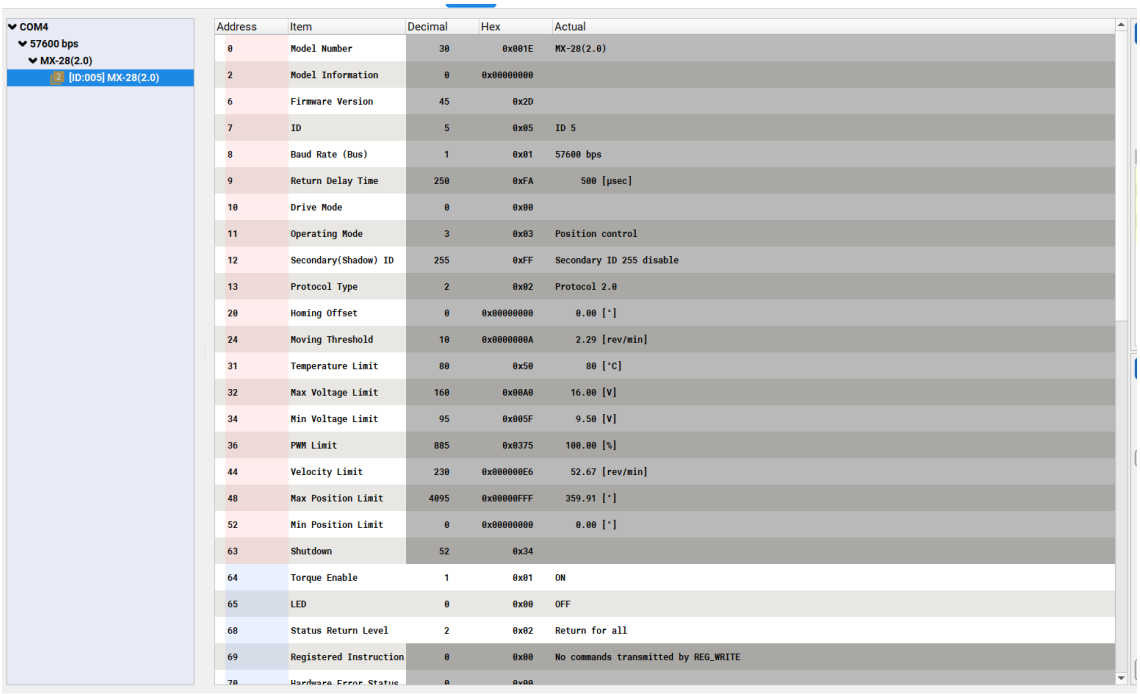
MAE C163A/C263A
Dynamixel MX-28AR Servo Motor Instruction

1. Give each servo motor a unique ID
   i. Download and install Dynamixel Wizard 2.0
   ii. Connect the servo motor to your PC with U2D2 and power it up **(only one motor at a time)**.
   iii. Connect the servo motor to the power supply with RX/EX Power Hub. You should see the motor red LED blink for one time.
   iv. Check this **reference** video on how to do a firmware recovery for Dynamixel Motors here (You should do this for a MX-28 (2.0) model with the latest version ~v45). Here are some items you want to ensure for its configuration.
      a) Protocol Type: 2.0
      b) ID number: Assign different numbers for all the motors
      c) Baudrate: 57600 bps
      d) Operating Mode: Position Control



Address	Item	Decimal	Hex	Actual
0	Model Number	30	0x001E	MX-28(2.0)
2	Model Information	0	0x00000000	
6	Firmware Version	45	0x2D	
7	ID	5	0x05	ID 5
8	Baud Rate (Bus)	1	0x01	57600 bps
9	Return Delay Time	250	0xFA	500 [μsec]
10	Drive Mode	0	0x00	
11	Operating Mode	3	0x03	Position control
12	Secondary(Shadow) ID	255	0xFF	Secondary ID 255 disable
13	Protocol Type	2	0x02	Protocol 2.0
20	Homing Offset	0	0x00000000	0.00 [°]
24	Moving Threshold	10	0x0000000A	2.29 [rev/min]
31	Temperature Limit	80	0x50	80 [°C]
32	Max Voltage Limit	160	0x00A0	16.00 [V]
34	Min Voltage Limit	95	0x005F	9.50 [V]
36	PWM Limit	885	0x0375	100.00 [%]
44	Velocity Limit	230	0x000000E6	52.67 [rev/min]
48	Max Position Limit	4095	0x00000FFF	359.91 [°]
52	Min Position Limit	0	0x00000000	0.00 [°]
63	Shutdown	52	0x34	
64	Torque Enable	1	0x01	ON
65	LED	0	0x00	OFF
68	Status Return Level	2	0x02	Return for all
69	Registered Instruction	0	0x00	No commands transmitted by REG_WRITE
70	Hardware Error Status	0	0x00	

Fig. 1. Configuration for MX-28AR ID:5

   v. Enable the motor torque in Dynamixel Wizard 2.0 and you should be able to drive the motor by changing its goal position parameter. Note that it changes from 0 to 4095 for one revolution and can only rotate less than 360 deg.
   vi. Repeat step ii to v for the rest motors.
   vii. Important Precautions:
      a) During firmware recovery, connect only one motor at a time.
      b) While Dynamixel Wizard is updating the firmware, avoid disconnecting or powering off the motor until the process is complete. Doing otherwise may result in permanent damage to the device.

2. Control servo motors in MATLAB **(Recommended)**
   i. Download DynamixelSDK and follow this **reference** video instruction here in how to set up the paths in MATLAB. You might need to install MinGW in MATLAB for compiling.
   ii. Connect all the servo motors like this. We call it a daisy chain link.
   iii. From the files shared on Bruin Learn, open initialize.m file and modify the DEVICENAME. Check which port is being used on your PC. Modify or add other parameters if necessary.
      a) Make sure to change the ID and the ROBOTIS motor series of the motors that you are controlling in the script (if needed).
   iv. With power on, run main.m file.
      a) If you encounter any issues while running the motors, you can try the following troubleshooting steps: turn the motors off and then back on, unplug and plug in the USB connection, or restart MATLAB.

      You should be able to control all the servo motors simultaneously.

3. Control servo motors with Arduino
   i. Connect the servo motor to Arduino with MAX485 like this. The capacitors are not necessary.
   ii. With power on, run main.ino file.
   iii. Add other instruction packets if necessary.

4. Control servo motors with other programming languages
   i. Check this out and good luck.