## Control Table

Control Table consists of data regarding the current status and operation of CM-730. The user can control CM-730 by changing data of Control Table via Instruction packet.

**EEPROM and RAM**

Data in RAM area is reset to initial values whenever the power is turned on while data in EEPROM area is kept once values are set even if the power is turned off.

**Address**

Represents the location of data. To read from or write data to the control table the user should assign the correct address in the Instruction packet.

**Access**

CM-730 has two kinds of data: Read-only data, used mainly for sensing, and read-and-write data used for driving.

**Initial Value**

In case of data in the EEPROM Area, the initial values on the right side of the below Control Table are the factory default settings.

In case of data in the RAM Area, the initial values on the right side of the following control table are the ones when the power is turned on.

**Highest/Lowest Byte**

In the Control table, some data share the same name, but they are attached with (L) or (H) at the end of each name to distinguish the address. This data requires 16-bit, but it is divided into 8bit each for the addresses (low) and (high). These two addresses should be written with one Instruction Packet simutaneously.

| Area | Address (Hexadecimal) | Name | Description | Access | Initial Value (Hexadecimal) |
|---|---|---|---|---|---|
| EEPROM | 0 (0X00) | Model Number(L) | model number low byte | R | 0(0X00) |
| | 1 (0X01) | Model Number(H) | model number high byte | R | 115 (0X73) |
| | 2 (0X02) | Version of Firmware | firmware version | R | - |
| | 3 (0X03) | ID | Dynamixel ID | RW | 200 (0XC8) |
| | 4 (0X04) | Baud Rate | Dynamixel baud rate | RW | 1 (0X01) |
| | 5 (0X05) | Return Delay Time | Return Delay Time | RW | 0 (0X0) |
| | 16 (0X10) | Status Return Level | Status Return Level | RW | 2 (0X02) |
| RAM | 24 (0X18) | Dynamixel Power | Dynamixel On/Off | RW | 0 (0X00) |
| | 25 (0X19) | LED Pannel | LED Pannel On/Off | RW | 0 (0X00) |
| | 26 (0X1A) | LED 5 (L) | LED 5 low byte | RW | 0 (0X00) |
| | 27 (0X1B) | LED 5 (H) | LED 5 high byte | RW | 0 (0X01) |
| | 28 (0X1C) | LED 6 (L) | LED 6 low byte | RW | 0 (0X00) |
| | 29 (0X1D) | LED 6 (H) | LED 6 high byte | RW | 0 (0X01) |
| | 30 (0X1E) | Button | Button status | R | - |
| | 38 (0X26) | Gyro_Z(L) | Gyroscope Z-axis low byte | R | - |
| | 39 (0X27) | Gyro_Z(H) | Gyroscope Z-axis high byte | R | - |
| | 40 (0X28) | Gyro_Y(L) | Gyroscope Y-axis low byte | R | - |
| | 41 (0X29) | Gyro_Y(H) | Gyroscope Y-axis high byte | R | - |
| | 42 (0X2A) | Gyro_X(L) | Gyroscope X-axis low byte | R | - |
| | 43 (0X2B) | Gyro_X(H) | Gyroscope X-axis high byte | R | - |
| | 44 (0X2C) | ACC_X(L) | Accelerometer X-axis low byte | R | - |
| | 45 (0X2D) | ACC_X(H) | Accelerometer X-axis high byte | R | - |
| | 46 (0X2E) | ACC_Y(L) | Accelerometer Y-axis | R | - |

