

WARNING

To minimize risk of serious injury, death or damage, before using MotoCrane UPC, all drivers and operators must read this Operation Manual and all on-product labels.




All practices and procedures stated herein are required for the proper and safe operation of the UPC.

If there are any questions, please contact MotoCrane Support at support@motocrane.com.

Keep this Operation Manual near your UPC for future reference.

Safety Signal Words

This manual and the safety labels attached to this equipment utilize signal words that signify safety hazards with different levels of severity. The words are preceded by a triangle signifying that these are safety related. Below are the words used and the definitions for these words:

-  **WARNING** indicates a hazardous situation which, if not avoided, could result in death or serious injury or damage
-  **CAUTION** indicates a hazardous situation which, if not avoided, could result in minor or moderate injury or damage
-  **NOTICE** is used to address practices not related to physical injury

The terms IMPORTANT and NOTE are also used to describe ideas for better and more efficient use of the UPC.

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Before the First Drive

Do the following before using the UPC for the first time.

1. Read this Operation Manual
2. Read the Warranty in the Terms of Sale
3. Watch any available video tutorials at www.motocrane.com/support
4. Recommended: Attend MotoCrane Training for in-person demonstration

IMPORTANT PRODUCT AND SAFETY INSTRUCTIONS

Safety

The MotoCrane UPC is not a toy and can cause serious injury, death or damage if not used properly. You must exercise caution during use of the UPC to ensure a safe filming environment for everyone. This Operation Manual describes safe operation and should be read in conjunction with the applicable online training videos or additional in-person training.

IMPORTANT: Restricted Use Statement

The UPC must only be used by trained operators 18 years of age or older. Only appropriate motor vehicles driven on a closed course with paved or finished surfaces (for example, asphalt, concrete, or tarmac) or moderate off-road (for example, gravel or dirt roads) conditions may be used. In addition, the speed and acceleration of the motor vehicle must not exceed system ratings for MotoCrane products as set forth in this Operation Manual.

Do not modify or adjust the UPC. The UPC has been calibrated before it is shipped to you. No modification or adjustment to the UPC is allowed without the express written approval of MotoCrane, LLC.

Disclaimer and Limitations of Liability

You agree that you are responsible for your own conduct and any content created while using the UPC, and for any consequences thereof. You agree to use this product only for purposes that are proper and in accordance with local laws, regulations or other legal requirements.

You also agree:


1. Any part of this disclaimer is subject to change without prior notice. Refer to www.motocrane.com/support for the latest version.
2. MotoCrane, LLC reserves the right of final interpretation of this disclaimer.
3. MotoCrane, LLC has no control over the use, setup, assembly, modification or misuse of the UPC, and therefore no liability shall be assumed or accepted by

MotoCrane, LLC for any resulting damage, death, or injury incurred directly or indirectly from the use of the UPC. By the act of use, setup or assembly, the user accepts all resulting liability.

Limited Warranty

The UPC has a limited manufacturer's warranty on parts and assembly. See the Terms and Conditions of Sale for your UPC for a complete description of this limited warranty. This Limited Warranty is incorporated by reference into this Operation Manual.

