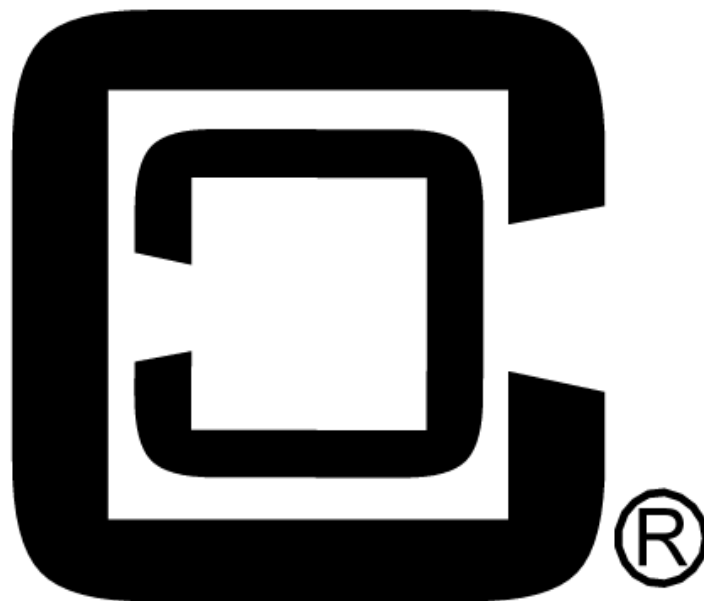


CLIPPERCREEK, INC.
INNOVATIVE INFRASTRUCTURE FOR
ELECTRIC AND HYBRID VEHICLES



User's Manual



Model CS-40

PLEASE NOTE

This user's manual includes the latest information at the time of printing. ClipperCreek, Inc. reserves the right to make changes to this product without further notice. Changes or modifications to this product by other than an authorized service facility may void the product warranty.

If you have questions about the use of this product, contact your customer service representative. Refer to the Customer Support section located in this guide.

Please visit ClipperCreek's Website @ www.clippercreek.net

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IMPORTANT SAFETY INSTRUCTIONS

Carefully read these instructions and the charging instructions in your vehicle owner's handbook before charging your electric vehicle.

The following symbols may be found in your handbook or on labels affixed to your conductive charge station:

Note *This means pay particular attention.* Notes contain helpful suggestions.



Caution *This symbol means be careful.* You are capable of doing something that might result in damage to equipment.



Warning *This symbol means danger.* You are in a situation that could cause bodily injury. Before you work on any electrical equipment, be aware of the hazards involved with electrical circuitry and standard practices for preventing accidents.

Safety Guidelines

- Use this charge station to charge electric vehicles equipped with a conductive charge port only. See the vehicle's owner's handbook to determine if the vehicle is equipped with a conductive charge port.
- Make certain the charge station's supply cable is positioned so it will not be stepped on, tripped over, or otherwise subjected to damage or stress.
- There are no user serviceable parts inside. Refer to the Customer Support section in this manual for service information. Do not attempt to repair or service the charge station yourself.
- Do not operate your charge station with a visibly damaged supply cable or charge station. Contact your Service Representative for service immediately. Refer to the Customer Support section in this manual for information on the Service Representative in your area.



Warning: Turn off input power to your charge station at the circuit breaker panel before servicing or cleaning the unit.

- **VENTILATION:** Some electric vehicles require an external ventilation system to prevent the accumulation of hazardous or explosive gases when charging indoors. Check the vehicle's owner's handbook to determine if your vehicle requires ventilation during indoor charging.

Note Those vehicles which follow the SAE J1772 standard for communication with the charging station can inform the CS-40 that they require an exhaust fan. The CS-40 is not equipped to control ventilation fans. If an exhaust fan is requested, the CS-40 will not charge the vehicle. If this function is required, ask your ClipperCreek representative for information on other products which have the exhaust fan control feature.



Caution: DO NOT charge your vehicle indoors if it requires ventilation. Contact your Service Representative for information.

FCC INFORMATION

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

This product has been designed to protect against Radio Frequency Interference (RFI). However there are some instances where high powered radio signals or nearby RF-producing equipment (such as digital phones, RF communications equipment, etc.) could affect operation.

