

UP-Debugger Manual

&

proMOTION CDS55xx Robot Servo

/BDMC1203 DC motor driver

Quick Start

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1.0.0	2010-2-2	徐俊辉	王野	Simple quick start
1.1.0	2010-3-20	王野		Revise
1.2.0	2010-9-2	王野		

The CDS55xx robot servo use special half-duplex UART bus as input source. User need to use a UP-debugger board to connect the robot servos to PC via USB port, or make a circuit to communicate to other host MCU (please refer to CDS55xx datasheet or BDMC1203 datasheet).

The BDMC1203 DC motor driver use similar circuits and program of CDS55xx robot servos. You can take it as a special robot servo, which can only work at "gear-motor mode". Both CDS55xx servo and BDMC1203 motor driver use the same instruction set.

This Quick start document will guide you to:

- Connect a robot servo(or a BDMC1203 motor driver) to your PC via USB port, using a UP-debugger board
- Tune CDS55xx servos or BDMC1203 motor driver's parameters
- Run CDS55xx servos or BDMC1203 motor driver though Robot Servo Terminal software

For more details, such as instruction sets, electrical schematics and timing table, please refer to CDS55xx datasheets.

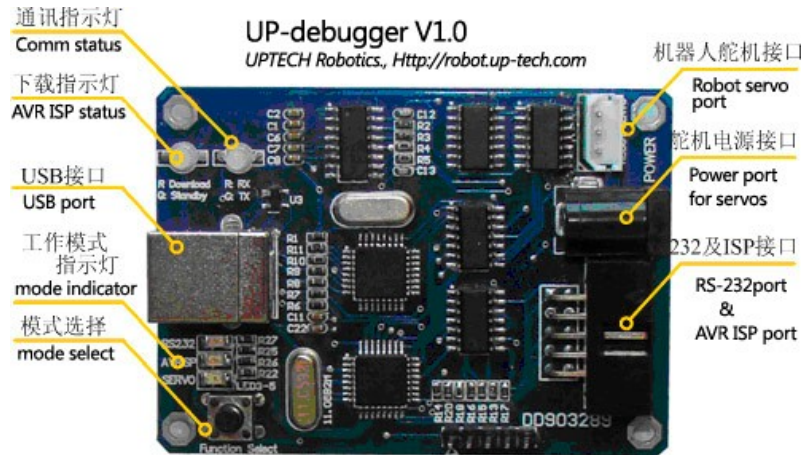
1 UP-Debugger: a 3-in-1 debugger

UP-Debugger is a 3-in-1 multi purpose board, can be used as three modes:

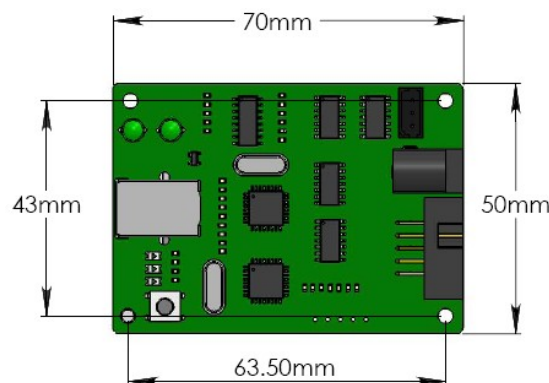
- RS-232: A USB to RS-232 adaptor
- AVRISP: An AVR-ISP programmer
- SERVO: A robot servo communicate adaptor (compatible with Robotis Dynamixel AX12+).

User can use UP-Debugger to setup and tune the CDS55xx robot servo. This document will discuss the robot servo communicate adaptor mode only.

The three modes can be switched by pressing the "mode select" button. When setup & tuning CDS55xx servos, user should switch the debugger to "SERVO" mode. The diagram of UP-debugger is shown as the following figure:



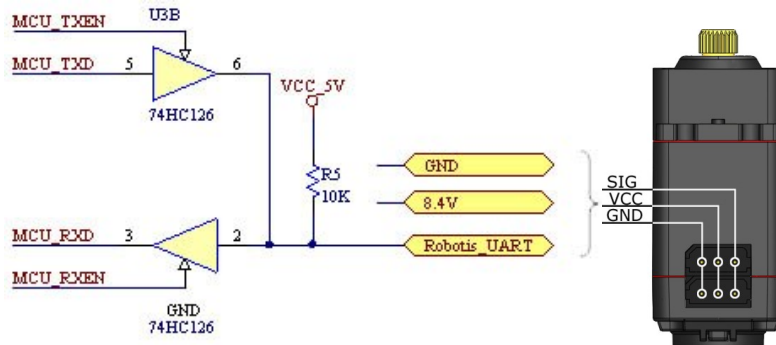
1.1 Structure of UP-debugger



The UP-Debugger does not have a full case. Please note that do not short-circuit any part of the board circuit.

