DEV (I04) Series Dual Channel Motor Drive User Manual

Rev1.0 — 02 Sep 2023

*This document is subject to change without notice.

Table of Contents

1. Before Using the Product

Only qualified personnel of electrical and mechanical engineering should work with the product.

1.1. Related documents

Document name	Document number
DEV (I04) Series Dual Channel BLDC Motor Drive Specifications	SS-01-S0583
DEV (I04) Series Dual Channel Motor Drive User Manual (this document)	UM-01-S0631
DEV Communication Manual	UM-01-S0605
DEXMART CANopen 說明 (中文版本)	UM-01-S0606

1.2. Safety precautions

The precautions described below are intended to ensure the safe and correct use of the product. Use the product only after carefully reading and fully understanding these instructions.

Description of signs

⚠ **WARNING！**	Handling the product without the aware of the instruction with a “WARNING!” symbol may result in serious injury or death.
⚠ **CAUTION！**	Handling the product without the aware of the instructions with a “CAUTION!” symbol may result in injury or property damage.
NOTE	Pertinent information that clarifies a process or operation. Important instructions that the user should observe to ensure safe use of the product.

⚠ **WARNING！**

- The main power must be disconnected and ensured to wait sufficient time for complete discharge before any inspection, installation and wiring to the motor and the drive is made. (For safety concern, please wait for 1 minutes or until the PWR LED is off).
- Any person who is involved in the installation, wiring, inspection, or setup of the drive should be a fully competent to do the work.
- When a problem occurred, stop operation, and turn off the main power supply. Failure to do so may result in fire, electrical shock, or injury.
- The product shall NOT be used for life support equipment.
- Do not use the product in explosive or corrosive environments, in the presence of flammable gases, in places subjected to splashin water. Doing so may result in fire, electrical shock, or injury.
- If an alarm of the drive is activated, remove the cause before resetting the alarm. Continuing the operation without removing the cause of the problem may result in malfunction, leading to injury or damage to equipment.
- Use a motor and a drive only in the specified combination. Incorrect combination may cause fire, electrical shock, injury, or damage to equipment.
- Connect the cables securely according to the wiring example. Failure to do so may result in fire, electrical shock, injury, or damage to equipment.

⚠ **CAUTION！**

- Do not sure the motor and drive beyond its specifications.
- Only apply the voltage specified in this manual to each terminal. Ensure that the cables are connected to the correct terminals. Otherwise, the drive may be damaged.
- Motor, motor drive and other equipment must be separated in a certain distance according to the regulations.
- Ground the drive using the ground terminal. The grounding method must comply with the laws of the country where the motor drive is to be installed.

2. Checking the product

2.1. Package contents

Verify that the items listed below are included.

- Motor drive ..... 1 unit
- CN1 Motor magnetic brake control connector ..... 1 unit
- CN4 Regenerative shunt resistor connector ..... 1 unit
- CN7 I/O connector ..... 1 unit

2.2. Product number code

DEV C - F 050 C E

① ② ③ ④ ⑤ ⑥

①	Series	**DEVC** : **DEV** (I04) series dual channel BLDC motor drive.
②	Communication	**R:** RS485 **C**: RS485/CANBUS
③	Power Supply Voltage	**F** : 20~70VDC
④	Max Output Current	**050** : 50A
⑤	Reserved	
⑥	Feature	**E** : Encoder

2.3. Motor and drive combination

The drive can be used with different types and power ratings of motors. Various parameters must be set depending on the motor.

The default setting of the drive is for driving two 24V 400W or two 48V 800W 8 poles motors with 2500 pulse increamental encoders.

NOTE Please check if the following parameters are set for the motors you are using.
NOTE The default PID parameter settings can be used for most of the motors. But some adjustment might be required in some special application scenarios.

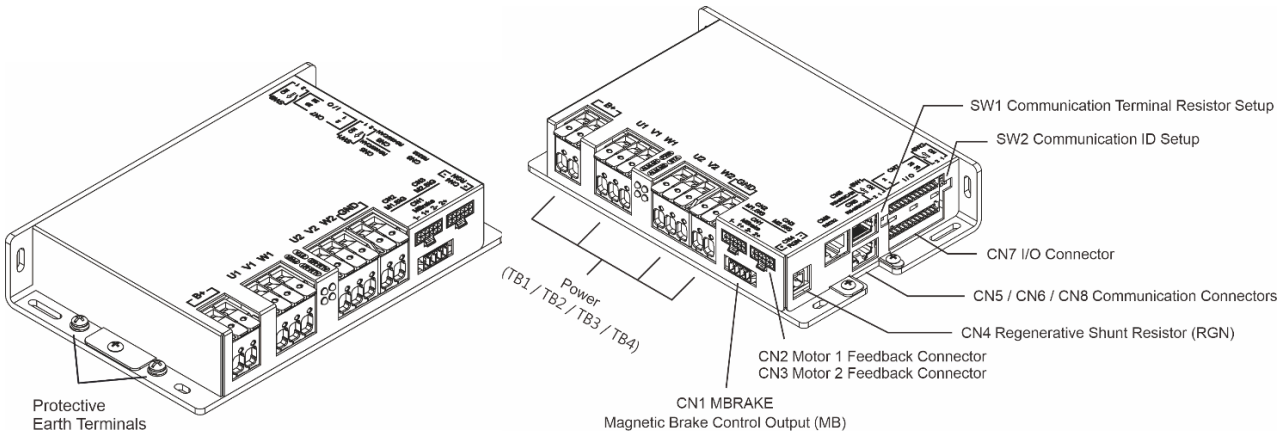
⚠ **CAUTION !**

- Please set the overvoltage and Over voltage recover depends on your motor and power supply system in case of injury or property damage.

ID	Field name	Register (hex)		Description	Def.	Eff.	Mode
		EEP	RAM				
01-01 01-17	M1 Motor/Sensor type M2 Motor/Sensor type	0100h 0110h	3D00h 3D10h	Bit Field: Motor type(bit0,1): 0=BLDC, 1 =Brushed DC Sensor type(bit2,3,4): 0=default, 1=Hall sensor, 2=INC ENC, 3=Hall+ENC Brushed DC motor type can only support duty mode. Bit2,3,4 is for encoder feedback only.	0	D	S/D/P
01-02 01-18	M1 Hall sequence M2 Hall sequence	0101h 0111h	3D01h 3D11h	Hall u edge to the motor back emf. 0: B sequence (rising edge) 1: A sequence (falling edge)	1	D	S/D/P
01-03 01-19	M1 Motor poles M2 Motor poles	0102h 0112h	3D02h 3D12h	Number of rotor poles in 2/4/8/10	8	D	S/D/P
01-04 01-20	M1 No load full speed M2 No load full speed	0103h 0113h	3D03h 3D13h	Motor full speed when rated voltage is applied. 0 ~ 65535 r/min	4188	C	S
01-06 01-22	M1 Encoder resolution M2 Encoder resolution	0105h 0115h	3D05h 3D15h	Pulse per revolution per channel. 0 ~ 65535 pulse per rev	2500	D	S/D/P
01-16 01-32	M1 Encoder offset M2 Encoder offset	010Fh 011Fh	3D0Fh 3D1Fh	When using ENC+HALL type feedback. The phase angle between ENC and HALL in 0 ~ 360deg.	0	C	S/D/P
02-18	Rated Output %	0211h	3E11h	Set the rated output ratio depends on the motor. 500 ~ 1000 (Unit:0.1%) Ex: When using a 24V 200W motor please set this value to 500.	1000	D	S/D/P
05-10	Over voltage	0509h	4109h	OVP alarm trigger voltage (should be set higher than	8500	C	S/D/P

				over voltage recover). 1500 ~ 9000 (0.01V)			
05-11	Over voltage recover (RGN voltage)	050Ah	410Ah	Voltage for OVP alarm to be able to reset. (should be set lower than over voltage). 1500 ~ 9000 (0.01V) *The regenerative output is active when BUS voltage reaches this setting.	7300	C	S/D/P
07-02 07-18	[PID parameter] M1 Control Constant Kp M2 Control Constant Kp	0701h	4301h	Value: 1 ~ 65535	16	C	S/D/P
07-03 07-19	[PID parameter] M1 Velocity Ctrl. Const. 1 M2 Velocity Ctrl. Const. 1	0702h	4302h	Value: 1 ~ 65535	1024	C	S/D/P
07-04 07-20	[PID parameter] M1 Velocity Ctrl. Const. 2 M2 Velocity Ctrl. Const. 2	0703h	4303h	Value: 1 ~ 65535	0	C	S/D/P

2.4. Names and functions of parts



Name	Sign	Description
Main supply source terminals	B+ (TB1)	Connect to the main power source.
Motor 1 power terminals	U1, V1, W1 (TB2)	Connect to channel 1 motor power UVW.
Motor 2 power terminals	U2, V2, W2 (TB3)	Connect to channel 2 motor power UVW.
Main supply GND terminals	GND (TB4)	Connect to the main power return (GND).
MBRAKE connector	CN1 (MBrake)	Motor magnetic brake control output connector.
Motor 1 feedback connector	CN2 (M1. SIG)	Channel 1 motor feedback signal (Hall/ENC) connector.
Motor 2 feedback connector	CN3 (M2. SIG)	Channel 2 motor feedback signal (Hall/ENC) connector.
Regenerative shunt resistor connector	CN4 (RGN)	Connect to external regenerative shunt resitor.
Communication BUS connectors	CN5 / CN6 (RS485/CAN)	Connect to RS232 / RS485 / CANBUS
I/O Connector	CN7 (I/O)	Connect to Digital IN/OUT / Analog IN signals.
Program connectors	CN8 (RS232)	Connect to RS232 (for parameter settings)
Communication terminal resistor setup	SW1	**SW1-1** ON: CANBUS with internal terminal resistor 120R. OFF: CANBUS without internal resistor. **SW1-2** ON: RS485 with internal terminal resistor 120R. OFF: RS485 without internal resistor.
Communication ID setup	SW2	**M1 ID** / **M2 ID** / **SW2-1** / **SW2-2** 1 / 2 / OFF / OFF 3 / 4 / ON / OFF 5 / 6 / OFF / ON 7 / 8 / ON / ON
PWR LED	PWR	ON：Normal (logic or main power on) OFF：logic power off
STA LED	STA	ON: RS-485/CANBUS normal Blink: RS-485/CANBUS signal received but cannot identify the message (baud-rate or protocol error). OFF: RS-485/CANBUS no signal (not connected).
Alarm LED	ALM-M1 ALM-M2	ALM-M1 indicates the alarm status of motor 1, ALM-M2 indicates the alarm status of motor 2. ON：Drive in WAIT status (SERVO-OFF). Slow Blink：Alarm occurs. The type of alarm can be confirmed by the blink count. Super-Fast Blink (30ms)： STO OFF (STO power not connected). OFF：Normal.
Protective earth terminals	NA	Connect to protective earth of the system.

