

SONY®

OPEN-R SDK

Model Information for ERS-7



115-01

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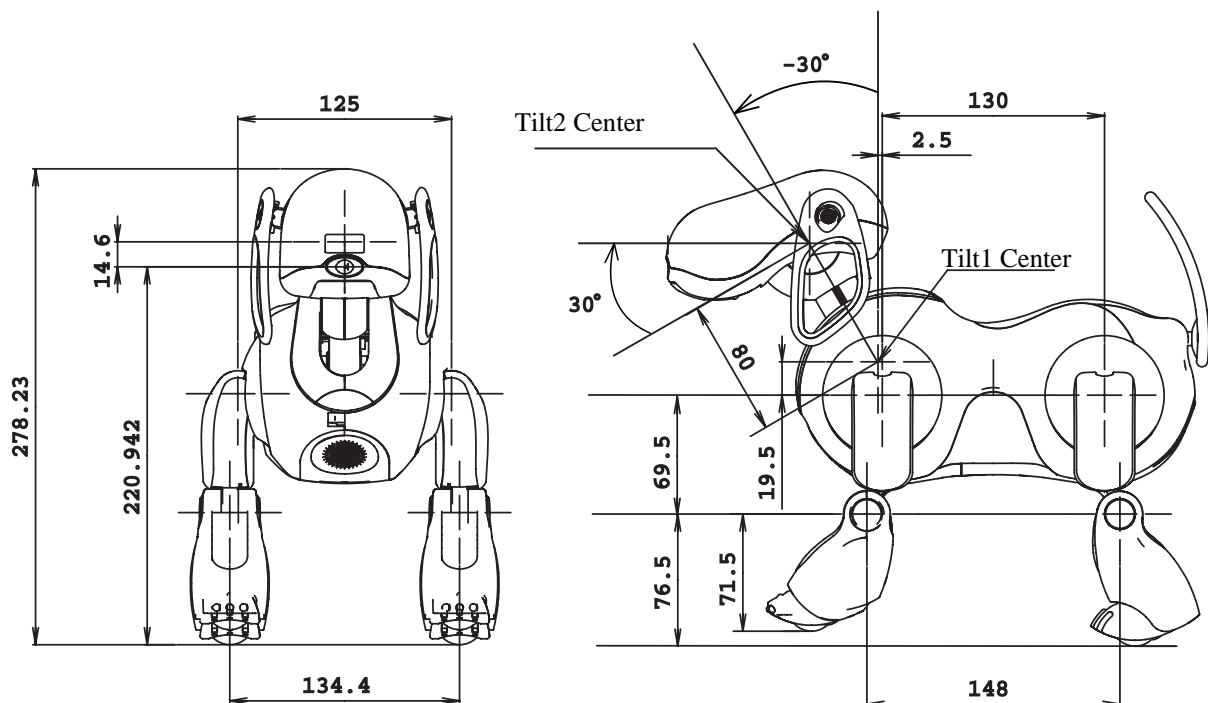
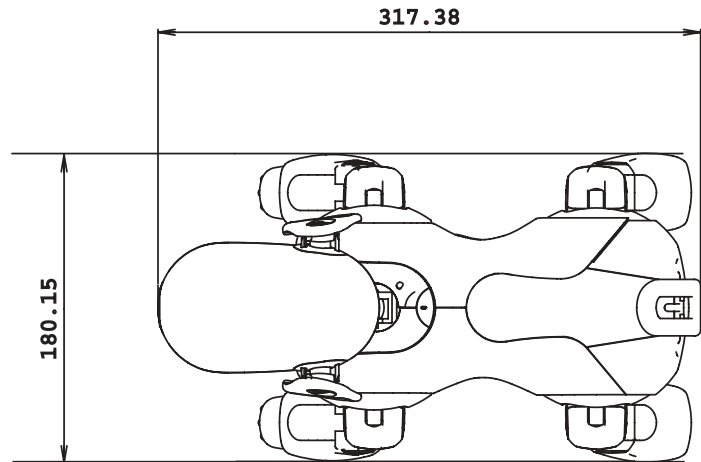
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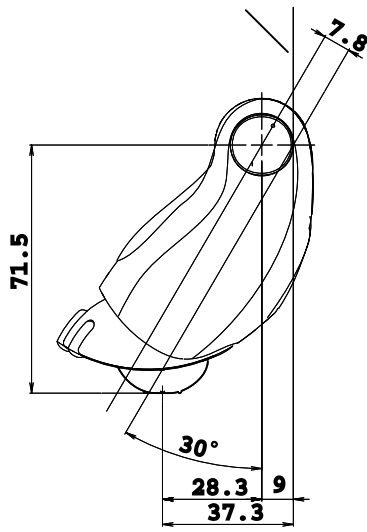
Chapter 1 Outside Specifications