If interference to your charge station is suspected, we suggest the following steps be taken before consulting your ClipperCreek Sales and Service Representative for assistance:



1. Reorient or relocate nearby electrical appliances or equipment during charging.
2. Turn off nearby electrical appliances or equipment during charging.

Caution Changes or modifications to this product by other than an authorized service facility could void FCC compliance.

OPERATION

The CS-40 Electric Vehicle Charging Station is a conductive charge station that provides the electric vehicle (EV) user with a safe and manageable link between the power grid and the electric vehicle.

Figure 1. The CS-40 Front Panel



The CS-40 Electric Vehicle Charging Station is very easy to use. Just remove the charging connector from its holder, and plug it into the vehicle's charge port. If there is a mechanical latch that holds the connector firmly while charging, be sure the latch has "clicked" into place. Normally, the vehicle will immediately request a charge, the Green CHARGING light will come on, and charging will begin. After an average driving day, it will require a few hours to recharge completely. Charging overnight is the most convenient way to ensure the vehicle's full range will be available for the next day.

If the vehicle has stopped charging, the Green CHARGING light will be out. Remove the cable and you're ready to use the vehicle. If the charging is still in progress, first push the button on the CS-40's front panel. The charging light will start blinking. Now you can remove the connector.

Front Panel

The front panel has a GREEN and a RED light to indicate the status of the CS-40. The operational state of the unit can be known just by looking at the panel lights, and comparing them with table 1 on page 4.

Table 1. Front Panel Indicators

(Green)	(Red)	Status of CS-40
CHARGING	PROTECTION	
--	--	Vehicle not connected, or vehicle not requesting charge.
lit	--	Vehicle is charging.
--	lit	The ground fault is tripped, the ground is missing, or service is required.
lit	lit	There is a problem on the vehicle.
blink	--	Charging was interrupted by the User - or - disabled by external Timer - or - unit is in Cold Load Pickup.

Note: in the table above, a (--) symbol indicates the LED is off.

In Case of Difficulty

ClipperCreek recognizes that this Charging Station will be heavily relied upon to charge your electric vehicle for daily transportation needs. Therefore, every effort will be made to restore service should problems arise.

In the event of a problem, charging will stop and the Red PROTECTION light will come on. If this happens, please try the two simple steps below before calling your Service Representative.

1. Remove the cable connector from the vehicle socket. The Red PROTECTION light may go out. If it *does* go out, plug the connector back into the socket, and see if charging begins normally.
2. If the Red PROTECTION light *does not* go out when the connector is removed, be sure the connector is removed from the vehicle socket and switch off power at the circuit breaker feeding power to the CS-40. Wait a few seconds and switch the circuit breaker back on again. If the Red PROTECTION light does not come back on, re-connect the cable to the vehicle. Charging should begin normally. If charging does not begin, or if the Red PROTECTION light comes back on, call Service Representative.

The information gained by the above steps will help the Service Representative decide what the problem is, and how best to get your CS-40 operational again as quickly as possible.

FEATURES

The following features are supported by the CS-40:

Personal Protection System: Ground Fault protection with Self-Testing and Auto-Reclosure (see below), no manual resetting or testing is necessary.

Ground Monitoring Circuit: Constantly checking for the presence of a Safety Ground connection.

Auto-Reclosure: If a problem occurs that interrupts charging, the unit will automatically clear all error indications after 5 minutes, and attempt to begin charging again. If the problem is immediately sensed a second time, it will wait another 5 minutes and try again. This process will repeat several times, at which point power will be removed and no further attempt will be made. The Red PROTECTION light on the front panel will be lit.

This feature helps ensure that your vehicle will be charged and ready for use when needed. Temporary problem indications such as ground-faults or utility power surges can be overcome automatically without the need for the user to manually re-initiate charging.

