

KZX1250 INSTALLATION & OPERATIONS MANUAL



Features:

- **Automatic Current Limiting** Unit will roll back pulse width to maintain a user set average current. This value is saved in non-volatile memory so current regulation will always be maintained at startup.
- **Charge Sensing Switch** Unit will turn on only after the engine is running by sensing the charge voltage. It will turn off immediately when engine stops running. This will prevent pulling current when the starter needs full cranking power (cold weather); prevent battery drain when alternator isn't charging the battery as well as prevent accidents due to leaving cell on.
- **Alternator Protection** Unit will back off on current if there are too many accessories turned on, regardless of the auto-current limit setting; unit will then revert to auto-current limiting when current capacity becomes available again.
- **Short Circuit Protection** Unit will shut down output immediately if the cell is shorted and display an error code. This means you don't need to replace costly fuses and your unit will shut down a lot faster than a fuse so there is less of a chance in damaging your unit.
- **Over-Current Protection** Unit will shut down output immediately if current is adjusted to 55 amps or above.
- **Over-Draw Protection** Unit will shut down output immediately if current draw rises significantly above recommended maximum.
- **Overheat Protection** Unit will shut down output immediately if the temperature rises above specifications and display an error code. If the fan dies or is restricted, the unit will not self-destruct like other PWM's would.
- **Bright LED Display** 3 digit easy to read display which will display duty cycle, frequency and temperature as well as any error codes should a malfunction occur. You'll never need a flashlight when monitoring in dark conditions.
- **Three LED Indicators** These indicators allow you to know what the status of your unit is at any moment.
- **Disable Line** Unit can be disabled by grounding this line anywhere on the chassis. You may hook up as many disable devices as you wish. These may be simple toggle switches or they could be pressure switches, temperature switches (for cell), water level switches, etc.
- **Small Package** Unit can be mounted in many places due to its size.
- **Runs Cool** Unit runs cooler compared to most other PWM's because of the highly efficient design. This means less heat, less wasted power and no blisters on your skin.
- **Mounting Brackets** Unit can easily be mounted with the built in mounts.

Introduction

Congratulations! You have purchased the KZX1250, the most advanced automotive PWM for on board electrolysis. With its unique advanced features, you can be sure it will last you many years and will provide you with maximum protection from fires or damage due to unforeseen circumstances. Experimenting with hydroxy gas is dangerous and powering a Cell can be tricky in an automotive environment. So many things can go wrong, especially when you are doing it yourself; but using the KZX1250, you can minimize most of the dangers that the KZX1250 was specially designed to protect you from. The KZX1250 throws exceptions if an error condition occurs, warning you of what happened and giving you an idea of what can be done to correct the fault. The output is immediately disabled and flashing numeric error codes are displayed. Error codes persist until the unit is powered down and restarted. So if you have an error code displayed, all you do is shut your engine off, correct whatever it was that caused it (short circuit, loose connection, etc.) and restart; you are back in business and no damage is done!

Overview

The KZX1250 has advanced features no other PWM can match. It is the result of 2 years of research & development in a quest to design the most robust, reliable, safe PWM to generate hydroxy gas in an automotive application as efficiently as possible. It has been designed to replace other inferior PWM's that pose a dangerous safety risk most people don't realize and to solve problems that other PWM's can cause. Doing things the proper way to begin with will ensure that the safety of yourself and others as well as your own property will stand a better chance of survival.

The **automatic current limiting** allows you to set your maximum Cell current so you can prevent your Cell from overheating due to thermal runaway. Some other PWM's have this feature which they incorrectly refer to as constant current. The KZX1250 automatic current limiting differs from other designs in that it doesn't jump instantly to the set current, but increases gradually so your electrical system isn't suddenly hit with a tremendous load.

