Long Ranger IV

(Used with Toyota Rav IV)

Operating Manual

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AC Propulsion Long Ranger™ Hybrid Trailer

General Trailer specifications:

Weight:	168-209Kg
Max Weight:	227Kg
Width:	1.27m
Length:	1.29m
Height:	0.76m
Toe out:	3.18mm
MPG typical:	20-30

Electrical:

Voltage output:	290-347VDC
Crowbar Voltage:	355V
Max power output:	22KW
Max efficiency:	90%

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Warning:

Never allow trailer to charge traction batteries to 100% S.O.C.

Never operate trailer with lid open, exhaust will damage paint and fiberglass. The lid may be removed by removing two hinge pins, disconnecting the light harness connector and remove the screw that holds the lid rope bracket to the fuel tank.

Never drive with the lid open or with it not fully latched down.

Trailer may over heat in power mode if stationary or moving slowly. Limit power operation to one minute or less while stationary.

Whenever possible toggle the trailer to idle mode for 30 seconds or more after power operation to allow alternator to cool down before shutting trailer off.

Trailer must be used with the special angle sensing hitch ball provided.

Safety features:

- Ignition shut off with loss of oil pressure.
- Auto shut off when engine coolant is over 110°C.
- RPM limited to below 8000 RPM.
- Voltage crowbar set to 355V.
- Voltage regulation limit set to 347V.
- Dual 100A fuses inside main traction battery pack.
- One 80A fuse accessible under vehicle above spare tire in sealed box.
- One 175A fuse for 12V feed to trailer located on vehicle firewall by Auxiliary battery.

Care and Maintenance:

For General Engine maintenance and service see Kawasaki Service Manual EN400/EN450

If trailer is to be stored for over a month disconnect the onboard 12V battery.

If trailer has been stored for over a few weeks with very little gas in gas tank fill tank up at least half way before attempting to start engine. This is to protect the fuel pump from running dry.

Before each use of the trailer, check coolant level (never check coolant when engine is hot) and oil level indicator on right side of engine. Oil level should be showing in viewing glass if trailer is on level ground. Check tire pressure it should be 50 PSI. Also inspect trailer for any damaged, missing or loose parts and look for any leaks.

Whenever filling up with gas check oil level and inspect trailer for any damage or leaks.

While operating in full power mode monitor trailer coolant temperature gauge and shut off the trailer if the temperature gets to hot, needle in red area, or if it rises too rapidly.

Recommended service schedule:
(Hour-meter is located on electronic panel)

Oil and filter change every 100 hrs of operation or every 12 months.

Change Coolant every 300 hours of operation or every 2 years.

Clean and inspect air filters every 100 hours of operation or every 12 months. Replace if necessary.

Clean and inspect spark plugs and wires every 50 hours of operation and replace if necessary.

Replace the inline fuel filter every 100 hours of operation or every 2 years.

Clean and inspect fuel pickup filter inside tank every 300 hours or 2 years replace if necessary.

Tire size 160/60R8
Engine air filter K&N part # KA R-1260
Alternator air filter AC Propulsion
Oil filter Kawasaki part # 16097-1066
Gas filter BMW part # 13641460450
Fuel pump strainer Borg Warner part # F3

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Procedure for Connecting Trailer:

1. Make sure the vehicle key is not in the switch.
2. Clean and grease trailer ball.
3. Align trailer with vehicle, drop hitch onto trailer ball and latch.
4. Feed trailer cable between vehicle hitch and right-hand hitch security chain, and back to the left side underneath vehicle hitch as shown in the diagram below.
5. Connect the trailer safety chain
6. Connect the trailer electric cable.

   CAUTION: The vehicle-side high-voltage connector will have battery voltage across the pins whenever the vehicle is in the ready mode. The trailer should never be connected or disconnected when the vehicle key is in the switch. The trailer should never be connected or disconnected when the engine on the trailer is running. The vehicle side high-voltage connector is equipped with a threaded cap. This cap should always be in place when the trailer is not connected.

   - Reach into cable tube at left rear of vehicle and pull vehicle-side connectors out from tube. A hook is provided to hold connectors in position.
   - Carefully align the high-power connector, push together and twist the threaded connector by hand until it is tight. **Do not cross-thread the connector.**
   - Align and push together the two halves of the red 12V power connector until they click together
   - Align and push together the two-halves of the white 12-pin signal connector until they click together.
   - Release the hook so the cable assembly is pulled back into the cable tube.
7. Secure the cable to the trailer hitch as shown in the diagram.
8. Secure the trailer hitch with the padlock.
9. Make sure the trailer lid is securely latched.

Operation of steering:

Active steering is active for as long as the vehicle ignition is on, the trailer engine does not need to be running. A warning horn will sound if trailer hitch angle is to sharp and about to jackknife or if backing up too fast, above 5 mph.