1.1 External Measurements

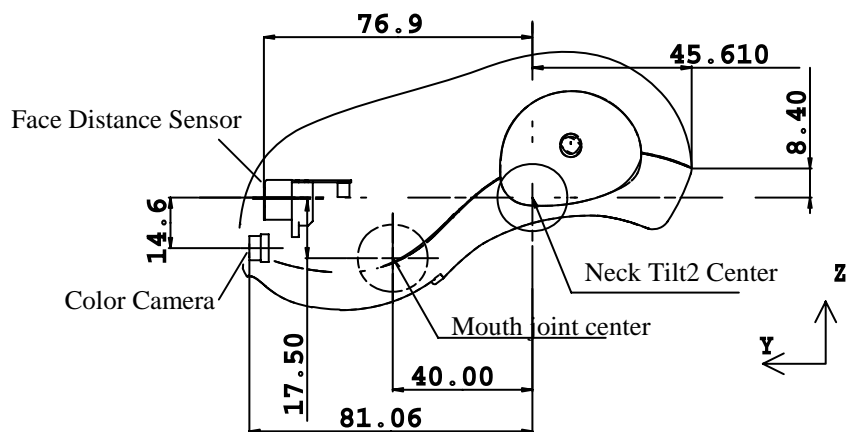
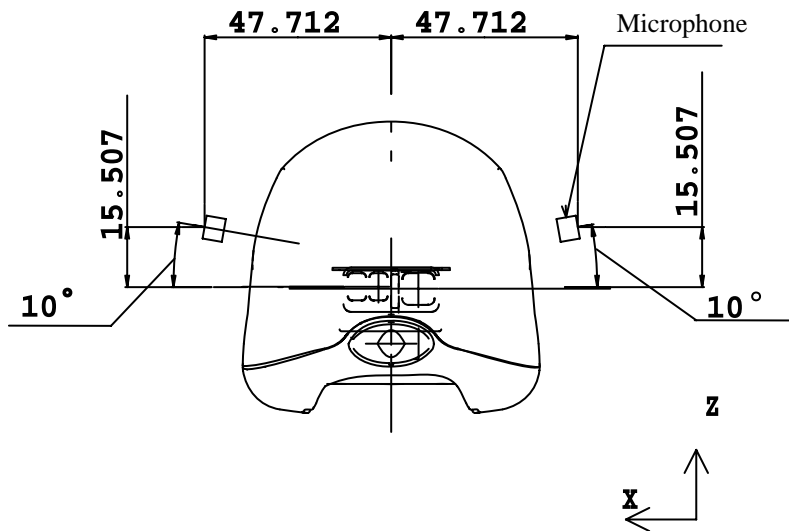
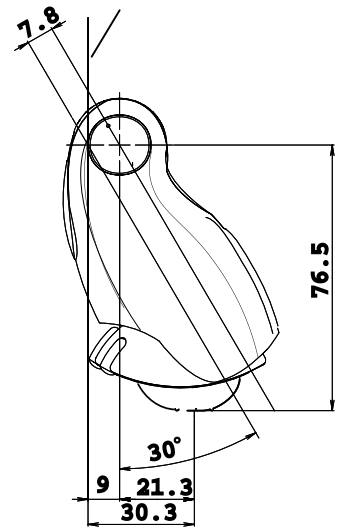


unit: mm

Line passed Front leg Joint1

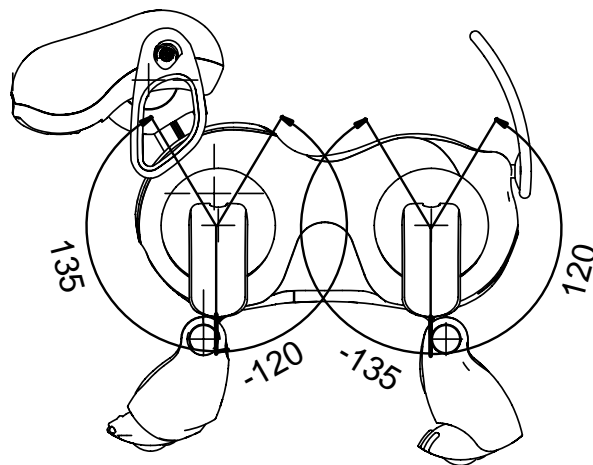
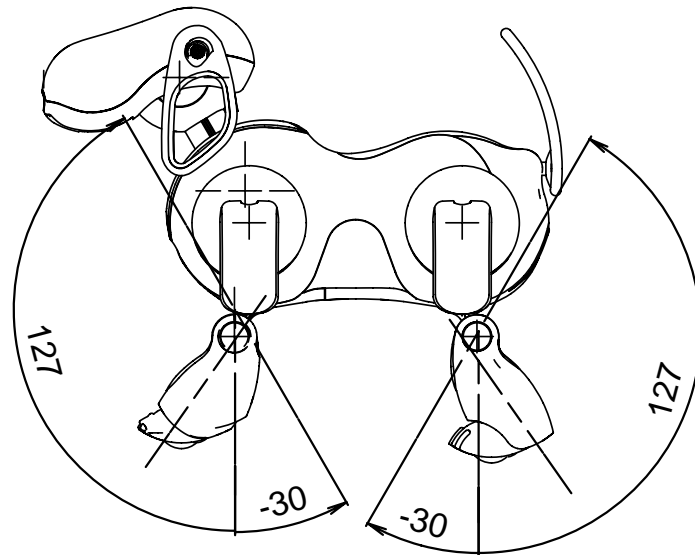
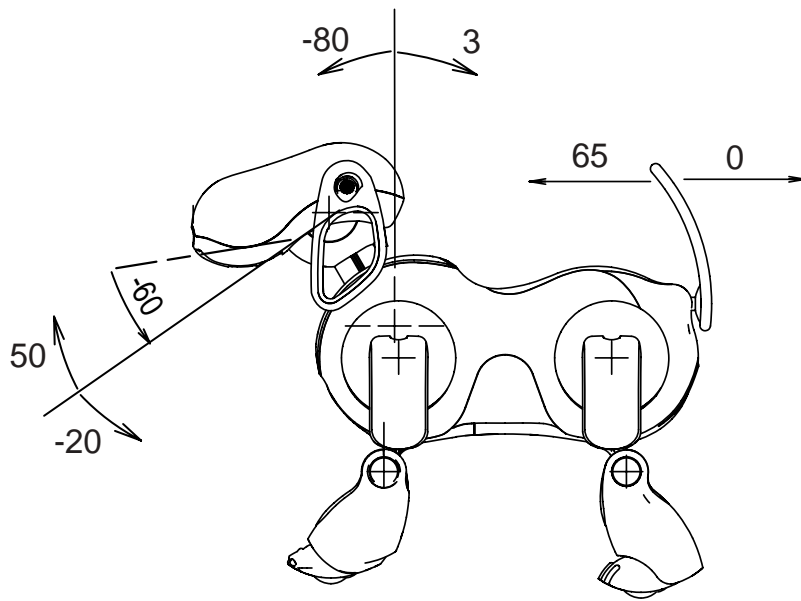