NOTE Power cycling is required for the switch configuration to be affective.

3. Installation and connection

3.1. Drive installation

Instal the drive in a well-ventilated location for better heat dissipation.
It is suggested to install the drive to a flat metal plate offering high heat conductivity.
If the ambient temperature exceeds the upper limit of the operating ambient temperature, an external cooling fan is required to keep within the operating ambient temperature.

Environment

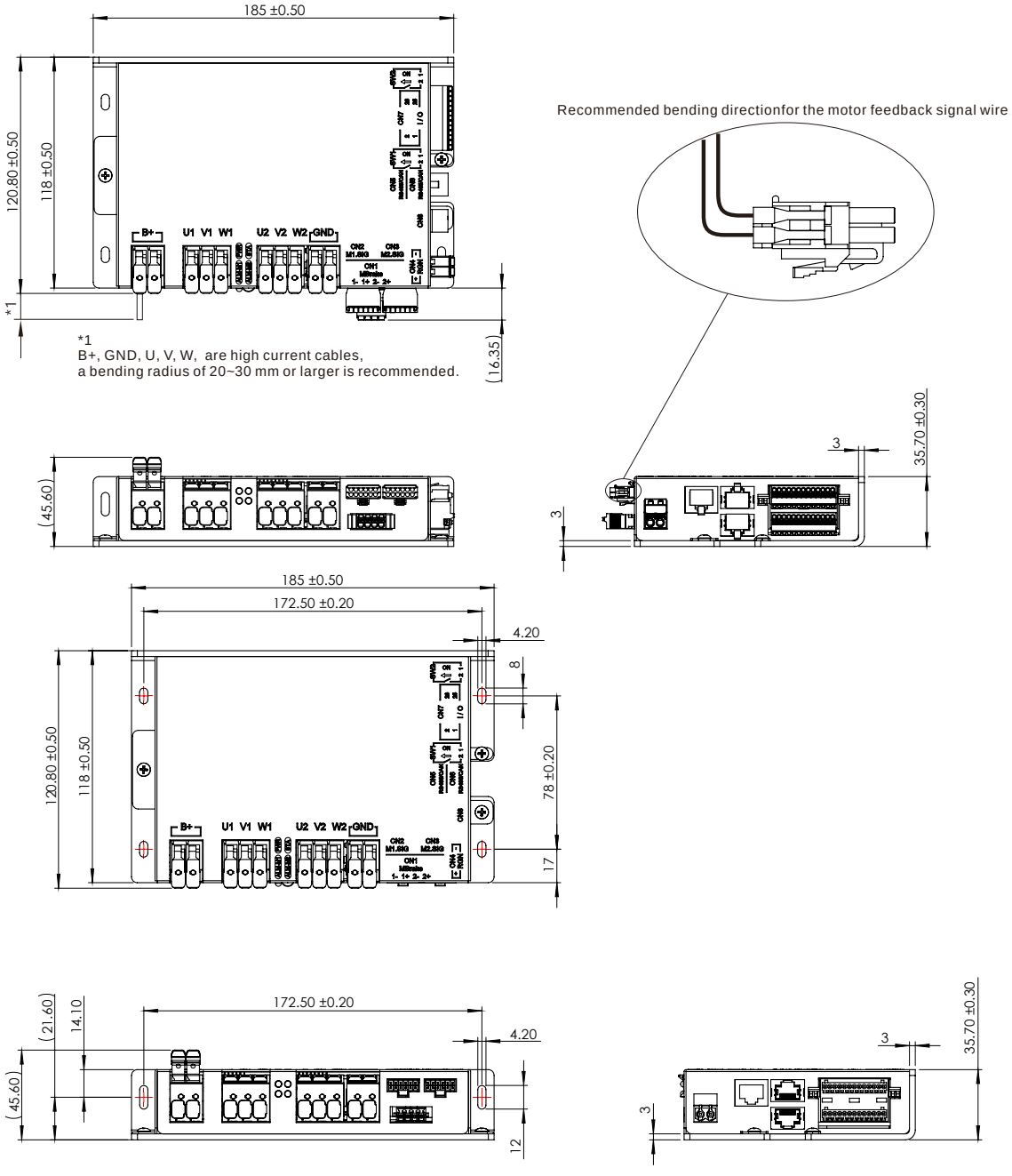
Operating ambient temperature	0℃ to +40℃ (non-freezing)
Operating ambient humidity	< 85 % RH (non-condensing)

Noise concern

Avoid running the power cables and the signal cables together. Extra shielding duct is suggested.
Do not install any equipment that generates a large amount of heat or noise near the drive.

3.2. Mounting dimension

Unit: mm



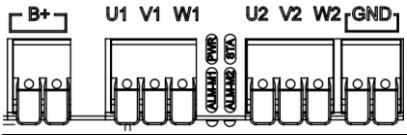
3.3. Connection

3.3.1. Power cable connection (B+/GND/U1,V1,W1/U2,V2,W2)

Follow the instruction for the main supply and motor power connection.

Connector / Terminal block type	For solid and ferruled conductors.
Applicable lead wire	**24V 400W/48V 800W** AWG 12 to 8 for motor power cable. AWG 10 to 8 for main power supply cable. **24V 200W /48V 400W** AWG 12 to 8 for motor power cable. AWG 12 to 8 for main power supply cable.
Wire strip length	12 to 14 mm
Insert the wire	Pull up the lever of the terminal, insert the cable terminal into the terminals block and then push the lever back to lock it. 
Removing the wire	Pull up the lever to unlock the cable, remove the cable from the terminal block and then push the lever back to lock it. 

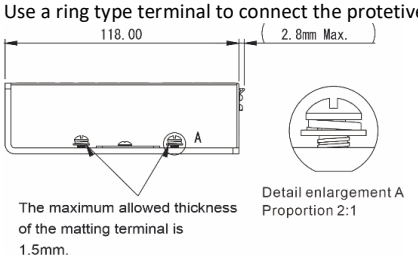
Pin assignment list



Pin	Description	Pin	Description
B+	Main Power In (TB1)	GND	Main Power GND (TB4)
U1	Motor 1 Output U (TB2)	U2	Motor 2 Output U (TB3)
V1	Motor 1 Output V (TB2)	V2	Motor 2 Output V (TB3)
W1	Motor 1 Output W (TB2)	W2	Motor 2 Output W (TB3)

3.3.2. Protective earth connection

Use a ring type terminal to connect the protetive earth to the system earth. If there is no protective earth in the system, please leave it unconnected.



3.3.3. Magnetic brake connection (CN1)

Connector / Terminal block type	For solid and ferruled conductors.
Applicable lead wire	AWG 24 to 16
Wire strip length	9 to 10 mm
Insert the wire	1. Insert the lead wire to the matting connector while pushing the orange button with a screwdriver. 2. After having inserted, release the buttone to secure the lead wire. 3. Connect the matting connector the to drive.
Removing the wire	1. Remove the matting connector from the drive. 2. Removing the lead wire while pushing the orange button with a screwdriver. 3. After removing, release the buttone to secure the lead wire.

Pin assignment list

Pin	Description	
MB1-	Motor 1 MB control output	 MB1- | MB1+ | MB2- | MB2+
MB1+	Motor 1 MB Power	
MB2-	Motor 2 MB control output	
MB2+	Motor 2 MB Power	

3.3.4. Regerative shunt resitor connection (CN4)

Connector / Terminal block type	For solid and ferruled conductors.
Applicable lead wire	AWG 20 to 12
Wire strip length	8 to 9 mm
Insert the wire	1. Insert the lead wire to the matting connector while pushing the orange button with a screwdriver. 2. After having inserted, release the buttone to secure the lead wire. 3. Connect the matting connector the to drive. 
Removing the wire	1. Remove the matting connector from the drive. 2. Removing the lead wire while pushing the orange button with a screwdriver. 3. After removing, release the buttone to secure the lead wire. 
Applicable shunt resistor	Miniumn resistance: 5ohm (for 48VDC). Miniumn power rating : 100W (for 48V 400W) / 200W (for 48V 800W) Shunt regulation max current: 12A The actual power rating of the resistor might various is depends on the motor power and the load inera. A larger power rating is required for large inertia applications.

Pin assignment list

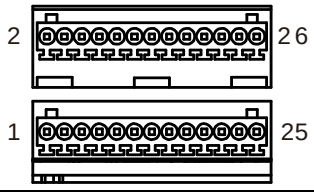
Pin	Description	
R+	Connect to a resistor more than 5 ohm, 40W (actual required resistor power rating may be larger depends on the load inertia).	 R+ | R-
R-		

3.3.5. I/O connection (CN7)

Connector / Terminal block type	For solid and ferruled conductors.
Applicable lead wire	AWG 26 to 20
Wire strip length	7 mm
Insert the wire	1. Insert the lead wire to the matting connector while pushing the orange button with a screwdriver. 2. After having inserted, release the buttone to secure the lead wire. 3. Connect the matting connector the to drive.
Removing the wire	1. Remove the matting connector from the drive. 2. Removing the lead wire while pushing the orange button with a screwdriver. 3. After removing, release the buttone to secure the lead wire.