The trailer steering is entirely automatic and controlled by the TSD module. The vehicle should be driven as if no trailer is attached. Attempts to use standard trailering techniques for reversing or maneuvering in tight quarters are unnecessary and counterproductive.

The trailer steering responds to trailer yaw with respect to the vehicle as measured at the trailer hitch. Accordingly, steering inputs made while the vehicle is stationary are not recognized until the vehicle begins to move. For this reason, best driving practice uses gradual steering inputs while the vehicle is moving, even if very slowly.

The trailer steering geometry includes Ackermann Effect for toe-out on turns. This means the wheels gain toe-out as they deviate from straight-ahead position. This toe-out will cause wheel scrub and high pulling effort if the trailer is moved by hand with the wheels at any significant steering angle. Before the trailer is disconnected it is best to drive forward straight for 10 feet or more to ensure that the trailer wheels are tracking straight ahead.

AC Propulsion Long Ranger™ Hybrid Trailer

Operation of hybrid:

Before each use of the trailer, check coolant level (never check coolant when engine is hot) and oil level indicator on right side of engine. Oil level should be showing in viewing glass if trailer is on level ground. Check tire pressure it should be 50 PSI. Also inspect trailer for any damaged, missing or loose parts and look for any leaks.

In order to start the trailer push the rocker switch all the way up to the APU start position, while cranking the temperature meter's needle will go up to the red area. When the trailer starts to idle on its own the needle will returns to normal or low temp, at that time release the start switch. The trailer will continue idling at 3400 RPM for 40 seconds then go to full speed (7200RPM) mode and start generating power.

You may toggle between idle (2700 RPM, 0 Amps) and full speed (7200RPM, 70Amps max) mode by pushing rocker switch up and releasing. You may idle while stationary for any amount of time.

To stop trailer push rocker switch to down position, APU stop. It is recommended that the trailer be allowed to idle for 30 seconds or more to cool the alternator before shutting it down.

Options:

Adjustable voltage limit (via RS232) from 290V to 347V (it is currently set to 345V)
Adjustable power/current output (via RS232) from 0kW to 20kW (it is currently set to 20KW)

In order to use this option one three pin JST connector will need to be reconnected and a computer with serial out will have to send information to the LRI computer on the trailer.

Serial commands for limiting power/current (I_Lim) and voltage (V_Lim) consists of four bytes. The first one is the command, A5 in Hex. The second byte is the V_Lim 0 to 100 is 290V to 347V. The third byte is I_Lim 0 to 100 0=20kW, 100=0kW. The fourth and last byte is the checksum, it is the result of an exclusive OR operation (XOR) on the first three bytes. If a valid serial command is not received in three seconds the LRI computer will revert to the defaults, 315V and 20kW. We can provide a Labview VI program but you will need the Labview software in order to run it.

Temperature, RPM, O2 sensor and MAF sensor information are also available via RS232.

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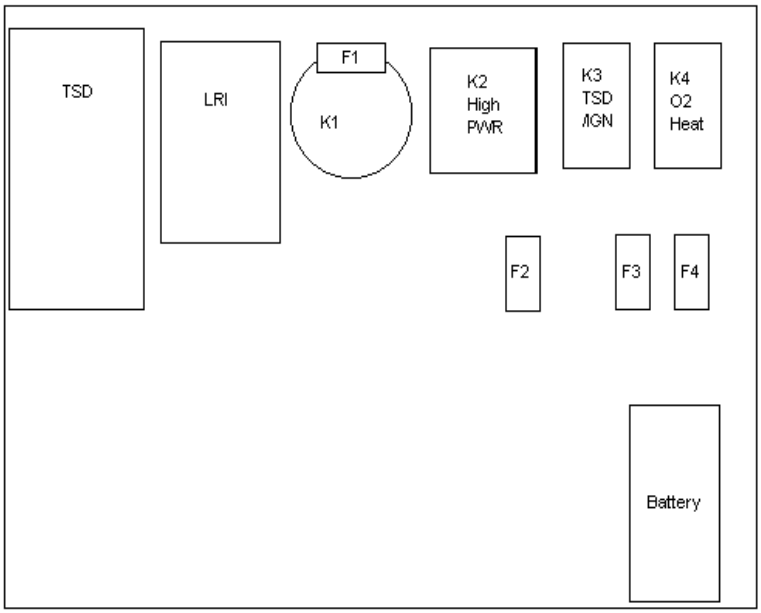
Fuse locations on the electronics panel.



Fuse Number	Function	Value	Type of fuse
1	Main feed	40A	ATO
2	TSD/IndAlt feed	10A	Mini ATO
3	High PWR feed	15A	Mini ATO
4	LRI/Fuel Pump/MAF feed	10A	Mini ATO