1.2 Schematic of the half-duplex UART

The UP-debugger, the CDS55xx robot servo and BDMC1203 motor driver use the same input interface circuit, a half-duplex UART. It's compatible to Robotis' Dynamixel AX12+. The following figure shows the schematic of the interface circuit.



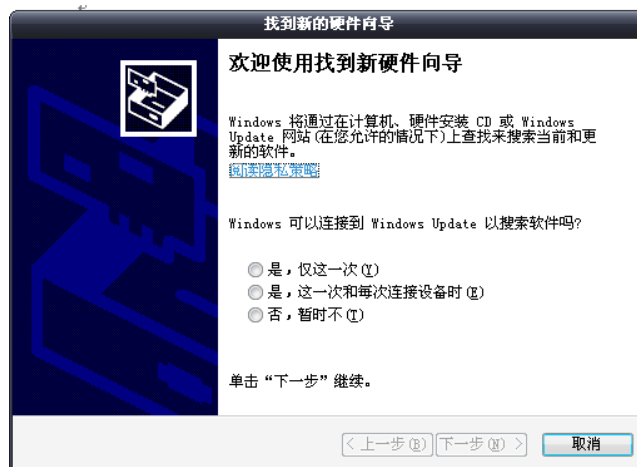
1.3 System requirement and driver

The UP-Debugger contains a USB to RS-232 (and to Dynamixel) converter IC. User need a PC running Windows 2000\ Windows XP or Windows Vista, and need to install a driver to use this board.

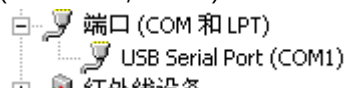
1.4 Use the UP-debugger

1. Install driver

- 1、 Download the driver installation, and unzip it to a folder. ([Click here for download](#))
- 2、 Use USB cable to connect the UP-Debugger to PC. There will be a dialog box informing you to install the driver. Following the wizard and choose the driver installation folder and click "Next" button.



- 3、 When installation succeed, there will be a virtual serial port (USB serial port) in "Device manager" of the windows control panel, shown as the following figure. Please remember the COM number (I.E. COM1,COM4)



2. The pin-configuration of the IDC-10 header of UP-debugger

IDC pin	Name	Function
1、	SCK	AVR-ISP SCK pin
2、	RXD	RS-232 RXD
3、	MISO	AVR-ISP MISO pin

4、	TXD	RS-232 RXD
5、	MOSI	AVR-ISP MOSI pin
6、	GND	Signal ground
7、	/RST	AVR-ISP reset pin
8、	N.C.	Reserved
9、	GND	Signal ground
10、	N.C.	Reserved

Note: the first pin of the IDC-10 header is marked by a "△" symbol.

3. Servo Mode

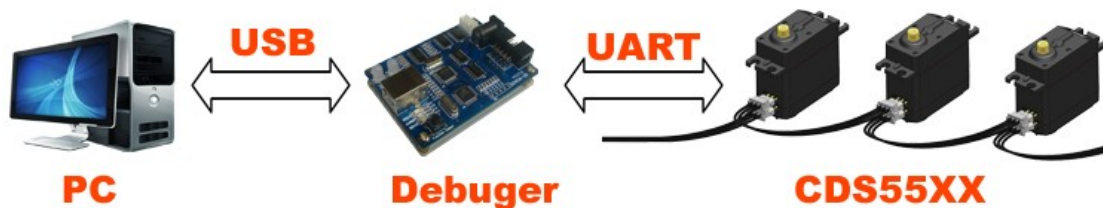
Pressing Function Select button on the board until "SERVO" LED on, to switch to SERVO mode.

Connect the robot servo(CDS55xx or Dynamixel AX12+) to the "Robot servo port" on the UP-debugger, connect the 7~9V/5A AC power adapter to the "Power port for servos". Then use the RobotServoTerminal software to setup and tune the robot servos.

2 RobotServoTerminal software

RobotServoTerminal is a software provide by UPTECH Robotics, it can be used to setup the robot servo and tuning it's parameters.

