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**BULLETIN
BUL-044**

ServoPod FORTH Firmware

The Kairos Pronto4 series of products use an embedded digital signal processor (DSP) called a ServoPod for direct control of motor modules and low level logic. This DSP is field programmable with a language called FORTH. The FORTH program is a human readable text file that can be downloaded to the system to replace the current program with a new program. It is also possible to simply enter a new program in an interpretive mode and test the program before committing it to permanent memory.

This document provides a basic overview for loading and diagnosing Pronto4 specific FORTH firmware. The overview is followed by a detailed updating procedure.

There are many other Pronto4 specific FORTH commands in other Pronto4 documentation. There are many books available that address other aspects of the FORTH language.

Because the main program is being replaced when performing a program reload, it is possible to render the system inoperable if careful steps are not taken. This is covered in more detail in the ServoPod Troubleshooting document.

Firmware Update Overview

There is a terminal window in Kairos Autonomi's djServoPod application that serves as the interface to the ServoPod hardware (SVP).

Opening the com port at "115200,n,8,1" will begin communications with the SVP. By toggling the DTR line, the SVP can be reset and begin from the start. If the SVP has already been programmed with a base program, as is almost always the case if it is in a functioning Pronto4, the program will reset and reload.

The valid boot up sequence on the terminal screen should look like:

READY

IsoMax V0.82



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This indicates that the SVP has properly booted. If several carriage returns are entered then the system responds with an OK such as:

READY

IsoMax V0.82

OK

OK

Command line operation can begin at this point. Typing the following commands should result in expected responses. If the responses are not as expected then the primary operational program is not loaded and must be loaded. The djServoPod executable provides a means to load the FORTH program text from a Windows XP based PC.

READ_VEHICLE1 - Read status from vehicle.
PACKET_ACTIVE - Enter packet communications mode.
100 BRAKE - Set brake to 100%.
500 THROTTLE - Set throttle to 50.0%.
SCRUB - Remove primary program from permanent memory.

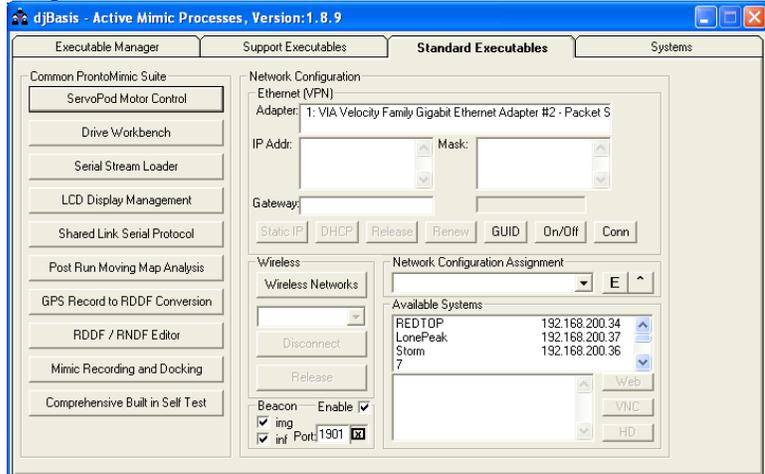
The command line can have a secure packet structure overloaded upon it where each command line operation requires addressing and checksum characters. This SVP boots into a normal command line without the packet structure and enters the packet structure when the PACKET_ACTIVE command is supplied. The packet communications are primarily designed to be used during machine to machine operations, not human to machine operations. It is challenging to perform command line operations when the packet communications have been enabled.

ServoPod Firmware Update Procedure

1. Connect a USB drive or exchange cartridge with the FORTH firmware file.
2. Ensure the Pronto4 is connected according to standard documentation, to include:
 - E-Stop or E-Stop Loopback
 - Remote E-Stop or Remote E-Stop Loopback
 - VIM
 - Power
3. Boot-up the Pronto4 according to standard documentation.

4. Either VNC into the Pronto4 unit (e.g., Shepherd's Asset VNC button) or connect the a keyboard and mouse (e.g., via Utility Breakout Board).
5. Close JAUS_IVN if it is running.

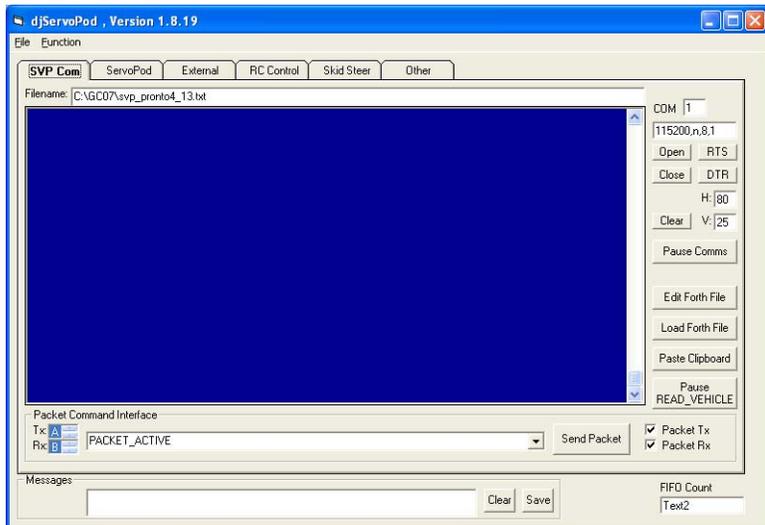
6. If djServoPod is open, restore it. If djServoPod is not running, restore the djBasis application, click on the "Standard Executables" tab, and single-click the "ServoPod Motor Control" button. This will launch the djServoPod application.



