ZERORPM®
IDLE MITIGATION SYSTEMS®

IMS2, IMS3, IMS4, IMS5
Operator Manual

This operators manual is applicable to vehicles equipped with IMS software version:

PLC: V4.95 and later
HMI: V4.95 and later

4806-00017 **Revision F**

Table of Contents

Section 1: Introduction

Section 1.1: Scope

This manual describes the operation of the ZeroRPM® IMS). It provides basic information about the system and describes both the general theory of operation and the theory of operation of specific aspects of the system.

The IMS is designed to control the vehicle's chassis engine to reduce idling while maintaining a comfortable work environment in the cab. It maintains electrical power required for computers, lighting, and vehicle accessories. The IMS provides an interface between the equipment and the vehicle while providing the operator with necessary information.

The operation and simulated screens presented in this manual are based on software stated on the title page of this document. The information covered in this manual is subject to change without notice.

Section 1.2: Definitions of Informational Headings

DANGER: This heading indicates noncompliance with the stated information **will** lead to serious injury or death.

WARNING: This heading indicates noncompliance with the stated information **may** lead to serious injury or death.

CAUTION: This heading indicates noncompliance with the stated information **may** lead to minor or moderate injury.

NOTICE: This heading draws attention to specific information.

Section 1.3: Safety

All general safety regulations for the prevention of accidents and the relevant operational safety instructions must be followed. Safety must be the top priority at all times.

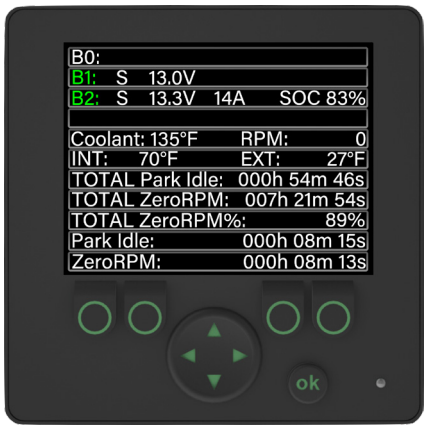
Section 2: Overview of the IMS Display

The IMS is controlled through the display's softkey integration.

CAUTION: The display is not a touchscreen.

- To select an option, press the relevant softkey(s).
- For example, if you wish to view the primary information screen, press and hold the OK softkey for two seconds.

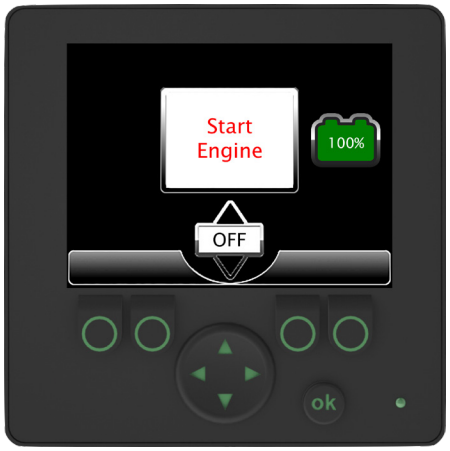
- The primary information screen will be displayed (see Section 12.1 for more information).



The softkeys are identified as follows:

- **F1** - far left
- **F2** - second from left
- **F3** - second from right
- **F4** - far right
- **D-pad** - directional arrows (Up, Down, Left, and Right)
- **OK** - labeled "ok"; below F3 and F4

Section 3: Basic Operation

The Idle Mitigation System can be started as follows: • When the ignition switch has been turned on, the IMS will power on and the ZeroRPM initialization screen will appear.	
After initialization, the display will indicate the current system status. The Start Engine message will be displayed on the screen, verifying the engine has not been started and is not running. • The green State of Charge icon displays the current percentage of charge in the lithium-iron battery pack. • If the red battery icon is displayed at this time, the lead-acid battery voltage has fallen below the set point. Either start the engine to begin charging or turn off the ignition switch.	

Once the vehicle has started, the system will continue to charge the lead-acid batteries (B0) until the set point conditions are met.

NOTICE: Idle Mitigation Mode will not be engaged until these conditions are met.

- To begin system operation, start the chassis engine.
- The display will show the green Engine Running icon, verifying the engine is running.

NOTICE: The lead-acid charging logic may prevent the engine from shutting down until the charging criteria are satisfied.

- Once the chassis has reached the base idle condition and the lead-acid battery/batteries have reached the set point, the countdown timer will appear. The default is five seconds, but it may be set to a greater value upon customer request.

NOTICE: The countdown can be overridden by pressing the vehicle's brake pedal to engage the Brake Override feature (if equipped; see Section 3.2 for details).

- When the countdown reaches 0, the engine will turn off and the ZeroRPM logo will be displayed. The IMS will now power the entire vehicle and will be ready to heat or cool.

If the engine is running while the vehicle is in Park, the IMS can be engaged by holding F1. To force the engine off during idle (in Park only), press and hold F1. This will also engage ZeroIDLE Mode if applicable (see Section 8 for details).

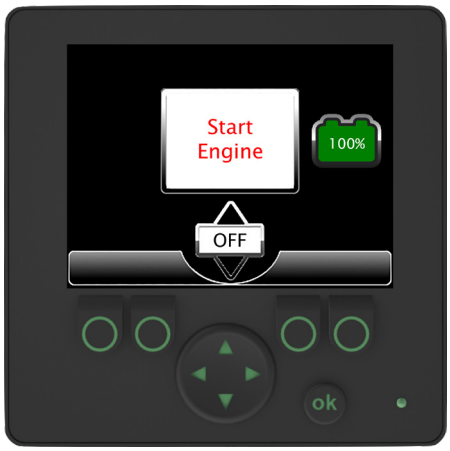
- A "Hold" message will be displayed for three seconds, then the chassis engine will shut down and the IMS will engage.
- If ZeroIDLE is equipped (see Section 8 for details), the operator can simply press F1 without holding it. Doing so will shut the engine down and engage ZeroIDLE Mode.

Section 3.1: Hood Sensor

If the Hood Open icon appears on the display, either the engine compartment hood is open or the controller has lost communication with the screen.

- This is a safety feature to prevent the engine from being started by the IMS controller when the hood is open. If the Hood Open icon is present, the engine can be started and stopped only by using the ignition switch.
- The Hood Open icon will disappear when the hood is closed.

NOTICE: When this condition occurs in Idle Mitigation Mode, it is required to cycle the ignition switch.



