Robotiq Adaptive Gripper
Technical Datasheet for Willow Garage

Version: December 9th, 2010

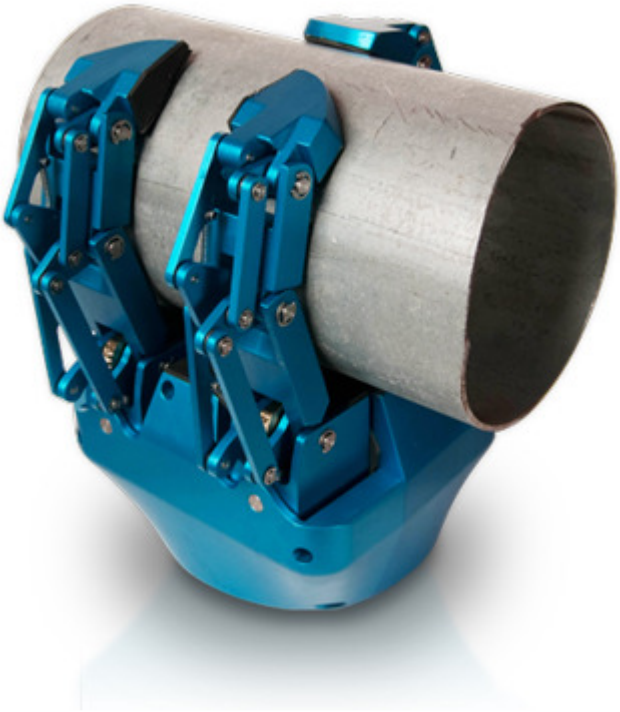

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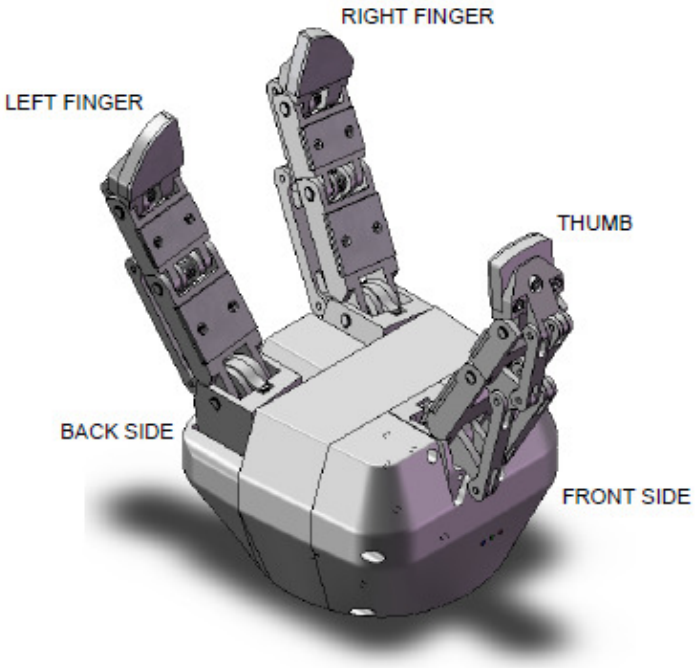
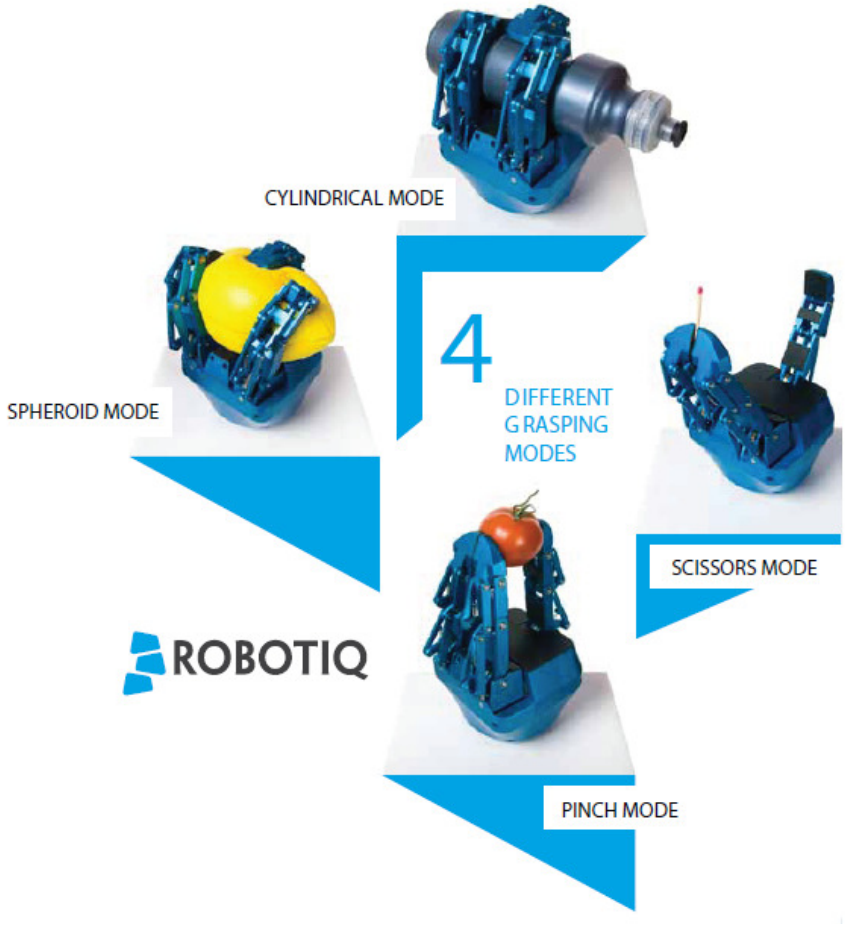
TABLE OF CONTENT