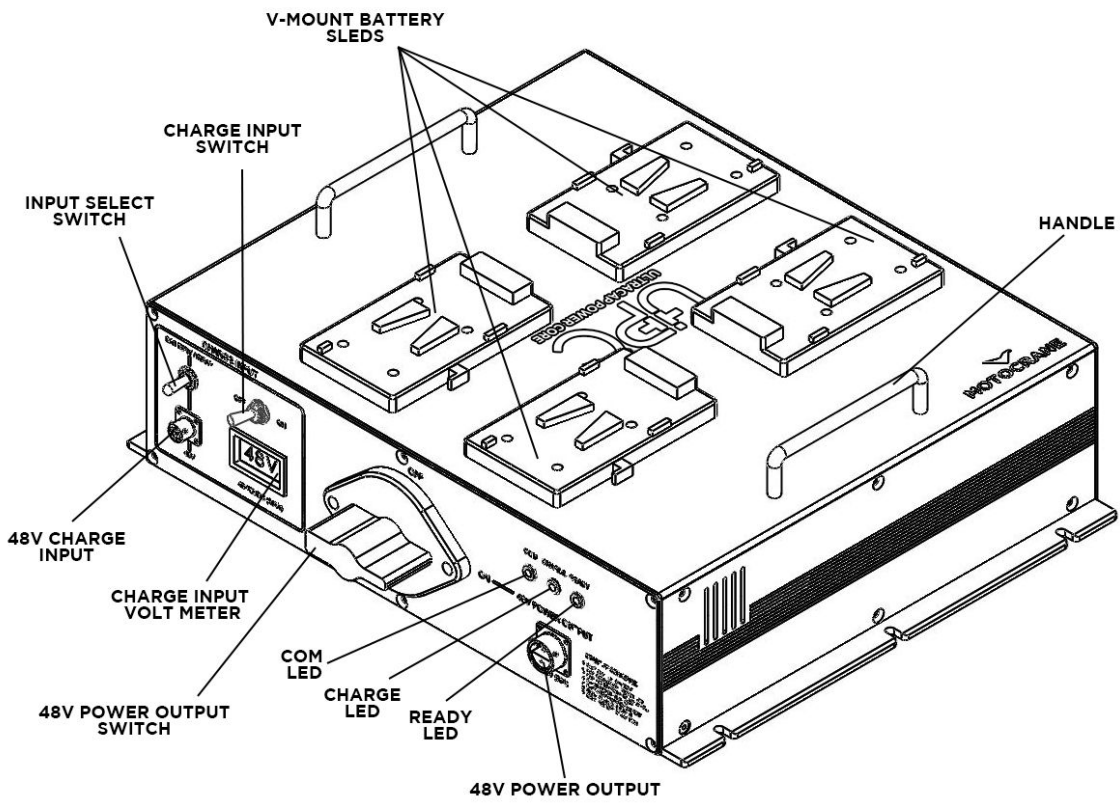
Intellectual Property

MotoCrane™, UPC, and  **MOTOCRANE** are trademarks of MotoCrane, LLC. You may not use the trademarks of MotoCrane, LLC without express written permission. All rights reserved.

Parts of the UPC

- UPC Module
- 10' Power Output Cable

UPC System Overview



Setting up the UPC

UPC Setup at a Glance

Below is the proper start-up sequence of the UPC. A summary of this procedure is also indicated on the front panel of the UPC (labeled "STARTUP SEQUENCE"):

1. Confirm all switches are in the OFF position.
2. Connect the charge input power source (48V input socket or 4 V-Mount batteries on the top lid).
3. Select the appropriate power source with the INPUT SELECT SWITCH, make sure the voltmeter shows expected voltage.
4. Connect the UPC output cable to the PSU. Make sure the PSU MAIN PWR switch is in the OFF position.
5. Turn the CHARGE INPUT SWITCH ON.
6. Turn the 48V POWER OUTPUT SWITCH ON to begin charging the ultra-capacitors. Allow around 4min to charge. Once the READY LED turns green, Turn ON the PSU MAIN PWR switch. Make sure that the PSU voltmeter displays 48V and that the COM LED on the UPC turns on.

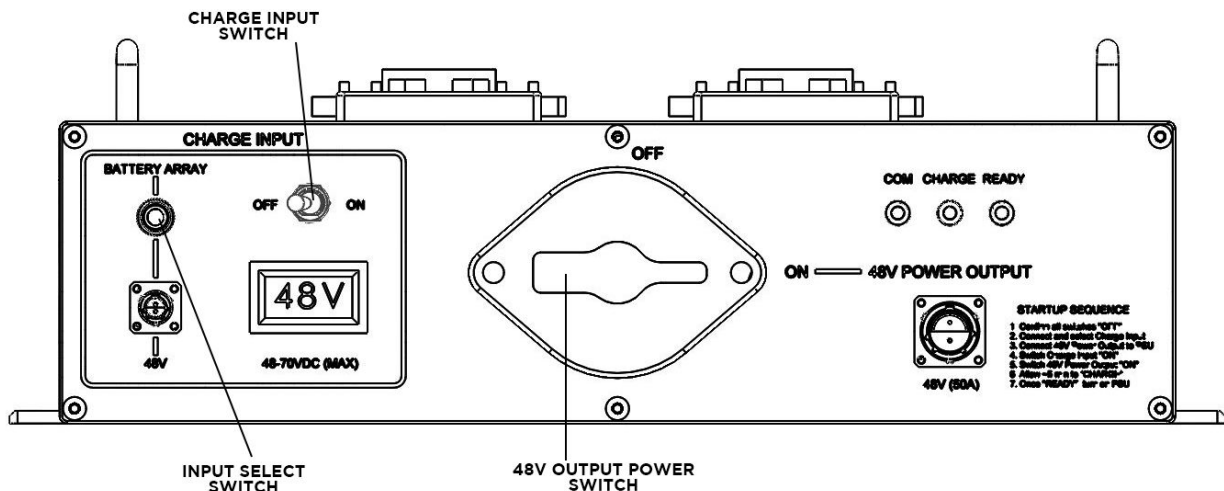
⚠ WARNING: Failure to follow these instructions and those below can result in serious injury, death or damage.

These instructions will be demonstrated in our training videos and found online at www.motocrane.com/support. All terminology is referred to in the above diagrams.

Setup Process

NOTE: UPC setup should occur before the MotoCrane Power Supply Unit (PSU) setup. See ULTRA Operation Manual for more information.

There are three switches on the UPC front panel, as shown below:



To properly power on ULTRA with the UPC, the switches must be activated in the following sequence:

1. Choose input with the INPUT SELECT SWITCH
2. Turn on the COM circuitry with the CHARGE INPUT SWITCH
3. Charge the ultra-capacitor bank with the 48V POWER OUTPUT SWITCH

The INPUT SELECT SWITCH allows the user to select between two power sources:

- an external 48V input (such as the 12VA)
- the BATTERY ARRAY (V-Mount) input.