Section 3.2: Brake Override

When the chassis engine is started, the base idle RPM is reached, and lead-acid charge set point is reached, the five-second countdown will appear. During the five-second countdown, the engine shutdown sequence can be overridden by pressing and holding the vehicle's brake pedal, thus engaging Brake Override (if applicable). When in brake override the engine running icon will have a yellow flashing background. • The engine will remain at idle as long as the override is active. • To disengage Brake Override and initiate the engine shutdown sequence again, perform one of the following actions (depending on your system settings): 1. *Release the brake pedal.* 2. *Press and hold F1.*	

Section 3.3: Brake Start

When the chassis engine is off and the IMS is active, the chassis engine can be started quickly by pressing the brake pedal.	

Section 3.4: IMS Bypass Mode (If Equipped)

IMS Bypass Mode prevents the engine from shutting down as long as the mode is active.

- Engaging the customer designated trigger (i.e. winches, emergency lights, lift gates, etc.) while the system is in Idle Mitigation Mode will start the chassis engine. The message "IMS BYPASS" will appear on the operator screen.
- Activating IMS Bypass Mode while the system is not in Idle Mitigation Mode will prevent the system from entering Idle Mitigation Mode. The message "IMS BYPASS" will appear on the operator screen.
- The "Emergency Light" switch must be disengaged before Idle Mitigation Mode can be re-entered.

Section 3.5: Rescue Switch

If the IMS does not wake up from a chassis start due to low battery voltage, the operator can use the rescue switch (a momentary pushbutton typically mounted near the ZeroRPM operator screen) to reactivate the IMS.

The rescue switch should be used under the following circumstances:

- Local or remote programming
- Diagnostics
- Secondary system wake-up due to the following:

1. *Low-voltage brown-out during engine start*
2. *Non-ignition switch system reboot*

NOTICE: The rescue switch is not intended for everyday use.

Section 3.6: Hybrid Disconnect Switch

The hybrid disconnect switch (a plunger mounted near the driver-side chassis battery) opens the connection between the lithium-iron batteries and the chassis. When the disconnect is active, the lithium-iron batteries cannot provide electrical power to the chassis, nor can they be charged.

- To engage the hybrid disconnect switch, push the plunger down. It will lock into the open position.
- To disengage the hybrid disconnect switch, twist the plunger clockwise. It will unlock and return to the closed position.
- The hybrid disconnect switch may be used under the following circumstances:

1. *Maintenance*
2. *Troubleshooting*
3. *Emergency situations*

NOTICE: The hybrid disconnect switch is not intended for everyday use.

NOTICE: The hybrid disconnect will not bypass the Idle Mitigation System but will continue to allow the vehicle to shut down. All loads will stay connected to the lead acid battery, the truck will remain in IMS mode, but IMS climate control will be disabled, and the engine will continue start stop depending on the condition of lead acid battery.

Section 3.7: Forced IMS Controller Shutdown

The green System Shutdown icon will be displayed when the vehicle's engine is turned off and the ignition switch is off and the key is removed (if applicable).

- Hold F1 for three seconds. The display will power off and the IMS PLC will enter a hibernation state. The PLC will remain in this state until the ignition is turned on again.

NOTICE: Taking no action within 30 seconds will also cause the display to power off and the PLC to enter a hibernation state.

Section 4: Climate Control

Section 4.1: Air Conditioning (If Equipped)

Air conditioning is activated by setting the chassis HVAC controls to the cool side and turning the blower fan on.

- The climate control field on the operator screen will change to read “COOL”, the arrow below the field will turn blue, and cool air will begin to blow from the vents within a few seconds.
- The snowflake icon will appear on the left side of the screen almost immediately.

NOTICE: If the engine starts due to an A/C fault/error, the snowflake icon will flash (see Section 11.2 for details). If the engine starts for any other condition, the snowflake icon will disappear.

- Cool air will continue to blow from the vents until the operator turns the blower fan off, turns the HVAC controls to heat, or disables air conditioning using the operator screen (see Page 10 for more information), or if the minimum temperature set point (default 60°F) is reached.

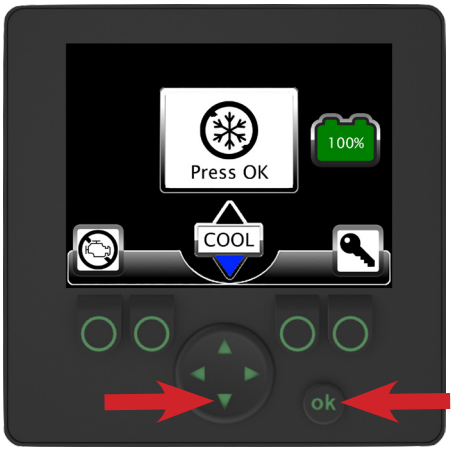
The air conditioning feature can be disabled through the following process:

- Press the Down arrow softkey and the OK softkey simultaneously.
- The display will show the Disable Air Conditioning icon to verify the selection.

NOTICE: The operator has 10 seconds to disable air conditioning. If no action is taken within 10 seconds, the Disable Air Conditioning icon will disappear.

- Press the OK softkey again to disable air conditioning.
- The blue arrow below the climate control field will turn grayish blue, indicating that the air conditioning feature has been disabled.

NOTICE: If the ignition switch is turned off while the air conditioning feature is disabled, the IMS will reset and the air conditioning will start as normal the next time the system is powered on.

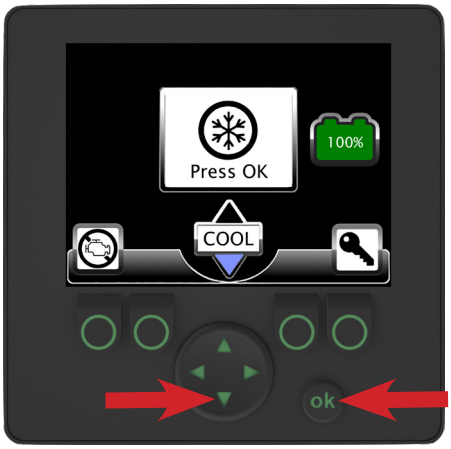


If the air conditioning feature has been disabled, it can be re-enabled through the following process:

- Press the Down arrow softkey and the OK softkey simultaneously.
- The display will show the Enable Air Conditioning icon to verify the selection.

NOTICE: The operator has 10 seconds to re-enable air conditioning. If no action is taken within 10 seconds, the Enable Air Conditioning icon will disappear.

- Press the OK softkey again to enable air conditioning.
- The grayish blue arrow below the climate control field will return to solid blue, indicating that the air conditioning feature has been re-enabled. The snowflake icon will reappear (if applicable) and the system will resume cooling.



Section 4.2: Heating (If Equipped)

NOTICE: If a fuel-fired heater is equipped, it will operate identically to the ZeroRPM heating mode.

Heating is activated by setting the HVAC controls to the heat side and turning the blower fan on.