1 Gripper Definition and Grasping Modes





2 Gripper Electrical Absolute Ratings

Parameter	Conditions	Value	Unit
1. Minimum supply voltage	For communication only	12	V
2. Minimum operating supply voltage	Lower bound for motor operation	48	V
3. Maximum supply voltage	Over voltage upper bound	80	V
4. Quiescent power	Minimum power consumption	4.1	W
5. Peak power	At maximum gripping force	35	W
6. Maximum RMS supply current	Supply voltage at 48 V	700	mA
7. Maximum operating temperature	Ambient temperature	50	°C
8. Minimum operating temperature	Ambient temperature	0	°C

3 Gripper Modes of Operation

The following table explains the modes of operation of the gripper according to the voltage supplied by the PR2's Power Board (PB)

PR2 Mode	PB Voltage	Gripper Mode
Disable	0 V	Offline
Reset	18 V	Communication enabled, motors are OFF
Standby	18 V	Communication enabled, motors are OFF
Enabled	54 V to 72 V	Communication enabled, motors are ON

4 Gripper LED Indicators

Power LED

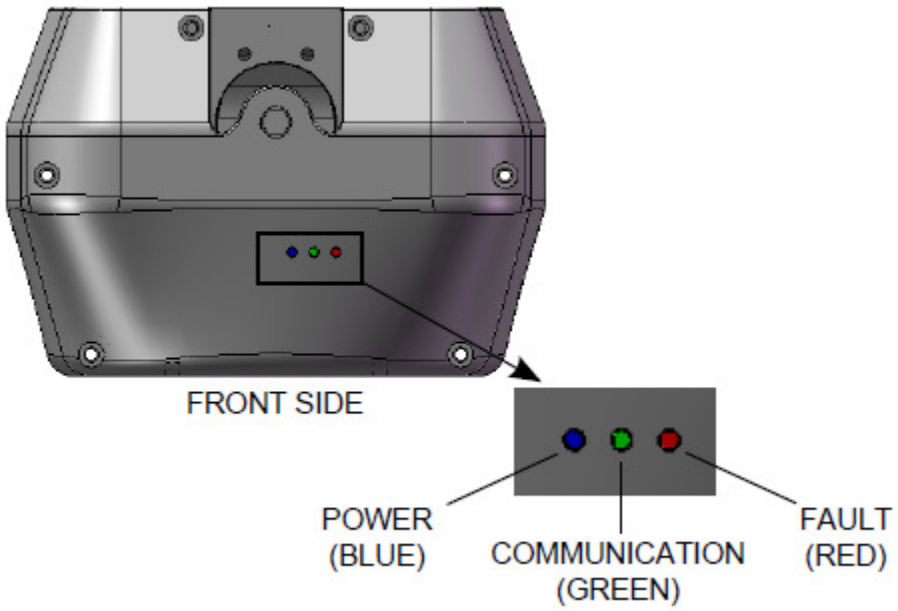
Color	State	Information
Blue	Off	Gripper is not supplied
Blue	On	The gripper is correctly supplied and the control board is running