| | | | | | |
|---|---|---|---|---|---|
| | | | low byte | | |
| | 47 (0X2F) | ACC_Y(H) | Accelerometer Y-axis high byte | R | - |
| | 48 (0X30) | ACC_Z(L) | Accelerometer Z-axis low byte | R | - |
| | 49 (0x31) | ACC_Z(H) | Accelerometer Z-axis high byte | R | |
| | 50 (0X32) | Present Voltage | Current Voltage | R | |
| | 51 (0x31) | MIC 1 (L) | Mic 1 low byte | R | |
| | 52(0x34) | MIC 1 (H) | Mic 1 high byte | R | |
| | 53(0x35) | ADC 2(L) | ADC channel 2 low byte | R | |
| | 54(0x36) | ADC 2(H) | ADC channel 2 high byte | R | |
| | 55(0x37) | ADC 3(L) | ADC channel 3 low byte | R | |
| | 56(0x38) | ADC 3(H) | ADC channel 3 high vyte | R | |
| | 57(0x39) | ADC 4(L) | ADC channel 4 low byte | R | |
| | 58(0x3A) | ADC 4(H) | ADC channel 4 high byte | R | |
| | 59(0x3B) | ADC 5(L) | ADC channel 5 low byte | R | |
| | 60(0x3C) | ADC 5(H) | ADC channel 5 high byte | R | |
| | 61(0x3D) | ADC 6(L) | ADC channel 6 low byte | R | |
| | 62(0x3E) | ADC 6(H) | ADC channel 6 high byte | R | |
| | 63(0x3F) | ADC 7(L) | ADC channel 7 low byte | R | |
| | 64(0x40) | ADC 7(H) | ADC channel 7 high byte | R | |
| | 65(0x41) | ADC 8(L) | ADC channel 8 low byte | R | |
| | 66(0x42) | ADC 8(H) | ADC channel 8 high byte | R | |
| | 67(0x43) | MIC 2 (L) | Mic 2 low byte | R | |
| | 68(0x44) | MIC 2 (H) | Mic 2 high byte | R | |

| | | | | | |
|---|---|---|---|---|---|
| | 69(0x45) | ADC 10(L) | ADC channel 10 low byte | R | |
| | 70(0x46) | ADC 10(H) | ADC channel 10 high byte | R | |
| | 71(0x47) | ADC 11(L) | ADC channel 11 low byte | R | |
| | 72(0x48) | ADC 11(H) | ADC channel 11 high byte | R | |
| | 73(0x49) | ADC 12(L) | ADC channel 12 low byte | R | |
| | 74(0x4A) | ADC 12(H) | ADC channel 12 high byte | R | |
| | 75(0x4B) | ADC 13(L) | ADC channel 13 low byte | R | |
| | 76(0x4C) | ADC 13(H) | ADC channel 13 high byte | R | |
| | 77(0x4D) | ADC 14(L) | ADC channel 14 low byte | R | |
| | 78(0x4E) | ADC 14(H) | ADC channel 14 high byte | R | |
| | 79(0x4F) | ADC 15(L) | ADC channel 15 low byte | R | |
| | 80(0x50) | ADC 15(H) | ADC channel 15 high byte | R | |

## Address Function Help

## EEPROM Area

### Model Number

Represents the Model Number.

### Firmware Version

Represents the firmware version.

### ID

Is a unique number to identify Dynamixel.

Values range from 0 (0x00) to 253 (0xFD), Value 254 (0xFE) is used as the Broadcast ID.

If the Broadcast ID is used to transmit Instruction Packet, then it can command to all Dynamixels.

Please be careful not to duplicate the ID of connected Dynamixels.

**Baud Rate**

Represents the communication speed. 0 (0x00) to 254 (0xFE) can be used for it.

This speed is calculated by using the below formula.

Speed(BPS) = 2000000/(Data+1)

| Data | Set BPS | Target BPS | Tolerance |
|---|---|---|---|
| 1 | 1000000.0 | 1000000.0 | 0.000 % |
| 3 | 500000.0 | 500000.0 | 0.000 % |
| 4 | 400000.0 | 400000.0 | 0.000 % |
| 7 | 250000.0 | 250000.0 | 0.000 % |
| 9 | 200000.0 | 200000.0 | 0.000 % |
| 16 | 117647.1 | 115200.0 | -2.124 % |
| 34 | 57142.9 | 57600.0 | 0.794 % |
| 103 | 19230.8 | 19200.0 | -0.160 % |
| 207 | 9615.4 | 9600.0 | -0.160 % |

Note : Maximum Baud Rate error of 3% is within the tolerance of UART communication.

**Return Delay Time**

Is the delay time per data value that takes from the transmission of Instruction packet until the return of Status packet.

0 (0x00) to 254 (0xFE) can be used. The delay time per data value is 2 microseconds (usec).