Line passed Rear leg Joint1

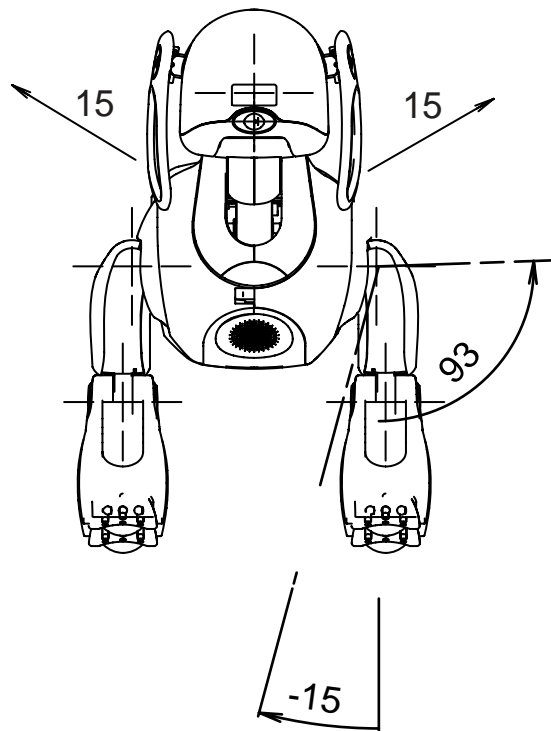
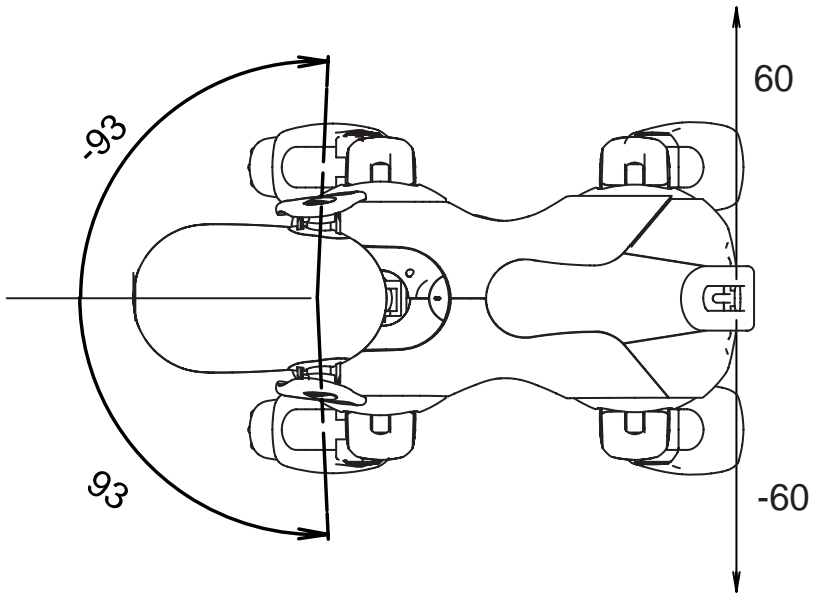


unit: mm

1.2 Hardware Limitations of Joint Motions



unit: degree



unit: degree

Chapter 2 Joints

Refer to Appendix A.1 for CPC Primitive Locator.