- The climate control field on the operator screen will change to read “HEAT”, the arrow above the field will turn red, and warm air will begin to blow from the vents.
- The flame icon will appear on the left side of the screen within five seconds.
- Warm air will continue to blow from the vents until the operator turns the blower fan off, turns the HVAC controls to cool, or disables heat using the operator screen (see Page 13 for more information), or if the maximum temperature set point (default 100°F) is reached. Otherwise, the heat will continue to run until the engine coolant temperature reaches its predetermined minimum of 104°F (40°C). When the engine coolant reaches 104°F, the chassis engine will start and will remain on until the engine coolant reaches 150°F (75°C). When the engine coolant reaches 150°F, the chassis engine will turn off and the IMS will re-engage for heat.

The heating feature can be disabled through the following process:

- Press the Up arrow softkey and the OK softkey simultaneously.
- The display will show the Disable Heat icon to verify the selection.

NOTICE: The operator has 10 seconds to disable heating. If no action is taken within 10 seconds, the Disable Heat icon will disappear.

- Press the OK softkey again to disable heat.
- The red arrow above the climate control field will turn grayish red, indicating that the heating feature has been disabled.

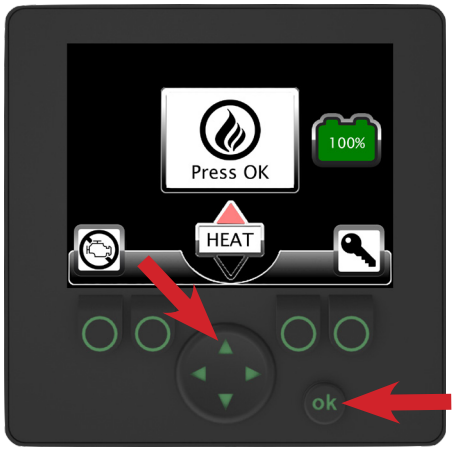
NOTICE: If the ignition switch is turned off while the heating feature is disabled, the IMS will reset and heating will start as normal the next time the system is powered on.

If the heating feature has been disabled, it can be re-enabled through the following process:

- Press the Up arrow softkey and the OK softkey simultaneously.
- The display will show the Enable Heat icon to verify the selection.

NOTICE: The operator has 10 seconds to re-enable heating. If no action is taken within 10 seconds, the Enable Heat icon will disappear.

- Press the OK softkey again to enable heat.
- The grayish red arrow above the climate control field will return to solid red, verifying that the heating feature has been enabled. The flame icon will reappear (if applicable) and the system will resume heating.



Section 4.3: Defrost Mode (If Equipped)

Defrost Mode engages the auxiliary A/C compressor and the coolant pump simultaneously to defrost the vehicle.

- To engage Defrost Mode, set the blend door to heat and press the factory defrost button.
- The Engage Defrost Mode icon will appear above F3.

- Press F3 to engage Defrost Mode. The icon will turn green; the Defrost Mode Engaged icon will appear on the left side of the screen and the temperature will be replaced with “DEF”; both climate control arrows will be displayed.
- Press F3 again to disengage Defrost Mode.

NOTICE: Defrost Mode runs in cycles of 10 minutes. During the first four minutes, the IMS runs both the heat pump and the A/C compressor. For the remaining six minutes, the IMS runs only the heat pump. This cycle will continue until Defrost Mode is disengaged.

Section 5: Battery Management

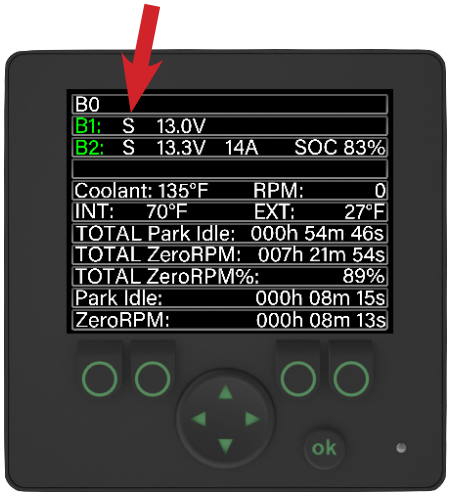
Section 5.1: Engine Starting for Low Battery

• If the state of charge (SOC) of the IMS batteries (or the chassis batteries) becomes lower than the predetermined low battery set points at any time during operation, the Engine Starting for Low Battery icon will be displayed and the five-second counter will begin counting down. • The chassis engine will turn on to replenish the batteries' energy. **NOTICE:** The engine may start for any of the conditions listed in Section 5.2.	

Section 5.2: Engine Running for Battery

The battery icons listed on this page are commonly displayed on the operator screen. The corresponding character will appear to the left of the voltage on the Primary Information Screen (see Section 12.1 for details).

- **0:** This icon indicates the engine is running to charge Battery 0 (the chassis lead-acid battery).
- **1:** This icon indicates the engine is running to charge Battery 1 (the 12V lithium-iron battery pack).
- **2:** This icon indicates the engine is running to charge Battery 2 (the hybrid lithium-iron battery packs).
- **I:** This icon indicates the engine is running because the hybrid battery pack voltage is ≤ 10V. The engine will run for a period of time determined by the system settings.
- **F:** This icon indicates the engine is running because an individual battery cell is low during ePTO mode (if a hybrid electric motor is equipped). The engine will run for a period of time determined by the system settings.
- **V:** This icon indicates the engine is running because an individual battery cell is low. The engine will run for a period of time determined by the system settings.
- **S:** This icon indicates the engine is running because the IMS battery packs have reached a state of charge (SOC) below the SOC charge set point. The engine will run for a period of time determined by the system settings.
- **P:** This icon indicates the engine is running because the hybrid battery pack voltage is < 11.2V in parallel or < 22.4V in series. The engine will run for a period of time determined by the system settings.
- **X:** This icon indicates an issue that does not correspond to one of the aforementioned scenarios has occurred. If this icon appears, it can be removed only by restarting the IMS (see Section 3.7 for more information). If the problem persists, contact your service department.



Section 5.3: ZeroRPM System Faults

NOTICE: The letter “E” inside the yellow triangle icon represents an energy error. This may result from the temperature or voltage of a low/unbalanced cell in the lithium-iron pack(s). If the error occurs, the lithium-iron batteries will no longer be allowed to connect to the vehicle. If you encounter this error and do not believe it to be temperature- or voltage-related, have the vehicle serviced as soon as possible.

IMS functionality varies at certain temperature ranges.

- If the ZeroRPM energy is between 135°F (57°C) and 32°F (0°C), normal system functions are permitted.
- If the ZeroRPM energy is below 32°F (0°C) and above -4°F (-20°C), the system will allow discharging but will prohibit charging.
- If the ZeroRPM energy is below -4°F (-20°C) or above 135°F, (57°C) the system will prohibit both charging and discharging.