Off-Peak Charging: For this feature, you must have an external timer installed (purchased separately), and also have your local utility install a special Time of Use meter. Many utilities plan to give very low rates to those EV owners who charge in the late evening. If a timer is installed, you do not have to wait until the late evening to plug the CS-40's connector into the vehicle. You may plug in at any time. Even though the vehicle may immediately request a charge, the timer will cause the CS-40 to delay energizing the cable until the off-peak hours when most electric utilities have light demand. With this feature, the Green CHARGING light will be blinking while the vehicle is waiting for the timer to allow charging.

If this feature is desired, please call your local utility to be sure the Time of Use meter is available in your area before having the timer installed. Technical information to help connect the timer to the CS-40 can be found in the section titled Load Management Inputs on page 16 in this manual.

Cold Load Pickup: This feature is built-in to the CS-40, but will only be apparent when the utility power fails during charging. If the charging connector is still plugged into the vehicle when utility power is restored, the Green CHARGING light will blink and the unit will not energize the cable for a random time between 2 and 12 minutes. This is to prevent the utility's grid from experiencing a large surge at turn-on, allowing EV's in the area to begin drawing current at random times rather than all at once.

Note: The vehicle does not need the owners attention after a power outage. The CS-40 will automatically resume charging when power is restored.

External Error Indication: Whenever the Red PROTECTION light is lit, a relay on the board will provide a contact closure that can be used to remotely indicate that a problem exists. A fleet vehicle yard, for example, could use this feature to light a lamp or ring a bell in the main office, letting them know immediately that a vehicle has a charging problem. This early warning helps assure that each vehicle will be properly charged and ready for use when needed.

Maintenance Current: If the unit is set up for Off-Peak Charging as described above, normal charging current cannot be drawn by the vehicle until the Off-Peak hours. However, the CS-40 can be set up to allow a minimum amount of current while waiting for the timer to allow full-rate charging. This is known as Maintenance Current, used for all power needs on the vehicle except charging the main battery pack. An example would be preheating the cab, or keeping the auxiliary battery topped off. As in the Off-Peak mode above, the Green CHARGING light will flash if the vehicle is connected and waiting for the timer to allow charging. The contactor will close immediately to supply this small amount of power, but the main battery pack will not be allowed to charge.

The Maintenance Current feature can be selected by connecting the Timer's control wire to the High/Low pin on the 4-terminal Terminal Block. Connecting to the High/Off pin will remove all power from the vehicle until the Off-Peak Charging time arrives. The correct pin can easily be identified by looking at the wiring diagram for the CS-40 on page 11. The other two pins on the terminal block are the relay contacts for the External Indicator.

In summary, making the best use of the Maintenance Current feature will require the following:

1. Installation of a Time-Of-Use meter by the electric utility.
2. Installation of a clock/timer to allow the CS-40 to charge only during Off-Peak hours.
3. Connecting the timer's control wire to the High/Low pin on the Terminal Block.

INSTALLATION

Service Connections



Caution **This is a single-phase device. Do not connect all 3 phases of a 3-phase feed !!!** You may use any two phases of a 3-phase wye-connected feed. The center-point of the 3 phases (usually used as Neutral) must be grounded somewhere in the system. A current-carrying Neutral is not needed by the CS-40. Only Line 1, Line 2, and Ground are required, as shown in Fig 4.



Caution The two phases used must each measure 120V to Neutral. Earth Ground must be connected to Neutral at only one point, usually at the Service Entry Breaker Panel.



Caution If a 240V 3-phase feed is from a Delta-connected secondary, the leg used must have a center-tap. That tap must be Grounded. Only the two phases either side of the center-tapped leg can be used. See Fig. 5 below.



Caution **Warranty is void if this unit is wired improperly**



Warning Only a qualified electrician should perform the installation. The installation must be performed in accordance with all local electrical codes and ordinances.

Only 3 wires are connected, but care must be taken that the service transformer secondary connection is definitely known, and the 3 wires from the main circuit breaker panel are connected and labeled correctly. Figures 3, 4, and 5 below show the most common service transformer secondary wiring formats.