The **charge sensing switch** is what activates the power to the KZX1250. When the engine is off, the charge sensing switch gates off power to the main unit and there are only micro-amps being consumed (less power than the battery consumes within itself). When charge voltage greater than approximately 13.8v is sensed, power is latched on and stays on until the charge voltage drops below approximately 13.2v (when alternator stops generating current). This means that the KZX1250 will only turn on when your alternator is supplying the current so it is impossible to leave it on and your starter will never have to compete with your PWM when you start your engine in the winter! Other PWM's require you to wire into the ignition circuit which has many issues we won't go into here.

The **short circuit protection** is not generic like a fuse; it is specially optimized for a Cell. Fuses are designed to open from the heat generated by the short circuit. They need to be flexible enough to work with motors and other inductive loads which generate current spikes that would open the fuse if this was not so; the same is true with generic circuit breakers. Fuses can take up to 100 milliseconds to open after exceeding their rated amperage; that's a tenth of a second. It may be quick enough for a motor winding, but not for a semiconductor. A typical PWM relying on fuse protection may survive several times after a short circuit, but the heat that the fuse sees is also the heat that the MOSFET's see. This means that every time a fuse pops, there is at least some damage happening to the MOSFET's due to the current spike in a typical PWM. The KZX1250 opens the circuit in less than 1 millisecond; that is less than 100th of the time it takes for a fuse to open! This means the MOSFET's see very little heat or current because the KZX1250 reacts to current, not heat and uses a microcontroller interrupt to immediately break the circuit within micro-seconds!

The **alternator protection** guards against situations that could over utilize your alternator and cause it to fail. One side effect of automatic current limited PWM's is that they give the Cell current high priority over every other circuit on your vehicle. To understand this better you need to understand how your electrical system works. If the system voltage drops, every device in your vehicle gets less current because their DC resistance is fixed; this is by design. Lower the voltage across a fixed resistance and less current flows through it; but attach a big load to a automatic current limited PWM and the current going through it will remain fixed as a lower voltage will cause the PWM to increase its duty cycle to maintain the fixed current. The alternators output capability depends on two things, the speed in which it is being driven and by the field current being fed to it through the voltage regulator. The voltage regulator maintains a voltage around 14v, give or take a few tenths of a volt. When the

system voltage falls below the regulated voltage, the regulator feeds more current to the field coils of the alternator to get it to produce more current. The higher current in the field coils adds a higher mechanical load to it which slows down the engine. This can cause stalling, forcing you to increase your idle; which in turn increases gas consumption. What the KZX1250 does is dial back the duty cycle regardless of what the current limit is set to until the current is again available (when you accelerate). It gives your Cell current the lowest priority in the system; which is exactly what should be done. After all, you really don't need much output when you are idling. So the alternator protection not only prevents your alternator from failing due to overload, but it also helps maintain a smooth idle and prevents you from unnecessarily having to increase your idle. One might think that having the throttle or engine speed control the duty cycle would yield the most optimum results, but it will actually have a negative effect. The reason is due to generator latency. Hydroxy gas is mostly needed when you accelerate and since it takes at least a few seconds for pressure to build after current is increased, there would be a deficiency of gas produced at the time when your engine needs it the most which will negatively affect your results.

Over-current protection prevents you from dialing in currents significantly higher than the KZX1250 recommends. It will throw an exception if average current is accidentally increased above 55 amps.

Overheat protection ensures that no matter what happens under the hood, your KZX1250 will never operate above 75 degrees centigrade. While a KZX1250 supplying 50 amps at 3 kHz in a 25 degree ambient environment will never generate temperatures above 65 degrees (test conditions showed that the temperature peaked out at around 55 degrees), under the hood temperatures can vary significantly and if the unit is installed too close to the engine, it could elevate the temperature. The fan on the KZX1250 could become clogged with dust and dirt or it can die altogether. If the fan cannot cool a PWM enough, the MOSFET's will burn out. Why should the life of a PWM depend on the most vulnerable component? The KZX1250 solves this issue by protecting itself from overheating regardless of how the heat was generated.