7. Click the first tab from the left ("COM10" in version 2.8.3 and earlier or "SVP Com" in newer versions).

8. Single-click on "Open" in the upper right hand corner. "Opened COM1" will appear in the large blue console area.

9. Single-click the "DTR" button. The button label will change to lower case "dtr". Single-click the "dtr" button so that it returns to upper case. "READY" and "IsoMax V0.82" may appear in the console area.

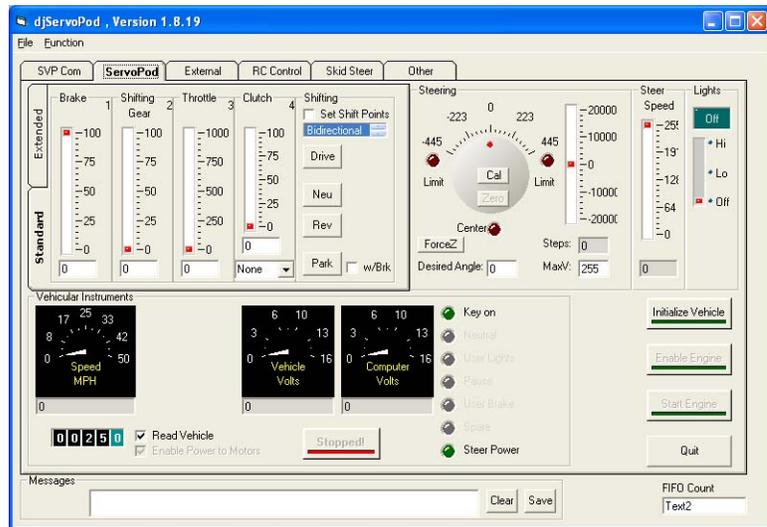


10. Single-click the "Pause READ_VEHICLE" button. The button label will change to "READ_VEHICLE Paused".

11. From the "Packet Command Interface" at the bottom of the djServoPod window, select "PACKET_DISABLE", then click the "Send Packet" button. Single-click in the large blue console area and press the "Enter" key a few times. Verify that "OK" appears each time. Other messages may also appear. If a question mark appears, resend the "PACKET_DISABLE" command.

12. Uncheck the "Packet Tx" and "Packet Rx" boxes that are next to the "Send Packet" button.
13. Firmware patches should be loaded from the clipboard, while full firmware updates should be loaded from a text file.
 - If the firmware update is a patch: open the patch in a text editor, highlight the update code, copy the update code into the clipboard buffer, and then in djServoPod click on the "Paste Clipboard" button. The contents of the clipboard will appear in the large blue console area.
 - If the firmware update is a full update text file: in djServoPod, click the "Load Forth File" button, select the text file with the firmware update, and click the "Open" button.
14. The blue console area will display "Scrub", and then file commands will start to scroll. The load process will take approximately 5 minutes.
15. When the file has been loaded, "OK" "OK" should appear. If only one "OK" appears for more than 5 seconds, single-click the "Close" button and then the "Open" button. The terminal should respond with "ISOMax V0.82". Single-click in the large blue console area and press the "Enter" key a few times. Verify that "OK" appears each time.
16. After the file has been loaded, type the command below into the "Packet Command Interface" box. Commands are based on Pronto4 model and configuration. The standard two commands are shown below; Kairos personnel will provide a command for your system if it differs from the standards.
 - Pronto4 Series 4 Mini: "P4S4_MINI_SETUP0"
 - Pronto4 Series 4 Planar: "P4S4_PLANAR_SETUP0"
 - Custom: _____
17. Single-click the "Send Packet" button.
18. The command entered should be mirrored in the blue box followed by "OK" (e.g., "P4S4_MINI_SETUP OK").
19. Type "SAVE-RAM", then click the "Send Packet" button. "SAVE-RAM OK" should appear in the blue box.
20. From the "Packet Command Interface" at the bottom of the djServoPod window, select "PACKET_ACTIVE", then click the "Send Packet" button.
21. Check the "Packet Tx" and "Packet Rx" boxes.
22. After the update has been applied, click the "Close" button in the upper right hand corner, to close the serial port.
23. Single-click the "READ_VEHICLE Paused" button. The button label will change to "Pause READ_VEHICLE".

24. Switch to the “ServoPod” tab and single-click the “Initialize Vehicle” button, then single-click the “Enable Engine” button.
25. Switch the VIM Auto/Man switch to the “Auto” mode.
26. Move the sliders for the actuators and verify that the Pronto4 behaves correctly.



Note that firmware changes have the possibility of damaging or rendering the Pronto4 inoperable. Care should be taken. If there are any questions, please contact Kairos Autonomi at 801-255-2950 or contact@kairosautonomi.com.