To select the 48V external input, 48V power source must be connected to the 48V INPUT socket (under the switch) and the INPUT SELECT SWITCH must set towards the 48V socket. At this stage, the input voltmeter should display the input voltage (48V).

To select the BATTERY ARRAY input, all four V-Mount batteries must be connected to their mounting plate on the top lid of the UPC and the INPUT SELECT SWITCH must be set towards the BATTERY ARRAY label. The input voltmeter should display the series voltage of the four V-Mount batteries (from 50V to 67V, depending on the charge levels of the batteries).

NOTICE While BATTERY ARRAY input is selected, the UPC will not turn on without 4 V-Mount batteries connected.

The CHARGE INPUT SWITCH turns on the circuitry that allows the UPC to self-diagnose and communicate with ULTRA. This gives the user insight on the different UPC parameters (input battery voltage levels, ultra-capacitor temperatures and charge, power consumption etc.). Refer to the 'UPC Features' section to see all the UPC parameters and data displayed on the ULTRA controller.

The 48V POWER OUTPUT SWITCH electrically separates the ultra-capacitor bank to the rest of the UPC. To begin charging the bank, turn this switch to the ON position. When the ultra-capacitors are charging, the CHARGE LED will be yellow. The LED will clear once the ultra-capacitors are fully charged. Note that the ultra-capacitor bank does not need to be charged to its maximum voltage (29V) to power on ULTRA. Once the bank reaches a voltage of 21V, the UPC is ready to power ULTRA through the PSU. The READY LED will turn green when the ultra-capacitor bank reaches 21V, notifying the user that the UPC is ready to power up ULTRA (the PSU switch MAIN power can be turned on).

CAUTION Wait until the READY LED turns green before turning on the PSU.

NOTICE During normal operation, the UPC will expend energy stored in the ultra-capacitors, causing the yellow CHARGE LED to turn on. This is normal but can indicate a temporary decrease in performance until recharging is complete. Please refer to the indicators on the controller to determine state of charge.

NOTES ON ULTRA-CAPACITOR CHARGING

The time it takes to charge the ultra-capacitors depends on the initial voltage level of the bank. If the UPC has not been used for more than a day, the voltage levels of the ultra-capacitors should be relatively low (less than 6V) and it will take around 4 minutes to charge to 21V (READY LED turns on) and around 5 minutes to charge to 29V (maximum voltage).

CAUTION If a fault occurs while the ultra-capacitors are charging, the CHARGE LED will change from yellow to RED. Do not power on the PSU if the CHARGE LED is RED, and immediately turn the 48V OUTPUT POWER SWITCH to the OFF position.

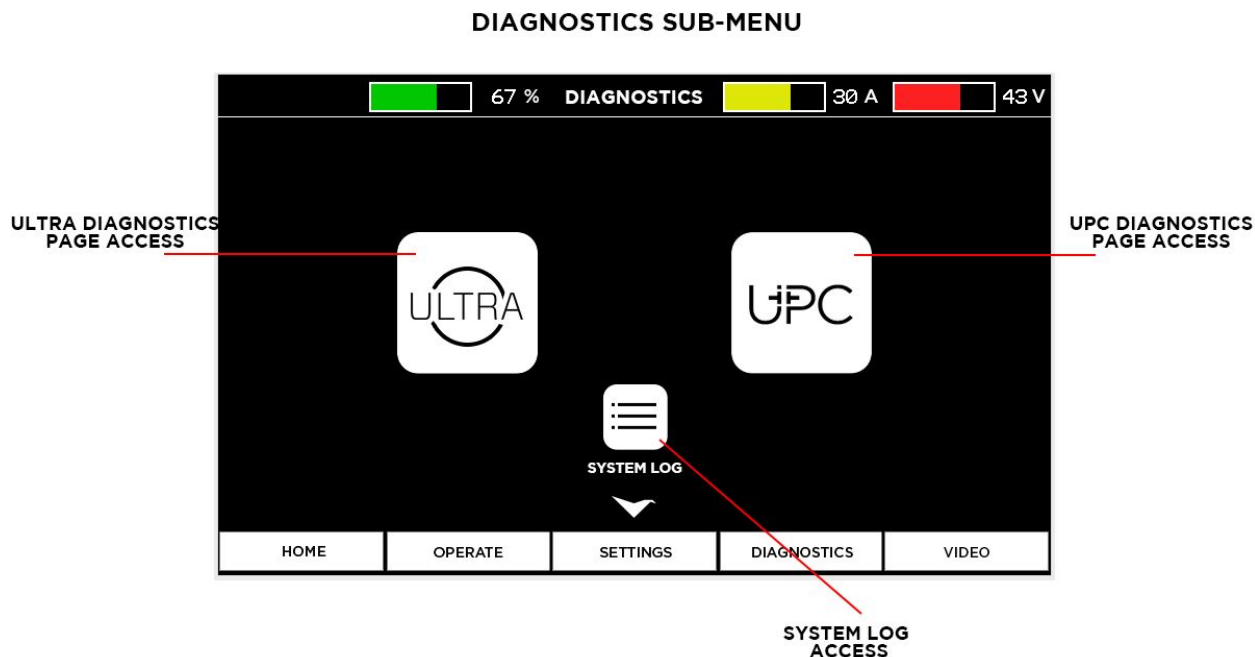
NOTICE If ULTRA is not connected to the UPC when the fault is occurring, the UPC will beep. Otherwise, the controller will beep.

