The Kairos E-Stop system transmits a 40-byte UDP packet command of run, pause or stop to port 7001 of its robots. This can either be a unicast message (e.g. 192.168.200.100) directed towards one particular robot or it can be a broadcast message (i.e. 255.255.255.255) directed to all robots on the network.

The run command is a 40 byte serial message:

```
24 28 B2 AA 11 27 A2 0B FD DF 00 00 AA 55 00 00 2A 2A 44 4F
5A 45 52 5F 42 41 53 45 2A 2A 00 00 00 00 00 00 00 5D 0D 0A
```

The stop command is the same 40 byte serial message with bytes 12 and 13 (starting from 0) swapped:

```
24 28 B2 AA 11 27 A2 0B FD DF 00 00 55 AA 00 00 2A 2A 44 4F
5A 45 52 5F 42 41 53 45 2A 2A 00 00 00 00 00 00 00 5D 0D 0A
```

The pause command is the same as the run command with bytes 35 and 36 (starting from 0) modified:

```
24 28 B2 AA 11 27 A2 0B FD DF 00 00 AA 55 00 00 2A 2A 44 4F
5A 45 52 5F 42 41 53 45 2A 2A 00 00 00 00 00 10 01 5D 0D 0A
```

The commands are based off legacy installations and have evolved over time.

The following is the E-Stop behavior if only using the Kairos Autonomi software with no external E-Stop receivers:

♦ When the Kairos software receives a stop command, the vehicle brake is applied proportional to the vehicle speed. Once the vehicle is stopped, the transmission shifts to park and the engine is shut down.

♦ When the Kairos Autonomi software receives a pause command, the vehicle brake is applied proportional to the vehicle speed. Once the vehicle is stopped, the transmission shifts to park and the engine remains on.

♦ When the Kairos Autonomi software receives a run command after it is in a stop or pause state, a counter begins. Once five (5) seconds pass without a stop or pause command, the vehicle engine is enabled and the operator can then start the engine and continue normal operation. After receiving a run command in a pause state, the vehicle can be operated immediately.

♦ Planned, but not currently implemented: if no commands are received within three (3) seconds, the vehicle goes into a pause state. After an additional ten (10) seconds of no commands, the vehicle goes into a stop state.

♦ Users can set the number of seconds between a loss of communication and entering a pause and stop state.

If the vehicle is equipped with an external E-Stop receiver, the following behavior occurs:

♦ When the receiver receives a stop command, the engine is immediately disabled and the brake engages at the same time. The transmission remains in its previous state.

♦ When the receiver receives a pause command, the vehicle brake is applied proportional to the vehicle speed. Once the vehicle is stopped, the transmission shifts to park and the engine remains on.

♦ After a stop event occurs, the receiver must receive twelve (12) consecutive run commands from any available source before the stop condition is cleared. This ensures that if there are multiple sources, the stop event from any one source will override the run commands from other sources. Once this occurs, the engine can be started and normal operation can resume.

♦ After a pause event occurs, the receiver must receive eight (8) run commands before the pause condition is cleared. Once this occurs, normal operation can resume.

♦ If no commands are received within three (3) seconds, the vehicle goes into a pause state. After an additional ten (10) seconds of no commands, the vehicle goes into a stop state.

♦ Users can set the number of run commands received before exiting a stop state and a pause state. Also, users can set the number of seconds between a loss of communication and entering a pause and stop state.