IMS functionality varies at certain voltage ranges.

- If the ZeroRPM energy is between 2.7V - 3.5V per cell, normal system functions are permitted. (If any cell is at 2.7V for 30sec the SOC will reset to 0%.)
- The ZeroRPM energy will allow charging, but will prohibit discharging if any cell voltage reaches 2.6V. If the voltage drops below 2.6V for any cell, neither charging or discharging will be permitted.
- The ZeroRPM energy will allow discharging, but will prohibit charging if any cell voltage reaches 3.6V. If the voltage exceeds 3.7V for any cell, neither charging or discharging will be permitted.

NOTICE: The letter “W” inside the yellow triangle icon represents a wiring related issue for battery #2.

NOTICE: The letter “G” inside the yellow triangle icon represents an ignition error. This error results could result from issues with ignition wiring or the ZeroKEY module is faulty or not properly programmed, preventing the truck from starting while in ZeroKEY.

NOTICE: The need for the engine to run varies among the aforementioned conditions. Various icons may be displayed on the ZeroRPM operator screen.

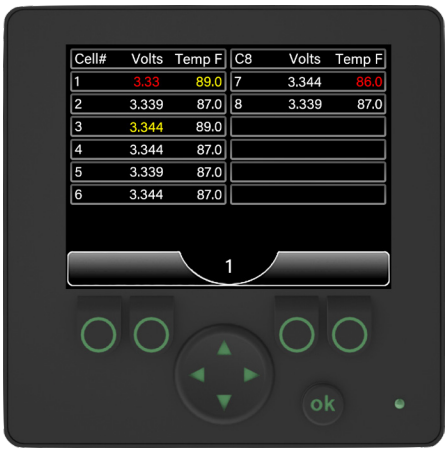
The “!” will alternate blinking with the fault code “W”, “G”, “E”, etc.

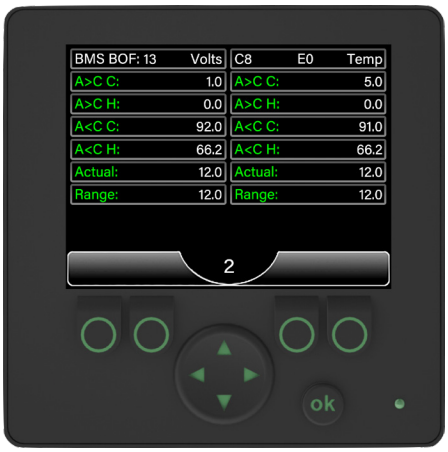
Section 5.4: Battery Management System Screens

The Battery Management System (BMS) displays the voltage and temperature of each cell within the lithium batteries (24 cells in total, reference table below) in real time.

- To access the BMS screens, press the Up arrow while the primary information screen is displayed.
- Screen 1 displays all 8 cells. The lowest voltage reading and temperature are displayed in red. The highest voltage reading and temperature are displayed in yellow.
- The BMS diagnostic screen (Screen 2) tracks any faults that occur within the BMS. You can cycle between the screens using the Left and Right arrows.

	IMS2	IMS3	IMS4	IMS5
Number of Cells	12	8	8-16	16-24





Section 6: Broadcasting to Intellimetrics®

All data collected from the IMS is routinely transmitted (weekly by default) to Intellimetrics, ZeroRPM's web-based data collection portal. To force a broadcast, perform the following steps:

- Simultaneously press and hold F4 and OK.

- The Broadcasting icon will be displayed above F4 within five seconds (replacing the ZeroKEY icon if ZeroKEY is equipped). The Broadcasting icon will remain present while the vehicle's data is transmitted to the online portal.
- The speed of the data transmission depends on the available cellular signal.
- The Broadcasting icon will briefly flash once if there is no cellular signal.

- The Broadcasting icon will disappear from the display when the data transmission is complete. The ZeroKEY icon will reappear above F4 if ZeroKEY is equipped.

Section 7: ZeroKEY™ Mode (If Equipped)

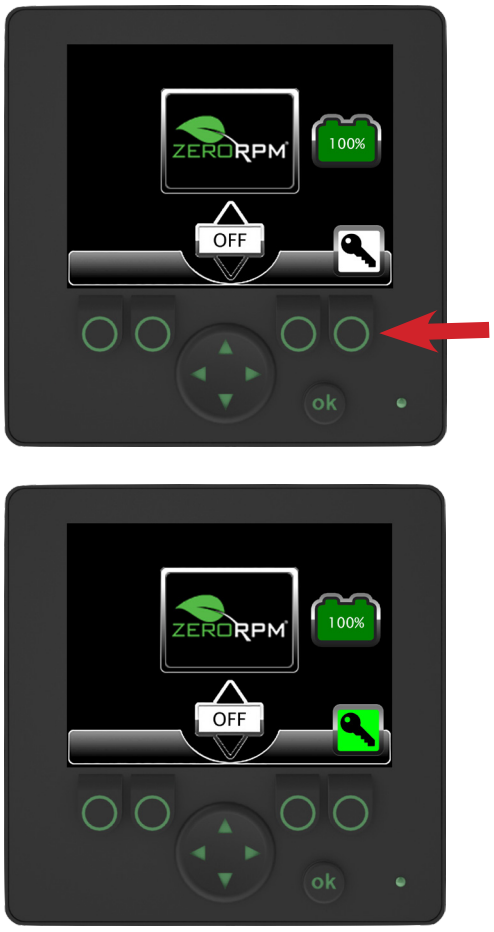
ZeroKEY Mode allows the operator to remove the key from the ignition and to secure the vehicle by locking the doors, all while the HVAC and the vehicle's electrical components continue to function.

- To engage ZeroKEY Mode any time the icon is present, press F4 and remove the key from the ignition. The ZeroKEY icon will turn green.

NOTICE: The operator has 10 seconds to remove the key from the ignition switch. If the key is not removed within 10 seconds, ZeroKEY Mode will disengage and the icon will turn white.

- The IMS will start the engine to charge the batteries if they reach the low battery set point.
- Brake Start will be disabled any time the key is not in the ignition and turned to the Run position.
- To exit ZeroKEY Mode, insert the key into the ignition and turn it to the Run position. The ZeroKEY icon will turn white.
- The vehicle can now be cranked by pressing the brake pedal or by turning the key to the Start position once ZeroKEY Mode is turned off.

NOTICE: If ZeroKEY Mode is turned off while Idle Mitigation Mode is active, removing the key from the ignition switch will shut down the system. If ZeroKEY Mode is not engaged when removing the key, the IMS and the vehicle will shut down.