Pin assignment list

Pin	Name	Description	Default	Pin	Name	Description	Default
1	X0	Digital input X0	M1 START/STOP	2	Y0_P	Digital output Y0+	M1 ALM-OUT
3	X1	Digital input X1	M2 START/STOP	4	Y0_N	Digital output Y0-	
5	COMI	Digital input external 24 COM input.	-	6	Y1_P	Digital output Y1+	M2 ALM-OUT
7	A0X	Analog input 0	M1 speed control	8	Y1_N	Digital output Y1-	
9	A1X	Analog input1	M2 speed control	10	YH0	High speed digital output YH0	Reserved
11	GND	Signal ground	-	12	YH1	High speed digital output YH1	M1 SPD-OUT
13	5V	5V (For I/O)	-	14	YH2	High speed digital output YH2	Reserved
15	CTRL+	Control supply input (20~70VDC)	-	16	YH3	High speed digital output YH3	M2 SPD-OUT
17	XH0+	Differential input XH0. Connect to XH0- when use SINK connection.	M1 CCW/CW	18	XH2+	Differential input XH2. Connect to XH2- when use SINK connection.	M2 CCW/CW
19	XH0-			20	XH2-		
21	XH1+	Differential input XH1. Connect to XH1- when use SINK connection.	Reserved	22	XH3+	Differential input XH3. Connect to XH3- when use SINK connection.	ALM-RST
23	XH1-			24	XH3-		
25	STO1	Reserved	-	26	STO2	Reserved	-



Digital input (X0 / X1)

SINK logic with interal 5VDC pulled-up.
External power supply can be connected to COMI for 15 to 30VDC (25mA).
Von low < 0.5 VDC.
Low or high active can be programmed.
Please reference to “3.4Wiring diagram” for wiring information.

Differential Digital input (XH0 / XH1 / XH2 / XH3)

Diferential input with 5V logic.
External 15 to 30VDC 25mA can be used when adding an external 2.4k resistor in series.
When using as single-ended input, connect the signal to the XHn- side.
Please reference to “3.4Wiring diagram” for wiring information.

Digital output (Y0/ X1)

Transistor output with internal 5VDC (25mA) pulled-up.
Yn_P is short to Yn_N when active and disconnected when deactive.
External 5 to 60VDC 100mA can be used when adding an external current limit resistor.
Please reference to “3.4Wiring diagram” for wiring information.

High speed digital output (YH0/ YH1 / YH2 / YH3)

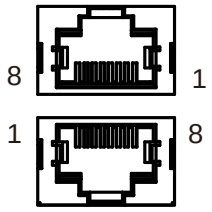
SINK logic output with internal 5VDC (25mA) pulled-up.
External 5 to 60VDC 100mA can be used when adding an external current limit resistor.
Can be used as a regular output.
Please reference to “3.4Wiring diagram” for wiring information.

3.3.6. Commnication connection (CN5 / CN6 /CN8)

Please use the regular RJ45 connector for communication connection.

CN5 / CN6 Pin assignment list

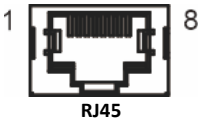
Pin	Name	Description
1	RS232_RX	Drive side RS232 RX
2	RS232_TX	Drive side RS232 TX
3	GND	Signal ground
4	RS485_A	RS485 A (Cannot be used with CAN at the same time)
5	RS485_B	RS485 B (Cannot be used with CAN at the same time)
6	GND	Signal ground
7	CAN_L	CANBUS L (Cannot be used with RS485 at the same time)
8	CAN_H	CANBUS H (Cannot be used with RS485 at the same time)



RJ45

CN8 Pin assignment list

Pin	Name	Description
1	RS232_RX	Drive side RS232 RX
2	RS232_TX	Drive side RS232 TX
3	GND	Signal ground
4	VCC_5V	5V supply for communication (20mAmx).
5	NC	Do not use.
6	NC	Do not use.
7	CAN_L	CANBUS L (Cannot be used with RS485 at the same time)
8	CAN_H	CANBUS H (Cannot be used with RS485 at the same time)



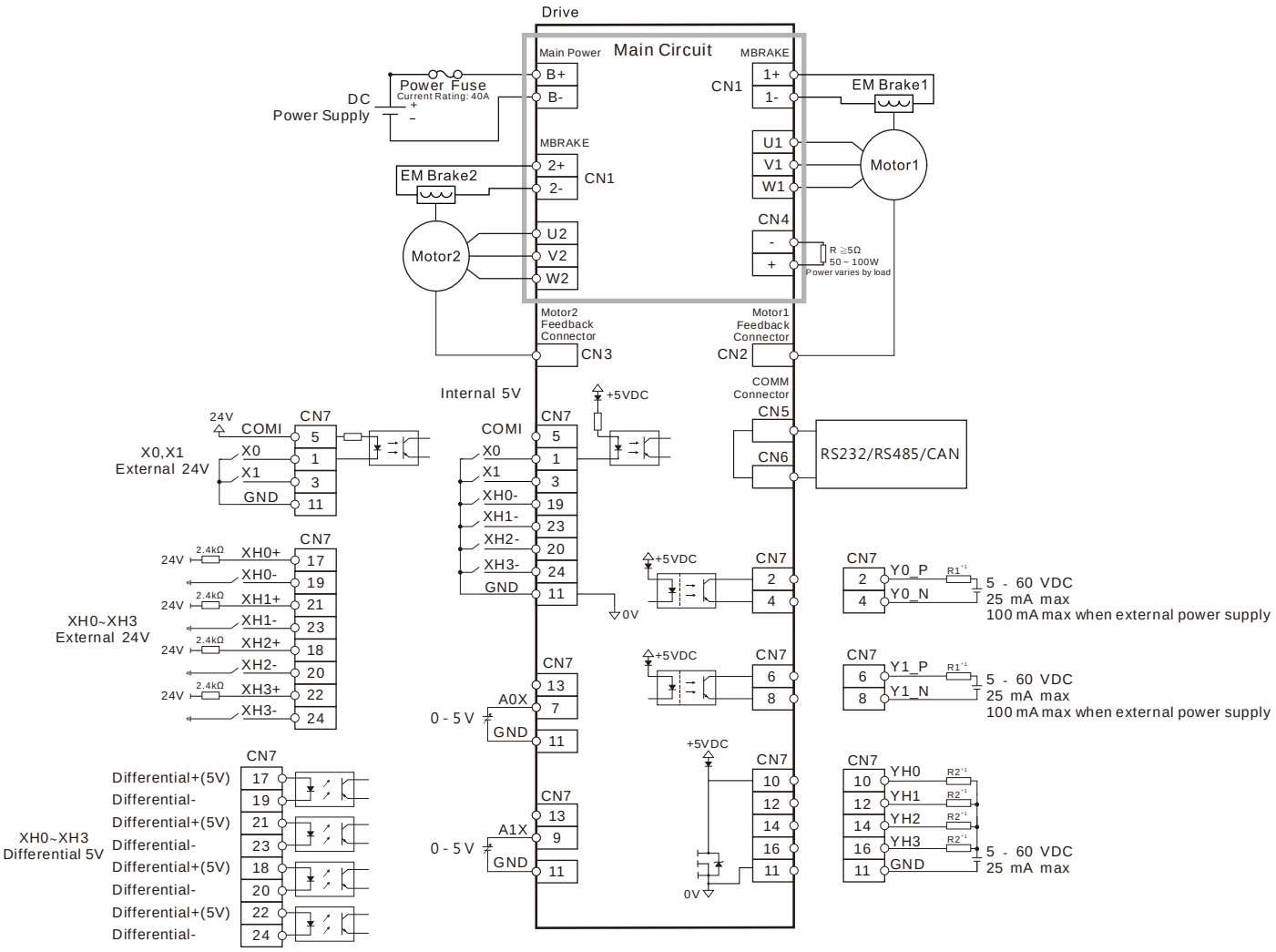
RJ45
Matting connector: optional

3.3.7. Motor feedback connection (CN2 / CN3)

Pin assignment list

Pin	CN2 Name	CN3 Name	Description
1	5V		5V for motor feedback sensor.
2	GND		Signal ground.
3	M1A-	M2A-	Encoder A- / Hall U
4	M1A+	M2A+	Encoder A+
5	M1B-	M2B-	Encoder B- / Hall V
6	M1B+	M2B+	Encoder B+
7	M1C-	M2C-	Encoder C- / Hall W
8	M1C+	M2C+	Encoder C+
9	M1S0	M2S0	HU for encoder + hall type sensor
10	M1S2	M2S2	HW for encoder + hall type sensor
11	M1S1	M2S1	HV for encoder + hall type sensor
12	NC	NC	NC

3.4. Wiring diagram



3.5. Digital input

Function and active logic of each digital input can set through parameters. Please erefence to document “DEV-COM-EN_UM-01-S0605” for detailed information about parameters.