The **bright 3 digit LED display** allows you to clearly see the duty cycle, frequency and amperage when you are under the hood and adding distilled water and electrolyte even in the darkest of night. You won't need a flashlight, screw drivers or meters when maintaining your Cell. The duty cycle reading lets you know if your fluids are too weak or too strong as the duty cycle of an automatic current limited PWM will be approximately 70% (depending on your Cell design) when the Cell is warmed up. If it is significantly higher, you know you have too little electrolyte and if it's significantly lower, you have too much electrolyte. If the Cell is cold, the current should be at or very close to the set limit (duty cycle will be approximately 100%). The 3 position switch allows you to easily select between displaying duty cycle (upper position), frequency (middle position) and average current (lower position).

The **disable terminal** allows you to hook up as many turn off devices as your application requires. These devices are essential to bullet-proof your system. Any connection to chassis ground will disable the KZX1250 output. You may use this for safety devices, such as temperature, water level, pressure switches on your Cell and/or just a simple toggle switch for when you don't want your Cell to operate.

The **small package** has built in mounting brackets which make it easier to find a place to install it unlike most other designs and since it's water resistant, it is safe to install under your hood. No need to clutter up your dashboard with space consuming, unpleasant looking enclosures and running wires all over the place. No point to having a gauge in your dash that is only going to show you what your current reading is which will always be what you set it to unless your PWM is damaged; a simple LED indicator is all you need in the dash. The KZX1250 requires very little effort to install and doesn't require you to tamper with or modify any existing connections on your vehicle. If you have to remove it for any reason, it is very easy to do as there are so few connections.

Your KZX1250 should serve you well and when you accidentally short the output, you will smile as you see a flashing error code instead of frowning because you need to replace a fuse; and you'll know your unit wasn't exposed to a damaging current spike that would otherwise destroy it or shorten its lifespan. Drive with confidence knowing that your system is being looked after under the hood by an on board computer that constantly monitors itself and its effect on your vehicle thousands of times a second so you don't have to worry so much about it.

Installation

Basic installation:

1. Acquire all hardware you will need (see what you need below).
2. Find a place to mount the KZX1250. It can be installed inside the car or under the hood. Be sure that it is in a place where there is plenty of airflow and where it won't get splashed with water. Make sure there is adequate room for the wires. Always plan ahead.
3. Cut out paper template from page 9 and tape it in the place where you would like to mount the KZX1250.
4. Center punch the two mounting holes. This step is very important!
5. Drill out the holes with a 1/8" drill bit and remove the template.
6. Position unit and fasten with #10 1/2" self-tapping screws. Make sure the unit is firmly fastened in place.
7. Prepare a ground strap using 8 gauge stranded core wire by crimping on a ring connector on each end. This strap should be as short as possible. It should connect from the ground terminal (center terminal, see diagram) to a place on the chassis as close as possible to the unit (a foot or so).
8. Drill a 3/16" hole in the chassis for the ground connection.

IMPORTANT UPDATE: When tightening the nuts on the terminals, make sure you hold the respective ring terminal with one hand in its final position while turning the nut with the other. Do not let the ring terminal turn with the upper nut. If this happens and you try to straighten it out by spinning the ring terminal counterclockwise, the lower nut will loosen up and the unit will not work correctly or in some cases not even power up. If this happens, you must remove the upper nuts and the ring terminals and then tighten the lower nuts while holding the respective fastener from the other side. These terminals have tooth washers on each side of the board and it is important that they are tight enough to bite through the conformal coating making solid contact with the pads. These lower nuts are very well tightened before shipping, but they can loosen up under some circumstances; especially if you re-install the unit.