2.1 Software Limitations of Joint Motions

2.1.1 Single Joints

Parts	Range (Unit: degree)
Neck tilt1	(-75, 0)
Neck pan	(-88, 88)
Neck tilt2	(-15, 45)
Mouth	(-55, -3)
Left leg(front/rear)J1	(-115, 130)
Left leg(front/rear)J2	(-10, 88)
Left leg(front/rear)J3	(-25, 122)
Right leg(front/rear)J1	(-130, 115)
Right leg(front/rear)J2	(-10, 88)
Right leg(front/rear)J3	(-25, 122)
Tail tilt	(5, 60)
Tail pan	(-45, 45)

2.1.2 Two Joints in Legs

Front leg J1-range	J2-range (Unit: degree)
(-115, -76)	(-1, 88)
(-75, -54)	(-2, 88)
(-55, -46)	(-3, 88)
(-45, -36)	(-4, 88)
(-35, -31)	(-5, 88)
(-30, -26)	(-6, 88)
(-25, -21)	(-7, 88)
(-20, -16)	(-8, 88)
(-15, -11)	(-9, 88)
(-10, 20)	(-10, 88)
(21, 25)	(-9, 88)
(26, 30)	(-8, 88)
(29, 40)	(-7, 88)
(41, 45)	(-6, 88)
(46, 50)	(-5, 88)
(51, 55)	(-4, 88)
(56, 65)	(-3, 88)
(64, 130)	(-2, 88)

Rear leg	
J1-range	J2-range (Unit: degree)
(115, 71)	(0, 88)
(70, 61)	(-1, 88)
(60, 51)	(-2, 88)
(50, 46)	(-3, 88)
(45, 41)	(-4, 88)
(40, 36)	(-5, 88)
(35, 31)	(-6, 88)
(30, 26)	(-7, 88)
(25, 21)	(-8, 88)
(20, 16)	(-9, 88)
(15, -10)	(-10, 88)
(-11, -15)	(-9, 88)
(-16, -20)	(-8, 88)
(-21, -25)	(-7, 88)
(-26, -30)	(-6, 88)
(-31, -35)	(-5, 88)
(-36, -40)	(-4, 88)
(-41, -45)	(-3, 88)
(-46, -55)	(-2, 88)
(-56, -70)	(-1, 88)
(-71, -130)	(0, 88)

2.1.3 Joints of Head and Mouth

Please be aware that there may be collisions between body parts outside these limits.

Mouth-range	Neck-tilt1-range	Neck-tilt2-range
(-30, -3)	(-75, -39)	(5, 45)
(-30, -3)	(-40, 0)	(-5, 45)

2.2 Servo Gain

Use standard values normally, and use weak gain values when large vibrations occur. PSHIFT, ISHIFT, DSHIFT are fixed values; please do not change these values.

(standard values)

CPC Primitive Locator	PGAIN	IGAIN	DGAIN	PSHIFT	ISHIFT	SHIFT
PRM:/r1/c1-Joint2:11	0x0A	0x04	0x02	0x0E	0x02	0x0F
PRM:/r1/c1/c2-Joint2:12	0x08	0x02	0x04	0x0E	0x02	0x0F
PRM:/r1/c1/c2/c3-Joint2:13	0x08	0x04	0x02	0x0E	0x02	0x0F
PRM:/r1/c1/c2/c3/c4-Joint2:14	0x08	0x00	0x04	0x0E	0x02	0x0F
PRM:/r2/c1-Joint2:21	0x1C	0x08	0x01	0x0E	0x02	0x0F
PRM:/r2/c1/c2-Joint2:22	0x14	0x04	0x01	0x0E	0x02	0x0F
PRM:/r2/c1/c2/c3-Joint2:23	0x1C	0x08	0x01	0x0E	0x02	0x0F
PRM:/r3/c1-Joint2:31	0x1C	0x08	0x01	0x0E	0x02	0x0F
PRM:/r3/c1/c2-Joint2:32	0x14	0x04	0x01	0x0E	0x02	0x0F
PRM:/r3/c1/c2/c3-Joint2:33	0x1C	0x08	0x01	0x0E	0x02	0x0F
PRM:/r4/c1-Joint2:41	0x1C	0x08	0x01	0x0E	0x02	0x0F
PRM:/r4/c1/c2-Joint2:42	0x14	0x04	0x01	0x0E	0x02	0x0F
PRM:/r4/c1/c2/c3-Joint2:43	0x1C	0x08	0x01	0x0E	0x02	0x0F
PRM:/r5/c1-Joint2:51	0x1C	0x08	0x01	0x0E	0x02	0x0F
PRM:/r5/c1/c2-Joint2:52	0x14	0x04	0x01	0x0E	0x02	0x0F
PRM:/r5/c1/c2/c3-Joint2:53	0x1C	0x08	0x01	0x0E	0x02	0x0F
PRM:/r6/c1-Joint2:61	0x0A	0x04	0x04	0x0E	0x02	0x0F
PRM:/r6/c2-Joint2:62	0x0A	0x04	0x04	0x0E	0x02	0x0F