If the data value is delayed by 10, 20 usec the initial value is 250 (0xFA) (i.e., 0.5 msec).

RAM Area

**Dynamixel Power**

| Value | Meaning |
|---|---|
| 0 | Turn off the power of all Dynamixels connected to CM-730. |
| 1 | Turn on the power of all Dynamixels connected to CM-730. |

**LED Panel**

| BIT | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Value | X | X | X | X | X | LED4 | LED3 | LED2 |

If each bit is SET, applicable LED lights up.

If each bit is RESET, applicable LED goes off.

EX) When the LED Panel = 3 (00000101), the LED4 and LED2 light up.

**LED5 / LED6**

| BIT | 15 | 14 ~ 10 | 9~ 5 | 4 ~ 0 |
|---|---|---|---|---|
| Value | X | the value of blue light | the value of green light | the value of red light |

LED HEAD/ LED EYE is 3 color LED. It can represent the value of 32 steps by colors.

It can be represent by controlling the value of light by colors.

### BUTTON STATUS

| BIT | 7 ~ 2 | 1 | 0 |
|---|---|---|---|
| **Value** | X | the state value of START button | the state value of MODE button |

It is the value which represents the state of buttons.

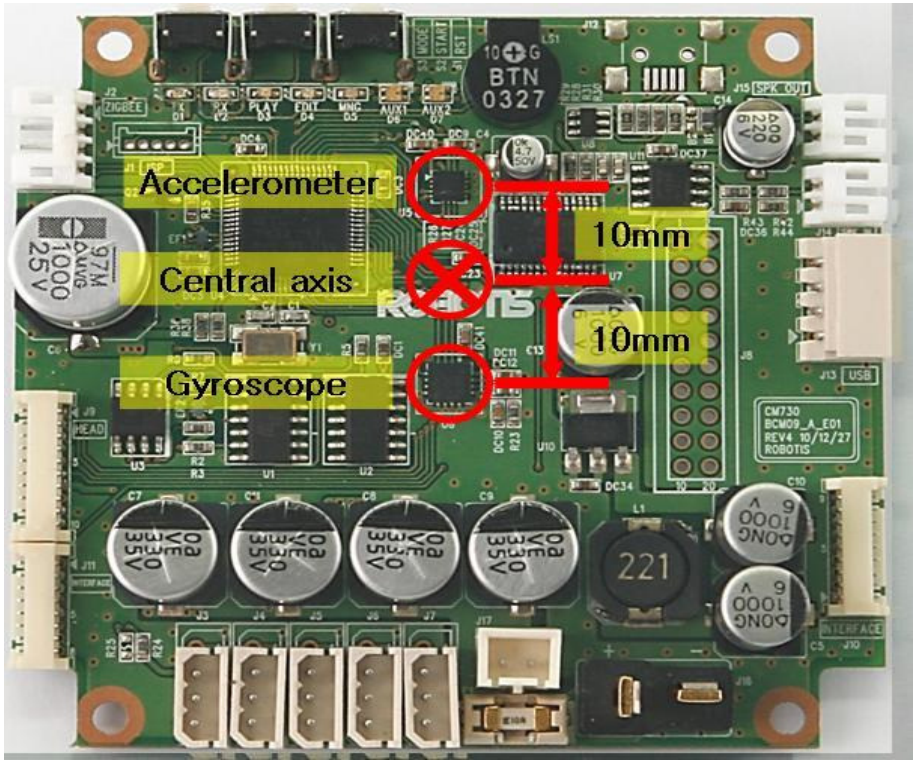
If the bit is SET, it represents that the button is pressed.

If the bit is RESET, it represents that the button isn't pressed.

