



D series SERVO(TTL/ RS485) Protocol Manual

Revision 1.06_EN

INDEX

1 D Series SERVO Control Protocol	3
1-1 Protocol.....	3
1-2 Communication System.....	3
1-3 Test Configuration.....	3
1-4 External User's Signal Transceiver	4
1-4.1 TTL Communication Circuit.....	4
1-4.2 RS-485 Communication Circuit.....	4
1-5 Packet Format	5
1-5.1 Header	5
1-5.2 ID.....	5
1-5.3 Address	6
1-5.4 Register Length.....	6
1-5.5 Data	6
1-5.6 Check Sum.....	7
2 D Series SERVO Register.....	8
2-1 Address Table.....	8
2-2 Status.....	9
2-2.1 REG_POSITION.....	9
2-3 Action.....	9
2-3.1 REG_POSITION_NEW	9
2-4 Configuration.....	10
2-4.1 REG_ID	10
2-4.2 REG_FAILSAFE_SET	10
2-4.3 REG_DEADBAND.....	11
2-4.4 REG_VELOCITY_MAX	11

2-4.5	REG_SOFT_START_SPEED.....	12
2-4.6	REG_OVERLOAD PROTECTION	12
2-4.7	REG_POSITION_MAX.....	12
2-4.8	REG_POSITION_MIN	12
2-4.9	REG_POSITION_MID	13
2-4.10	REG_POWER_CONFIG	13
2-4.11	REG_DEFAULT	13
2-4.12	REG_CONFIG_SAVE	13

1 D Series SERVO Control Protocol

1-1 Protocol

Using D Series Protocol, you can write or read data in the register of the D series SERVO.

1-2 Communication System

D Series SERVO communicates with external device by using Half Line of TTL communication with only one line as signal line. In case of RS485 SERVO, it communicates with external device by 2 wire Half Duplex method.

It can send and receive bi-directional communication and it supports both of "Multi-Drop" which can control several SERVO using only one line and "Single-Drop" which can control SERVO using a single connection method.

1-3 Test Configuration

It can be controlled by connecting with PC using DPC-11 (TTL) and DPC-485 (SERVO for RS485 communication) provided separately. When the user configures the controller, the user needs to configure the circuit by referring to the Interface Circuit Diagram below.

(Communication Parameter: Baud rate - 115,200bps, stop bit - 1, parity - none)



- SERVO PINMAP(LEFT) only for RS485 // SERVO PINMAP(RIGHT) for TTL, PWM



- TTL and RS-485 configuration using our products DPC-485, DPC-11

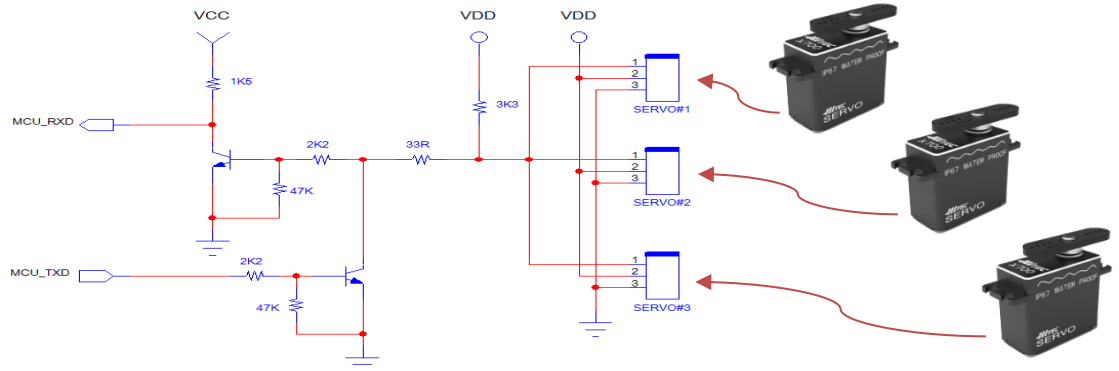
1-4 External User's Signal Transceiver

Please refer to the manual below when you use a separate controller without using DPC-11.