9. Connect the ground strap and tighten both connections firmly. It is very important that these connections are tight to ensure good conduction. Loose connections can cause excessive heat.
10. Prepare a 16 gauge stranded core wire for the 12v line. Make sure it is long enough to reach from the battery to the unit; and leave a small amount of slack. Connect a ring or spade terminal to both ends of the wire.
11. Connect one end to the 12v terminal (smaller terminal on the right – see diagram) and the other end to the battery. When this connection is made, you may see a small spark. Do not be alarmed; it is just the internal capacitors charging up; after which there will no longer be any significant (less than 1 milliamp) current flow. **Note: Do not fuse this connection because if it is opened, current will backflow through backlash diode and can damage unit.**
12. Prepare an 8 gauge stranded core wire long enough to extend from the KZX1250 to your cell. Crimp a ring terminal on each end.
13. Connect the wire from the Cell terminal on the unit (Terminal on the left – see diagram) to the ground electrode on your cell. Tighten all connections; ensure that they are all tight.
14. Prepare a fused (60 amp) 8 gauge wire from the battery to the 12v electrode on your cell. **Note: This fuse is necessary for complete protection against shorts that can occur between the cell and ground which the unit will not see. A short across the cell terminals will not open this fuse as the KZX1250 will react much quicker than a fuse. It will also make the unit fail safe in the unlikely event that a MOSFET becomes shorted.**

Disable switch installation (Optional) – Users usually want some way of turning off their Cell to drive without it under some circumstances. The KZX1250 automatically comes on every time your engine is running and will always supply current to your cell. Hooking up a disable switch allows you to disable the output so you can run without the Cell at will. **Note: The unit will always turn on when the engine is started, but will not output any current if the disable input is grounded.**

1. Drill hole in the place where you intend to mount the switch. The hole size obviously depends on the switch you intend to use.
2. Solder some small gauge wire from a point on your chassis (ground) to one pole on the switch.
3. Solder a small gauge wire from the other pole on the switch to a spade connector which will connect to the disable line on the KZX1250.
4. Mount the switch.

Status Indicators installation (Optional) Many users want a visual indication of the status of their system and if you are mounting the unit under the hood you will not know what is happening. The current doesn't need to be monitored because it is automatically controlled by the unit, but there should be an idiot light that informs you if the system should malfunction such as if the unit turns off due to a disable device (water level, pressure or temperature sensor, etc.) or an error condition occurred. These indicators include a disable LED and a power output LED.

1. Drill two holes where you intend to mount your LED's. Hole size obviously depends on the size of the LED's used.
2. If using 12V LED's, skip to step 3. Solder one 1K resistor to each anode of the LED's. Heat
3. Solder the two anodes together (If you attached resistors in step two, connect the other ends of the resistors together instead) and connect 12V to this connection.
4. Connect some small gauge wire from the cathode of the green LED to the negative terminal of your cell and another wire from the cathode of the red LED to the switch terminal that is connected to the disable line of the KZX1250. Shrink tubing is handy for sealing your connection, but electrical tape will work just as well.

Setup and Testing

Basic Setup and testing:

1. Flip the display mode switch to duty cycle display mode (top position). Adjust the top duty cycle adjustment all the way counter-clockwise. Start the engine. The KZX1250 should start up and after a couple of seconds, the green LED should light up. This means that the unit is now operational and the output is enabled. The display should read zero (duty cycle). **Note: The factory setting is manual mode; however, if the display is reading anything other than 0 or if the yellow 'auto current' LED is illuminated, push the program set button to return it to manual mode.**
2. Turn the duty cycle knob clockwise. The display should follow the duty cycle (0 – 100%).
3. Flip the switch to 'frequency display' mode (center position). Adjust the 'frequency adjustment' knob from high frequency (counter-clockwise) to low frequency (clockwise); the display should follow. Note that the display reads in hertz, unless you see a decimal point in which case it is in kilohertz (ie 3.00 = 3 kHz, 300 = 300 Hz). Adjust to your desired frequency setting. **Note: Duty cycle must be 1-99% or frequency will display zero regardless of frequency knob simply because there is no frequency generated at 0% and 100% (which is full off and full on respectively).**
4. Flip the display mode switch to current display mode (third position). You can now adjust the 'duty cycle adjustment' knob to your desired current. At this point you probably want to set your current limit. To do this, turn the 'duty cycle

adjustment' knob to maximum (fully clockwise) or until you reach your target current. If you don't know what your target current should be, you should monitor your cell temperature. If it is still warming up, you may have to wait. Keeping the duty cycle knob fully clockwise, the current displayed should continue to rise as your cell heats up.