Section 8: ZeroIDLE™ Mode (If Equipped)

ZeroIDLE Mode prevents the IMS from starting the engine automatically. This allows the operator to use the IMS in designated "No Idle" zones. ZeroKEY Mode automatically engages when ZeroIDLE Mode is active.

- To engage ZeroIDLE Mode, the vehicle must be in Park, the hood must be closed, and the IMS must be active.
- Press F1.
- The ZeroIDLE icon will turn green.
- ZeroIDLE Mode is now engaged. The IMS will not start the engine.

NOTICE: IMS bypass functionality is fully operational from all locations while in ZeroIDLE Mode. When the engine is started by one of the vehicle's bypass options, the engine will remain on indefinitely until manually stopped by one of the following means: 1) disengaging the Remote Start switch; 2) pressing the brake pedal; or 3) turning the ignition off.

- When ZeroIDLE Mode is engaged, press F1 or the brake pedal to turn the mode off.
- The ZeroIDLE icon will turn white.
- If (while in ZeroIDLE Mode) the IMS senses a condition that would require the chassis engine to start, a message requesting the operator start the engine will be displayed for five minutes (or until a critical condition is met) and the IMS will shut down all HVAC functionality (excluding the blower) to conserve energy.
- Once the five-minute warning has passed, the IMS will shut down in its entirety to prevent any damage to its battery packs. If this occurs, the system must be rebooted using the rescue switch; a reboot is not necessary if ZeroKEY Mode is active.

NOTICE: If ZeroIDLE Mode is turned off using the F1 softkey within the five-minute warning window, the engine will start immediately.

- If a critical condition is detected, the screen will display the message "Powering Down" and will shut down within 10 seconds. If this occurs, the engine must be run; a reboot is not necessary if ZeroKEY Mode is active.

If ZeroKEY Mode is active (green icon) and the key is removed from the Run position, ZeroIDLE Mode will override the ZeroKEY Mode auto-start function and the chassis will power down completely. If the system completely powers down, reinsert the key into the ignition and turn it to the Run position to restore power.

ZeroKEY Mode should always be used in conjunction with ZeroIDLE Mode. If the IMS powers down while in ZeroIDLE Mode and the key is left in the Run position, the operator could be left with a dead chassis battery due to leaving the key in the Run position with nothing to manage the load/power consumption.

Section 9: ZeroDRAW™ Mode (If Equipped)

Any time the ignition switch is turned off after being in the Run position, ZeroDRAW Mode will be engaged until one of the following scenarios occurs:

- A predetermined amount of time has passed. This is indicated by a countdown which appears on the Primary Information Screen (see Section 12.1 for details).
- The ZeroDRAW SOC offset is reached. The default is 10% over the SOC set point (*e.g.* low SOC = 20%; ZeroDRAW Mode turns off at 30%).
- The operator has pressed the F2 soft key causing the ZeroDraw feature to shutdown early to save energy. (F2 manual shut down is a custom feature available upon request).

After either of the aforementioned scenarios occurs, the IMS will switch back to the chassis lead-acid batteries and disconnect non-OE loads to prevent parasitic draw on the lead-acid batteries.

Section 10: Boost Mode (if Equipped)

Boost Mode allows the vehicle to be started using the lithium-iron batteries to charge the vehicle's starting battery/batteries in the event the vehicle requires a jump-start.

- Boost Mode will allow the lithium-iron batteries to charge the lead-acid starting battery/batteries only if the lead-acid battery voltage is greater than 7.5VDC.
- If the lead-acid battery/batteries are lower than 7.5VDC, the vehicle will need to be started through other means.
- Consult with your vehicle up-fitter on the installation location of the BOOST activation switch or button.

Section 11: Further System Information

Section 11.1: Communication Error

If the Loss of Communication icon appears on the display, a communication error between the IMS controller and the vehicle has occurred.

- In this condition, the engine can only be started and stopped manually by the operator using the ignition switch. The shutdown and engagement of Idle Mitigation Mode will no longer take place while the vehicle is in Park or Neutral.
- The vehicle can be driven as if the IMS were not present.
- The vehicle requires service to check the operation of the IMS. When this icon is present, contact your fleet maintenance department immediately to ensure there are no other defects on the vehicle that may cause the vehicle to be unsafe to drive.

One of the following codes will appear along with the Loss of Communication icon:

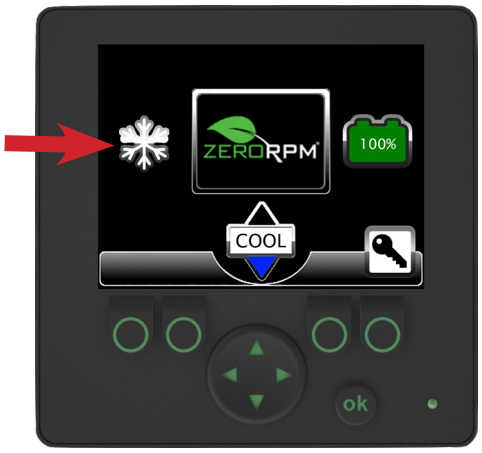
- **CAN1:** Communication over the data network that does not directly involve the vehicle.
- **CAN2:** Communication between the IMS controller and the chassis.

Section 11.2: A/C Error Codes

There are six A/C error codes to inform the operator of an issue with the air conditioning. Each code is represented by the number of times the snowflake icon flashes in sequence; for example, the snowflake icon will flash four times to represent A/C Error Code 4. The code will continue to flash until the ignition switch is cycled and/or the issue is corrected.

- **1:** Blower Off
- **2:** A/C Confirm Not Received
- **3:** Compressor Fault
- **4:** Temperature Moving in Wrong Direction
- **5:** Temperature Controlling Wrong Position
- **6:** Low A/C Pressure

NOTICE: The two most recent A/C error codes are displayed on Information Screen 4.



Section 11.3: Shore Power Charging

The shore power outlet allows both the vehicle's and IMS's batteries to charge from an A/C outlet via an extension cord.

NOTICE: It is recommended the operator use shore power to charge the lithium-iron batteries to 100% SOC at least once per month, such as during regularly scheduled preventive maintenance.

- The shore power icon will be displayed and the green SOC icon will flash on the screen any time the shore power outlet is connected and charging the system, and the ignition switch is on (even if the ignition is not on, if equipped with certain settings, the shore power icon will remain on the screen). If the ignition switch is not on, the battery icon will continue to blink, but the shore power icon will not be present; only the ZeroRPM logo will be present.

- As long as the shore power outlet is connected, the engine will not start (unless the vehicle is equipped with an auto-eject shore power plug). This feature helps prevent the operator from driving the vehicle while an extension cord is still connected.

WARNING: The auto-eject plug (if equipped) will eject rapidly when the vehicle is started.