2.1 Check the connection and open software



Before open the software, make sure you:

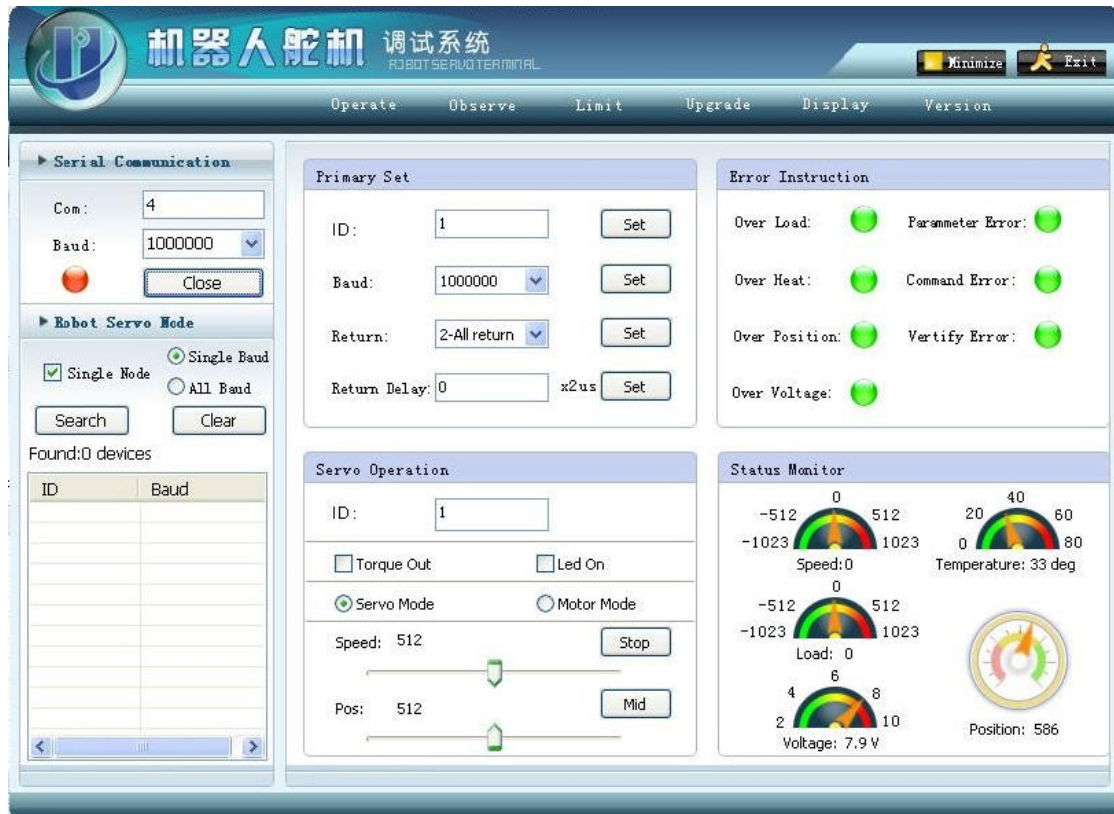
- Connect the UP-Debugger to PC USB port, the power LED on(Running windows)
- Connect at least one CDS55xx servo to the UP-Debugger
- Connect the 7~15V/5A AC adapter, power supplied
 - 12V/5A AC adapter recommended
- UP-Debugger driver Installed

2.2 Set servo ID of CDS55xx(or BDMC1203)

Each CDS55xx servo should have a ID for identification during communication. The default ID is "1" of all new CDS55xx servos. When use multiple CDS55xx servos in one serial connection, you should assign different ID for each servo, otherwise all servos can not work properly.

The following is a example to show you how to change the ID of a servo from ID"1" to ID"10".

Open RobotSevo_Terminal.exe, the following window will appear:

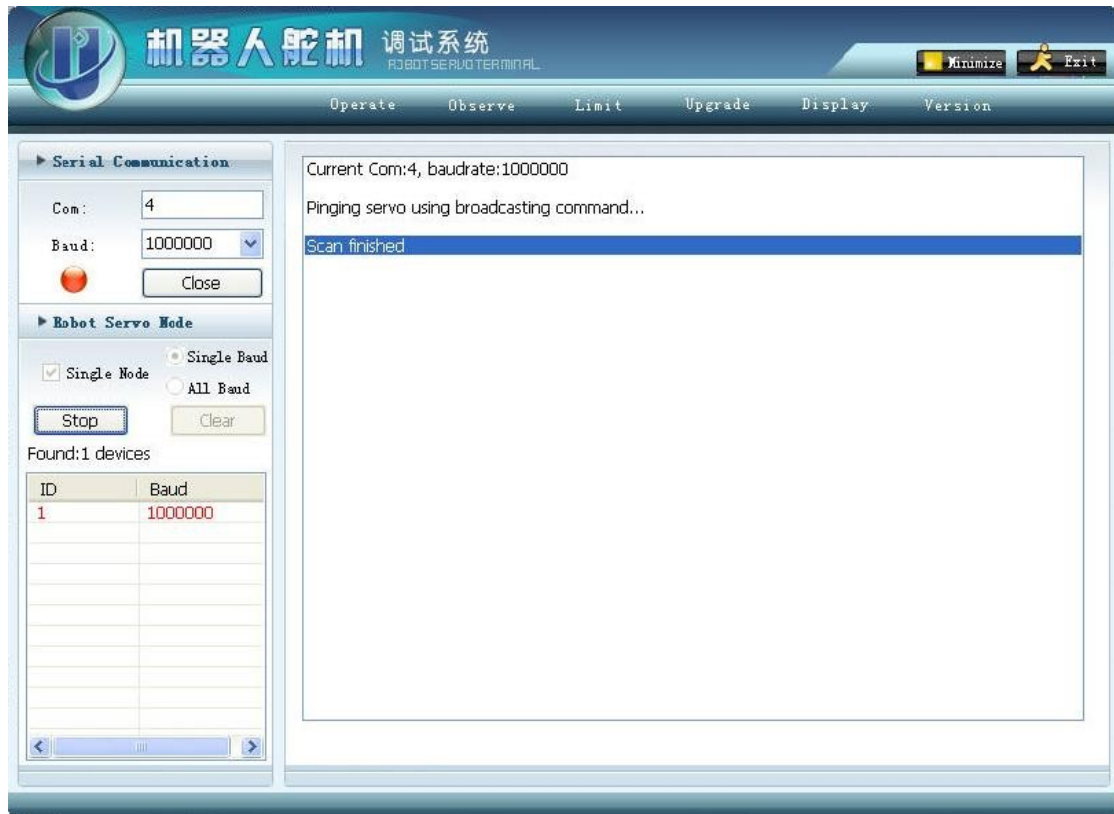


The default baud rate of CDS55xx servo is 1Mbps (1,000,000). User can change baud rate in "Primary Set" window.

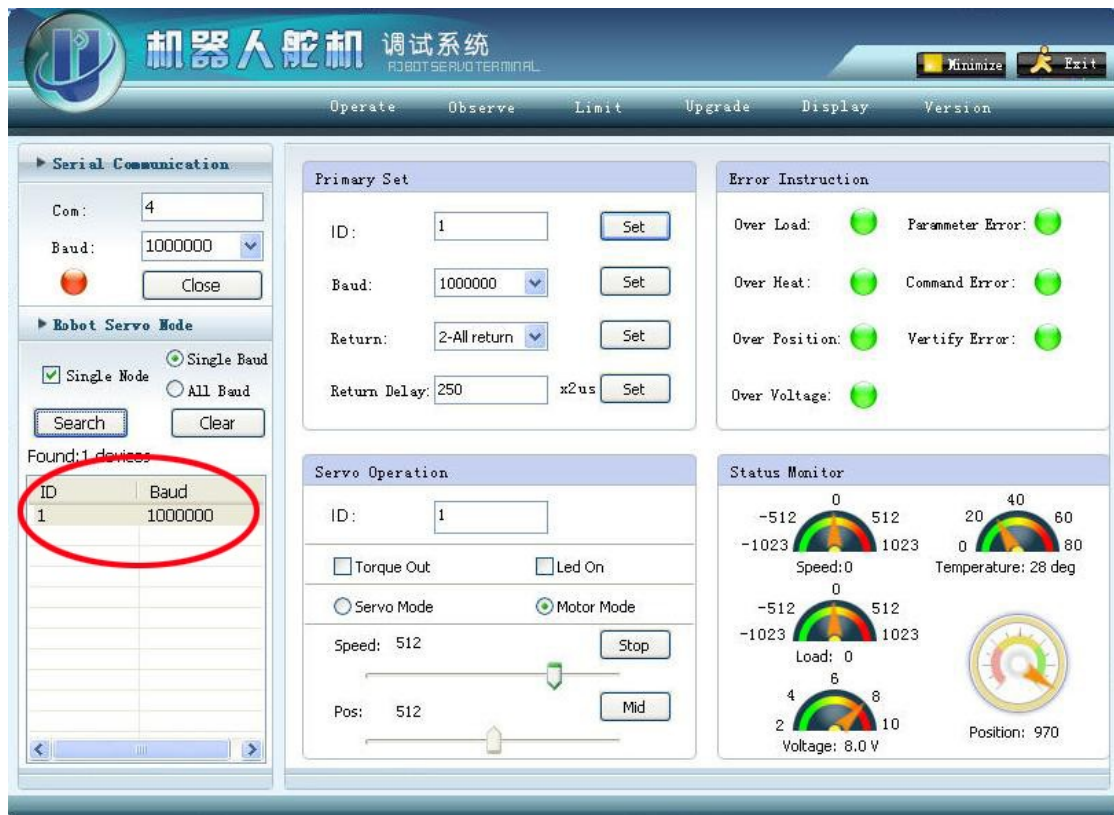
- Single Node: This check box should be checked when only one servo connected;
- Single Baud: The software will search the serial bus with the chosen baud rate;
- All Baud: The software will search the serial bus with all available baud rates;

