

Pioneer Server Operating System (PSOS) Updates
Last updated October 29, 1998. -WPK

Consult the Pioneer Operation manual for additional details.

```
*****
* Version history
*
* 4.9  fixed watchdog when under VEL2
*      added user-adjustable (de)acceleration parameter
*
* 4.8  fixed compass readings quadrant 3
*      added COM_KICK command
*      added COMsetv, COMsetrv commands
*
* 4.7  added support for compass on serial I/O
*      shows compass reading on LCD
*      fixed COM_PSU for non-multiplexed RC servos (no
*          experimenter board).
*      added KICK (one-shot) command
*
* 4.6  changed connect message to show headcount for rotation
*      added support for Sony camera with RS232 multiplexing
*      put class/subclass names into EEPROM; names are pionlm,
*      pionlx, pionat
*
*
* 4.5  tracked down pesky servo glitch
*      added support for 5 servos on exp board
*      changed COM_PSU to take 2 byte args: servo # and 10us time
*
*
* 4.4  changed to true PID control
*      put motion parameters in EEPROM, configurable
*      added extra encoder count tables for Pioneer AT
*      10 KHz encoder poll
*
*
* 4.3  added DCHEAD command
*      PSU cycle steady
*      read params from EEPROM
*      experimenters board flag
*
*
* 4.2  changed COM_digout to take a mask as first byte
*      changed pac_string max to 40 chars
*      added COMsay
*      added gripper and speaker functionality
*      added comHEAD command for absolute angle positioning
*      added comRVEL command for rotational velocity, units ~ang/sec
*
*
* 4.1  added support for new Pittman motors, using psos-4.lm-conf
*      changed angular units to 0-4095, using single sin table
*      changed config info to last sync return
*      added support for flash PROM
*      fixed bug in DHEAD command
*      added support for independent wheel velocity control
*
*
* 4.0  added testing of digital/analog I/O
*      added config packets
*      added nose and general I/O functions and commands
*      added user A/D output and command
*
*
* 3.9  added string args in commands
*      added sonar polling command
*
*
* 3.8  added PSU (position servo unit) support on OC3
*      added stall info return in bumpers bytes
*      added ORIGINCOM
*      put buzzer into encoder interrupt, encoder on OC4
*
*
* 3.7  sonar polling doesnt call sonar 7
*      faster VELCOM speeds
```

PSOS client-command communication packet

Component	Bytes	Value	Description
Header	2	0xFA, 0xFB	Packet header; same for client and server
Byte Count	1	N + 2	Number of command bytes plus checksum; must be < 200 total bytes long
Command Number	1	0 - 255	Client command number; see Table 4-4
Arg Type (optional)	1	0x3B or 0x1B or 0x2B	Data type of command argument, if included: (<i>sfARGINT</i>) positive integer (<i>sfARGNINT</i>) negative int or absolute value (<i>sfARGSTR</i>) string, null-terminated
Argument (optional)	n	data	Command argument; integer or null-terminated string
Checksum	2	computed	Packet integrity checksum

Note that Byte Count includes 2-byte checksum, but not 2-byte header.

PSOS 4.9 Command Set

Command	#	Arguments	Description	Version Implemented
SYNC0	0	none	Start connection; PSOS echoes these synchronization commands back to client.	3.x
SYNC1	1	none		
SYNC2	2	none		
PULSE	0	none	Communication pulse	3.x
OPEN	1	none	Open the motor controller	3.x
CLOSE	2	none	Close server and client connection	3.x
POLLING	3	string	Sets sonar polling sequence	3.9
SETV	6	pos integer mm/sec	Sets velocity for Colbert move command	4.8
SETO	7	none	Set server origin	3.x
SETRV	10	pos integer deg/sec	Sets rotational velocity for Colbert turn and turnto commands	4.8
VEL	11	signed int mm/sec	Forward (+) or reverse (-) velocity	3.x
HEAD	12	unsigned int degrees	Turn to absolute heading 0-359 degrees	4.2
DHEAD	13	signed int degrees	Turn heading +-255 degrees	3.x
SAY	15	string, int	Up to 20 pairs of duration (20 ms increments) /tone (half-cycle) pairs; int is number of string bytes	
RVEL	21	signed int degrees/sec	Set rotational velocity +- 255 degrees/sec	4.2
DIGOUT	30	integer	Msb mask selects output port(s) OD0-7; lsb pattern sets/unsets those selected ports	4.2
DIGOUT*	30	integer bits 0-7	Sets/resets digital output bits	4.0
TIMER	31	integer pin 0-7	Initiate user input timer, triggering an event with specified PIN	
VEL2	32	int 4*mm/sec	Independent wheel velocity; lsb=right wheel; msb=left wheel; +-4mm/sec increments	4.1
GRIPPER	33	integer 0, 1, 4, 5	Sets Gripper state	4.2
KICK	34	integer ms	Trigger digital output port OD0 for ms milliseconds (one-shot).	4.8
PTUPOS	41	Integer msb=0-4; lsb=1-2000µs	Set pulse-width for position servo control; lsb is pulse width in 100µs units; msb addresses mux'd RC0-4 on Experimenter's Module.	4.5
PTUPOS**	41	integer 1-2000µs	Set pulse-width for position servo control.	4.0
STEP	64	none	Single-step mode (simulator only)	3.x