Using the UPC

The UPC is a high power device, capable of providing power to MotoCrane ULTRA, even during the most demanding applications. The UPC is designed to provide a user experience continuous with that of a conventional battery. However, with the UPC there are some features and protections that the user should recognize in order to ensure safe and reliable operation. The UPC has built in intelligence and self-diagnostics, just like the rest of the ULTRA system. The user can access UPC diagnostics and real-time information from the ULTRA Controller GUI. Please see the 'UPC Interface' section for reference on the information contained within the UPC Diagnostics portion of the GUI.

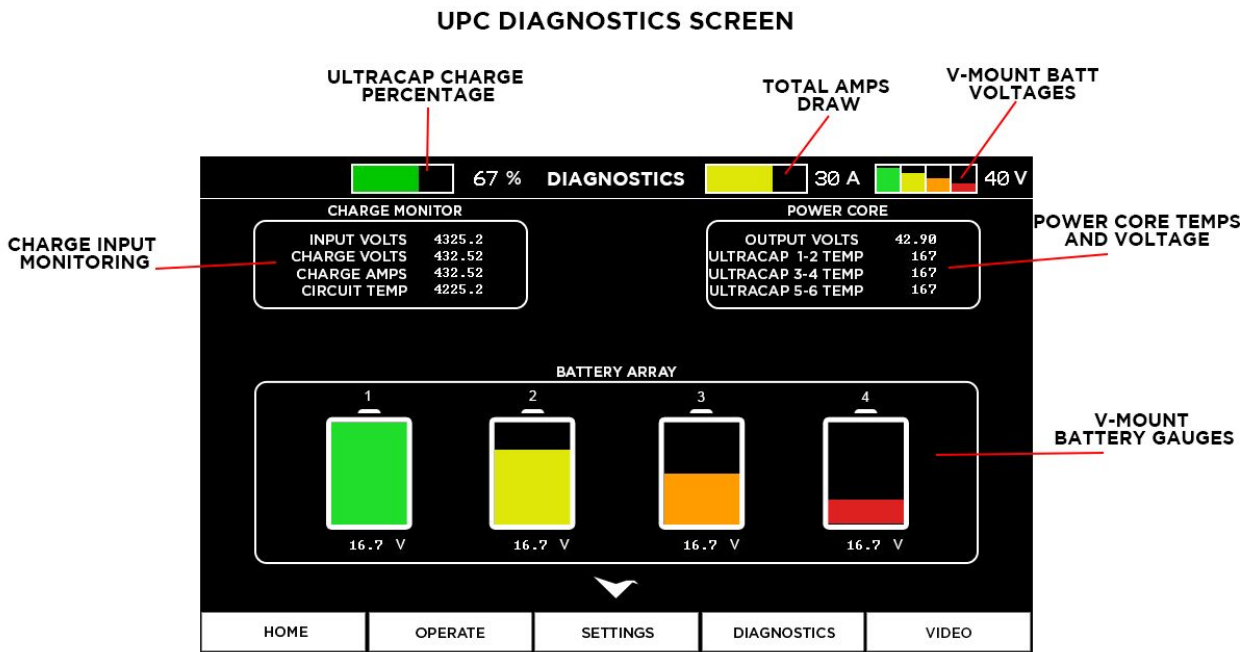
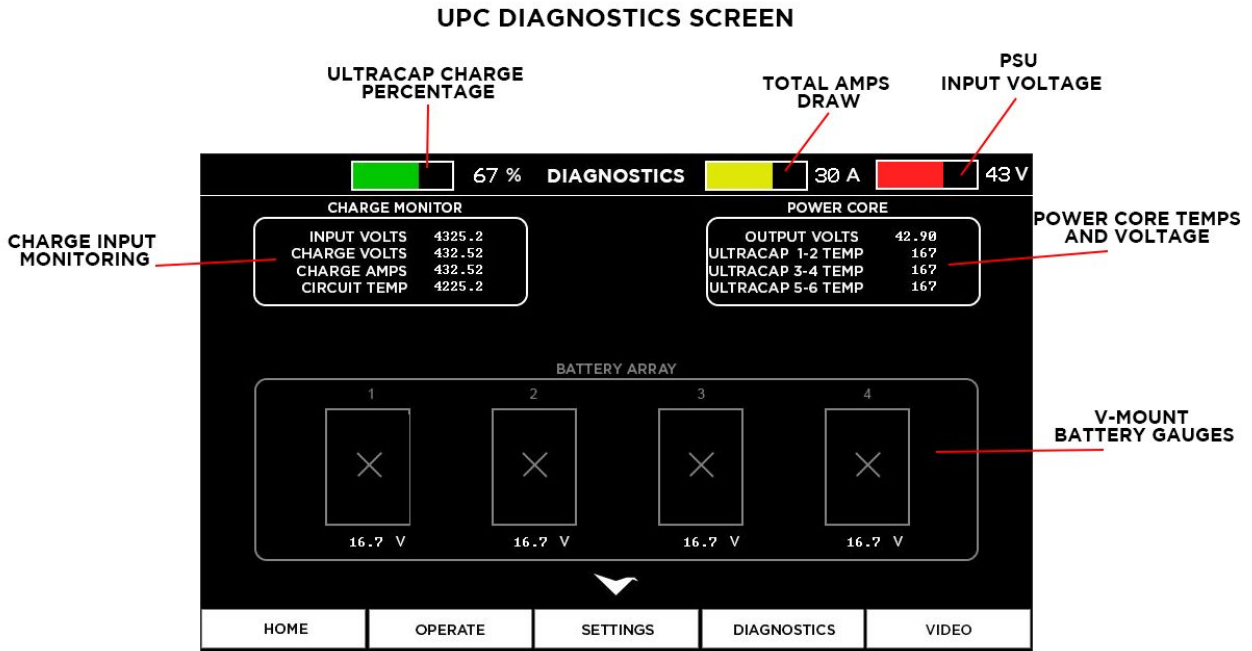
UPC Interface