- Once the extension cord is disconnected, the flashing green SOC battery icon will disappear and the vehicle can be started as usual.

- The shore power will first charge the lithium-iron batteries to 100%. For the remaining time on shore power, the charger will maintain the lead-acid batteries.

- The shore power will then charge the lithium-iron batteries until meeting either of the following conditions before switching back to charge the lead-acid batteries:

1. *The lithium-iron batteries have remained at or above 98% SOC for one hour.*

2. *The lithium-iron batteries have been charged for six hours.*

NOTICE: If the shore power is connected while the engine is in operation, the engine will be switched off automatically.

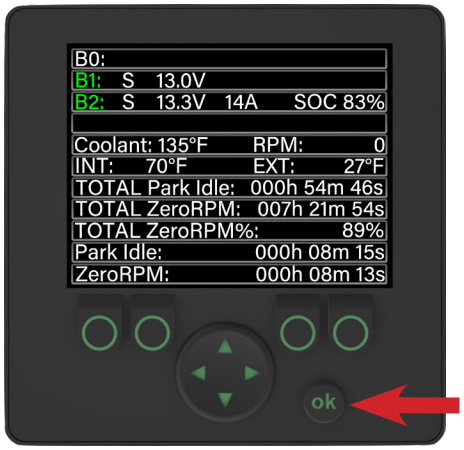
Section 12: Information Screens

Section 12.1: Primary Information Screen

The IMS allows the operator to monitor many aspects of the vehicle in real time.

NOTICE: You can access the primary information screen by pressing and holding the OK softkey for two seconds.

- **Battery Voltage:** The system is able to monitor two battery banks installed on the vehicle. The IMS monitors both the chassis battery and the hybrid battery pack. See Sections 12.1.1-12.1.4 for more information.
- **Vehicle RPM:** This indicates the engine revolutions per minute taken from the vehicle's CAN bus when the engine is running. It will read "0" when the engine is turned off.
- **Coolant:** This indicates the actual temperature of the engine's coolant taken from the vehicle's CAN bus. If the information is not available, it will display "-40" as a value.
- **INT:** The interior temperature is provided by a ZeroRPM sensor that has been installed in the cab for monitoring the temperature of the cab.
- **EXT:** The exterior temperature is received from the vehicle's CAN bus if it is available. If the information is not available, it will display "-40" as a value.
- **Idle Time:** The idle time is a count (in seconds) of how much time the vehicle has been in Park or Neutral with the engine idling.
- **KEY IN IM:** This indicates the amount of time the system has been in Idle Mitigation Mode since the last system shutdown. It will accumulate throughout the day until the system is turned off.



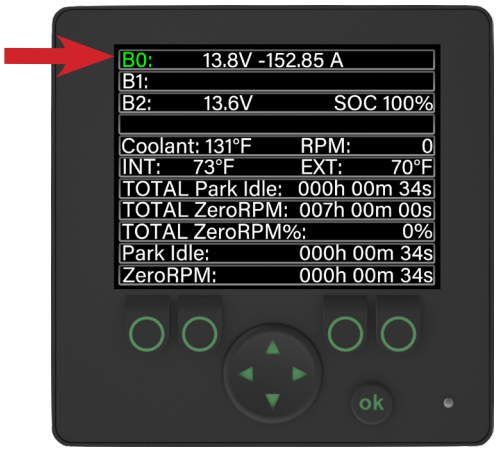
Section 12.1.1: B0

B0 represents the chassis lead-acid battery.

- B0 is displayed only when the system is connected to the chassis lead-acid batteries. The lead-acid batteries are connected under the following circumstances:

1. *The operator turns the ignition switch on but does not start the vehicle.*
2. *The vehicle is connected to shore power. The connection is intermittent based on the charging logic.*
3. *The engine is being used by the charging logic to ensure proper battery maintenance.*

- If connected, B0 will read a higher voltage when the engine is running due to the chassis alternator's charging voltage.
- If connected, B0 will read a higher voltage when shore power is plugged in due to the IMS charger's charging voltage.
- B0 and B1 are displayed in the same location on the screen. They will never appear at the same time.



Section 12.1.2: B0 Current

B0 current will typically display negative amperage (as low as -10A) when the engine is running.

- This is the amount of current going into the lead-acid batteries.

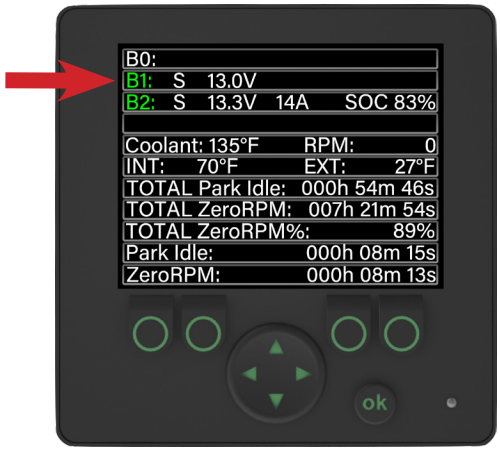
Section 12.1.3: B1 and B2

B1 represents the IMS's 12V lithium batteries.

- B1 is displayed in place of B0 when the 12V lithium batteries are connected. If B1 is displayed, B0 is no longer being monitored.
- B1 will be connected with the engine running if the charging logic has determined that the 12V lithium batteries need to be charged (via the chassis alternator).
- B1 will be connected when Idle Mitigation Mode is engaged unless the hybrid disconnect is pressed.
- B1 will be connected after the lead-acid batteries have been charged for 30 minutes. When the lithium-iron batteries have remained at or above 98% SOC for one hour, or when they have been charged for six hours, the charging will switch back to the lead-acid batteries.

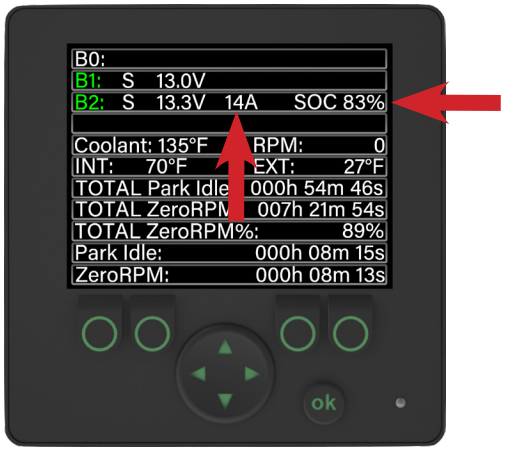
B2 represents the batteries (whether switching or non-switching) that provide energy for the A/C compressor, external motor, battery equalizer, *etc*.

- B2 is always displayed on the primary information screen.
- B1 and B2 are in parallel any time the voltage is 12V nominal.