(weak gain values)

CPC Primitive Locator	PGAIN	IGAIN	DGAIN	PSHIFT	ISHIFT	DSHIFT
PRM:/r1/c1-Joint2:11	0x0A	0x04	0x02	0x0E	0x02	0x0F
PRM:/r1/c1/c2-Joint2:12	0x08	0x02	0x04	0x0E	0x02	0x0F
PRM:/r1/c1/c2/c3-Joint2:13	0x08	0x04	0x02	0x0E	0x02	0x0F
PRM:/r1/c1/c2/c3/c4-Joint2:14	0x08	0x00	0x04	0x0E	0x02	0x0F
PRM:/r2/c1-Joint2:21	0x10	0x04	0x01	0x0E	0x02	0x0F
PRM:/r2/c1/c2-Joint2:22	0x0A	0x04	0x01	0x0E	0x02	0x0F
PRM:/r2/c1/c2/c3-Joint2:23	0x10	0x04	0x01	0x0E	0x02	0x0F
PRM:/r3/c1-Joint2:31	0x10	0x04	0x01	0x0E	0x02	0x0F
PRM:/r3/c1/c2-Joint2:32	0x0A	0x04	0x01	0x0E	0x02	0x0F
PRM:/r3/c1/c2/c3-Joint2:33	0x10	0x04	0x01	0x0E	0x02	0x0F
PRM:/r4/c1-Joint2:41	0x10	0x04	0x01	0x0E	0x02	0x0F
PRM:/r4/c1/c2-Joint2:42	0x0A	0x04	0x01	0x0E	0x02	0x0F
PRM:/r4/c1/c2/c3-Joint2:43	0x10	0x04	0x01	0x0E	0x02	0x0F
PRM:/r5/c1-Joint2:51	0x10	0x04	0x01	0x0E	0x02	0x0F
PRM:/r5/c1/c2-Joint2:52	0x0A	0x04	0x01	0x0E	0x02	0x0F
PRM:/r5/c1/c2/c3-Joint2:53	0x10	0x04	0x01	0x0E	0x02	0x0F
PRM:/r6/c1-Joint2:61	0x0A	0x04	0x04	0x0E	0x02	0x0F
PRM:/r6/c2-Joint2:62	0x0A	0x04	0x04	0x0E	0x02	0x0F

2.3 Notes on Programming

(1)The following is used for OCommandInfo's type variable.
ERS-7's ear odataJOINT_COMMAND4

(2) If you want to make the jam detection less strict, put and edit
the following file:

/OPEN-R/SYSTEM/CONF/VRCOMM.CFG

and set 'JamDetectionHighThreshold' in this file.

(3) Don't activate the ear plunger to 'on' for an extended period; it may
cause damage to AIBO.

Chapter 3 Devices

- (1)Refer to Appendix A.1 for CPC Primitive Locator.
- (2)Refer to Level2 Reference Guide for details of functions and values.

3.1 Output Devices

3.1.1 Light

Specifications

LED method

Face lights are controlled by A /B faces. (Refer to A.2)

OCommandInfo's type variable, and structure of OCommandData's value variable

Face light, Back light : odataLEDCOMMAND3, OLEDCommandValue3

Others : odataLEDCOMMAND2, OLEDCommandValur2

Notes

(1)Face lights can show A /B faces by setting OLEDCommandValue3's mode variable to the following. (mode is ineffective on Back lights.)

oled3_MODE_A, oled3_MODE_B

(2)Face lights and Back lights can show a range between 0 and 255 by setting OLEDCommandValue's intensity variable.

Color of Face lights

(A1 means Face light 1's A surface)

Face light's ID, Color of A surface, Color of B surface

- 1 white green (A1 and B1 are same position.)
- 2 white green (A2 and B2 are same position.)
- 3 white green (B3 and B13's left are same position.)
- 4 white green (B4 and B13's right are same position.)
- 5 white green (A5 and B5 are same position.)
- 6 white white (A6 and B6 are same position.)
- 7 white white (A7 and B7 are same position.)
- 8 white white (A8 and B8 are same position.)
- 9 white white (A9 and B9 are same position.)
- 10 white white (A10 and B10 are same position.)
- 11 white white (A11 and B11 are same position.)
- 12 white white (A12 and B12 are same position.)
- 13 red blue (A13 and A9:A10(B9+B10) are same position.
B13 and B3+B4 are same position)
- 14 red blue

Notes

- (1) You can't use A/B surface's LED at the same time. (ex. A1 and B2)
- (2) If you use same position's LED at the same time, the colors become blended. (ex. A9 and A13)

3.1.2 Speaker

Specifications

Sampling frequency: 8kHz/16kHz
Quantized bit length: 8bit/16bit (Linear PCM)
Channel: 1 channel (monaural)

Variables which can be set during OPENR::ControlPrimitive()'s request

`oprmmreqSPEAKER_MUTE_ON`

`oprmmreqSPEAKER_MUTE_OFF`

`oprmmreqSPEAKER_SET_VOLUME`

set the following `OSpeakerVolume` to param's variable

`ospkvolinfdB` (minimum)