The upgraded ULTRA Controller GUI redirects all DIAGNOSTICS buttons to a new DIAGNOSTICS sub-menu, shown below. The standard ULTRA DIAGNOSTICS can be entered by pressing the button on the left, while the new UPC DIAGNOSTICS can be accessed by pressing the button on the right. SYSTEM LOG information about both pieces of the system can be accessed through the SYSTEM LOG button on the DIAGNOSTICS sub-menu. For further information about standard ULTRA DIAGNOSTICS features and general GUI organization, please refer to the ULTRA Operation Manual.



The UPC DIAGNOSTICS page is shown in the following figures. Depending on the configuration of the UPC, the V-Mount battery gauges may or may not be present. If you are using the 4 V-Mount batteries as the power input source of the UPC, you will

see real-time battery level information. If you are using the 12VA as an input source, the battery gauges will be absent. Note the differences in the following figures:



***Numeric Battery Array voltages should be used for reference only, as actual voltage may differ by up to 300mV (.3 volts)

Known Hazards

WARNING

The following list represents a list of known hazards that exist when operating the UPC. This is not exhaustive, but represents some common hazards to watch out for.

- **UPC mounting.** The UPC should not be subject to movement relative to the vehicle during operation. Make sure the UPC is secured and does not slide. Keep any moving objects away from the UPC switches.
- **Input power source.** Make sure the power source input is robustly connected to the UPC. For the 48V external input, make sure the power source is properly mounted (no sliding). For the Battery Input source, makes sure the V-Mount batteries are correctly installed on the mounting plates.
- **User awareness.** The user should be aware of the different UPC parameters, warnings and errors displayed on the controller. If the controller is not connected to the UPC, the user should pay close attention to the LEDs on the UPC front panel.
- **Capacitor charge level.** The user should be monitoring the ultra-capacitor charge level gauge at all time. Do not let the ultra-capacitors discharge below 0%. The ULTRA controller will notify the user with a warning/error when the charge level is getting too low.

Transporting the UPC

- All switches must be in the OFF position,
- 48V external input and/or V-Mount batteries should be disconnected from the UPC
- storage temperature between -40°C and 70°C

Troubleshooting

Diagnosing with COM and CHARGE LEDs

The UPC contains three LEDs to assist in operating the unit safely, as well as to assist with debugging in the event that an issue arises. The COM LED will turn on when the UPC electronics are successfully communicating on the CAN-bus with the other parts of the ULTRA system. Keep in mind that the 48V POWER OUTPUT SWITCH needs to be turned ON for the electronics in the UPC to function. For the COM LED to be present, the following conditions must be satisfied:

1. The UPC is connected to the ULTRA PSU, and the ULTRA system is fully connected (i.e. all cables are connecting the ULTRA modules to the PSU)
2. INPUT SELECT SWITCH is set to the correct source of power (e.g. set to 'BATTERY ARRAY' if 4 V-Mount batteries are connected)
3. CHARGE INPUT SWITCH is turned ON
4. 48V POWER OUTPUT SWITCH is turned ON
5. Ultracapacitor bank is charged to at least 21V
6. The ULTRA PSU MAIN POWER INPUT SWITCH is turned ON

If all of these conditions are satisfied, and the COM LED is off, this indicates that either the electronics in the UPC have stopped functioning properly, or a wiring issue has developed that prevents normal communication to occur. If COM LED issues are occurring elsewhere in the ULTRA system, please refer to the ULTRA Operation Manual for further debugging.