Notice that L1, L2, & Gnd are labeled on each diagram. Those transformer outputs correspond to the same inputs on the CS-40. Also, each of the two 3-phase diagrams shows an L3 output, which *is not used*. **Do not connect all three phases of a 3-phase secondary to the CS-40. This is a single-phase device.**

The Neutral at the service panel must be connected to earth ground somewhere in the system on any of the three connection arrangements. Ground-fault protection is not possible unless the Neutral (center-tap on the service transformer) is connected to an earth ground. If no ground is provided by the electrical service, a grounding stake must be driven into the ground nearby, following local electrical codes. The grounding stake must be connected to the ground bar in the main breaker panel, and Neutral connected to ground at that point.



Warning Local electrical codes must always be followed when installing the grounding stake.

The following diagrams illustrate the 3 service transformer secondary connections most common in the United States.

Figure 3. 220/240V Single Phase

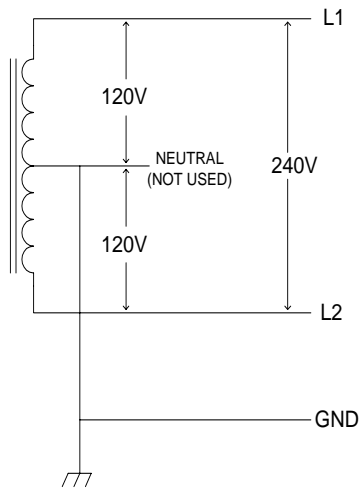
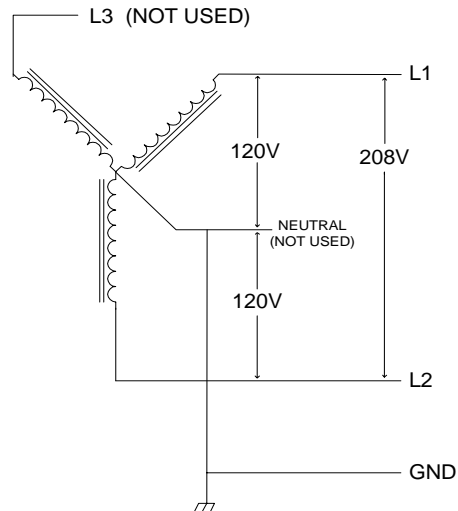
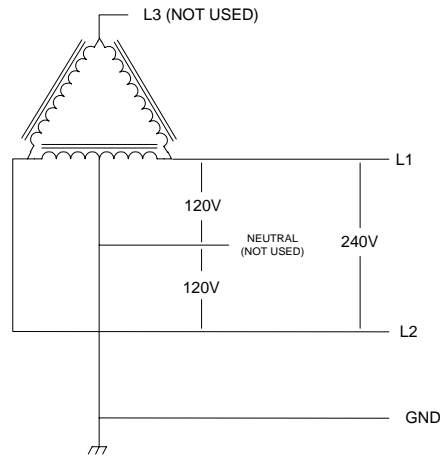


Figure 4. 208V 3-Phase, Wye-Connected



Note With a wye-connected secondary, any two of the legs can be used to provide 208V to the CS-40. For example, L1 & L2, or L1 & L3, or L2 & L3. Leave the unused leg open. Do not connect it to a Neutral bar, or to Ground. Be sure the center point is grounded to earth somewhere in the system.

Figure 5. 240V 3-Phase, Delta-Connected, with center-tap on one leg.



Caution With the delta connection, one leg *must* be center tapped, and *only* the two phases on either side of the center tap can be used. The two phases must *both* measure 120V to neutral. The third line (L3) of the delta is 208V, with respect to neutral, and is sometimes referred to as a “stinger”. ***Do not use this thirdline!*** Consult the transformer manufacturer’s literature to be sure the single leg can supply the required power..

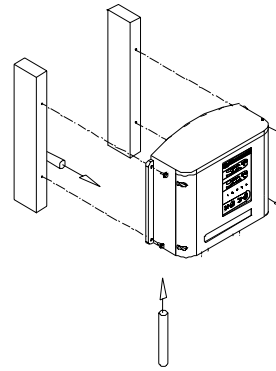


Caution A 3-phase delta-connected transformer secondary without a center-tap on one leg is *not usable with the CS-40*. No “neutral” point is available to be connected to ground for ground-fault protection, and the CS-40 will not allow the contactor to close if it does not sense the presence of a ground wire connected to a “neutral” point on the transformer secondary.