3.5.1. Digital input parameters

ID	Field name	Register (hex)		Description	Default	Eff.	Mode
		EEP	RAM				
06-01	Input X0 function	0600h	4200h	The function setup of direct inputs 0: NC (X0, X1) 0: A-IN (A0X, A1X) 0: PWM-IN (XH0~XH3) 1: START/STOP (FWD) 2: CCW/CW (REV) 5: FREE 6: STOP-MODE 7: EBRAKE/ALM-RST 8: ALM-RST 9: STOP-MODE2 10: D0 11: D1 13: EBRAKE 14: SERVO-EN 17: STOP 21: EXT-ERROR The functions above affect both channels. Function value + 100: affects channel M1 only. Function value + 200: affects channel M2 only. Ex: 101 is START/STOP(FWD) for M1 only.	101	C	S/D/P
06-02	Input X1 function	0601h	4201h		201	C	S/D/P
06-03	Input X2 (A0X) function	0602h	4202h		0	C	S/D/P
06-04	Input X3 (A1X) function	0603h	4203h		0	C	S/D/P
06-05	Input X4 (XH0) function	0604h	4204h		102	C	S/D/P
06-06	Input X5 (XH1) function	0605h	4205h		0	C	S/D/P
06-07	Input X6 (XH2) function	0606h	4206h		202	C	S/D/P
06-08	Input X7 (XH3) function	0607h	4207h		8	C	S/D/P
06-09	X8 (STO1)	0608h	4208h	Reserved	23	C	S/D/P
06-10	X9 (STO2)	0609h	4209h	Reserved	24	C	S/D/P
06-11 ~ 06-14	X10 (Always ON IN0) ~ X13 (Always ON IN1)	060Ah ~ 060Dh	420Ah ~ 420Dh	The state of the input function assigned to these virtual inputs will be ON. The setting items are the same as direct inputs. NOTE: Do not assign START/STOP, FWD, REV to these inputs unless you do it on purpose to make the motor start running right after power on.	0	C	S/D/P`
06-15	SC/CC mode (Start-stop/direction mode)	060Eh	420Eh	0: SC mode. Use START/STOP, CCW/CW inputs. 1: CC mode. Use FWD, REV inputs.	0	C	S/D/P
06-16	Input logic	060Fh	420Fh	Set the logic for input terminals, where each bit corresponds to an input logic. 0: open-circuit/high-active, 1: closed-circuit/low-active Bit 0: X0 logic Bit 1: X1 logic Bit 2: X2 (A0X) logic Bit 3: X3 (A1X) logic Bit 4: X4 (XH0) logic Bit 5: X5 (XH1) logic Bit 6: X6 (XH2) logic Bit 7: X7 (XH3) logic Bit 8: X8 (STO1) logic Bit 9: X9 (STO2) logic Bit 10~ 15: Reserved	64767	C	S/D/P

3.5.2. Digital input functions

■ FWD(START/STOP) [Func No. 1]、REV(CCW/CW) [Func No. 2]

SC Mode (START/STOP and CCW/CW mode)

When in speed and duty control mode, If the START/STOP input is ON, acceleration and operation are performed in the direction set by the CCW/CW input at the rate set by the acceleration time setting. If the START/STOP input is OFF, the motor stops at the rate set by the deceleration time.
The STOP MODE input can change how the motor should stop.
If the CCW/CW input is OFF, the operation direction is set to clockwise direction. If the CCW/CW input is ON, the operation direction is set to counterclockwise direction. When changing the target direction during motor operation, the motor delelerates to about zero speed and then accelerates into the new set direction.

CC Mode (FWD and REV mode)

If the FWD input is ON, acceleration and operation are performed in the clockwise direction at the rate set by the acceleration time setting. If the FWD in put is OFF, the motor stops.
If the REV input is ON, acceleration and operation are performed in the counterclockwise direction at the rate set by the acceleration time setting. If the REV in put is OFF, the motor stops.
The STOP MODE input can change how the motor should stop.
NOTE If both FWD and REV are ON simultaneously, the motor stops.
NOTE Other inputs takes precedence over FWD(START/STOP) and REV(CCW/CW) inputs.

■ FREE [Func No. 5]

If the FREE input is ON, the motor excitation is canceled. Which may cause the motor to coast to stop (free to stop).
NOTE The FREE input takes precedence over other inputs.
NOTE When parameter “01-10/01-26 M1/M2 Drive Enable” is 1, the MBRAKE can be released when the FREE input is ON. Special careful to consider when there is external force that could pull to motor.

■ STOP-MODE [Func No. 6]

The STOP MODE input determines how the motor should stop. If the STOP MODE input is OFF, the motor will stop at the rate set by the deceleration time setting. If the STOP MODE input is ON, the motor will stop instantaneously (dynamic brake).

■ EBRAKE/ALM-RST [Func No. 7]

The EBRAKE/ALM-RST input works as EBRAKE input during normal operations.
When an alarm generates (protection function activated and the motor stopped), the EBRAKE/ALM-RST input works as ALARM RESET input.

■ ALM-RST [Func No. 8]

To release the protection function and restart the drive system, set the ALM-RST input to OFF for the minimum duration of 0.5 sec than set it to ON for the minimum duration of 0.5 sec. The drive system is enabled after the next OFF edge.
NOTE Some prection functions can NOT be reset by the ALM-RST input. These alarms must be reset by recycling the power.

■ D0 [Func No. 10]、D1 [Func No. 11]

Digital indexing operation data number selection bits. When an operation data select bit is not in use, it works as OFF state (0).

Operation dataNo.	D1	D0
0	OFF	OFF
1	OFF	ON
2	ON	OFF
3	ON	ON

■ EBRAKE [Func No. 13]

While the motor is running, setting the EBRAKE input to ON will make the motor to stop instantaneously (dynamic brake).
When the EBRAKE input is ON, the motor is disabled (NO operation allowed).
When the EBRAKE input is OFF, the motor is enabled.
To start motor operation, be sure to set the EBRAKE input to OFF.
NOTE The E BRAKE input takes preference over other inputs except the FREE input.

■ SERVO-EN [Func No. 14]

Parameter “01-10/01-26 M1/M2 Drive Enable” is 1 or 2:

When the SERVO-EN input is OFF, the motor excitation is canceled. Which may cause the motor to coast to stop (free to stop).
The motor state will be 6 (WAIT/INHIBIT/SERVO OFF).
NOTE When parameter 01-10/01-26 is set to 1, the MBRAKE is controlled by FREE input.
NOTE When parameter 01-10/01-26 is set to 2, the MBRAKE is released when the motor state is 6 (WAIT/INHIBIT/SERVO OFF).

Parameter “01-10/01-26 M1/M2 Drive Enable” is 0:

The motor state will leave 6 (WAIT/INHIBT/SERVO OFF) automatically after power-up. SERVO-EN input is not used.

■ STOP [Func No. 17]

While the motor is running, setting the STOP input to ON will make the motor to stop at the rate set by the deceleration time. The STOP MODE input can change how the motor should stop.
To start motor operation, be sure to set the STOP input to OFF.

■ EXT-ERROR [Func No. 21]

When the EXT-ERROR input is ON, an external stop alarm is generated. The drive activates its protection function and cuts off the power to the motor (motor coasts to stop if not affected by other external forces).
To reset the external stop alarm, be sure to set the EXTERROR input to OFF.

■ CW-LIMIT [Func No. 25]

When the CW-LIMIT input is ON, the motor can nolonger do the CW(FWD) operation. It can do the CCW(REV) operation.

■ CCW-LIMIT [Func No. 26]

When the CCW-LIMIT input is ON, the motor can nolonger do the CCW(REV) operation. It can do the CW(FWD) operation.

■ STO1/STO2 [Func No. 23/24]

If either one of the STO1 or STO2 input is OFF, the motor excitation is canceled. Which may cause the motor to coast to stop (free to stop). The motor state will be 9 (STO).
To start motor operation, besure to set both the STO1 and STO2 to ON.
NOTE This is a hardware power off function. Certification is still in progress.

3.6. Digital output

3.6.1. Digital output paremeters

ID	Field name	Register (hex)		Description	Default	Eff.	Mode
		EEP	RAM				
06-17	Output Y0 function	0610h	4210h	The function setup of direct outputs 0: NC 1: SPD-OUT 2: ALM-OUT 3: BUSY-OUT 4: VA-OUT 5: EN-OUT 6: ALM-PULSE 7: BUS-ALM-PULSE 11: RUN-OUT 12: DIR-OUT 13: VA-OUT2 14: VA-EN-OUT The functions above affect M1 channel only. Function value + 100: affects channel M1 only. Function value + 200: affects channel M2 only. Ex: 202 is ALM-OUT for M2 only.	102	C	S/D/P
06-18	Output Y1 function	0611h	4211h		202	C	S/D/P
06-19	Output Y2 (YH0) function	0612h	4212h		0	C	S/D/P
06-20	Output Y3 (YH1) function	0613h	4213h		101	C	S/D/P
06-21	Output Y4 (YH2) function	0614h	4214h		0	C	S/D/P
06-22	Output Y5 (YH3) function	0615h	4215h		201	C	S/D/P
06-23 ~ 06-28	Reserved	0616h ~ 061Bh	4216h ~ 421Bh	Reserved	-	-	-
06-29	MBRAKE (Electromagnetic brake) control	061Ch	421Ch	0: Holding voltage same as the main power supply. Other: Tens/one digit: holding % Thousand/hundreds digit: Starting time in 0.1 sec Setting Example: 50: release voltage = 50% PWM of the main power 2050: release voltage = 100% main power for 2.0 sec for releasing and then drop to 50% PWM for holding. *Do not change this setting unless you verified the requirements to release the electromagnetic brake you are using.	0	C	S/D/P
06-30	Speed in range (VA)	061Dh	421Dh	VA-OUT outputs ON, when the difference between actual and command motor speed is less than this value. Setting range" 0 to 1,000 r/min.	100	C	S/D/P
06-31	EN-OUT speed	061Eh	421Eh	EN-OUT outputs ON, when the motor speed is higher than this value. Setting range: 200 to 10,000 r/min	1000	C	S/D/P
06-32	Output logic	061Fh	421Fh	Set the logic for output terminals, where each bit corresponds to an output logic. Bit 0: Y0 logic Bit 1: Y1 logic Bit 2: Y2 (YH0) logic Bit 3: Y3 (YH1) logic Bit 4: Y4 (YH2) logic Bit 5: Y5 (YH3) logic Bit 6 ~ 15: Reserved	65535	C	S/D/P
08-16 08-32	M1: ENC-OUT divider M2: ENC-OUT divider	080Fh 081Fh	440Fh 441Fh	SPD-OUT output divider for encoder feedback. Set this value to 0(disable) or greater than 100.	0	C	S/D/P

3.6.2. Digital output functions

■ SPD-OUT [Func No. 1]

The motor speed pulse output.