Under normal situations the CHARGE LED will be either a yellow color (while charging), or completely off. If a problem arises within the UPC that affects the charging circuit, the CHARGE LED will turn RED. If this happens, please turn OFF the 48V POWER OUTPUT SWITCH and contact MotoCrane Customer Support for further debugging and diagnostic procedures.

Note that if a fault occurs when ULTRA is not connected to the UPC (PSU is not connected), the CHARGE LED will buzz in addition to turning RED.

Diagnosing with GUI Warning and Error Messages

ULTRA has multiple internal sensors and an error reporting system built into the GUI. The UPC shares this error and warning reporting infrastructure and allows the user to monitor these events via the Controller GUI. If an active error or warning is present, the respective red or yellow icon will be displayed. A yellow icon indicates a warning, and the controller will beep once to alert the user. A red icon indicates an error, and the controller will beep repeatedly until the icon is touched or the DISARM physical switch is pressed by the user. Touching the error or warning icon will bring you to the Status page, where you can see a list of active errors and warnings. If you are experiencing an intermittent issue, and the warning or error is not currently active, you can review events by navigating to the System Log, which is accessible through the Diagnostics page. The System Log will also provide a list of errors and warnings that have occurred, along with the time since the event occurred (in 2 minute increments). Note that the System Log will only hold the most recent 10 events. Note that the system log events are retained upon power cycle, but all time information is lost. From either the Status or System Log page, you can access the Code Lookup Table, which will provide you with a short description of the error or warning and a recommended first step for troubleshooting and clearing the issue. For reference, the 'Controller - GUI' section of the ULTRA Operation Manual shows the location of the System Log and Code Lookup

buttons within their respective pages. More detail is given below about each error message along with a description of what to try if the first step does not work.

**When debugging any error or warning, first ensure that all cables are properly connected and check the status of the COM and CHARGE LEDs

Code	Description	Service	Details
142	Power Accessory Input Voltage Warning	<ul style="list-style-type: none"> • Ensure correct voltage of input power source 	If using 4 V-Mount batteries, this warning will be triggered if the input voltage is below 51V or if a single V-Mount battery's input voltage is below 12.8V. If using the 48V input, this warning will be triggered if the input voltage is below 46V.
143	Power Accessory Input Voltage Error	<ul style="list-style-type: none"> • Ensure correct voltage of power source 	If using 4 V-Mount batteries, this warning will be triggered if the input voltage is below 49.5V or if a single V-Mount battery's input voltage is below 11.9V. If using the 48V input, this warning will be triggered if the input voltage is below 45V.
147	Power Accessory Over-Current Error	<ul style="list-style-type: none"> • Disarm system and remove power source • Ensure the proper power source is being connected 	The main UPC processor communicates with the current-limiting charging circuitry to ensure that the charging current amplitude never exceeds a certain level (9A). If this threshold is exceeded, this error will be triggered. If this error persists, contact Customer Support.
152	Power Accessory Over-Voltage Error	<ul style="list-style-type: none"> • Disarm system and remove power source • Ensure the proper power source is being connected 	The main UPC processor communicates with the current-limiting charging circuitry to ensure that the charging voltage amplitude never exceeds the maximum allowed voltage for the ultra-capacitor modules. If this threshold is exceeded, this error will be triggered. If this error persists, contact Customer Support.
154	Power Accessory Ultracap Level Warning	<ul style="list-style-type: none"> • Reduce use until the Ultracaps have the chance to charge more 	To ensure that the UPC is outputting 48V to power ULTRA, the ultra-capacitor bank must be within a certain window of voltages (21-29V). The percentage gauge

			on the ULTRA controller shows that voltage window mapped from 0 to 100%. If the percentage goes below 25%, a warning will be triggered.
155	Power Accessory Ultracap Level Error	<ul style="list-style-type: none"> • Discontinue movements immediately • Reduce use until Ultracaps have the chance to charge more 	To ensure that the UPC is outputting 48V to power ULTRA, the ultra-capacitor bank must be within a certain window of voltages (21-29V). The percentage gauge on the ULTRA controller shows this voltage window mapped from 0 to 100%. If the percentage goes below 10%, an error will be triggered.
157	Power Accessory COM Warning	<ul style="list-style-type: none"> • Disarm system and power cycle PSU and UPC 	Within the UPC, several communication channels exist. This warning indicates that the communication has been intermittent between the main UPC processor and the current-limiting charging circuitry. If a power cycle does not solve the issue, or the issue persists, contact Customer Support, as the electronics may be malfunctioning and require replacement.
158	Power Accessory COM Error	<ul style="list-style-type: none"> • Disarm system and power cycle PSU and UPC 	Within the UPC, several communication channels exist. This error indicates that the communication has been lost between the main UPC processor and the current-limiting charging circuitry. If a power cycle does not solve the issue, or the issue persists, contact Customer Support, as the electronics may be malfunctioning and require replacement.
162	Power Accessory Temp Warning	<ul style="list-style-type: none"> • Use caution and watch temperature in the Diagnostics page of the Controller GUI 	The charging circuit used to safely manage the ultra-capacitors generates significant heat while actively managing charging current. A certain amount of heat is normal. If the temperature exceeds a safe range, this warning will be triggered. If the warning is consistently triggered, contact Customer Support, as there may be an issue with your UPC.
163	Power	<ul style="list-style-type: none"> • Disarm and discontinue 	The charging circuit used to safely