PSOS server information data packet (minimum contents)

Name	Data Type	Description
Header	int	Exactly 0xFA, 0xFB
Byte Count	byte	Number of data bytes + 2; must be less than 201 (0xC9)
Status	byte = 0x3S; where S =	Motors status
	<i>sfSTATUSNOPOWER</i>	Motors power off
	<i>sfSTATUSSTOPPED</i>	Motors stopped
	<i>sfSTATUSMOVING</i>	Robot moving
Xpos	unsigned int (15 ls-bits)	Wheel-encoder integrated coordinates; platform-dependent units—multiply by DistConvFactor in the parameter file to convert to mm; roll-over ~ 3 m
Ypos	unsigned int (15 ls-bits)	
Th pos	signed int	Orientation in platform-dependent units—multiply by AngleConvFactor for degrees.
L vel	signed int	Wheel velocities (respective Left and Right) in platform-dependent units—multiply by VelConvFactor to convert to mm/sec.
R vel	signed int	
Battery	byte	Battery charge in tenths of volts
Bumpers	2 bytes - L and R	Motor stall indicators
Control	signed int	Setpoint of the server's angular position servo—multiply by AngleConvFactor for degrees
PTU	unsigned int	Pulse width of position servo
Compass	byte; 0-179	Compass heading in 2-degree units
Sonar readings	byte	Number of new sonar readings included in information packet; readings follow:
Sonar num	byte	Sonar number
Sonar range	unsigned int	Sonar reading—multiply by RangeConvFactor for mm
<i>... rest of the sonar readings ...</i>		
Input timer	unsigned int	User input timer reading
User Analog	byte	User analog input reading
User Input	byte	User digital input pins
User Output	byte	User digital output pins
Checksum	int	Checksum (see previous section)

Note that Byte Count includes 2-byte checksum, but not 2-byte header.

Pioneer configuration commands and parameters

Command	P1 Defaults	Description
serial	FFFF	Serial number of this Pioneer board, in hexadecimal. Pioneers built before November 1997 will not have a preset serial number. If you change the value, please use the serial number that came with your robot.
subclass	Pion1m	String identifies Pioneer type and is included on SYNC2 return packet for use by client. Set to PionAT for the Pioneer AT; set to Pion1m for a Pioneer 1 with new motors (see the entry for motors , later in the table); set to Pion1x for a Pioneer 1 with the older motors.
revcount	40000	The decimal number of encoder ticks for a 360 degree revolution of the robot. The default value is for Pioneer 1s built after October 1996 (old PSOS version number contained suffix m) and 25600 for those built before that date. We encourage you to follow the “Turn Calibration” directions to set this parameter to a value that best reflects the characteristics and environment for your robot.
motor	1	Set this to 1 if your robot was built after October 1996 (old PSOS version number contained suffix m). Otherwise, set this parameter to 0.
experiment	0	Set to 1 if a Gripper or Experimenter’s board is present; 0 if it is not.
name	nobody	Unique name you may give your Pioneer. Besides its ownership value, this parameter gets passed to a connecting client as the first argument in the SYNC2 packet, therefore it is useful for differentiating among multiple Pioneers. Maximum of 20 characters; no intervening spaces.
baud	9600	Set to 0 for 9,600 baud; 1 for 19,200 baud.
stallmax	16384	Maximum integrated current before Pioneer 1 motors stall (ATs have no stall feedback). Default is the typical value; values as high as 64000 mean a higher current stall threshold, which is useful for Pioneers carrying heavy payloads and climbing steep slopes.
stallwait	4	Pioneer 1 halt time after stall, in 500ms increments.
watchdog	100	Specifies the amount of time, in 20ms increments, a Pioneer will wait for a client command before halting all motor activity. Default equals 2 seconds; don’t set below 500ms when using a Saphira client.
acc †	4	(De)acceleration parameter; values range from 1 to 20, higher values for faster (de)acceleration.
pparam	10	Proportional control parameter controls the basic responsiveness of the drive system. Values range from 5 to 20; lower values give a slower, less-responsive system; higher values make the robot “zipper”, but can lead to overshoot and oscillation. A heavily loaded robot (payload of 10 pounds) works well with a pparam setting of 16.
dparam	45	Differential control parameter dampens oscillation and overshoot. Values range from 20 to 60; increasing values gives better control oscillation and overshoot, but they also make the robot’s movements more sluggish.
iparam	10	Integral control parameter adjusts residual error in turning and velocity. Values range from 0 to 20; higher values make the robot correct increasingly smaller errors between its desired and actual angular position and speed.
compass comp compy cal cdata		See the <i>Pioneer Electronic Compass</i> manual for details.
show		Display the current identifying and operating parameters for Pioneer.
defaults 0/1		Resets values to default parameters; 0=Pioneer 1; 1=Pioneer AT.
quit exit		Stops the PSOS configuration program

† New in PSOS 4.9

Platform-Specific Configuration Defaults (PSOS 4.9).

Parameter	Pioneer AT	RoboCup Pioneer
subclass	PionAT	RoboCup
revcount	46000	40000
motor	1	1
stallmax	n/a	16384
stallwait	n/a	4
acc	8	8
pparam	8	6
dparam	35	35
iparam	4	4
defaults	1	0