For hall feedback

For an 8 poles motor, there will be 12 pulses per motor revolution.
The motor speed = (SPD_OUT freq[Hz] / 12) * 60.

For encoder feedback

When the parameter “08-16/08-32 M1/M2 ENC-OUT divider” is 0, The SPD-OUT is disabled.
The number of pulses per motor revolution = (encoder resolution *2 / divider).
NOTE The divider should be at leaset 100.

For a 2500 pulse per channel encoder, 100 dividers: The number of pulses per motor revolution = (2500 *2 / 100) = 50.
The motor speed = (SPD_OUT freq[Hz] / 50) * 60.

■ ALM-OUT [Func No. 2]

The ALM-OUT output is ON when there is a protect function(alarm) in action and the motor state is in the 5 (FAULT state).
The ALM-OUT output is OFF when there is no protect function(alarm) in action and the motor state is not 5 (FAULT state).

■ BUSY-OUT [Func No. 3]

The BUSY-OUT output is OFF when the motor excitation is canceled. The BUSY-OUT output is ON when the motor is excited (powered) by the drive.

■ VA-OUT [Func No. 4]

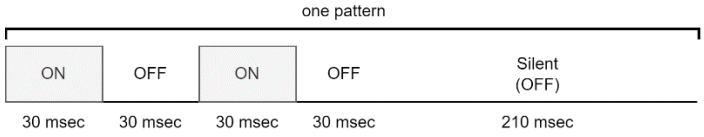
VA-OUT outputs ON, when the difference between actual and command motor speed is less than the value set by parameter “06-30 Speed in range (VA)”.

■ EN-OUT [Func No. 5]

EN-OUT outputs ON, when the motor speed is higher than the value set by parameter “06-31 EN-OUT speed”.

■ ALM-PULSE [Func No. 6]

When there is a pretct function (alarm) in action, the ALM-PULSE output generates a pulse corresponding to the error code of the fault. The pulse pattern is the same as the ALM-LED.
For example, if an overload alarm (error code 2) is activated the ALM-PULSE will repeat the pattern below until the alarm is reseted.



■ BUSY-ALM-PULSE [Func No. 7]

The BUSY-ALM-PULSE output works as BUSY-OUT during normal operations.
When an alarm generates (protection function activated and the motor stopped), the BUSY-ALM-PULSE output works as ALM-PULSE output.

■ DIR-OUT [Func No. 12]

The DIR-OUT output is OFF when motor is under CW(FWD) operation.
The DIR-OUT output is ON when motor is under CCW(REV) operation.
The DIR-OUT output remains last state when the motor is not moving.

■ VA-OUT2 [Func No. 15]

Act like VA-OUT but only works when the command speed is not 0.

■ VA-EN-OUT [Func No. 16]

VA-EN-OUT outpus is OFF, when the motor speed is lower than the value set by parameter “06-31 EN-OUT speed”.
VA-EN-OUT output acts like, when the motor speed is larger than the value set by parameter “06-31 EN-OUT speed”.

4. Operation

The DEV motor drive can be controlled by direct IO, RS485 or CANOpen depending on the control mode and user sernario.

4.1. Motor state description

No.	Motor State	Conditions (ParameterM1/M2)	Magnetic Brake Output*1
0	STOP	The stop state of the motor when in speed or duty control mode (01-11/01-27=0 or 1) and the slight-position-keeping is not in use (08-11= 0: free or 1: phase short). The input signal of operation is OFF (S/S, FWD, REV etc.).	Lock
2	RUN	Motor operation in CW or CCW when in speed or duty control mode.	Release
3	BRAKE	When EBRAKE (input or command) is ON, the drive shorts the phase of the motor to brake the motor. Priority lower than FREE, FAULT, and SERVO-OFF.	Release during motor decelerating. Lock after motor stops.
4	FREE	When FREE (input or command) is ON, the drive turns off all the output to the motor. Priority lower than FAULT and SERVO-OFF.	Release (closed circuit).
5	FAULT	When an alarm generates, the motor stops, and the state will be FAULT. There will be no output from the drive to the motor. Priority lower than SERVO-OFF.	Release when the FREE is ON otherwise it locks.
6	WAIT/INHIBIT (SERVO OFF)	The drive output is disabled when one of the follow conditions holds: SERVO-ON (input or command) is OFF when parameter 01-10/01-26 is 1 or 2 (Enable by SERVO-ON input). Main power (B+) is lower than the under-voltage protect value。	Release when 01-10/01-26 is 2. Release when 01-10/01-26 is 0 or 1 and FREE is ON
7	MOVING(SERVO ON)	The motor is in position control mode when 01-11/01-27 is 2 and SERVO-ON is ON. This is state is for encoder motor only.	Release.
9	SLIGHT-POS-KEEPING	The drive holds the motor position when it stops with a max of 50% rated torque when 01-15/01-13 is set to 2 (slight-position-keeping).	Release.
*1. Magnetic Brake Output: Release = closed circuit, Lock = open circuit.			

4.2. Operation data and Torque limit function

Operation data can be used to set the speed, output duty (duty mode only), torque limit current, acceleration, or deceleration for the motor operation.
Users can preset the operation data in EEP or set the RAM address through communication (RS232/RS485/CAN) during operation.
There are 4 data per operation data which can be selected by the operation data No. set by the D0, D1 (input or command) indexing.

ID	Field name	Register (hex)		Description	Range	Default	Effective
		EEP	RAM				
03-01 ~ 03-04	M1 Speed No.0 ~ M1 Speed No.3	0300h ~ 0303h	3F00h ~ 3F03h	Ch1 motor speed for digital indexing and position control.	60 ~ 10000 r/min	3000	A
03-05 ~ 03-08	M1 Duty No.0 ~ M1 Duty No.3	0304h ~ 0307h	3F04h ~ 3F07h	Ch1 motor output duty for digital indexing for duty mode.	0 ~ 1000 (1=0.01%)	100	A
03-09 ~ 03-12	M1 Tq Limit No.0 ~ M1 Tq Limit No.3	0308h ~ 030Bh	3F08h ~ 3F0Bh	Ch1 motor torque limit for digital indexing.	0 ~ 2000 (1=0.01%)	2000	A
04-01 ~ 04-04	M1 ACC Time No.0 ~ M1 ACC Time No.3	0400h ~ 0404h	4000h ~ 4004h	Ch1 motor acceleration time. Speed: 0 to 3000 RPM Duty: 0 to 100.0%	100 ~ 15000 (1=1ms)	1000	A
04-05 ~ 04-08	M1 DEC Time No.0 ~ M1 DEC Time No.3	0404h ~ 0407h	4004h ~ 4007h	Ch1 motor deceleration time. Speed: 3000 to 0 RPM Duty: 100.0 to 0%	100 ~ 15000 (1=1ms)	1000	A
03-17 ~ 03-20	M2 Speed No.0 ~ M2 Speed No.3	0310h ~ 0313h	3F10h ~ 3F13h	Ch2 motor speed for digital indexing and position control.	60 ~ 10000 r/min	3000	A
03-21 ~	M2 Duty No.0 ~	0314h ~	3F14h ~	Ch2 motor output duty for digital	0 ~ 1000	100	A

03-24	M2 Duty No.3	0317h	3F17h	indexing for duty mode.	(1=0.01%)		
03-25 ~ 03-28	M2 Tq Limit No.0 ~ M2 Tq Limit No.3	0318h ~ 031Bh	3F18h ~ 3F1Bh	Ch2 motor torque limit for digital indexing.	0 ~ 2000 (1=0.01%)	2000	A
04-17 ~ 04-20	M2 ACC Time No.0 ~ M2 ACC Time No.3	0410h ~ 0413h	4010h ~ 4013h	Ch2 motor acceleration time. Speed: 0 to 3000 RPM Duty: 0 to 100.0%	100 ~ 15000 (1=1ms)	1000	A
04-25 ~ 04-28	M2 DEC Time No.0 ~ M2 DEC Time No.3	0418h ~ 041Bh	4018h ~ 401Bh	Ch2 motor deceleration time. Speed: 3000 to 0 RPM Duty: 100.0 to 0%	100 ~ 15000 (1=1ms)	1000	A

■ Torque limit function

ID	Field name	Register (hex)		Description	Def.	Eff.	Mode
		EEP	RAM				
03-13 03-29	M1 Torque Limit Alarm M2 Torque Limit Alarm	030Ch 031Ch	3F0Ch 3F1Ch	The alarm setting of torque limit function. * The setting is affected by parameter "05-15 Overload Protect" When 05-15 Bit1 is 0: 0: Continuous output (No alarm) 1 ~ 65535: Overload alarm activates when the output current > Tq limit value over the overboost time and motor stalled (speed 0) over this duration (Unit: ms). When 05-15 Bit1 is 1: 0: Overload alarm activates when the Tq limit activates. 1 ~ 65535: Overload alarm activates when the output current > Tq limit value over the duration of overboost time + this setting (Unit: ms).	3000	C	S/D/P
03-14 03-30	M1 Tq Limit Overboost Time M2 Tq Limit Overboost Time	030Dh 031Dh	3F0Dh 3F1Dh	Tq limit activates to decrease output current to the limited value when the output current is higher than Tq limit over this duration (Unit: 0.1 sec)	300	C	S/D/P
03-15 03-31	M1 Tq Limit Recovery Time M2 Tq Limit Recovery Time	030Eh 031Eh	3F0Eh 3F1Eh	Tq limit deactivates when the output current is lower than the limited value over this duration (Unit: 0.1 sec)	600	C	S/D/P