Mounting Procedures

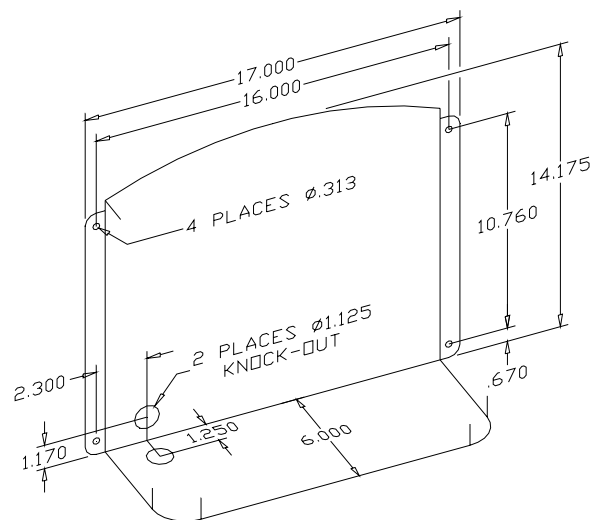
- 1 Locate the wall mounting position of the EVSE: *Figure 6. Wall mounting of CS-40.*

- Position the bottom of the charge station 38 inches above the ground.
- The mounting holes are spaced 16" apart to accommodate wall studs.
- If you do not have solid structural framing on those centers, you must provide an adequate alternative mounting surface for the EVSE.



- 2 Attach the charge station to the wall studs using (4) ¼ x 2 ½" lag screws.
- 3 Use a multi-set or equivalent if mounting on a concrete wall.
- 4 Remove the applicable knock-out in the charge station, push the power leads through the hole, then connect the power conduit to the hole.
- 5 After mounting, continue the installation using the Wiring Instructions beginning on Page 11.

Figure 7. CS-40 Installation Template

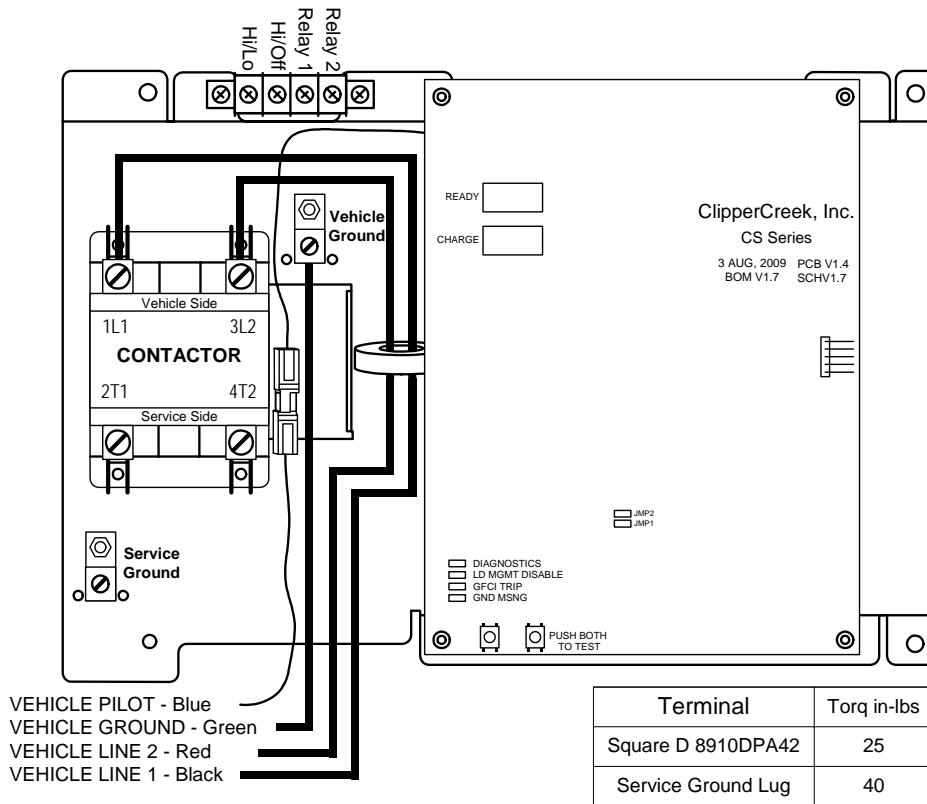


Note: To open the enclosure door, remove the two screws on the left-hand side, using a T15 Torx L Driver.