`ospkvol25dB` (-25dB)

`ospkvol18dB` (-18dB)

`ospkvol10dB` (-10dB)

`oprmmreqSPEAKER_GET_SOUND_TYPE`

`oprmmreqSPEAKER_SET_SOUND_TYPE`

set the following `OSpeakerVolume` to param's variable

`soundType(ospksndMONO8K8B)`

`soundType(ospksndMONO16K16B)`

3.2 Input Devices

3.2.1 Color Camera

Specifications

CMOS part: 1/4 inch
The number of picture elements: 416(H) x 320(V), 30 FPS
Lens: F 2.8, f = 3.27mm
Angle of view:
 Horizontal angle 56.9 degrees
 Vertical angle 45.2 degrees
Default:
 White balance 5000K fixed
 Shutter speed 1/100 sec fixed
 Gain 0dB fixed

Variables which can be set during OPENR::ControlPrimitive()'s request

White balance

oprmmreqCAM_SET_WHITE_BALANCE
ocamparamWB_INDOOR_MODE (2856K)
ocamparamWB_FL_MODE (5000K)
ocamparamWB_OUTDOOR_MODE (6500K)

Shutter speed

ocamparamSHUTTER_SLOW (1/50sec)
ocamparamSHUTTER_MID (1/100sec)
ocamparamSHUTTER_FAST (1/200sec)

Gain

ocamparamGAIN_LOW (-6dB)
ocamparamGAIN_MID (0dB)
ocamparamGAIN_HIGH (+6dB)

Notes

In ERS-7, the CDT is effective for channel 0-6 and channel 7 is NOT available.

3.2.2 Stereo microphones

Specifications

Sampling frequency: 16kHz
Quantized bit length: 16bit (Linear PCM)
Channel: 2 channel (stereo)

Variables which can be set during OPENR::ControlPrimitive()'s request

No effective variable.

3.2.3 Head sensor, Back sensor

Specifications

Electrostatic method

Value of OSensorValue's signal and value variables

Signal and value variables are the same AD value and the output range is about (0,80).

(reference) on/off's thresholds

	on's threshold	off's threshold
Head sensor	9	9
Back sensor(front)	12	12
Back sensor(middle)	14	10
Back sensor(rear)	14	10

Notes

(1)The back sensors' thresholds consider hysteresis and shape of the sensor.

(2)Thresholds may vary according to temperature and humidity.

3.2.4 Paw sensor, Chin sensor

Specifications

Switch method

Value of OSensorValue's signal and value variables

Return the following values.

OswitchON, oswitchOFF

3.2.5 Distance sensor

Specifications

The head distance sensor switches between the near and far sensors.

(Refer to A1.3.)

Range of OSensorValue's value variable (unit: 10^{-6} m)

Chest distance sensor	(100000, 900000)
Head distance sensor(near)	(50000, 500000)
Head distance sensor(far)	(200000, 1500000)

Notes

(1)The output values for the near/far head distance sensor appears alternatively. During each sensor's turn, the result will show the most recent value. At other times, the result will show 0 for the signal, and remember the most recent value for the value(e.g. the previous' frame's value). For example:

(sample for near distance sensor)

frame-ID turn signal value

0	near	s1	v1
1	far	0	v1
2	near	s2	v2
3	far	0	v2

(2)The device measurement period of the head distance sensor is about 50msec; the chest distance sensor's period is about 40msec; and the software's sampling period is about 8msec. So, there might be a small delay to update the latest value due to the differences in the various update periods.

3.2.6 Acceleration sensor

Specifications

3 axis(front-back, right-left, up-down)

Range of OSensorValue's value variable (unit: 10^{-6}m/sec^2)

(-19613300, 19613300)

3.2.7 Vibration sensor

Specifications

The vibration sensor is connected to a microprocessor for battery control.

Variables which can be set during OPENR::Shutdown()'s bootCondition

If the following variable is set, when the vibration sensor detects a vibration, the battery control microcomputer can boot AIBO.

obcbVIBRATION_DETECTED

Appendix

A.1 List of CPC Primitive Locators

To use these locators, specify the CPC Primitive Locator in OPENR::OpenPrimitive() and retrieve the ID.

For ease of reading, this list shows the small character 'l' in the color blue, and the numeral '1' in the color black.