Section 12.1.4: B2 Current and State of Charge

- B2 current is provided by the current shunt inside the IMS lithium battery enclosure.
- B2 current will display positive amperage if the IMS is running the auxiliary A/C compressor and/or providing energy to the chassis (*i.e.* discharging the lithium batteries).
- B2 current will display negative amperage if the battery is being charged by the engine or by shore power (*e.g.* charging the lithium batteries).
- B2 current will read either positive or negative amperage and should be disregarded when the system is connected to B0.
- State of Charge (SOC) is the remaining usable energy contained within the lithium batteries. This value is located next to the B2 current.
- SOC is calculated using only B2. Neither B0 nor B1 is factored into this percentage.



Section 12.2: Information Screen 1

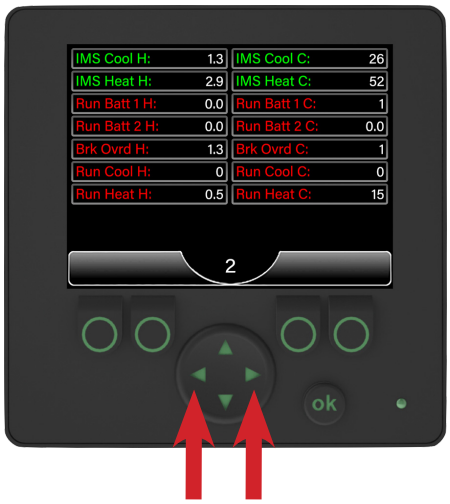
NOTICE: Switch between Information Screens 1 through 4 using the Left and Right arrow soft keys. Pressing the "OK" button at anytime will jump back to the home screen. When the values turn green on the screen, this means that the value is being actively counted.

- **VIN:** The Vehicle Identification Number.
- **Date:** The current date (if Intellimetrics is equipped).
- **Time:** The current time (if Intellimetrics is equipped).
- **Key Life H:** The total number of hours the ignition switch has been on.
- **Idle Mitiga H:** The total number of hours spent in Idle Mitigation Mode.
- **All Idling H:** The total number of hours the vehicle has idled.
- **All Run H:** The total number of hours the engine has run above the maximum idle set point (any gear).
- **P/N Idling H:** The total number of hours the engine has idled in Park or Neutral with RPMs below the maximum RPM set point.
- **P/N Run H:** The total number of hours the engine has idled in Park or Neutral with the RPMs above the maximum RPM set point.
- **Into Drive C:** The total number of times the transmission has been placed in Drive.
- **Accl OvRd C:** The total number of times the accelerator has been used to override the engine shutdown countdown.
- **Pwr Only H:** The total number of hours the IMS has been in Monitor Mode (engine off but not doing anything specific such as requesting heat or A/C).
- **Pwr Only C:** The total number of times the IMS has been in Monitor Mode (engine off but not doing anything specific such as requesting heat or A/C).

12.3: Information Screen 2

NOTICE: Switch between Information Screens 1 through 4 using the Left and Right arrow softkeys.

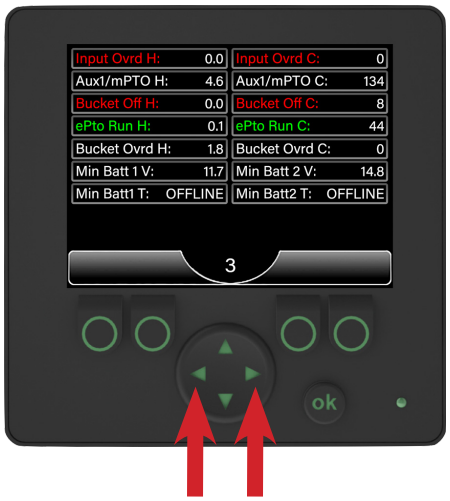
- **IMS Cool H:** The total number of hours the IMS has run for A/C.
- **IMS Cool C:** The total number of times the IMS has run for A/C.
- **IMS Heat H:** The total number of hours the IMS has run for heat.
- **IMS Heat C:** The total number of times the IMS has run for heat.
- **Run Batt 1 H:** The total number of hours the engine has run to charge Battery 1.
- **Run Batt 1 C:** The total number of times the engine has run to charge Battery 1.
- **Run Batt 2 H:** The total number of hours the engine has run to charge Battery 2.
- **Run Batt 2 C:** The total number of times the engine has run to charge Battery 2.
- **Brk Ovrd H:** The total number of hours the brake has been used to override the engine shutdown countdown.
- **Brk Ovrd C:** The total number of times the brake has been used to override the engine shutdown countdown.
- **Run Cool H:** The total number of hours the engine has run for A/C.
- **Run Cool C:** The total number of times the engine has run for A/C.
- **Run Heat H:** The total number of hours the engine has run for heat.
- **Run Heat C:** The total number of times the engine has run for heat.



Section 12.4: Information Screen 3

NOTICE: Switch between Information Screens 1 through 4 using the Left and Right arrow softkeys.

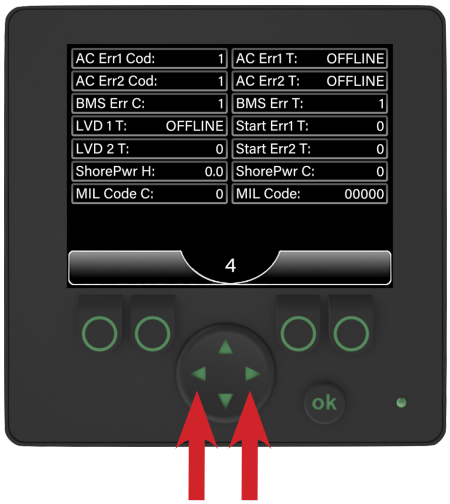
- **Input Ovrd H:** The total number of hours an input over CAN has overridden the IMS and forced the engine to run.
- **Input Ovrd C:** The total number of times an input over CAN has overridden the IMS and forced the engine to run.
- **Aux1/mPTO H:** The total number of hours mPTO has been on.
- **Aux1/mPTO C:** The total number of times mPTO has been selected.
- **Bucket Off H:** The total number of hours the boom (if equipped) has been out of stow while in Idle Mitigation Mode.
- **Bucket Off C:** The total number of times the boom (if equipped) has been out of stow while in Idle Mitigation Mode.
- **ePto Run H:** The total number of hours ePTO has been on (if a hybrid electric motor is equipped).
- **ePto Run C:** The total number of times ePTO has been selected (if a hybrid electric motor is equipped).
- **Bucket Ovrd H:** The total number of hours the start/stop function has been used to disengage Idle Mitigation Mode and start the engine.
- **Bucket Ovrd C:** The total number of times the start/stop function has been used to disengage Idle Mitigation Mode and start the engine.
- **Min Batt 1 V:** The lowest voltage read from Battery 1 (checks every 20 seconds and records the lowest number).
- **Min Batt 2 V:** The lowest voltage read from Battery 2 (checks every 20 seconds and records the lowest number).
- **Min Batt1 T:** The time the minimum voltage from Battery 1 was recorded (comes from CAN remote time).
- **Min Batt2 T:** The time the minimum voltage from Battery 2 was recorded (comes from CAN remote time).



