CLEARPATH ROBOTICS™

From The Desk of The Robotsmiths

Thank you for your Jackal order! As part of the integration, we have prepared this quick reference sheet for you and your team detailing your specific package.

System Operational Tips

For best performance, it is advised that the batteries are charged regularly. If the vehicle begins halting unexpectedly, doing one or more of the following may improve performance:

- Reducing motor power draw by lowering acceleration, turning in place less, or limiting the grade of terrain being traversed.
- Reducing peripheral power draw by unplugging or otherwise shutting off devices which are not in use.

Network Information

The wifi router in your Jackal is configured to search for and connect with the included base station. It will then act as a bridge repeater, which means you may connect to either the base station's SSID or either of the SSIDs being broadcast by the Jackal itself. When the base station is connected to a live internet connection, the Jackal will also be able to access the internet. When connecting to either the base station or the Jackal wifi router, your computer will be assigned an IP address by DHCP. Please note that your computer will only be assigned an IP address by DHCP if the base station is turned on.

Parameter	Value
Base Station IP	192.168.1.9
Base Station login	admin/clearpath
Base Station SSID	Clearpath Base Station
Base Station wifi password	clearpath
Jackal wifi router IP	192.168.1.10
Jackal wifi router login	admin/clearpath
Mini-ITX IP	192.168.1.11
Mini-ITX hostname	cpr-uaf01
Mini-ITX login	administrator/clearpath
LIDAR IP	192.168.1.14

You may change the wifi passwords by accessing the router configuration pages through a web browser.

Software Information

- All nonstandard ROS packages are located in **~/catkin_ws.**
- A custom repository has been created for your robot, located in **catkin_ws/src/uaf01_jackal**. It contains all of the custom urdfs and meshes required by your Jackal to properly display in rviz. It is good practice to clone this repository into your own account for backup and development.
- This system is pre-configured to start a joystick interface node for teleoperation. At any time, the wireless gamepad may be used to drive the Jackal. Hold the "L1" button for fast mode or "L2" for slow, and steer with the left analog stick.
- The hardware launch script will run on startup. It can be started in the background with **sudo service ros start** and stopped with **sudo service ros stop**. It may be launched in the foreground using **sudo ros-start**. Your team should never need to start or stop the service—just use roslaunch to launch additional nodes which interface with the persistent ones. If you have to stop the service type **rostopic list** to make sure that all the nodes have been stop.

Remote Connection to Jackal

Your robot is set up with Ubuntu 14.04 and ROS Indigo. For maximum compatibility, we recommend your ROS workstation be configured the same way. Suggested steps:

- Download and install Ubuntu Desktop 14.04 LTS from Ubuntu.com
- Set up ROS Indigo: http://wiki.ros.org/indigo/Installation/Ubuntu
- Install the Desktop packages for Jackal:

```
$ sudo apt-get install ros-indigo-jackal-desktop
```

To communicate directly with the Jackal PC, you can SSH in. It will be necessary to ssh into the robot for tasks such as installing, modifying or removing software and files on the Jackal. First turn on the base station, and after about a minute turn on the Jackal. Note that you will not be able to use GUI tools such as rviz over an SSH connection. In the command prompt:

```
$ ssh administrator@cpr-uaf01
```

In order to use rviz and other visualization tools, you must declare the Jackal as master. In a console, type:

```
$ export ROS_MASTER_URI=http://cpr-uaf01:11311
```

You should then be able to view a list of topics published by the Jackal with:

```
$ rostopic list
```

It will be necessary to declare the Jackal as master in every new terminal window, unless you change the master permanently in your ROS environment variables. If you are able to see a list of topics but no data is being published, you may need to add the Jackal to your computer's /etc/hosts file. Add this line at the top:

```
192.168.1.11        cpr-uaf01
```

Example Usage

GPS

Your Jackal has been equipped with three different GPS receivers. The default Jackal GPS outputs to the topic /navsat:

```
$ rostopic echo /navsat/fix
```

The Microstrain GX4-45 publishes to /gx4_45:

```
$ rostopic echo /gx4_45/navsat/fix
$ rostopic echo /gx4_45/filter/fix
```

Finally, the Novatel Smart6 publishes to /navsat/upgrade:

```
$ rostopic echo /navsat/upgrade/fix
```

The raw data from the default and Novatel GPS receivers is available from the "nmea_sentence" topic instead:

```
$ rostopic echo /navsat/nmea_sentence
$ rostopic echo /navsat/upgrade/nmea_sentence
```

Bumblebee Camera

The camera image cannot be viewed via ssh, it must be accessed by declaring the Jackal computer as master, then using the image_view utility. You may choose either the higher quality "compressed" topic or the more bandwidth-efficient "theora" stream, depending on your network speed. The examples are for the left camera, but the right camera may be viewed in a similar manner.

```
$ rosrun image_view image_view image:=/camera/left/image_color compressed
$ rosrun image_view image_view image:=/camera/left/image_color theora
```

Upon receipt of your Jackal you may want to calibrate your Bumblebee. Instructions on the process are available here:

http://wiki.ros.org/camera_calibration/Tutorials/StereoCalibration

Microstrain IMU

The Microstrain GX4-45 publishes both raw and filtered data. Note that the filtered data may only be valid when a valid GPS fix is achieved. The imu data may be checked by echoing the following topics:

```
$ rostopic echo /gx4_45/imu/data
$ rostopic echo /gx4_45/filter/imu/data
```

SICK LMS151 LIDAR

LIDAR data is not generated in a human-readable format. It is best visualized in rviz. However, you can verify that it is publishing data using hz:

```
$ rostopic hz /scan
```

Visualizing the Jackal in rviz

The Jackal may be visualized using rviz. The Bumblebee, LIDAR and Novatel GPS meshes and transforms have been pre-loaded so that the data they produce is relative to their position on the robot. In order to properly display the meshes that represent your custom configuration, the uaf01_jackal package will need to be built on your local PC. The robot must be turned on.