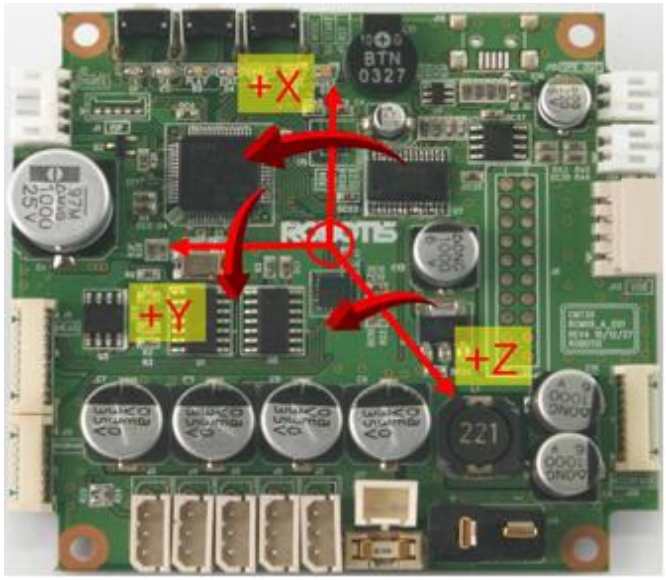
### GYRO / ACC

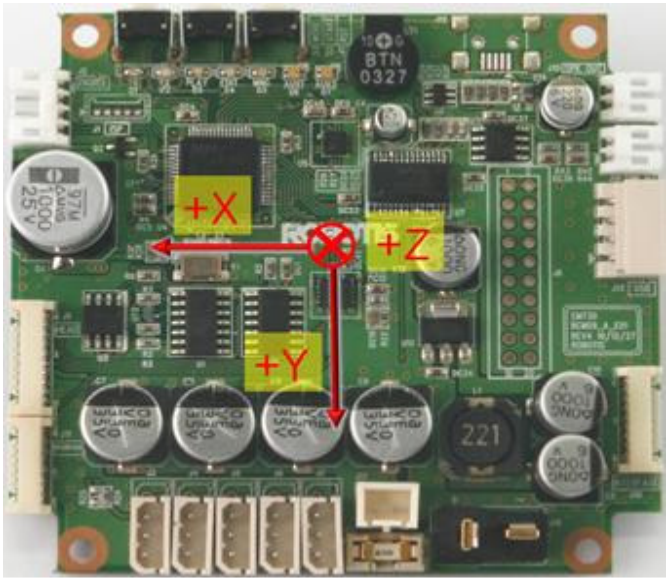
The following picture is the direction of axis at CM-730.

The Gyroscope and Accelerometer is 10mm distant respectively from the central axis of Dawin.

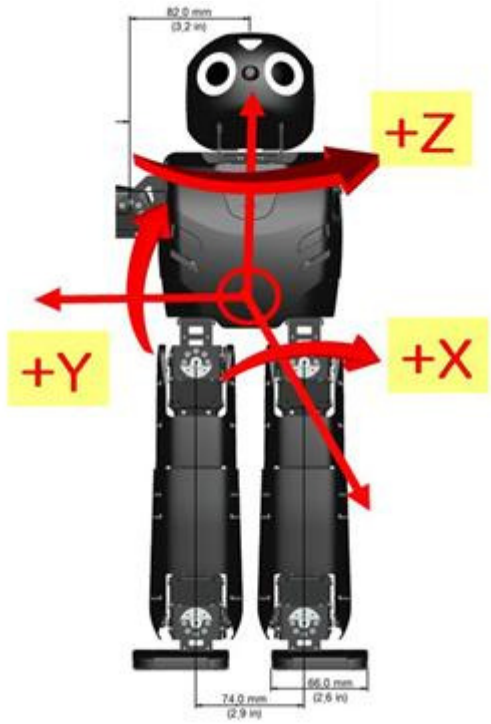


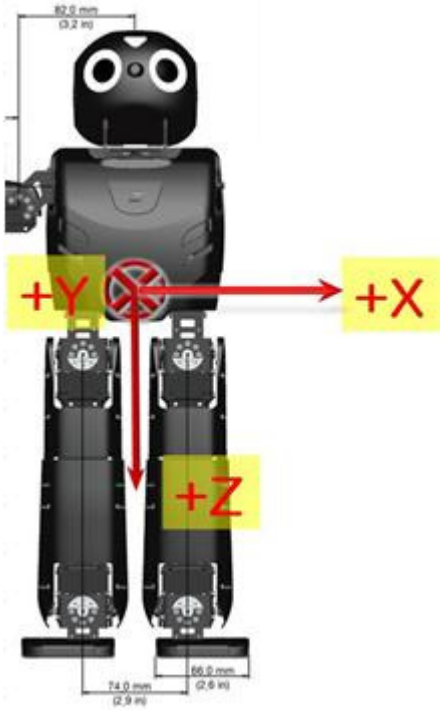
**[the positions of central axis and sensor at Dawin]**