STEP 1:

Select proper COM port(Virtual serial port number can be found in "Control panel/Device Manager" of your Windows system, when UP-debugger connected and driver installed), Click "Search" button, the software will connect the serial port. Then you can see the following window. If the only servo found, you can click "Stop" button to stop search.

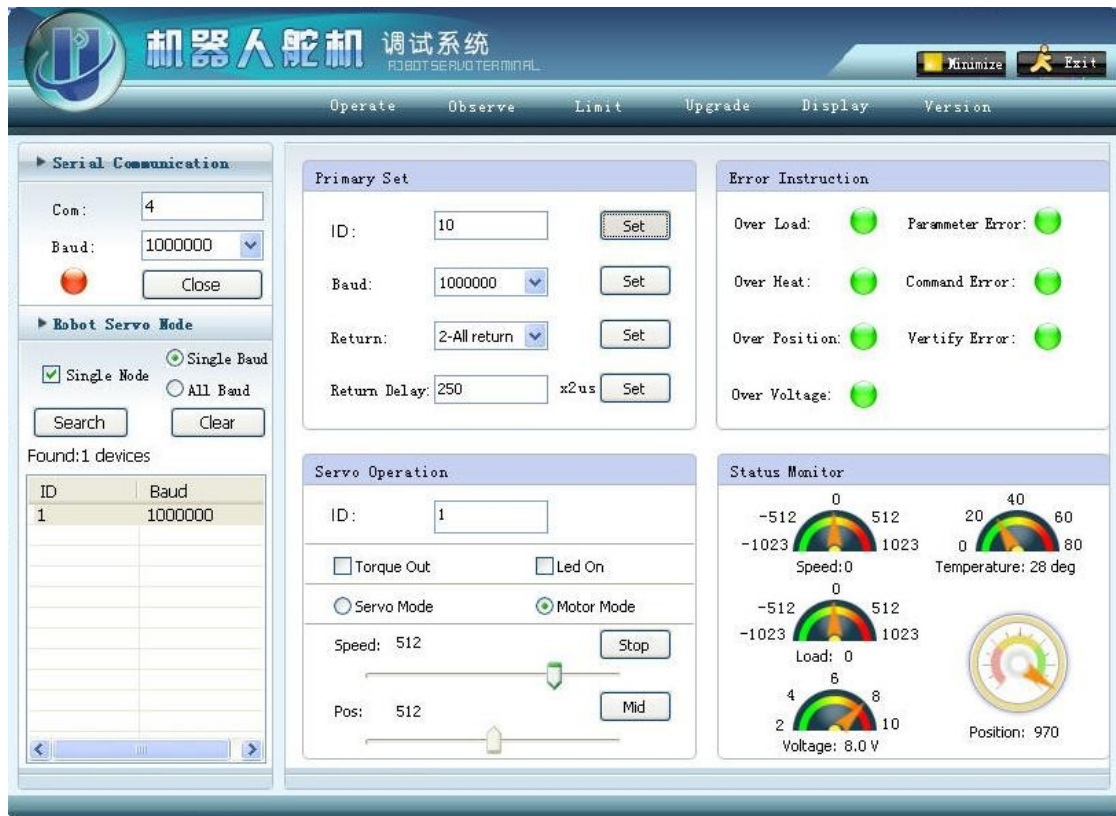


Click the "Operate" window:

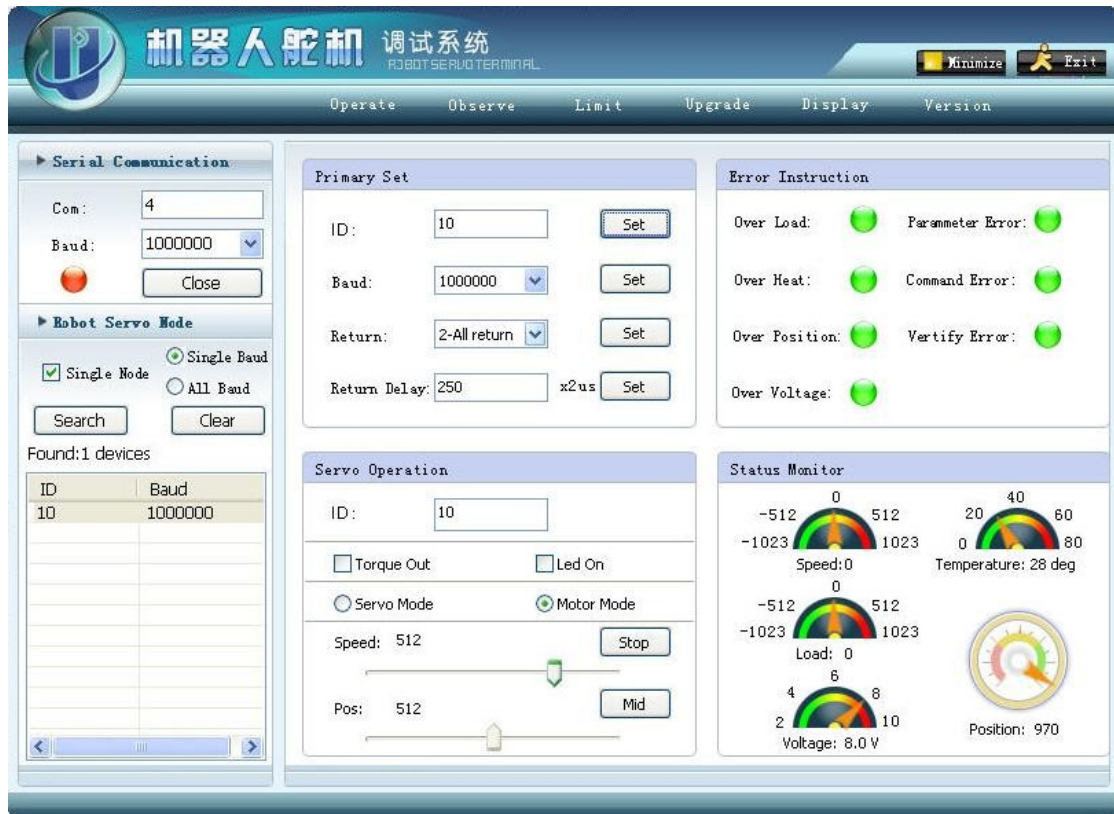


Click the only servo found in the list box (left side of the window). Input "10" in "ID" text box of "Operate/ Primary Set" window on the right side, and click "Set" button. The

changing ID operate is succeed and will take effect. The new ID will be stored in the servo, until you change it again.