1. First of create a catkin workspace on your local computer. In a command prompt:

```
$ mkdir -p ~/catkin_ws/src
$ cd ~/catkin_ws/src
$ catkin_init_workspace
$ cd ~/catkin_ws/
$ catkin_make
$ source devel/setup.bash
```

2. Then copy the uaf01_jackal directory from the robot into the workspace. For example using scp from your host machine, via ethernet:

```
$ scp -r administrator@192.168.1.11:/home/administrator/catkin_ws/src/uaf01_jackal
~/catkin_ws/src
```

3. Build and source the workspace

```
$ cd ~/catkin_ws/
$ catkin_make
$ source devel/setup.bash
```

4. Install the Jackal_viz package

```
$ sudo apt-get update
$ sudo apt-get install ros-indigo-jackal-viz
```

5. Launch rviz

```
$ roslaunch jackal_viz view_robot.launch
```

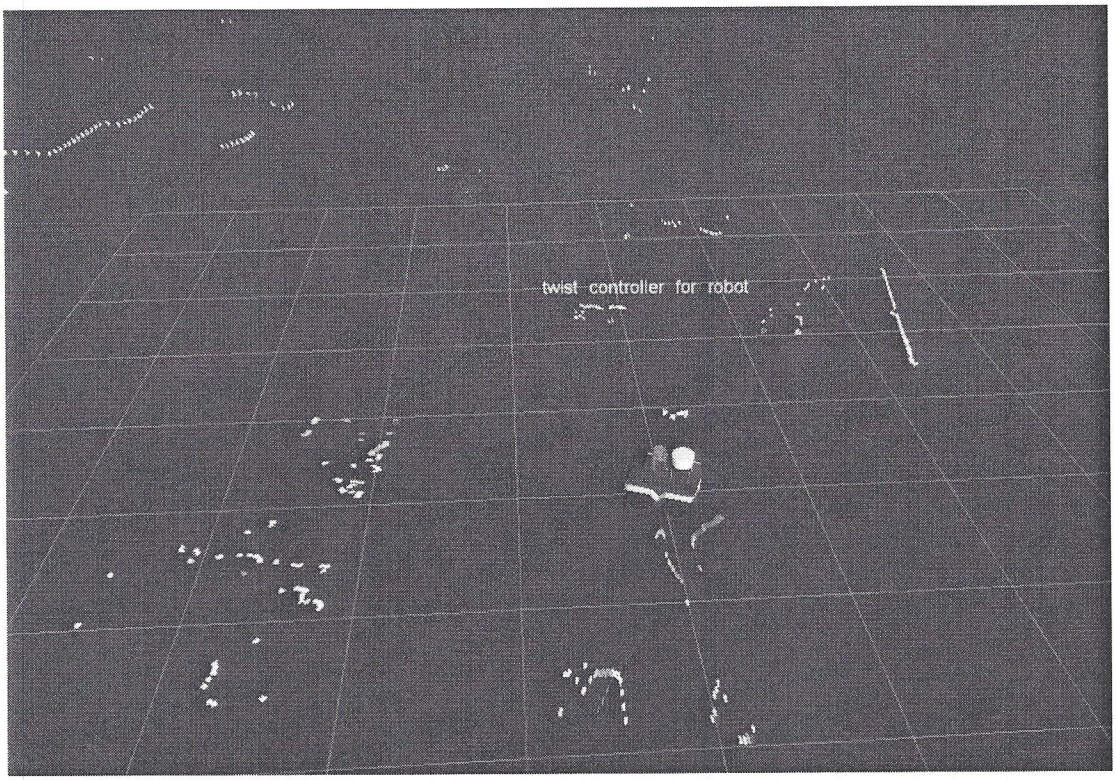
You can rotate the model using your cursor, and zoom in or out by scrolling up or down. Strafe by holding down Shift and dragging the model. The Jackal itself may be driven directly from rviz by changing to interact mode. In this mode, arrows appear around the Jackal model. Drag the arrows to make the Jackal move.

The LIDAR data may be added to the rviz interface by clicking the "Add" button in the bottom left, selecting "By topic," then choosing the LaserScan topic.

A camera feed may be added to the rviz interface by clicking the "Add" button in the bottom left, selecting "By topic," then choosing the desired camera feed from the list. We suggest image_color, Image, theora.

More information on rviz is available here: http://wiki.ros.org/rviz

Information on Jackal_viz is available here: http://wiki.ros.org/jackal_viz



Base Station

The Base Station should require no configuration. However, should you need to change any settings simply connect to its LAN port or connect via wifi. Access its configuration page by entering its IP address into a web browser.

Connecting the external WAN port to a live Internet connection will allow any computers connected to the base station to access the internet. Ensure the base station has fully powered on before turning on the Jackal.

An AC-DC power supply has been provided for powering the base station in a lab setting.

Learning

If you are new to using ROS, please visit our support page for information on how to get started using your new Jackal:

support.clearpathrobotics.com

Please contact our support team directly at **support@clearpathrobotics.com** if you have any questions that aren't answered on our support page. For ROS-specific questions, we recommend visiting **answers.ros.org**, which we also keep an eye on.

Sincerely,

The Robotsmiths