Section 12.5: Information Screen 4

NOTICE: Switch between Information Screens 1 through 4 using the Left and Right arrow softkeys.

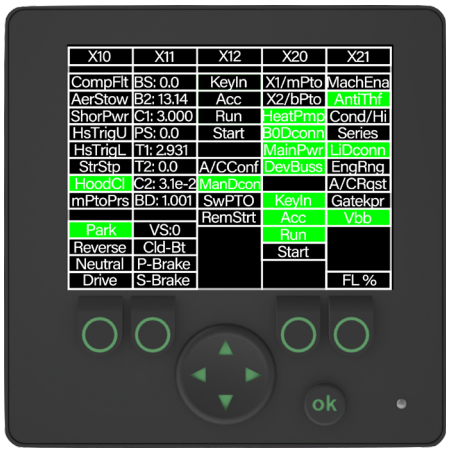
- **AC Err1 Cod:** The most recent auxiliary A/C error code.
- **AC Err1 Tim:** The time of the most recent auxiliary A/C error code.
- **AC Err2 Cod:** The second most recent auxiliary A/C error code.
- **AC Err2 Tim:** The time of the second most recent auxiliary A/C error code.
- **BMS Err C:** The most recent BMS error code.
- **BMS Err T:** The time of the most recent BMS error code.
- **LVD 1 Time:** The time of the most recent occurrence of the remote disconnect opening due to low voltage.
- **Start Err1 T:** The time of the most recent start error (after five attempts at 10-second intervals).
- **LVD 2 Time:** The time of the second most recent occurrence of the remote disconnect opening due to low voltage.
- **Start Err2 T:** The time of the second most recent start error (after five attempts at 10-second intervals).
- **ShorePwr H:** The total number of hours a 110V connection has been plugged into the shore power port.
- **ShorePwr C:** The total number of times a 110V connection has been plugged into the shore power port.
- **MIL Code C:** The total number of Malfunction Indicator Light (MIL) codes present.
- **MIL Code:** The MIL code at the top of the list sent from the vehicle.

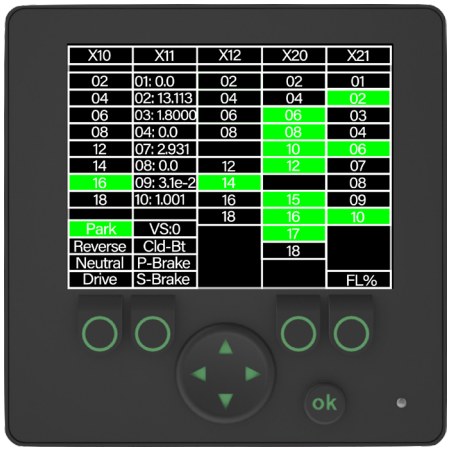


Section 13: Input/Output Screens

The input/output screens display the signals of each pin-out on the IMS controller. For a glossary of the signals displayed on these screens, see Section 13.1.

- To access the input/output screens, press the Down arrow while the primary information screen is displayed.
- *The text-based screen will be displayed by default. You can switch to a numerical display using the Right arrow and return to the textual display using the Left arrow.*
- A green background indicates that a position is active. Any positions with black backgrounds are inactive.
- Column X11 does not follow the same nomenclature as the other columns because it contains varying analog signals.





Section 13.1: Signal Glossary

Section 13.1.1: Inputs

X10	
CompFlt	Compressor Fault
AerStow	
ShorPwr	Shore Power #1
HsTrigU	Shore Power #2
HsTrigL	
StrStp	Start/Stop
HoodCl	Hood Closed
mPtoPrs	ZeroDRAW Status

X11	
BS:	Blower Speed (Analog)
B2:	Remote Battery Sense
C1:	Current Sensor 1 (Analog)
PS:	A/C Pressure Switch (Analog)
T1:	Temperature Sensor 1 (Analog)
T2:	AUX HVAC Input
C2:	ZeroDRAW Sense
BD:	Blend Door (Analog)

X12			
	J1939	**Ford**	**Ram**
KeyIn	Run (Ignition Input)	Key In (Ignition Input)	Key In (Ignition Input)
Acc	Accessory (Ignition Input)	Accessory (Ignition Input)	
Run	Start (Ignition Input)	Run (Ignition Input)	
Start		Start (Ignition Input)	
A/CConf	A/C Confirm		
ManDcon	Manual/Hybrid Disconnect		
SwPTO	Manual ZeroKEY Switch		
RemStrt	Remote Start		

Section 13.1.2: Outputs

X20			
X1/mPTO	Charger Interrupt		
X2/bPTO	Battery Heat/BEQ Enable		
HeatPmp	Coolant Pump/Heater		
B0Dconn	Battery 0 Disconnect (Lead Acid Disconnect)		
MainPwr	Main Power		
DevBuss	Device Buss		
	J1939	**Ford**	**Ram**
KeyIn	Run (Ignition Input)	Key In (Ignition Input)	Key In (Ignition Input)
Acc	Accessory (Ignition Input)	Accessory (Ignition Input)	
Run	Start (Ignition Input)	Run (Ignition Input)	
Start		Start (Ignition Input)	

X21	
MachEna	Secondary Fuel-fired Heater Interlock, ZeroIDLE Alarm
AntiThf	ZeroKEY Module
Cond/Hi	Condenser Fan High
Series	Battery 2 Series/Parallel, Remote Disconnect #2
LiDconn	Remote Disconnect #1
EngRng	ZeroDRAW Shutdown
A/CRqst	A/C Request
Gatekpr	Engine Running/High Idle
Vbb	Battery Positive 25A

Section 13.1.3: Communication Connections

P/N1	
Pin 1	Main Power
Pin 2	Chassis Ground
Pin 3	CAN 1 Low
Pin 4	CAN 1 High
Pin 5	CAN 2 Low
Pin 6	CAN 2 High

N2	
Pin 1	Jumper (Pin 5)
Pin 2	Screen/Temperature Sensor Ground
Pin 3	RS-232 RxD
Pin 4	RS-232 TxD
Pin 5	Jumper (Pin 1)
Pin 6	Open - No Signal

Section 13.2: Screen/Controller Signal Locations