Wiring

Before connecting wires to the CS-40, please carefully read the section of this manual titled Service Connections, on page 7. If you are unsure of the type of power provided at the service panel, please consult with your local utility or call your Service Representative for assistance.

Figure 8. CS-40 Service Wiring



- The CS-40 requires a dedicated 208/240 VAC 50/60 Hz, single-phase circuit, with its own 40A circuit breaker.
- Do not use a GFCI breaker with the CS-40. The CS-40 contains a Personnel Protection circuit that is the equivalent and specifically designed for use with electric vehicles.
- Only 3 wires are needed to wire the CS-40 (Line 1, Line 2, and Service Ground), as shown in Fig 8. Wire the unit from the breaker panel using wire sized according to local electrical codes. The circuit breaker should be rated at 40A. Derating a 40A breaker 25% for continuous duty allows 30A of continuous current.
- The two phases (Line 1 and Line 2) are terminated on the input side of the contactor itself, as shown in Figure 8. Use 75°C or greater copper wire for the contactor Line 1 and Line 2 service input.
- The Service Ground is terminated on the Ground Terminal at the bottom of the enclosure. Use 75°C or greater copper or aluminum wire for the Service Ground.
- Be careful not to damage the PC Board when removing the power-entry knockout, attaching the conduit, or when wiring the service conductors to the contactor.

Testing After Installation

- Apply utility power, and observe that only the Diagnostic LED is flashing on the circuit board. If it is not flashing, the board may be defective.
- The Charge Test buttons on the PC board simulate connection to a vehicle. Push the two Charge Test buttons at the same time. The contactor should close, and the large Green CHARGING light should light.
- If a vehicle is available, connect the CS-40 to the vehicle and verify that the contactor closes and the Green CHARGING light comes on.

Installation is complete.

FOR THE SERVICE TECHNICIAN

There are 4 small LEDs on the PC board to help diagnose problems:

Diagnostic – this is the “heartbeat” of the system. When *only* this LED is slowly flashing, the system has not detected any failures. If it is lit but not flashing, the board is defective. If its not lit, either no power is applied, or the board is defective.

To test the system, press and hold the two Charge Test buttons simultaneously. If the contactor closes, the CS-40 is operating normally. If a vehicle is available, connect the charging cable. The contactor should close. If not, the charging cable or vehicle socket may be defective, or the vehicle is not requesting a charge.

If the CS-40 detects an internal failure, the Diagnostic LED will blink at a faster rate. One of the other LEDs may also be lit and indicate the nature of the problem, such as an inoperative Ground Fault circuitry, or a missing Service Ground.

Load Management Disable: Lit, with a slow-blinking Diagnostic LED, when either the Cold Load Pickup or External Timer mode are active. This is not a failure mode, merely a status indicator. The front panel green Charge LED will be blinking. The CS-40's cable must be connected to a vehicle for this LED to blink. The front panel light will be off when the cable is not connected.

GFCI Trip: Lit when the unit has detected a ground fault. When a fault has occurred, the contactor will open, the front panel Red PROTECTION light will also be lit, and the Diagnostic LED will be flashing at a faster rate. The system waits 5 minutes after sensing a fault, then automatically attempts recovery. After several such attempts, it will stay in the Protection mode.

If a ground fault error or an EV connection error has been detected:

1. Remove the EV connector from the vehicle
2. Inspect the connector and the vehicle's charge port. Be sure they are clean and undamaged.
3. Reconnect to the vehicle. If the fault condition persists, a problem may exist on the vehicle.
4. Refer to the vehicle owner's manual for instructions on inspecting and cleaning the charge port.
5. Plug the EV connector back into the vehicle.
6. If the ground fault error is still detected, contact your customer Service Representative for assistance.