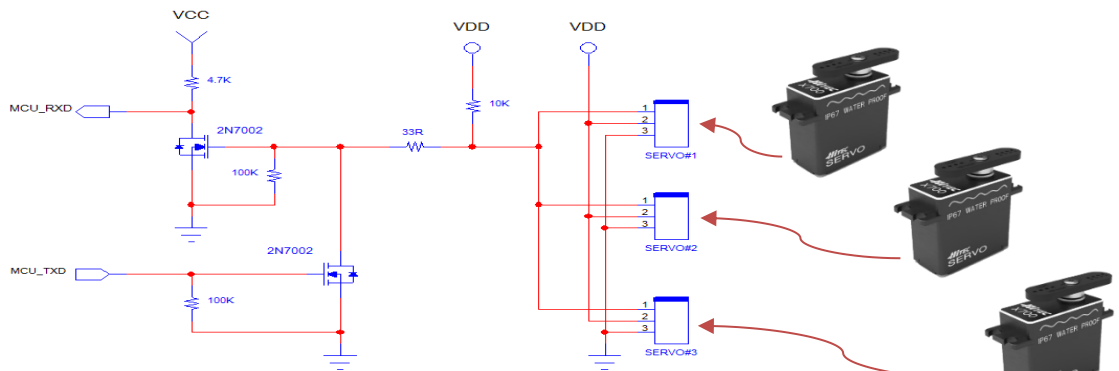
1-4.1 TTL Communication Circuit

Please configure a Half duplex circuit.

- MCU_TXD must be low when reading SERVO data.



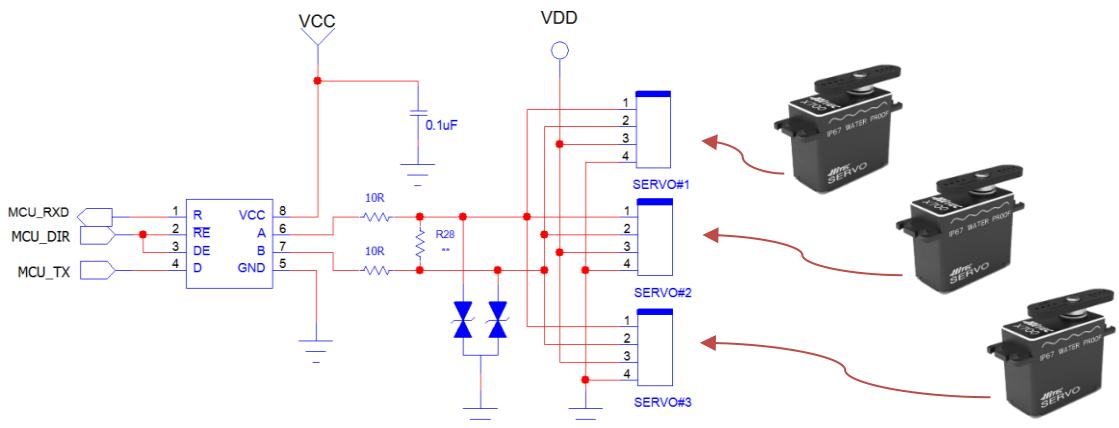
<Circuit example using transistors>



<Circuit example using FET>

1-4.2 RS-485 Communication Circuit

Please configure RS-485 transceiver circuit.



<Circuit example using RS-485 transceiver IC>

1-5 Packet Format

Packet Format is divided into 6 areas such as Header, ID, Address, REG Length, Data, Check Sum as follow.

- Data format - Little Endian
- Check Sum = (ID + Address + REG Length + Data Low + Data High) & 0xFF

● Normal Write

- Data write to Servo

Write Header	ID	Address	REG Length	Data Low	Data High	Check Sum
0x96	0xXX	0xXX	0x02	0xXX	0xXX	0xXX

● Normal Read

- Request a response to SERVO

Write Header	ID	Address	REG Length	Check Sum
0x96	0xXX	0xXX	0x00	0xXX

- Response from SERVO

Return Header	ID	Address	REG Length	Data Low	Data High	Check Sum
0x69	0xXX	0xXX	0x02	0xXX	0xXX	0xXX

1-5.1 Header

Packet starts with Byte. Every Protocol Packet should start with Header Byte. Packets sent from the controller to SERVO begin with 150 (0x96), and packets returned by the SERVO to the controller begin with 105 (0x69).

Header	ID	Address	REG Length	Data Low	Data High	Check Sum
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1-5.2 ID

It shows Byte which represents the unique ID of SERVO to receive the packet. The corresponding packet is recognized only in the servo that matches the ID of the packet. Unmatched servo will not respond. ID can be specified from 0 to 255.

Header	ID	Address	REG Length	Data Low	Data High	Check Sum
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- Packets whose ID is set to 0 (0x00) are recognized as the same parameters in all servo regardless of the SERVO unique ID.

1-5.3 Address

It is Register Address Byte.

Registers of SERVO are configured in 2-byte units, and Register Address has Even value.

Header	ID	Address	REG Length	Data Low	Data High	Check Sum
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1-5.4 Register Length

It is a Byte that indicates the length of Data in the Packet.