	CPC Primitive Locator	Parts	
Head	PRM:/r1/c1-Joint2:11	Neck tilt1	
	PRM:/r1/c1/c2-Joint2:12	Neck pan	
	PRM:/r1/c1/c2/c3-Joint2:13	Neck tilt2	
	PRM:/r1/c1/c2/c3/c4-Joint2:14	Mouth	
	PRM:/r1/c1/c2/c3/e5-Joint4:15	Left ear	
	PRM:/r1/c1/c2/c3/e6-Joint4:16	Right ear	
	PRM:/r1/c1/c2/c3/t1-Sensor:t1	Head sensor	
	PRM:/r1/c1/c2/c3/p1-Sensor:p1	Head distance sensor(near)	
	PRM:/r1/c1/c2/c3/p2-Sensor:p2	Head distance sensor(far)	
	PRM:/r1/c1/c2/c3/c4/s5-Sensor:s5	Chin sensor	
	PRM:/r1/c1/c2/c3/l1-LED2:l1	Head light(color)	
	PRM:/r1/c1/c2/c3/l2-LED2:l2	Head light(white)	
	PRM:/r1/c1/c2/c3/l3-LED2:l3	Mode Indicator(red)	
	PRM:/r1/c1/c2/c3/l4-LED2:l4	Mode Indicator(green)	
	PRM:/r1/c1/c2/c3/l5-LED2:l5	Mode Indicator(blue)	
	PRM:/r1/c1/c2/c3/l6-LED2:l6	Wireless light	
	PRM:/r1/c1/c2/c3/la-LED3:la	Face light1	
	PRM:/r1/c1/c2/c3/lb-LED3:lb	Face light2	
	PRM:/r1/c1/c2/c3/lc-LED3:lc	Face light3	
	PRM:/r1/c1/c2/c3/ld-LED3:ld	Face light4	
	PRM:/r1/c1/c2/c3/le-LED3:le	Face light5	
	PRM:/r1/c1/c2/c3/lf-LED3:lf	Face light6	
	PRM:/r1/c1/c2/c3/lg-LED3:lg	Face light7	
	PRM:/r1/c1/c2/c3/lh-LED3:lh	Face light8	
	PRM:/r1/c1/c2/c3/li-LED3:li	Face light9	
	PRM:/r1/c1/c2/c3/lj-LED3:lj	Face light10	
	PRM:/r1/c1/c2/c3/lk-LED3:lk	Face light11	
	PRM:/r1/c1/c2/c3/l1-LED3:l1	Face light12	
	PRM:/r1/c1/c2/c3/lm-LED3:lm	Face light13	
	PRM:/r1/c1/c2/c3/ln-LED3:ln	Face light14	
	PRM:/r1/c1/c2/c3/i1-FbkImageSensor:F1	Color Camera	
	PRM:/r1/c1/c2/c3/m1-Mic:M1	Stereo microphones	
	Left front leg	PRM:/r2/c1-Joint2:21	Left front legJ1
		PRM:/r2/c1/c2-Joint2:22	Left front legJ2
PRM:/r2/c1/c2/c3-Joint2:23		Left front legJ3	
PRM:/r2/c1/c2/c3/c4-Sensor:24		Left front leg, paw sensor	
Left rear leg	PRM:/r3/c1-Joint2:31	Left rear legJ1	
	PRM:/r3/c1/c2-Joint2:32	Left rear legJ2	
	PRM:/r3/c1/c2/c3-Joint2:33	Left rear legJ3	
	PRM:/r3/c1/c2/c3/c4-Sensor:34	Left rear leg, paw sensor	

Right front leg

PRM:/r4/c1-Joint2:41	Right front legJ1
PRM:/r4/c1/c2-Joint2:42	Right front legJ2
PRM:/r4/c1/c2/c3-Joint2:43	Right front legJ3
PRM:/r4/c1/c2/c3/c4-Sensor:44	Right front leg, paw sensor

Right rear leg

PRM:/r5/c1-Joint2:51	Right rear legJ1
PRM:/r5/c1/c2-Joint2:52	Right rear legJ2
PRM:/r5/c1/c2/c3-Joint2:53	Right rear legJ3
PRM:/r5/c1/c2/c3/c4-Sensor:54	Right rear leg, paw sensor

