Kairos Autonomi
498 W. 8360 S.
Sandy, Utah 84070
801-255-2950 (office)
801-907-7870 (fax)
www.kairosautonomi.com

Command Set for Autonomous Vehicle Interpretation Language (AVIL)

Command and control of an autonomous vehicle involves many layers of hardware, software, and system design. Communications between those layers is the job of various protocols. This document describes a communications protocol used to communicate between a human controlled host and a software driven autonomous land vehicle.

Name: Autonomous Vehicle Interpretation Language (AVIL)

Table 1: Language Control

INFO, comment	**Information**
PAUSE, timems	Pause command in milliseconds.
WAIT, user text	Wait for user response to continue, if Debug On.
END	Terminate execution, optional user text is displayed.
DEBUG, mode	Turn on or off debug mode.
STARTELAPSED	Start the elapsed timer or reset it.
ELAPSED	Print the elapsed time since start, does not reset.
UPDATE,state	Enable and disable updating of screen parameters, ON or OFF.
CYCLE,ms	Set the cycle time of system execution.
SPEEDTEST	Increment SpeedTest shared variable each cycle.
SETVAR, varname	Set value of variable for expression evaluator, only VAR1 and VAR2 valid.
INCLUDE, filename, (#)	Begin execution from filespec referenced from the application directory, resume when done, reentrant and nestable. # = number of times to execute.

Table 2: User Interaction

SAVE,(PROMPT)	Saves the cmd & action list, optional prompt for data.
MSG, comment	Add a comment to the action screen and log.
PROMPTYESNO,yes/no,question	Ask the user to respond yes/no to a question. Saved to actions & log.
PROMPT, prompt_msg	Ask the user to input data, saved to actions & log.

Table 3: Indicators and Status

STATUS	Displays acc,gps,cmp status.
LOGGING, mode	On/Off.
LCD, text	Display message on user screen.
INDICATORS, mode	Off, all, left, right, active, warning, ready.
MARKER, mode	Set trail marker on, off or pulse.
MP3PLAY, file#	Play MP3 file#.
MP3STOP	Stop playing MP3 file.
RADIO, mode	ON, OFF.
RADIOMSG, msg	Send message to radio messaging system.
ENC2,<yes,no>	Show ENC2 on the LCD.

Table 4: Basic Vehicle Control

LIGHTS, mode	High, low, off.
ENGINE, mode	Set engine to enable, disable, start, stop.

*RPM, x	Maintain vehicle RPM, in RPM.
*SPEED, x	Maintain vehicle speed, in MPH.
MAXTHROTTLE, %	Set maximum throttle position usable.
FRONTBRAKE, %,mS	Vehicle Command, front brake in percentage in milli-seconds (mS).
REARBRAKE, %,mS	Vehicle Command, front brake in percentage In milli-seconds (mS) .
THROTTLE, 1-1000,mS	Vehicle Command, throttle value in percentage of max throttle in milli-seconds (mS).
MOTION, dist, steer angle	Driving parameters in machine units, accepts 0 distance and just turns steering. Accepts formulas.
STEER, angle	Set steering angle, +-22 degrees.
MSTEER, enc counts	Set steering to raw encoder positions.
STOP	Brakes on, throttle off.
MANUAL	Steering off, brakes off, human mode.
FULLSTOP	Applies brakes until fully stopped, no rolling, then manual mode.

Table 5: Complex Vehicle Control

*DIRECTION, dir	Set direction to be forward or reverse.
DRIVE, dist., steering angle	Driving in feet and degrees. Accepts formulas.
COMPASS, dist, bearing	Drive machine units using compass bearing. Use radians or rad(degrees) formula. Accepts formulas. Accepts CUR_BEARING.
DRIVECOMPASS, dist, bearing	Drive dist in feet using compass bearing. Use radians or rad(degrees) formula. Accepts formulas. Accepts CUR_BEARING.

GPS, long, lat, lbo	Go to GPS location, in decimal coordinates, up to Lateral Boundary Offset (lbo). Accepts GPS_LAT, GPS_LON.
GPST,long,lat,lbo,spd	Same as GPS but with throttle command.

Table 6: Pathing Vehicle Control

GPSSPOKE,dist,head	Set GPS point specified feet from current point in specified compass heading.
GPSPATHRESET	Reset and restart the path point and automatically find next RDDF point.
GPSNEXT	Go to next defined GPS point in waypoint file.
GPSPATH	Follow loaded waypoint file until end.

Table 7: I/O Management

COMPASSTOUSE, cmp	cmp is: CMP1(default), CMP2, GPS1CMP, GPS2CMP, GPS3CMP.
GPSTOUSE, gps	gps is: GPS1(default), GPS2, GPS3.
CALIBRATE, device	Begin calibration sequence for steering, CMP1, CMP2, ALL_COMPASSES, distance, or turning.
HANDLE_ANOMALY,mode on/off.	Turns off compass driving over anomalies.
USEAUTOCMP,<dev>	CMP1, CMP2, GPS1CMP, GPS2CMP. This command must be followed by COMPASSTOUSE,AUTOCMP. JOGSTACK,d_bfr_jog,d_in_jog,steer_ang.
LOWPOWER,state	Set low power mode ON or OFF.

Table 8: Object Avoidance

SMARTJOG, state	Turn on or off the usage of SmartJog.
CENTERLINE,value	Set centerline value for jogging.

JOGSTACK, bdist, jdist, joga	Place value in jog stack for jogging in bdist for a distance of jdist at an angle of joga. Distance is in feet and angle in degrees.
MJOGSTACK, bdist, jdist, joga	Place value in jog stack for jogging in bdist for a distance of jdist at an angle of joga. Distance is in ticks and angle in encoder counts.

Table 9: Advanced Set

*Load, route	Load map track to follow.
*Follow	Follow track.
*Avoidance, state	On, off.
*IF flag THEN action	Flag and action defined by system.
*Userulefile, rulefile	Load and use supplied rule base.

* Commands with a single '*' are not implemented
** Parameters for DRIVE and MOTION are passed through an expression evaluation ActiveX control prior to usage. Angular measurements should be in degrees.

Notes:
- All commands are case insensitive
- All commands are separated by commas
- All numbers are integers unless otherwise noted
- Some commands wait until complete
  M, wait, pause
- Other commands execute quickly
  Throttle, FrontBrake, etc.
- Invalid or incomplete commands are ignored. In debug mode a message comes up.
  An indication is always sent to the action list
- Degrees are positive to right.

Future Additions
- 2 letter mnemonics for each command text type
- Look into comma elimination
- Look into formula evaluation