■ Advanced operation data

ID	Field name	Register (hex)		Description	Range	Default	Effective
		EEP	RAM				
04-09 ~ 04-12	M1 ACC Time Rate No.0 ~ M1 ACC Time Rate No.3	0408h ~ 040Bh	4008h ~ 400Bh	Ch1 motor acceleration change rate (time for acceleration change from 0 to the set value). (Ineffective in position mode).	1 ~ 15000 (1ms) 1 = not in use	1	A
04-13 ~ 04-16	M1 DEC Time Rate No.0 ~ M1 DEC Time Rate No.3	040Ch ~ 040Fh	400Ch ~ 400Fh	Ch1 motor deceleration change rate (time for deceleration change from 0 to the set value). (Ineffective in position mode).	1 ~ 15000 (1ms) 1 = not in use	1	A
04-21 ~ 04-24	M2 ACC Time Rate No.0 ~ M2 ACC Time Rate No.3	0414h ~ 0417h	4014h ~ 4017h	Ch2 motor acceleration change rate (time for acceleration change from 0 to the set value). (Ineffective in position mode).	1 ~ 15000 (1ms) 1 = not in use	1	A
04-29 ~ 04-32	M2 DEC Time Rate No.0 ~ M2 DEC Time Rate No.3	041Ch ~ 041Fh	401Ch ~ 401Fh	Ch2 motor deceleration change rate (time for deceleration change from 0 to the set value). (Ineffective in position mode).	1 ~ 15000 (1ms) 1 = not in use	1	A

4.3. Control mode setting

There are 3 control modes (speed mode, duty mode, and position mode) which can be selected by parameters.

4.3.1. Control mode setting parameters

ID	Field name	Register (hex)		Description	Default	Eff.	Mode
		EEP	RAM				
01-11 01-27	M1 Control mode M2 Control mode	010Ah 011Ah	3D0Ah 3D1Ah	0: Speed (closed-loop) 1: Duty (open-loop) 2: Position (Multi-drive)	0	C	S/D/P
01-12 01-28	M1 Duty/Speed OP mode M2 Duty/Speed OP mode	010Bh 011Bh	3D0Bh 3D1Bh	Duty and speed operation mode (command source selection). 0: A1X/A2X (Analog input) 1: Digital (Parameter Indexing) 2: XH0 PFM(Pulse frequency) 3: XH0 PWM 4: Multi-Drive Lite	0	C	S/D

Control mode setting method

- Step 1: Set parameter “01-11/01-27 M1/M2 Control mode”.
- Step 2: Set parameter “01-12/01-28 M1/M2 Duty/Speed OP mode” (only for speed and duty mode).

4.4. Speed mode

Use motor speed as the main operation data to control the motor.

4.4.1. Parameter setting to use speed mode

- Set parameter “01-11/01-27 M1/M2 Control mode” to 0.
- Set parameter “01-12/01-28 M1/M2 Duty/Speed OP mode” depending on the command source you want to use.

Parameter of speed mode command

ID	Field name	Register (hex)		Description	Default	Eff.	Mode
		EEP	RAM				
02-01	Max speed	0200h	3E00h	Only effective when parameter 01-12/01-28 is 0,2 or 3. Speed upper limit when set by analog / pulse input. 100 ~ 10,000 r/min.	3000	C	S
02-02	Min speed	0201h	3E01h	Only effective when parameter 01-12/01-28 is 0,2 or 3. Speed lower limit when set by analog / pulse input. Encoder feedback: 1 ~ 10,000 r/min Hall feedback: 60 ~ 10,000 r/min	85	C	S
02-09	Analog input range	0208h	3E08h	0: 0 to 5V 1: 0 to 10V	0	C	S/D
02-10	External command signal gain (control input gain)	0209h	3E09h	Only effective when parameter 01-12/01-28 is 0,2 or 3. Analog input 0 ~ 10,000 r/min(100%) per V	708	C	S/D
02-11	External command signal threshold (control input offset)	020Ah	3E0Ah	Only effective when parameter 01-12/01-28 is 0,2 or 3. Analog input or pulse signal mapped virtual voltage threshold (unit: 0.01V).	10	C	S/D
02-12	External command signal threshold speed (offset speed)	020Bh	3E0Bh	Only effective when parameter 01-12/01-28 is 0,2 or 3. The speed setting when command is at the threshold value. (unit: r/min)	85	C	S/D
02-25	Throttle type	0218h	3E18h	0: Single-ended 1: Single-ended reverse 2: Wig-wag 3: Wig-wag reverse 4: Unipolar	0	C	S/D

4.4.2. Speed operation mode (OP mode)

01-12/01-28 M1/M2 OP mode	Speed	Accelration Time	Deceleration Time	Torque Limit
0	M1: A0X analog input M2: A1X analog input	By operation data RAM register (data No. can be selected depending on the D0/D1 input).		
1	By operation data RAM register.			
2	M1: XH0 PFM (pulse frequency). M2: XH2 PFM (pulse frequency).			
3	M1: XH0 PWM M2: XH2 PWM			
4	Multi-drive Lite JG command			
5	M1: A0X as throttle input M2: A1X as throttle input Throttle type can be set by parameter "02-25 throttle type".			
6	M1: XH0 pulse input M2: XH2 pulse input			

■ OP Mode 0 (Analog)

When OP mode is 0, the command speed is set by the analog input from A0X(for M1) and A1X(for M2).

Command_speed [RPM]= (*Vin – V_threshold*) * *control_input_gain* + *speed_low_threshold*

ID: 02-11 ID:02-10 ID:02-12

Vin is the votlage from A0X/A1X [V].
NOTE If the command speed is beyond the limit set by parameter "02-01 Max speed or 02-02 Min speed", it will be set to the limit value.

■ OP Mode 1 (Digital operation data)

When OP mode is 1, the command speed is set by operation data register.
The data number can be selected by input D0/D1.

D1	D0	Data No.	ID	Item	EEP	RAM
OFF	OFF	0	03-01 03-17	M1 Speed No.0 M2 Speed No.0	0300h 0310h	3F00h 3F10h
OFF	ON	1	03-02 03-18	M1 Speed No.1 M2 Speed No.1	0301h 0311h	3F01h 3F11h
ON	OFF	2	03-03 03-19	M1 Speed No.2 M2 Speed No.3	0302h 0312h	3F02h 3F12h
ON	ON	3	03-04 03-20	M1 Speed No.3 M2 Speed No.3	0303h 0313h	3F03h 3F13F

■ OP Mode 2 (PFM)

When OP mode is 2, the command speed is set by the pulse frequency from the input XH0 (for M1) and XH2 (for M2).
The input pulse will first be mapped into a virtual voltage value (Vin_v). The virtual voltage then will be used to map to a command speed.
*Vin_v = pulse_freq[Hz] * 0.005 [V]*
*Command_speed [RPM]= (Vin_v – V_threshold) * control_input_gain + speed_low_threshold*

ID: 02-11 ID:02-10 ID:02-12

pulse_freq is the pulse signal frequency from XH0/XH2 [unit=Hz].
Vin_v is the mapped virtual voltage [V].
NOTE If the command speed is beyond the limit set by parameter "02-01 Max speed or 02-02 Min speed", it will be set to the limit value.

■ OP Mode 3 (PWM Duty)

When OP mode is 3, the command speed is set by the duty cycle of the PWM from the input XH0 (for M1) and XH2 (for M2).
The PWM will first be mapped into a virtual voltage value (Vin_v). The virtual voltage then will be used to map to a command speed.
*Vin_v = pwm_duty[%] * 0.1 [V]*
*Command_speed [RPM]= (Vin_v – V_threshold) * control_input_gain + speed_low_threshold*

ID: 02-11 ID:02-10 ID:02-12

pwm_duty is the pwm duty cycle signal frequency from XH0/XH2 [unit=1%].
Vin_v is the mapped virtual voltage [V].
NOTE If the command speed is beyond the limit set by parameter "02-01 Max speed or 02-02 Min speed", it will be set to the limit value.

■ OP Mode 4 (Multi-drive Lite)

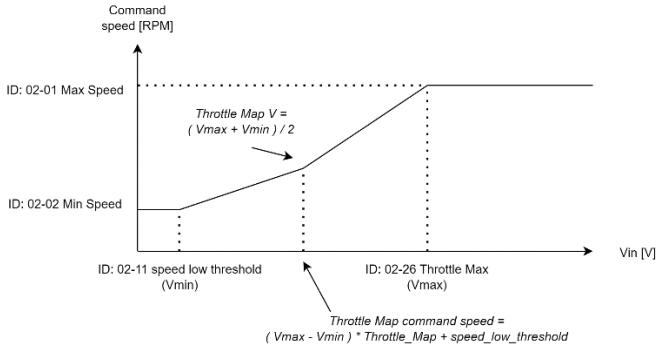
When OP mode is 4, the command speed is set by communication in Multi-drive lite command "JG".
NOTE For more detail of Multi-drive lite, please reference to the document "DEV-COM-EN_UM-01-S0605" in the section of "5.

■ OP Mode 5 (Throttle)

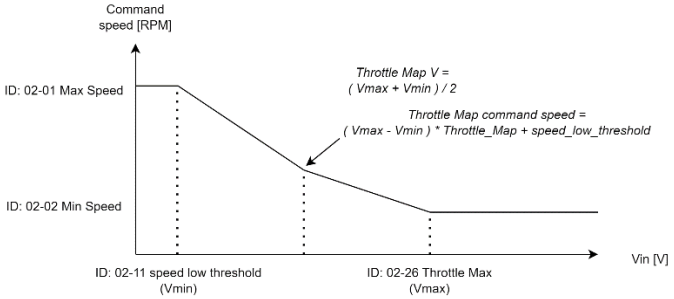
When OP mode is 5, the command speed is set by analog throttle signal from A0X(for M1) and A1X(for M2).
The type of the throttle can be set by parameter “02-25 Throttle type”.