Communication LED

Color	State	Information
Green	Off	No network detected
Green	On	An EtherCAT network has been detected
Green	Blinking	An EtherCAT communication has been established

Fault LED

Color	State	Information
Red	Off	No fault detected
Red	On	Action and/or Communication fault occurred. See FAULT STATUS register in section 6
Red	Blinking	A major fault occurred. See FAULT STATUS register in section 6



5 Gripper EtherCAT Configuration

Identification

Vendor ID	0xE0000044
Product Code	0x0000000B
Revision Number	0x00000000
Serial Number	0x00000000

Data

Input Data Bytes	12
Output Data Bytes	12

6 Gripper Register Mapping

Register	Robot Output / Gripper Input	Robot Input / Gripper Output
Byte 0	ACTION REQUEST	GRIPPER STATUS
Byte 1	SAFETY SHUTDOWN (RS232 Modbus only)	OBJECT STATUS
Byte 2	VELOCITY	RESERVED
Byte 3	FORCE	FAULT STATUS
Byte 4	PARTIAL OPEN	THUMB POSITION
Byte 5	PARTIAL CLOSE	RIGHT FINGER POSITION
Byte 6		LEFT FINGER POSITION
Byte 7		SCISSORS POSITION
Byte 8		THUMB CURRENT
Byte 9		RIGHT FINGER CURRENT
Byte 10		LEFT FINGER CURRENT
Byte 11		SCISSORS CURRENT

Notes

- Register format is Little Endian (Intel format), namely from LSB (Less significant bit) to MSB (Most Significant Bit)

7 Gripper Input / Robot Output Registers

Register: ACTION REQUEST
Address: Byte 0

Bit	Name	Description
0	rINI	0 – Reset Gripper 1 – Initialize Gripper (Must stay on after initialization is completed)
1	rMOD	00 – Go to Cylindrical Mode 10 – Go to Pinch Mode 01 – Go to Spheroid Mode 11 – Go to Scissors Mode
2		
3	rGRP	00 – Stop 10 – Open 01 – Close 11 – Stop
4		
5	rPRO	0 – Set opening displacement to maximal opening 1 – Set opening displacement up to requested position (See Register PARTIAL OPEN)
6	rPRC	0 – Set closing displacement to maximal closing 1 – Set closing displacement up to requested position (See Register PARTIAL CLOSE)
7	rRS1	Reserved

Register: SAFETY SHUTDOWN (RS232 Modbus only)
Address: Byte 1

Bit	Name	Description
0 – 3	rRS2	Reserved
4 – 7	rSSH	Timeout between successive requests before shutdown 0x0 – No Shutdown 0x1 – 20ms 0x2 – 40ms 0x3 – 80ms 0x4 – 160ms 0x5 – 320ms 0x6 – 640ms 0x7 – 1280ms 0x8 – 2560ms 0x9 – 5120ms 0xA to 0xF – 10240ms

Register: VELOCITY
Address: Byte 2

Bit	Name	Description
0 – 7	rVEL	Set Grasping Velocity 0x00 (Minimum velocity) to 0xFF (Maximum velocity)

Register: FORCE
Address: Byte 3

Bit	Name	Description
0 – 7	rFOR	Set Grasping Force 0x00 (Minimum force) to 0xFF (Maximum force)