	Accessory Temp Error	use until temp is reduced	manage the ultra-capacitors generates significant heat while actively managing charging current. A certain amount of heat is normal. If the temperature exceeds a maximum value, this error will be triggered. If the error is consistently triggered, contact Customer Support, as there may be an issue with your UPC.
164	Power Accessory Temp Sensor Failure	<ul style="list-style-type: none"> • Use caution - contact Customer Support 	The charging circuit used to safely manage the ultra-capacitors generates significant heat while actively managing charging current. A temperature sensor monitors this to ensure safe operation. If the sensor fails or becomes disconnected internally, this warning will trigger. Contact Customer Support for next steps.
173	Power Accessory Ultracap Temp Error	<ul style="list-style-type: none"> • Discontinue use - contact Customer Support 	The Ultracap modules themselves should not generate significant heat during normal operation. Under certain rare situations (such as a problem with the internal balancing circuit), an ultra-capacitor module could become damaged and produce heat. This situation is detected via internal temperature sensors. If this error persists after power cycling and allowing the temperatures to cool, please contact Customer Support for next steps.
174	Power Accessory - Ultracap Temp Sensor Failure	<ul style="list-style-type: none"> • Use caution - contact Customer Support 	An internal temperature sensor for the Ultracap modules has failed or become disconnected. The UPC should continue operating normally, but the temp sensor should be repaired as soon as convenient, to ensure the safe operation of the UPC. Contact Customer Support for next steps.
175	Power Accessory - Ultracap Sensor COM Failure	<ul style="list-style-type: none"> • Use caution - contact Customer Support 	The communication channel between the temperature sensing processor and the main UPC processor has been compromised. The UPC should continue operating normally, but the fault should

			be repaired as soon as possible. If power cycling does not fix this warning, please contact Customer Support for next steps.
181	Power Accessory Heartbeat Failure	<ul style="list-style-type: none"> Disarm system and power cycle PSU and UPC 	The heartbeat message is detected by the ULTRA Controller and is an indication that the UPC is functioning and communicating correctly. If this heartbeat signal is lost, error and warning reporting could be compromised. If power cycling does not solve the issue, please contact Customer Support for next steps.

If these steps don't fix your problem, please contact us at support@motocrane.com. We can help troubleshoot and diagnose the issue. If we determine that a manufacturing defect exists in a part and it is covered under the Limited Warranty, we will repair the unit at no cost to you. If your system is experiencing general wear and tear, we can advise on your options to get your system back to 100%. This includes potential upgrades, component replacement, or sending your unit back to MotoCrane Headquarters for a tune up.

Maintenance

None required - contact Customer Support if you believe the unit requires service or maintenance.

Weather & Water

The UPC is NOT WATER RESISTANT and should be kept out of direct sunlight to avoid unnecessary heat buildup within the unit.