Ground Missing: Lit when the unit has detected a missing Service Ground. The CS-40 will not close the contactor until a proper Service Ground has been connected. The front panel Red PROTECTION light will be lit, and the Diagnostic LED will be flashing at a faster rate.

Note: If a missing ground is discovered, power should be turned off before re-connecting the ground. If ground is reconnected without turning off the power, it will be necessary to wait 5 minutes for the CS-40 to clear the Ground Missing error.

Table 2 below illustrates the information that can be obtained from the 4 LEDs on the PC board.

Table 2. PC Board Diagnostic LEDs

Status	LED 1	LED 2	LED 3	LED 4
	Diagnostic Blink Rate	Load Mgmt Disable	GFCI Trip	Ground Missing
Normal Operation	slow	--	--	--
Charging	slow	--	--	--
Charge Disabled	slow	lit	--	--
CCID Trip	fast	--	lit	--
Ground Missing	fast	--	--	lit
Service Required	fast	--	--	--

Note: a (--) symbol indicates the LED is off.

SPECIFICATIONS for CS-40

Line Input Power - Service Entrance

Voltage & Wiring	240V AC single-phase - L1, L2, and Safety Ground 208V AC 3-phase, wye-connected - Any 2 phases, and Safety Ground 240V AC 3-phase, delta-connected. With center-tap on one leg, must use only the two phases on either side of the center-tap. The two phases must both measure 120V AC to ground. Do not use the third leg (208V “stinger”).
Current	40A Circuit Breaker. The maximum current for the vehicle is 30A, set by the duty cycle of the Pilot waveform.
Frequency	50/60 Hz
Output Power	Variable depending on vehicle. Vehicles will be limited to 30A. At 240V, this will be about 7.2 KW.
Dimensions	
Height	304 mm (12 in)
Width	457 mm (18 in)
Depth	203 mm (8 in)
Color	Gray
Cable Length	approximately 6.8 m (22 ft)
Weight (without Cable)	11 kg (24 lbs)
<u>Environment</u>	
Operating Temperature	-22°F to 122°F (-30°C to +50°C)
NEMA Rating	NEMA 4 - outdoor use, watertight.
Timer Connection	Ground to disable charging, leave open to charge. 12 volts with 1K source resistance when open circuit, 12 ma sink current when grounded.
Error Relay Contacts	Dry contact, 24V AC/DC max, 5A current max, closed if error present.
Agency Approvals	UL Listed, FCC Part 15 Class B

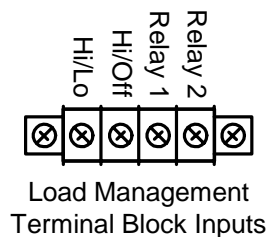
Load Management Inputs

If your unit has been configured for Off-Peak Charging, the Green CHARGING light may be blinking after you plug in the cable, and the contactor may not close. This means that a timer, or other device, has been connected to the Load Management input, and charging will not occur until a specified time, possibly later in the evening when electrical rates are better. To override this feature and begin charging immediately, push the button.

Pressing the button will alternately Stop and Re-Start charging. The button will not initiate charging unless the cable is connected, and the vehicle is requesting a charge.

There are two Load Management inputs, labeled High/Low and High/Off, on a terminal block as shown in Fig. 9 below. Grounding High/Off will completely inhibit charging until it is released. Grounding High/Low will tell the CS-40 to send a signal to the vehicle instructing it not to charge, but instead to draw only a minimum amount of current for auxilliary uses such as cooling down the battery pack, or pre-heating the cab in the early morning.

Fig 9. 4-Position Terminal Block



Relay Output

The 2 terminals labeled Relay Out 1 & 2 are dry contacts that are normally open. If the Protection light comes on, or if other internal problem is sensed by the CS-40's computer, these contacts will close. This can be used to power a remote indicator to warn the user that a problem exists, giving them the opportunity to correct the problem and help ensure the vehicle will be charged when needed.