Register: PARTIAL OPEN
Address: Byte 4

Bit	Name	Description
0 – 7	rPPO	Set position for partial opening 0x00 (Full opening) to 0xFF (No opening)

Register: PARTIAL CLOSE
Address: Byte 5

Bit	Name	Description
0 – 7	rPPC	Set position for partial closing (0x00 – 0xFF) 0x00 (No closing) to 0xFF (Full closing)

8 Gripper Output / Robot Input Registers

Register: GRIPPER STATUS
Address: Byte 0

Bit	Name	Description
0	gINI	0 – Gripper Resetted 1 – Initialization completed
1 2	gMOD	00 – Cylindrical Mode 10 – Pinch Mode 01 – Spheroid Mode 11 – Scissors Mode
3 4	gGRP	00 – Stop 10 – Open 01 – Close 11 – Mode Change, Initialization
5 6	gSTA	00 – Requested action has faulted (see Register FAULT STATUS) 10 – Requested action is in progress 01 – Illegal/Undefined 11 – Requested action was successfully completed
7	gRS1	Reserved. Set to 1

Register: OBJECT STATUS
Address: Byte 1

Bit	Name	Description
0 1	gOBJ	00 – No object detected 10 – One finger detected an object (Illegal for Scissors mode) 01 – Two fingers detected an object (Illegal for Scissors mode) 11 – All fingers (or Scissors in Scissors mods) detected an object
2	gOBT	0 – No object was detected by the Thumb 1 – An object was detected by the Thumb
3	gOBR	0 – No object was detected by the Right Finger (looking from Front) 1 – An object was detected by the Right Finger (looking from Front)
4	gOBL	0 – No object was detected by the Left Finger (looking from Front) 1 – An object was detected by the Left Finger (looking from Front)
5	gOBS	0 – No object was detected by the Scissors 1 – An object was detected by the Scissors
6 7	gRS2	Reserved. Set to 0

Register: RESERVED
Address: Byte 2

Bit	Name	Description
0	gRS3	Reserved. Set to 0

Register: FAULT STATUS
Address: Byte 3

Bit	Name	Description
0 – 7	gFLT	0x00 – No Fault Priority Fault 0x11 – Action delayed, initialization must be completed prior to action 0x12 – Action delayed, mode change must be completed prior to action Communication Fault 0x21 – Communication timeout, Gripper is stopped 0x22 – Insufficient supply voltage, Gripper is stopped Action Fault. 0x31 – Changing mode fault, interferences detected on Scissors 0x32 – Gripper opening fault, interferences detected on Fingers 0x33 – Gripper opening fault, interferences detected on Scissors 0x34 – Gripper closing fault, abnormal displacement of Fingers 0x35 – Gripper closing fault, abnormal displacement of Scissors Major Fault. Reset is required 0x41 – Initialization fault, insufficient Scissors displacement 0x42 – Initialization fault, insufficient Fingers displacement

Register: THUMB POSITION
Address: Byte 4

Bit	Name	Description
0	gPOT	Position of the Thumb 0x00 (Fully opened) to 0xFF (Fully closed)

Register: RIGHT FINGER POSITION
Address: Byte 5

Bit	Name	Description
0	gPOR	Position of the Right Finger (looking from Gripper Front) 0x00 (Fully opened) to 0xFF (Fully closed)

Register: LEFT FINGER POSITION
Address: Byte 6

Bit	Name	Description
0	gPOL	Position of the Left Finger (looking from Gripper Front) 0x00 (Fully opened) to 0xFF (Fully closed)

Register: SCISSORS POSITION
Address: Byte 7

Bit	Name	Description
0	gPOS	Position of the Scissors 0x00 (Fully opened) to 0xFF (Fully closed)

Register: THUMB CURRENT
Address: Byte 8

Bit	Name	Description
0	gCUT	Current of the Thumb 0.1 * Current (in mA)

Register: RIGHT FINGER CURRENT
Address: Byte 9

Bit	Name	Description
0	gCUR	Current of the Right Finger (looking from Gripper Front) 0.1 * Current (in mA)