ID	Field name	Register (hex)		Description	Default	Eff.	Mode
		EEP	RAM				
02-25	Throttle type	0218h	3E18h	0: Single-ended 1: Single-ended reverse 2: Wig-wag 3: Wig-wag reverse 4: Unipolar	0	C	S/D

Throttle type 0: single-ended



Throttle type 1: single-ended reverse

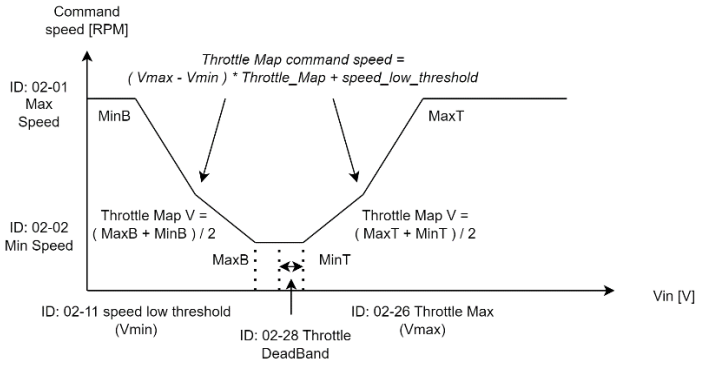


Throttle type 2 (Wig-wag) / 3 (Wig-wag reverse) / 4 (unipolar)

Throttle type	Command direction	Command speed
2 (Wig-wag)	Vin < V_neutral : CW Vin > V neutral : CCW	See graph below.
3 (Wig-wag reverse)	Vin < V_neutral : CW Vin > V neutral : CCW	
4 (unipolar)	Set by CCW/CW input.	

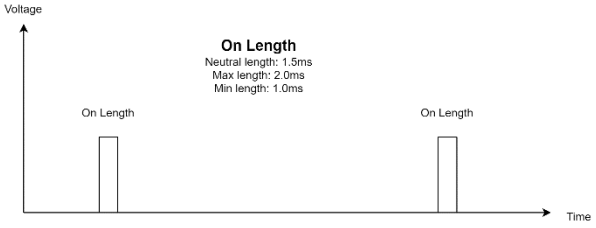
V_neutral [V]= (V_threshold + Throttle_max)

ID: 02-11 ID:02-26

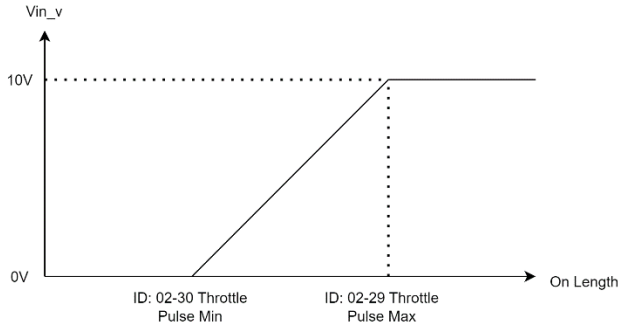


■ OP Mode 6 (Pulse input)

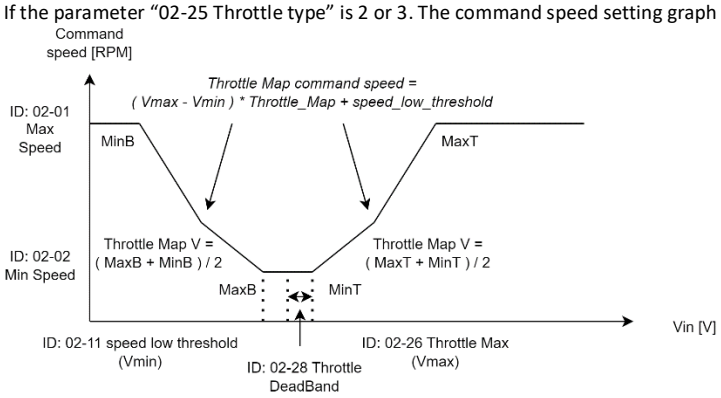
When OP mode is 6, the command speed is set by the pulse length from XH0(for M1) and XH2(for M2).
The pulse length will first be mapped into a virtual voltage value (Vin_v). The virtual voltage then will be used to map to a command speed.
NOTE It is suggested to set the parameter “02-25 Throttle type” to 2 (Wig-wag) or 3 (Wig-wag reverse) to have the neutral and direction control feature for the pulse input control.
The pulse length of the signal.



Map the pulse length into the virtual voltage (Vin_v)



If the parameter “02-25 Throttle type” is 2 or 3. The command speed setting graph is the same as wig-wag / wig-wag reverse type.



4.5. Duty mode

Use output duty cycle % as the main operation data to control the motor.

4.5.1. Parameter setting to use duty mode

- Set parameter “01-11/01-27 M1/M2 Control mode” to 1
- Set parameter “01-12/01-28 M1/M2 Duty/Speed OP mode” depending on the command source you want to use.

Parameter of duty mode command

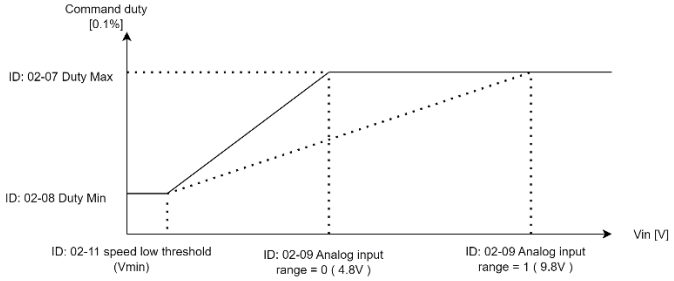
ID	Field name	Register (hex)		Description	Default	Eff.	Mode
		EEP	RAM				
02-01	Max duty	0206h	3E06h	Only effective when parameter 01-12/01-28 is 0,2 or 3. The max setting for output duty set by analog input in 0.10%.	1000	C	D
02-02	Min duty	0207h	3E07h	Only effective when parameter 01-12/01-28 is 0,2 or 3. The min setting for output duty set by analog input in 0.10%.	0	C	D
02-09	Analog input range	0208h	3E08h	0: 0 to 5V (4.8 VDC) 1: 0 to 10V (9.8 VDC)	0	C	S/D
02-10	External command signal gain (control input gain)	0209h	3E09h	Only effective when parameter 01-12/01-28 is 0,2 or 3. Analog input 0 ~ 10,000 r/min(100%) per V	708	C	S/D
02-11	External command signal threshold (control input offset)	020Ah	3E0Ah	Only effective when parameter 01-12/01-28 is 0,2 or 3. Analog input or pulse signal mapped virtual voltage threshold (unit: 0.01V).	10	C	S/D
02-12	External command signal threshold speed (offset speed)	020Bh	3E0Bh	Only effective when parameter 01-12/01-28 is 0,2 or 3. The speed setting when command is at the threshold value. (unit: r/min)	85	C	S/D
02-25	Throttle type	0218h	3E18h	0: Single-ended 1: Single-ended reverse 2: Wig-wag 3: Wig-wag reverse 4: Unipolar	0	C	S/D

4.5.2. Duty operation mode (OP mode)

01-12/01-28 M1/M2 OP mode	Duty	Accelration Time	Deceleration Time	Torque Limit
0	M1: A0X analog input M2: A1X analog input	By operation data RAM register (data No. can be selected depending on the D0/D1 input).		
1	By operation data RAM register.			
2	M1: XH0 PFM (pulse frequency). M2: XH2 PFM (pulse frequency).			
3	M1: XH0 PWM M2: XH2 PWM			
4	Multi-drive Lite JG command			
5	M1: A0X as throttle input M2: A1X as throttle input Throttle type can be set by parameter “02-25 throttle type”.			
6	M1: XH0 pulse input M2: XH2 pulse input			

■ OP Mode 0 (Analog)

When OP mode is 0, the command duty is set by the analog input from A0X(for M1) and A1X(for M2).
The command duty [0.1%] is a linear mapping by Vin min and Vin max to the duty min and duty max.



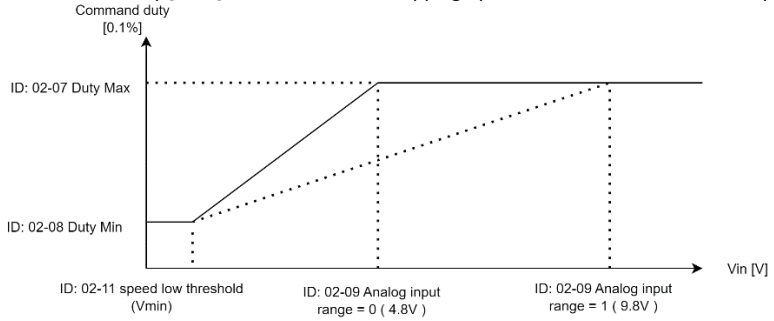
■ OP Mode 1 (Digital operation data)

When OP mode is 1, the command duty is set by operation data register.
The data number can be selected by input D0/D1.