5. Once your cell reaches your target temperature, push the program set button; the yellow LED should light. Note your cell current on display; your unit is now regulating current. If you switch the display mode to duty cycle (top switch position), you can see the duty cycle slowly roll back as your cell heats up and demands more current. The 'duty cycle adjustment' knob will no longer control current as it is now in auto-current mode.
6. Enable alternator protection by turning on all accessories you intend to use on a daily basis (including your cell); for most users, this will be the headlights and the radio. Make sure heat/AC blower is off. Hold down the program set button until red LED comes on (approx 5 seconds) and release; alternator protection is now enabled. You can test this by turning on other accessories, such as heat/AC blower, wipers, etc. The red LED should come on and the current should come down somewhat; then turn the accessories off and observe the current rise back to set value. **Note: Duty cycle adjustment knob must not be in zero position when you push the 'program set' button or auto-current mode will be reset to manual and you'll have to start over.**
7. Shut the engine off. The unit should immediately turn off outputs and power down. Note: If there is no load on the unit (cell disconnected) when the engine is shut off, it may take 20 – 30 seconds on some vehicles to shut down due to the battery bleeding off the overcharge voltage; this is nothing to be alarmed about.

Note: To restore the duty cycle control operation and cancel auto current mode, rotate the duty cycle knob all the way to minimum position and press the 'program set' button. Yellow LED will turn off and you will now be able to manually adjust the duty cycle again.

Do not run the unit at a high current with a low duty cycle. If your duty cycle is less than 50%, you are using too strong of a mixture of electrolyte and distilled water. Your target current should run at or very close to 100% duty cycle when the system is started cold. If your duty cycle is low, you need to add more water. Remember, if you're drawing 30 amps at 25% duty cycle, you are actually pulsing 120 amps! The unit will usually throw a E03 (overdraw) or E04 (overheat) to remind you. Part of maintenance is to make sure water is added when the duty cycle drops below the recorded value.

Disable Switch Testing:

1. Start the engine.
2. The green LED should come on. The higher the duty cycle, the brighter the LED will be.
3. Disable the unit using the installed switch.
4. The green LED should go out and the red LED should come on.
5. Re-enable the unit.
6. The red LED should go out and the green LED should come back on.

The green LED should always give you an indication that the cell is receiving current. If the green LED is out and the red LED is also out, you should check the unit for a flashing error message; it could be that there was a malfunction (see error codes below). If the red LED is on, check all disable switches that are connected to your unit as any one of them can be on; such as water level switch, pressure switch, etc.

What you will need

Basic installation:

1. Wire – Should have enough 8 gauge stranded wire to connect from the KZX1250 output terminal to the ground connection on your cell and a short piece that connects from KZX1250 ground to the chassis (usually a foot or less) and enough 16 gauge wire to connect from KZX1250 +12v terminal (see diagram) to battery. **Do not use any other gauge wire for the ground and output terminals. The KZX1250 is designed to use 8 gauge ring terminals and 8 gauge wire as it is capable of supplying 55 amps. Using heavier gauge wire means using bigger ring terminals which will not fit the screws and will cause electrical and cosmetic damage to the unit. Do not use any other hardware that is not included such as washers. Ignoring these warnings will void the warranty.**
2. Ring Terminals – 4 8 gauge ring connectors and 2 16 gauge ring terminals.
3. Self Tapping Screws – 3 half inch #8 screws; 2 for mounting KZX1250 and 1 for connecting the ground strap to chassis.