LIMITED WARRANTY – ELECTRIC VEHICLE SUPPLY EQUIPMENT
MODEL CS-40
ClipperCreek, Inc.
11850 Kemper Road
Auburn, California 95603

ClipperCreek shall provide the following warranty with respect to the Products to Representative, its Sub-Representatives and their customers:

Product 1-year parts, 1-year factory labor,

ClipperCreek, Inc. warrants this product to be free from defects in material and workmanship. The warrantee period shall commence on the date of installation date (first use). The product installation date must be evidenced and communicated to ClipperCreek by way of the warrantee registration card (or its equivalent). The warrantee registration card must be filled out completely and accurately, and returned to ClipperCreek within 30 days after installation, and the product installation date shall be within 6 months after the purchase date. If a Product installation date is not communicated to ClipperCreek as described above, the product purchase date shall serve as the warranty commencement date.

If this product is defective in materials or workmanship during the warranty period, ClipperCreek will, at its option, repair or replace the product. Repair parts and /or replacement products may be either new or reconditioned at ClipperCreek's discretion. This limited warranty does not cover service or parts to repair damage due to improper installation or use, including but not limited to improper connections with peripherals, external electrical faults, accident, disaster, misuse, abuse or modifications to the product not approved in writing by ClipperCreek. Any service repair outside the scope of this limited warranty shall be at applicable rates and terms then in effect.

All other express and implied warranties for this product including the warranties of merchantability and fitness for a particular purpose, are hereby disclaimed. Some states do not allow the exclusion of implied warranties or limitations on how long an implied warranty lasts, so the above limitation may not apply to you.

If this product is not as warranted above, your sole and exclusive remedy shall be repair or replacement as provided above. In no event will ClipperCreek, any of its authorized sales and service representatives, or its parent company be liable to customer or any third party for any damages in excess of the purchase price of the product.

This limitation applies to damages of any kind including any direct or indirect damages, lost profits, lost saving or other special, incidental, exemplary or consequential damages whether for breach of contract, tort or otherwise or whether arising out of the use of or inability to use the product, even if ClipperCreek or an authorized ClipperCreek representative or dealer has been advised of the possibility of such damages or of any claim by any other party. Some states do not allow the exclusion or limitation of incidental damages for some products, so the above limitation or exclusion may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which may vary from state to state.

To obtain warranty service:

Call your nearest authorized Service Representative or ClipperCreek at the above number. You will receive information as to how service for the product will be provided.

If you mail or ship the product in for service, you must insure the product, prepay all shipping charges, and properly pack it for shipment in its original shipping container or its equivalent. You are responsible for all loss or damage that may occur in transit.

You must provide proof of purchase of the product and the purchase date before any warranty service can be performed.

CUSTOMER SUPPORT

Call your Service Representative at any time, 24 hours a day, at the number below. **PLEASE HAVE THE MODEL NUMBER AND SERIAL NUMBER AVAILABLE WHEN YOU CALL.** These can be found on the side of the enclosure. If your call is made after business hours or on weekends, please leave your name, telephone number, the unit's serial number, and a brief description of the problem. A Service Representative will call back at the earliest opportunity.

**Distributor
Place Contact Information
Sticker Here.**

MAINTENANCE

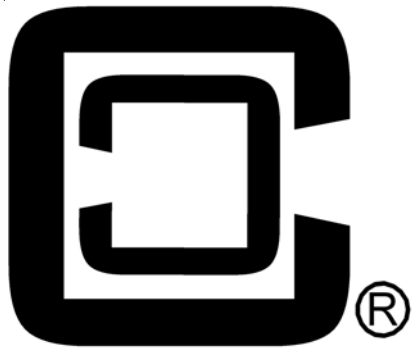
The CS-40 requires no periodic maintenance other than occasional cleaning.



Warning To reduce the risk of electrical shock or equipment damage, do not allow liquid to enter the unit while cleaning it.

1. Turn off your charge station at the circuit breaker before cleaning.
2. Clean your charge station using a soft cloth lightly moistened with mild detergent solution. Never use any type of abrasive pad, scouring powder, or flammable solvents such as alcohol or benzene.

Please visit ClipperCreek's Website @ www.clippercreek.net



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