**[Gyroscope]** **[Accelerometer]**



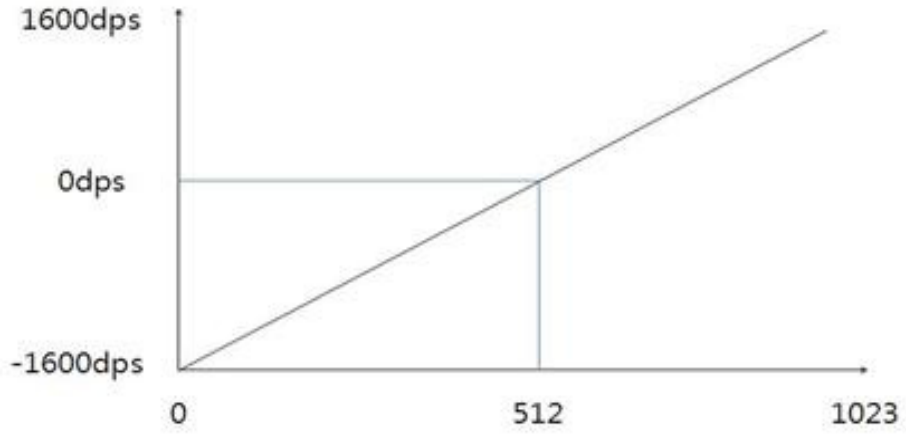

**[The Gyroscope axis DARwIn-OP]** **[the Accelerometer axis in DARwIn-OP]**

**GYRO_X, GYRO_Y, GYRO_Z**

They represent the angular velocity values of X-axis, Y-axis, Z-axis respectively.

The observable maximum velocity is -1600DPS ~ 1600DPS.

The following graph shows the process that angular velocity represents to value in reality.

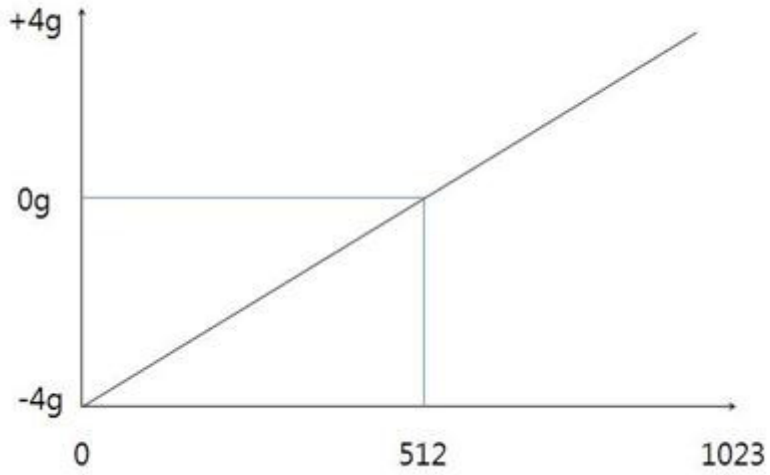



**ACC_X, ACC_Y, ACC_Z**

They represent the acceleration values of X-axis, Y-axis, Z-axis respectively.

The observable maximum velocity is -4g ~ +4g.

The following graph shows the process that acceleration represents to value in reality.




**PRESENT VOLTAGE**

**current (input) voltage.**

This value is 10 times larger than the actual voltage. For example, when 10V is supplied, the data value is 100 (0x64)

**MIC 1 , MIC 2**

They are the wave values of MIC on the ears at HEAD PCB.

It is the value of ADC, and its range is 0~1023.

**ADC 2 ~ ADC15**

They are ADC values of ADC channel connected external port(J8).

CM-730 has ADC of 10BIT RESOLUTION.

Its range is 0~1023