flashing on the Display, the vehicle is ready to start.
4. Crank the engine using manufacturer's guidelines, typically in 3 to 5 second bursts. The high current engine starting function requires a resting/cooling period between tries. The charger will switch back to regular charge mode after 5 seconds and will not allow operation in this mode for 4 minutes. Wait 4 to 5 minutes before a second attempt at starting the engine, if needed.
5. During the rest period, the battery is charging at 40 amps. After engine starts, follow the steps outlined in "Important Safety Instructions" at the front of this manual to disconnect.

Recondition Mode

Whenever a lead-acid battery begins to discharge, lead sulfate, an insulator, begins to build up on the battery's internal plates. This reduces the ability of the battery to hold a full charge. When that battery has an immediate charge, most of the lead sulfate is dissolved and the plates are free of this insulation. If a battery remains in a discharged condition over a longer period of time, the lead sulfate changes to a hard crystalline form, making a full charge difficult to achieve. Reconditioning may "save" a sulfated battery.

BATTERY RECONDITION MODE should only be used with 10 Amp Hour (Ah) or larger capacity lead-acid batteries. Charge the battery to be treated for 20 minutes, before using RECONDITION Mode. Observe the Digital Display for any codes. This initial charge will check the battery for shorted cells (F01), open cells (F03) or battery too low to accept a charge (F02), and to ensure the battery can take a charge. If code (F03) is displayed, change to the BATTERY RECONDITION MODE.

Remove or disconnect the vehicle's battery when reconditioning.

1. Make sure the charger is in initiation state with a circulating pattern on the display or in charge OFF mode with "000" on the display. If not, press 4/10/20/40 AMP button repeatedly until "000" shows on the display.
2. Press the Battery Recondition button to start the process.
3. DES appears on the display for 3 seconds, then it changes to three horizontal moving bars.
4. The process takes 24 hours and stops automatically. The display shows "000" when complete.

Alternator Voltage Check

Part 1

No Load (Turn OFF all vehicle's accessories): The battery must be fully charged before testing the alternator. Run the engine long enough to achieve normal idle speed and verify there is a no-load voltage.

1. Press Alternator Check to start the check.
2. Alternator Good LED will light to indicate the alternator is good, or F07 will display if alternator output voltage is out of typical operation range.
3. Press Alternator Check again to stop the test.

Part 2

Under Load (Accessories ON): Next, load the alternator by turning on as many accessories as possible (except for A/C and DEFROST)

1. Press Alternator Check to start the check.
2. Alternator Good LED will light to indicate the alternator is good, or F07 will display if alternator output voltage is out of typical operation range.
3. Press Alternator Check again to stop the test.

If the first alternator check indicates a good alternator and the second indicates the alternator is bad, the problem could stem from: loose fan belts, an intermittent diode failure or possibly bad connections between the battery and alternator and/or ground.

Notes: ***BATTERY VOLTAGE button is disabled in Alternator Check mode.***

F07 may display because someone has added a number of accessory loads on the charging system, thereby increasing current demand from the alternator. MAKE SURE THAT THE ALTERNATOR IS RATED TO SUPPORT THE APPLICATION.

This check may not be accurate for every make, manufacturer and model of vehicle.

Check only 12 volt systems.

APPROXIMATE CHARGING TIMES

The ***4/10/20/40 Amp 12 Volt Smart Battery Charger*** will automatically adjust the charge rate as the battery becomes charged and stop when the battery is fully charged. Deep cycle batteries may require longer charging time.

For estimates of the time it takes to charge a battery, refer to the following table.

Percent of charge in battery	**75%**	**50%**	**25%**	**0%**
at 4 Amp rate	3.5 HRS	7 HRS	10.5 HRS	14 HRS
at 10 amp rate	1.4 HRS	2.8 HRS	4.2 HRS	5.5 HRS
at 20 Amp rate	1 HR	1.5 HRS	2.1 HRS	2.8 HRS
at 40 Amp rate	1 HR*	1 HR*	1 HR*	1-2 HRS*

* Not recommended for charging batteries less than 80 Ah

The times shown in the table above are approximate and refer to a 50 Ah automotive battery. For example, a 50 Ah (12 volt) battery is discharged (50%). How long should it be charged at the 10 amp rate? See the chart above under "50%" and "at 10 amp rate."

In most cases, battery charging times will vary depending on the size, age and condition of the battery. Smaller batteries should be charged at a lower rate (4 amps) and an extra hour added to charge time.

CARE AND MAINTENANCE

With proper care and minimal maintenance, the ***4/10/20/40 Amp 12 Volt Smart Battery Charger*** will provide years of dependable service. For maximum performance, manufacturer recommends:

- After each use, clean the battery charger clamps — be sure to remove any battery fluid that will cause corrosion of the clamps.
- Clean the outside case of the charger with a soft cloth and, if necessary, mild soap solution.
- Do not allow liquid to enter the charger. Do not operate when charger is wet.
- Keep the charger cords loosely coiled during storage to prevent damage to the cords.

TROUBLESHOOTING

Display Indications/Common Problems/Possible Solutions

No Functions

- Check and make sure the charger is plugged into a live 110/120 volt AC outlet.
- Follow the steps outlined in the Operating Instructions section.

F01 — Internal Shorted Cell Battery

If the battery being charged has an internal shorted cell, the F01 will show. We recommend taking your battery to a certified automotive service center for evaluation.

F02 — Bad Battery Connection or Battery Voltage Too Low to Accept Charge

When F02 appears, the most common cause is poor connection to battery.

- Follow the steps outlined in "Important Safety Instructions" at the front of this manual to disconnect AC cord and clamps, clean battery terminal and reconnect.
- If the situation persists, we recommend taking your battery to a certified automotive service center for evaluation.

F03 — Sulfate or Unchargeable Battery

Appears when the battery is highly sulfated and cannot accept normal charge current.

- Follow the steps in "Recondition Mode" to recondition the battery.
- Follow the steps in "Equalizing" to equalize the battery.
- If the situation persists after reconditioning and equalizing, we recommend taking your battery to a certified automotive service center for evaluation.

F04 — Overtime Condition

Appears when charging time exceeds 18 hours. You may be using a charge current rate too low for a large battery. Select higher charge rate to charge the battery.

F05 — Overheated Condition

The ventilation grill that prevents the air from flowing in and out of the charger may be blocked.

- Follow the steps outlined in "Important Safety Instructions" at the front of this manual to disconnect AC cord and clamps, allow the unit to cool for 30 minutes and reconnect.
- Make sure there is ample ventilation before resuming operation.

F06 — Reverse Polarity

The connections to the battery's POSITIVE and NEGATIVE terminals are incorrect. Follow the steps outlined in "Important Safety Instructions" at the front of this manual to disconnect AC cord and clamps and reconnect to battery with correct polarity.

F07 — Alternator Voltage

Alternator output voltage is out of typical operation range.

Charging a Very Cold Battery

If the battery to be charged is very cold (in temperatures below freezing — 0°C/ 32°F), it cannot accept a high rate of charge. The initial charge rate will be low. The charge rate will increase as the battery warms. Never attempt to charge a frozen battery.