Header	ID	Address	REG Length	Data Low	Data High	Check Sum
--------	----	---------	-----------------------	-------------	--------------	--------------

- Write Mode
It indicates the number of Bytes behind REG Length.
- Read Mode
If the .REG Length is '0', it means that there is no data transmitted afterwards, which is used to read the data from the register corresponding to the packet address.

1-5.5 Data

The data you want to write to the Register.

When the Data is [Write Mode], it can have a length from 1 byte to a maximum of 255 bytes.

When the Data is [Read Mode], it has a length of 0 Byte. In other words, Data is omitted after REG Length in Packet.

When writing or reading 2 Byte Data value to register specified by Address of Packet, follow Little Endian rule as follows. Data [0] has 2 bytes of Low Byte and Data[1] has High Byte.

Header	ID	Address	REG Length	Data Low	Data High	Check Sum
--------	----	---------	---------------	---------------------	----------------------	--------------

1-5.6 Check Sum

This is a byte to verify the error of the packet. If CheckSum does not match, it recognizes as an error packet and does not respond to the corresponding packet. CheckSum is the lower 1 byte value of the sum of the bytes of all areas excluding the header in the packet.

Header	ID	Address	REG Length	Data Low	Data High	Check Sum
--------	----	---------	---------------	-------------	--------------	----------------------

- Read Mode Check Sum Calculation
Check Sum = (ID + Address + Length) & 0xFF
- Write Mode Check Sum Calculation
Check Sum = (ID + Address + Length + Data Low + Data High) & 0xFF

2 D Series SERVO Register

2-1 Address Table

Address	Name	length	R/W	Range			Feature	
				reset	min	max		
Status	0x0C	REG_POSITION	2	r	0	0	16383	Read the Position.
Action	0x1E	REG_POSITION_NEW	2	r/w	3000	0	6000	Set the New Position.
Config	0x32	REG_ID	2	r/w	0	0	255	Set the SERVO ID.
	0x4C	REG_FAILSAFE_SET	2	r/w	0	0	5000	Set the Failsafe position.
	0x4E	REG_DEADBAND	2	r/w	0	0	10	Set the Position Dead band.
	0x66	REG_VIBRATION_DEADBAND_MIN	2	r/w	1	0	4095	Set the vibration Dead band min.
	0x68	REG_VIBRATION_DEADBAND_MAX	2	r/w	5	0	4095	Set the vibration Dead band max.
	0x54	REG_VELOCITY_MAX	2	r/w	4095	0	4095	Set the Servo Speed.
	0x60	REG_SOFT_START_SPEED	2	r/w	1	1	10	Set the Soft start Speed.
	0x9C	REG_OVERLOAD PROTECTION	2	r/w	100	0	100	Set the Overload Protection.
	0xB0	REG_POSITION_MAX	2	r/w	16383	0	16383	Set Max position.
	0xB2	REG_POSITION_MIN	2	r/w	0	0	16383	Set Min position.
	0xC2	REG_POSITION_MID	2	r/w	8192	0	16383	Set Mid position.
	0x46	REG_POWER_CONFIG	2	w	0	0	1	Reboot the Servo.
	0x6E	REG_FACTORY_DEFAULT	2	w	0	0	3855	Restore data to factory default.
0x70	REG_CONFIG_SAVE	2	w	0	0	65535	Save changed data in memory.	

2-2 Status

It is a Register that store status information.

2-2.1 REG_POSITION

It is the current position value of SERVO and the range is 0 to 16383.

The Actual operating ranges are 360° for MD series servo, 220° for Standard D series servo, and 200° for mini & Micro D servo.

The actual sensor resolution is $360^\circ/4096=0.0898^\circ$ for MD series servo and $220^\circ/4096=0.0537^\circ$ for Standard D series servo and $200^\circ/4096=0.0488^\circ$ for Mini & Micro D series servo.

Address	Length	R/W	Reset	Min	Max
0x0C	2	R	-	0	16383

- MD Series (360°): $-90^\circ=4096$, $0^\circ=8192$, $90^\circ=12288$.
(The MD Series servo may have different values around 0°.)
- Standard D Series (220°) → $-90^\circ=1489$, $0^\circ=8192$, $90^\circ=14895$.
- Mini & Micro D Series (200°) → $-90^\circ=819$, $0^\circ=8192$, $90^\circ=15565$.

2-3 Action

It is the REGISTER to operate SERVO.

2-3.1 REG_POSITION_NEW

It is the target position value of SERVO and the range is 0 to 6000. The value of 400, 3000, 5600 is converted into the actual operation range of SERVO which is the setting range of POSITION_MIN, POSITION_MID, POSITION_MAX and it makes SERVO move.