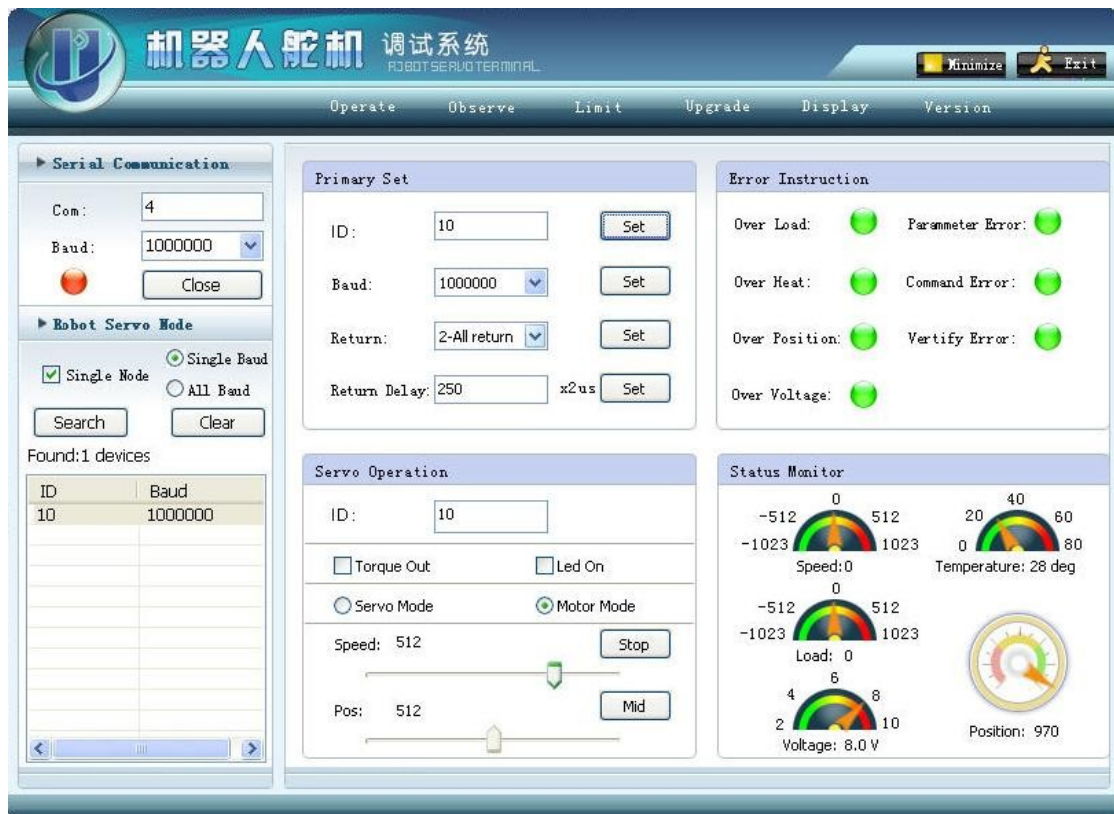


You can set other properties of the CDS55xx servos in the "Primary Set" window. Now click "Search" button again, you can see the servo ID is changed from 1 to 10.



2.3 Try CDS55xx servo(or BDMC1203 motor driver)

Click "Operate" button to show the operate window.



In “Servo Operation” window, “ID” text box is the ID of current active servo. All operation will be applied on this ID. “Torque” check box is to enable the servo. “Led On” is to light the inside status LED of the servo (for CDS5500 servo, the LED is invisible to user). “Servo Mode” and “Motor Mode” can change the work mode of CDS55xx servo: this series of robot servo can work at servo mode(300 degrees position servo) or motor mode(endless turning gear motor mode).

In ““Error Instruction”” window, you can see the error status of the servo. On error, the corresponding green lamp will change to red color.

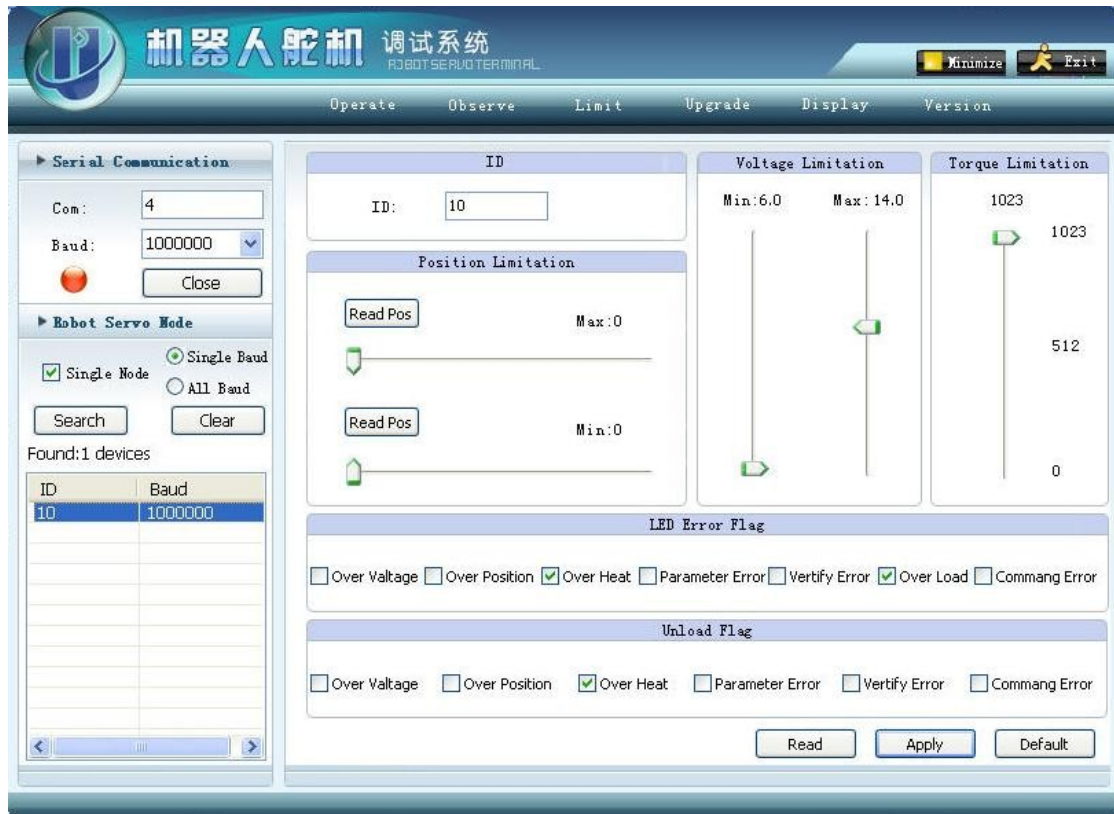
In default, “Over temperature” and “Over load” will trigger “Torque Out” protection. The following table explains all error status:

Name	Function
Command Error	Unknown command Or no <u>REG WRITE</u> command received before <u>ACTION</u> command
Over Load	Output torque is less than payload (Servo mode only)
Verify Error	Checksum error
Parameter Error	Command parameter over limit
Over Heat	Over Heat (temperature limit programmable)
Over Position	Over Position (position limit programmable)
Over Voltage	Over Voltage

Status Monitor window shows current real-time velocity, position PWM output, voltage and temperature of active servo.

2.4 Configure CDS55xx(BDMC1203) limits

Click “Limit” button to show the limitation window.



You can set position limitation of the active servo in “Position Limitation” window. At servo mode, CDS55xx can run from 0° to 300°, the parameter is 0 to 1023. In some case if you want to limit the servo position range from 0° to 200°, you can set position limit from 0 to 682 (682 corresponding to 200°) . In this case, when user give the servo a position command larger than 682, the servo will ignore and the position will be 682.”Read position” button can be used to read the actual position of the active servo.

Voltage Limitation window is used to set the voltage limitation. The physical voltage limit of CDS5500/ 5516 is 6.5 to 10V.

Torque Limitation window is used to limit the maximum output torque of CDS55xx servos. For example, If a “512” is assigned as torque limit, the output torque will be limited to half maximum toque. This function is very useful in many conditions.

In “Led Error Flag” window, you can enable or disable all kinds of protection. Please note that this may disable some protection of the servo, and result in damage to the servo.

In “Unload Flag” window, you can assign one or more condition to trigger “Unload”. Unload means the servo will cut down torque output.

3 Differences between CDS55xx and Robotis AX-12+

CDS55xx servos are mostly compatible with Robotis AX12+. **User can read AX12+ documents and use CDS55xx as Dynamixels in most condition**, except the following:

3.1 CDS55xx special feature

1. Output torque can be limited and controlled by user
2. Acceleration and deceleration can be set by user to get smooth motion
3. The velocity can be feed back at "motor mode"
4. Intelligent I²T current limit enables user to control torque and load current
5. Refresh rate of feedback data can be up to 1KHz
6. available baud rate is 19200, 57600, 115200, 250K, 500K, 1M
7. Hardware temperature limit is 80°C, user can not exceed this limit
8. CDS55xx use the following 6 parameters to control PWM algorithm:
 - a) ACC Acceleration
 - b) DEC Deceleration
 - c) P_CW Coefficient of proportionality, CW
 - d) P_CCW Coefficient of proportionality, CCW
 - e) Dead_CW Dead band width, CW
 - f) Dead_CCW Dead band width, CCWWhen AX12+ use other 6 parameters: CW Compliance Slope, CCW Compliance Slope, CW Compliance Margin, CCW Compliance Margin, Punch
9. Status LED is currently unavailable in CDS5500/5501.

3.2 Support

- For Technical support please visit our technical BBS:
<http://robot.up-tech.com/bbs/index.asp?boardid=10>
- For other documents and software please visit our product web page(English):
<http://robot.up-tech.com/en/ProductView.asp?ID=58>

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