Register: LEFT FINGER CURRENT
Address: Byte 10

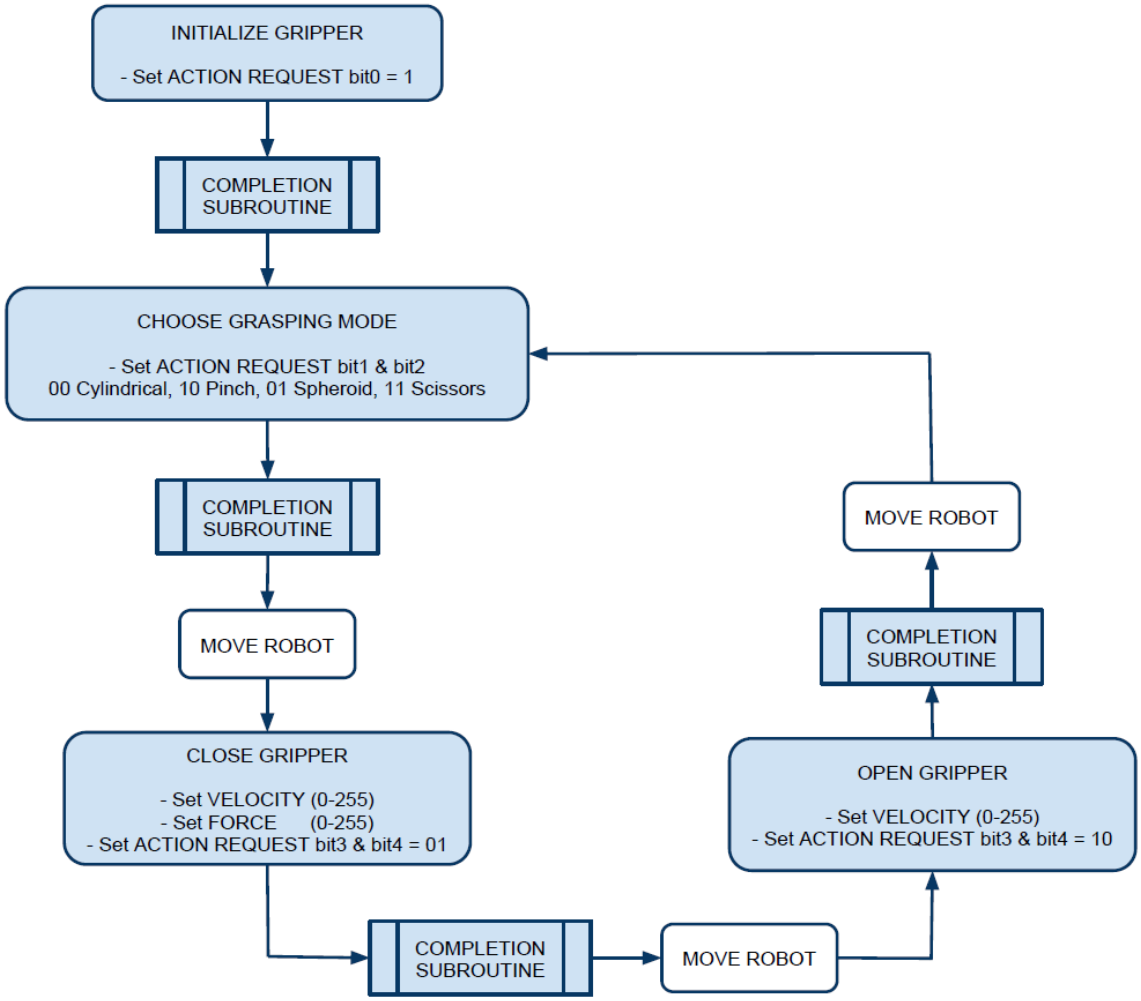
Bit	Name	Description
0	gCUL	Current of the Left Finger (looking from Gripper Front) 0.1 * Current (in mA)

Register: SCISSORS CURRENT
Address: Byte 11

Bit	Name	Description
0	gCUS	Current of the Scissors 0.1 * Current (in mA)

9 Gripper Control Organigram

Main Algorithm



Completion Subroutine Algorithm