Address	length	R/W	Reset	Min	Max
0x1E	2	R/W	3000	0	6000

- When REG_POSITION_NEW=400, the value read from REG_POSITION is REG_POSITION_MIN.
- When REG_POSITION_NEW=3000, the value read from REG_POSITION is REG_POSITION_MID.
- When REG_POSITION_NEW=5600, the value read from REG_POSITION is REG_POSITION_MAX.

2-4 Configuration

Register that set the operating environment of the servo. Configuration Data can be saved and initialized.

2-4.1 REG_ID

Set the ID.

Set the ID. If multiple D Series SERVO are connected by the same signal line, the ID must be assigned a unique value. Only the D Series SERVO that matches the ID of the packet will recognize the corresponding packet. Unmatched SG33 will not respond.ID can be specified from 0 to 255.

Address	length	R/W	Reset	Min	Max
0x32	2	R/W	0	0	255

- If REG_ID is changed, it operates with changed ID from the next power reset.

2-4.2 REG_FAILSAFE_SET

Setup the Failsafe function of D Series SERVO.

The input signal moves to the PWM position set at the time of failure.

Address	Length	R/W	Reset	Min	Max
0x4C	2	R/W	0	0	5000

- If the Data is 1, disable the failsafe function
- If the Data is 0, when in Failsafe condition, torque becomes 0.
- The range of setting position shift value is 2~5000usec.

2-4.3 REG_DEADBAND

Set the section that does not control the position near the target point.

Address	Length	R/W	Reset	Min	Max
0x4E	2	R/W	-	0	4095

- When setting up the Dead Band area, please refer to the table below.

REG_DEADBAND	REG_VIBRATION_ DEADBAND_MIN	REG_VIBRATION_ DEADBAND_MAX
1	5	11
2	8	14
3	12	18
4	16	22
5	20	26
6	24	30
7	28	34
8	32	38
9	36	42
10	40	46

2-4.4 REG_VELOCITY_MAX

Set the maximum speed of SERVO. If you increase the data from 0 to 2, you can adjust the speed by 10%. (The setting range may differ for SERVO product)

When the maximum speed of SERVO is set to 100%, set it to 4095.

Address	length	R/W	Reset	Min	Max
0x54	2	R/W	4095	0	4095

2-4.5 REG_SOFT_START_SPEED

Set the initial start speed of SERVO.

Address	length	R/W	Reset	Min	Max
0x60	2	R/W	10	1	10

- Refer to the table below when setting the initial start speed.

REG_SOFT_START_SPEED	Initial start speed
1	20%
3	40%
6	60%
8	80%
10	100%

2-4.6 REG_OVERLOAD PROTECTION

Set the torque value of SERVO when OVERLOAD PROTECTION function operates.

The torque is output as much as the percentage of the currently set torque.

1% = 1, so if the value is 100, 100% torque is output.

Address	length	R/W	Reset	Min	Max
0x9C	2	R/W	100	0	100

2-4.7 REG_POSITION_MAX

Set the maximum position where the SERVO can operate.

It is the POSITION value when inputting 5600 as REG_POSITION_NEW value.

Address	length	R/W	Reset	Min	Max
0xB0	2	R/W	16383	0	16383

2-4.8 REG_POSITION_MIN

Set the minimum position where the SERVO can operate.

It is the POSITION value when inputting 400 as REG_POSITION_NEW value.

Address	length	R/W	Reset	Min	Max
0xB2	2	R/W	0	0	16383

2-4.9 REG_POSITION_MID

Set the middle position of SERVO

It is the POSITION value when inputting 3000 as REG_POSITION_NEW value.

Address	length	R/W	Reset	Min	Max
0xB2	2	R/W	0	0	16383

2-4.10 REG_POWER_CONFIG

If you input Data 1, Power RESET is activated.

Address	length	R/W	Reset	Min	Max
0x46	2	W	0	0	1

2-4.11 REG_DEFAULT

Return all Register Values to factory default.

Inputting 3855 on this register, all values of Configuration Register return to factory default. If you want to maintain this state after power reset, you should save all values of Configuration Register by using REG_CONFIG_SAVE register.

Address	length	R/W	Reset	Min	Max
0x6E	2	W	0	0	3855

2-4.12 REG_CONFIG_SAVE

Save all Register change vales.

Even if the register change value is changed, it is restored to the last saved contents after the power is reset. However, if 0xFFFF is written to this register, all current Configuration Register values are saved in Flash ROM, so that it can be maintained after power reset.

Address	length	R/W	Reset	Min	Max
0x70	2	W	0	0	65535

- After saving, previously saved Configuration Register values cannot be recalled. Please be careful about the use