Specifications

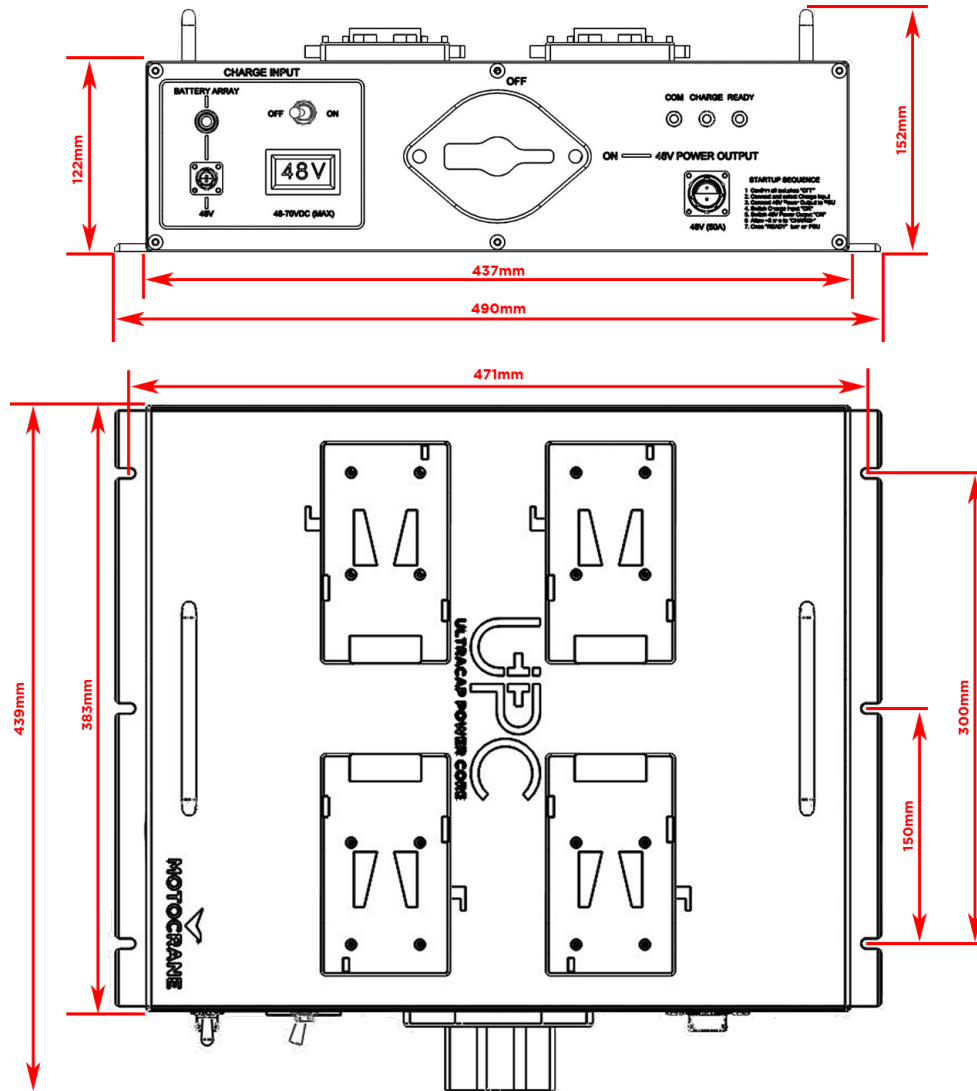
Mechanical
Module Weight
 UPC: 15lbs

Electrical
 UPC Output: 48V 50A peak, CAN-BUS Signal
 UPC Input: 4x V-Mount Battery or 48V 8A supply (12VA)
Certifications: CE, RoHS

Mounting/Dimensions of UPC

The UPC is equipped with a mounting flange that can be used for more permanent installation of the module. Make sure adequate room is given for cable and wire routing to the UPC, and for the easy install/removal of V-Mount batteries.

The UPC can be mounted in any orientation, but must be protected from water and direct sunlight.

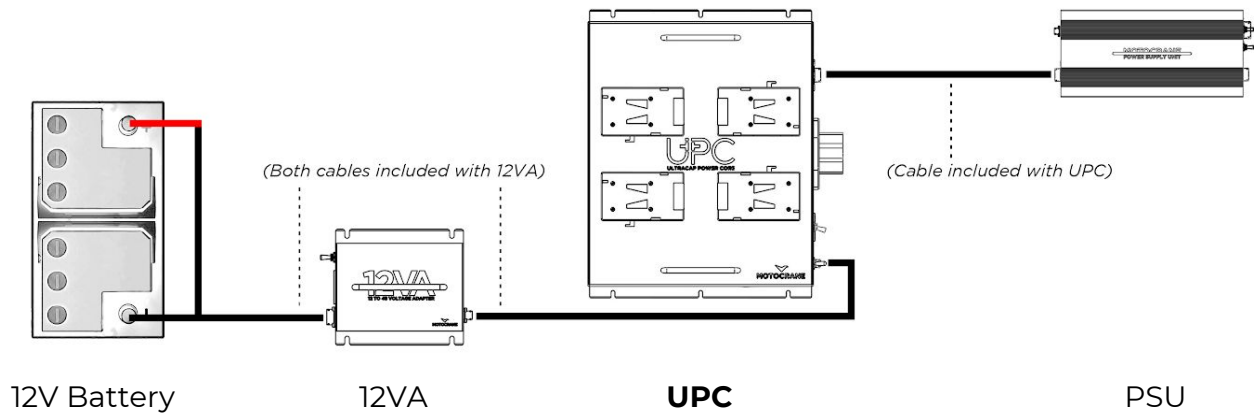


The 6x mounting flange clearance slots are designed for M6 or 1/4" bolts/screws.

UPC Connection Diagram

The UPC is used in conjunction with the 48V Power Supply (PSU) included with every ULTRA, and can also be used with the available 12VA accessory to use the 12V car battery/alternator as a charge input.

Use the diagram below to better understand how these various components are connected together:



Revision History

Revision	Date	Description
1.0	SEP, 2019	Initial Release

MotoCrane Support
support@motocrane.com

This content is subject to change.

Download the latest version from
www.motocrane.com/support

If you have any questions about this document, please contact MotoCrane, LLC by sending a message to contact@motocrane.com.

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