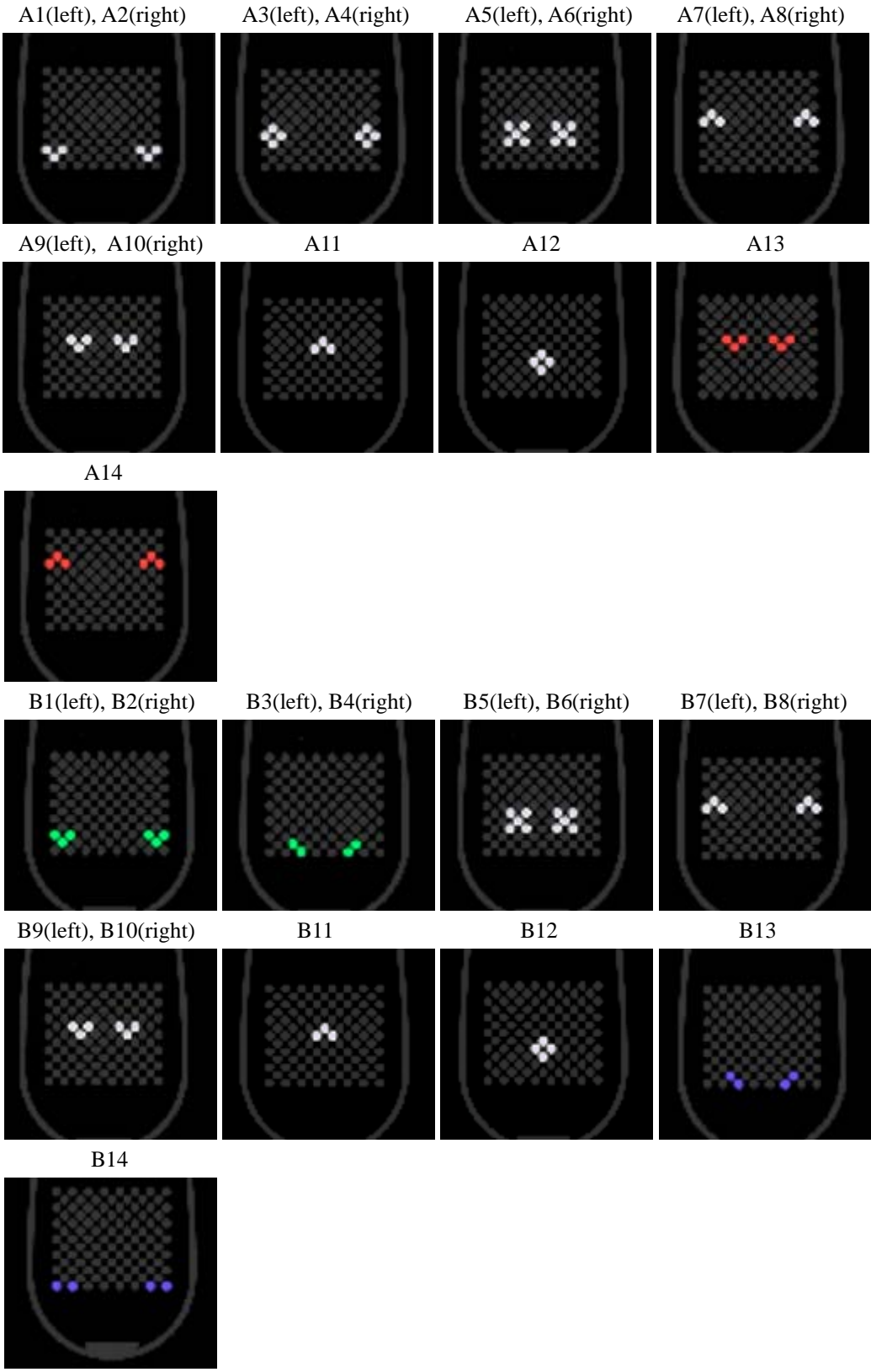
Tail/Others

PRM:/r6/c1-Joint2:61	Tail tilt
PRM:/r6/c2-Joint2:62	Tail pan
PRM:/s1-Speaker:S1	Speaker
PRM:/p1-Sensor:p1	Chest distance sensor
PRM:/b1-Sensor:b1	Wireless LAN switch
PRM:/t2-Sensor:t2	Back sensor(rear)
PRM:/t3-Sensor:t3	Back sensor(middle)
PRM:/t4-Sensor:t4	Back sensor(front)
PRM:/lu-LED3:lu	Back light(front, color)
PRM:/lv-LED3:lv	Back light(front, white)
PRM:/lw-LED3:lw	Back light(middle, color)
PRM:/lx-LED3:lx	Back light(middle, white)
PRM:/ly-LED3:ly	Back light(rear, color)
PRM:/lz-LED3:lz	Back light(rear, white)

Acceleration sensor

PRM:/a1-Sensor:a1	Acceleration sensor(front-back)
PRM:/a2-Sensor:a2	Acceleration sensor(right-left)
PRM:/a3-Sensor:a3	Acceleration sensor(up-down)

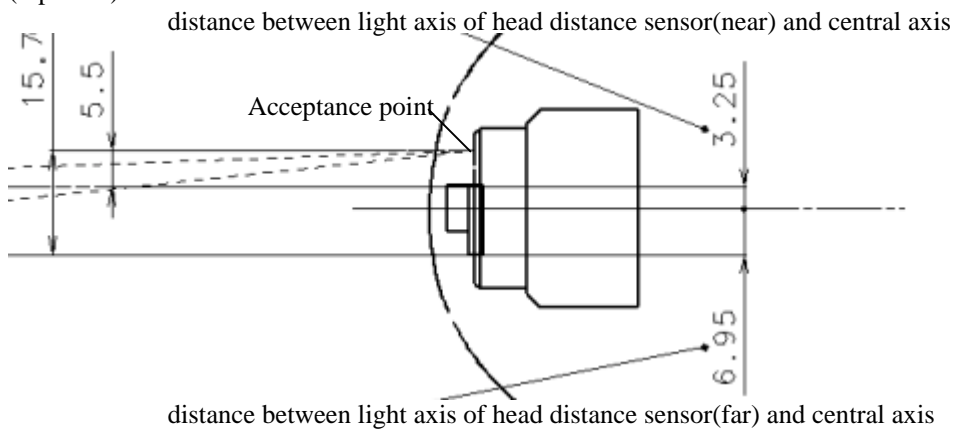
A.2 Position and Color of Face lights



A.3 Direction of Distance sensors

Head distance sensor

(top view)



Chest distance sensor

(side view)