Disable switch installation (Optional):

1. SPST switch.
2. Small gauge (16-22) wire.
3. 1 spade connector.

Status Indicators installation (Optional):

1. LED's; 1 Red and 1 Green and bezel to mount them. These could be 12v LED's or regular LED's
2. 2 1K 1/8W or better resistors (Only necessary if 12V LED's cannot be obtained).
3. Small (16-22) gauge wire.

Helpful Hints and Tips

- Try to keep duty cycle 70% or higher after Cell is warmed up. Lower duty cycles mean that you are using too high of a concentrate of electrolyte which is inefficient and could trigger the circuit protection if excessive.
- Use the duty cycle as a guide when adding distilled water to your system. If duty cycle is high (80% or more) after Cell reaches operating temperature, it would indicate that your Cell could use more electrolytes. Add electrolyte slowly giving it time to adequately mix with the water until the duty cycle comes back down to approximately 70%.
- Do not clean with harsh chemicals; put some mild soap (such as Windex) on a paper towel and wipe.
- Do not use this PWM to control motor speed or dim lights. It is designed specifically for use with an Electrolyzer in an automobile and the protection circuits are optimized for this specific purpose.
- Apply petroleum jelly (Vaseline) to terminals after installation to help prevent oxidation.
- Make sure there is nothing restricting air to the unit; and that no wires or objects can come in contact with the fan blades.
- Tie wrap all connections to keep wires neat and away from vibrating parts that will slowly eat away at the insulation over time.
- The KZX1250 is water resistant. It is not waterproof or hose resistant. Please keep this in mind when determining where to install it. Big hard splashes of water can stop the fan and completely submerging the unit in water can cause irreversible damage it.

Error Codes

Code	Meaning	Cause
E01	Short Circuit	Output circuit is shorted.
E02	Over current	User increased current above useable limit (above 55 amps).
E03	Over Draw	Load is drawing too much current (i.e. too strong electrolyte).
E04	Over Heat	Unit is getting too hot (i.e. fan failed or unit located in a bad spot).

Troubleshooting

Symptom	Cause	Solution
Unit flashes 'E01' at startup	There is a short circuit present in your system.	Disconnect Cell from circuit and check for shorts. If message appears even with Cell disconnected, make sure terminals are tight otherwise unit may need to be serviced.
	There is too much electrolyte in Cell.	
Unit flashes 'E02'	User increased the current above maximum.	Lower the duty cycle and/or use less electrolyte.
Unit flashes 'E03' at startup	There is too much electrolyte in Cell or there is a partial short.	Refill Cell with fresh mixture.
Unit flashes 'E03' at random times		
Unit flashes 'E04'	Circuit is getting too hot.	Fan may be dead, restricted or unit may not be located in a good place.

If the unit is not operating properly it is highly probable that one or more of the terminals are loose; even if the top nuts are tight, the lower nuts may be loose. This can happen particularly when the unit is uninstalled and reinstalled since loosening the upper nuts will tend to loosen the bottom nuts. The ring terminal connectors should not be able to move easily if they are installed correctly. If this is the case, please follow the **important update** in the installation instructions above on page 4.

Warrantees and service:

The KZX1250 was designed to outlast all other PWM's on the market, but like any electronic product, there could be a failure due to manufacturing defects or misuse. The KZX1250 is covered under warrantee for 30 days in case of manufacturing defects. Damage caused by user will be subject to modest repair costs. Shipping must be paid by user both ways. If service is needed, please send email to sales@adicorp.net with the word "service" in the subject. Please include your name, address and the issue you are having. Please make sure you have used the troubleshooting section for problems before requesting service.

Disclaimer: Upon purchasing this unit, you agree to hold manufacturers and vendors harmless to any damages you may be subjected to using this product. The KZX1250 is the safest PWM there is on the market for use in an automobile, but we cannot be responsible for what you do with it. Please use this device under your own discretion.

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Installation Template

Print out this template and use it as a drill guide.

Make sure the printer doesn't scale this image.

Do not drill through the holes in the unit or damage may result.

Always use a center punch before drilling to keep the drill bit from wandering.