D1	D0	Data No.	ID	Item	Range [Unit]	EEP	RAM
OFF	OFF	0	03-05 03-21	M1 Duty No.0 M2 Duty No.0	0 to 1000 [0.1%]	0304h 0314h	3F04h 3F14h
OFF	ON	1	03-06 03-22	M1 Duty No.1 M2 Duty No.1	0 to 1000 [0.1%]	0305h 0315h	3F05h 3F15h
ON	OFF	2	03-07 03-23	M1 Duty No.2 M2 Duty No.3	0 to 1000 [0.1%]	0306h 0316h	3F06h 3F16h
ON	ON	3	03-08 03-24	M1 Duty No.3 M2 Duty No.3	0 to 1000 [0.1%]	0307h 0317h	3F07h 3F17F

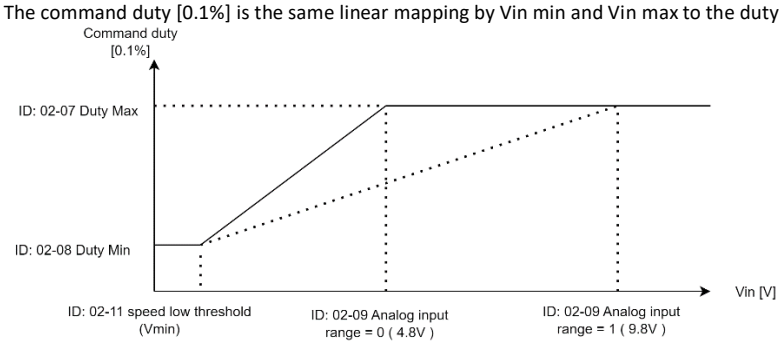
■ OP Mode 2 (PFM)

When OP mode is 2, the command duty is set by the pulse frequency from the input XH0 (for M1) and XH2 (for M2).
The input pulse will first be mapped into a virtual voltage value (Vin_v). The virtual voltage then will be used to map to a command duty.
*Vin_v = pulse_freq[Hz] * 0.005 [V]*
For example, pulse_freq = 2000Hz, Vin_v = 2000 * 0.005 = 10V
pulse_freq is the pulse signal frequency from XH0/XH2 [unit=Hz].
Vin_v is the mapped virtual voltage [V].
The command duty [0.1%] is the same linear mapping by Vin min and Vin max to the duty min and duty max.



■ OP Mode 3 (PWM Duty)

When OP mode is 3, the command duty is set by the duty cycle of the PWM from the input XH0 (for M1) and XH2 (for M2).
The PWM will first be mapped into a virtual voltage value (Vin_v). The virtual voltage then will be used to map to a command duty.
*Vin_v = pwm_duty[%] * 0.1 [V]*
For example, pwm_duty = 100%, Vin_v = 100 * 0.1 = 10V
pwm_duty is the pwm duty cycle signal frequency from XH0/XH2 [unit=1%].
Vin_v is the mapped virtual voltage [V].
The command duty [0.1%] is the same linear mapping by Vin min and Vin max to the duty min and duty max.



■ OP Mode 4 (Multi-drive Lite)

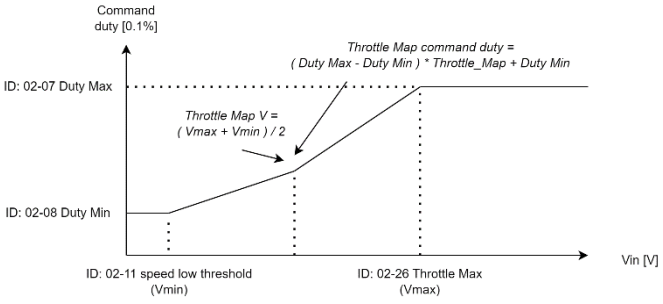
When OP mode is 4, the command duty is set by communication in Multi-drive lite command “JG”.
NOTE For more detail of Multi-drive lite, please reference to the document “DEV-COM-EN_UM-01-S0605” in the section of “5.

■ OP Mode 5 (Throttle)

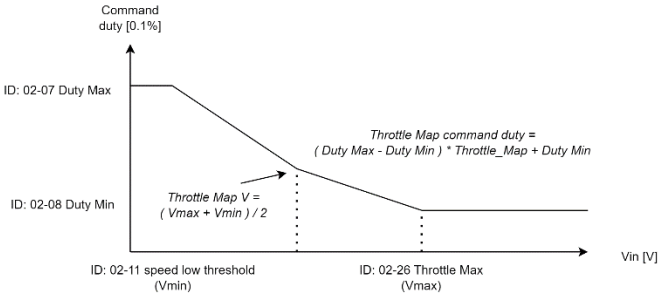
When OP mode is 5, the command duty is set by analog throttle signal from A0X(for M1) and A1X(for M2).
The type of the throttle can be set by parameter “02-25 Throttle type”.

ID	Field name	Register (hex)		Description	Default	Eff.	Mode
		EEP	RAM				
02-25	Throttle type	0218h	3E18h	0: Single-ended 1: Single-ended reverse 2: Wig-wag 3: Wig-wag reverse 4: Unipolar	0	C	S/D

Throttle type 0: single-ended



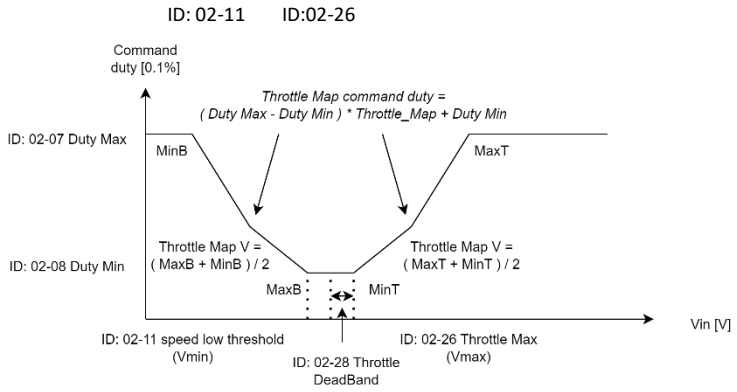
Throttle type 1: single-ended reverse



Throttle type 2 (Wig-wag) / 3 (Wig-wag reverse) / 4 (unipolar)

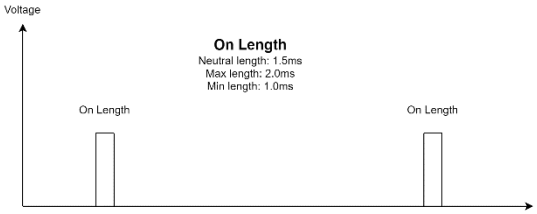
Throttle type	Command direction	Command speed
2 (Wig-wag)	Vin < V_neutral : CW Vin > V neutral : CCW	See graph below.
3 (Wig-wag reverse)	Vin < V_neutral : CW Vin > V neutral : CCW	
4 (unipolar)	Set by CCW/CW input.	

V_neutral [V]= (V_threshold + Throttle_max)

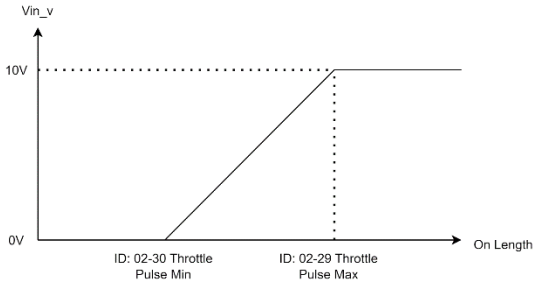


■ OP Mode 6 (Pulse input)

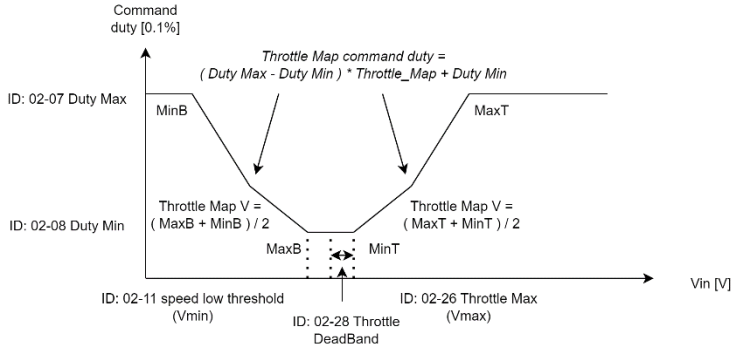
When OP mode is 6, the command duty is set by the pulse length from XH0(for M1) and XH2(for M2).
The pulse length will first be mapped into a virtual voltage value (Vin_v). The virtual voltage then will be used to map to a command duty.
NOTE It is suggested to set the parameter "02-25 Throttle type" to 2 (Wig-wag) or 3 (Wig-wag reverse) to have the neutral and direction control feature for the pulse input control.
The pulse length of the signal.



Map the pulse length into the virtual voltage (Vin_v)



If the parameter "02-25 Throttle type" is 2 or 3. The command speed setting graph is the same as wig-wag / wig-wag reverse type.



4.6. Position (Multi-drive) mode

Use Multi-drive protocol to control the motor.
Multi-drive is a customized RS485 protocol which is based on the customized function code of the Modbus protocol.
With Multi-drive, one can control up to 4 different drives with different operations in one message to reduce the communication delay. And each drive can respond in sequence.
Multi-drive supports both continuous(speed) and positioning operation.
NOTE When using Multi-drive, the M2 ID is M1 ID +1.
NOTE Only encoder models support multi-drive protocol.

4.6.1. Parameter setting to use duty mode

- Set parameter “01-11/01-27 M1/M2 Control mode” to 2

NOTE For more detail of Multi-drive, please reference to the document “DEV-COM-EN_UM-01-S0605” in the section of “4.

A1 - Alarm

When an alarm generates, the drive activates its protection function and cuts off the power to the motor (motor coasts to stop if not affected by other external forces).
The ALM-OUT turns ON and the ALM-LED blinks (The type of alarm can be confirmed by the alarm code or the blink count of ALM-LED).
Before resetting an alarm, always remove the cause of the alarm to ensure safety and perform one of the operations below to reset the alarm.
Turn the ALM-RST OFF for more than 0.5 sec then turn it ON for another 0.5 sec then turn it OFF again.
Cycle the power. When cycling the power please turn the power off for at least 30sec or till the PWR LED go off then turn the power on again.

NOTE Some alarms can only be reset by cycling the power
NOTE The alarm cannot be reset if the drive operation command is ON (etc. START/STOP, FWD, REV input is ON). Please turn all the operation command to OFF before reset the alarm.

■ Alarm error code register

Channel	Dynamic data	Monitor data
M1	0003h	4601h
M2	0031h	4A01h

■ ALM LED

The blink count of ALM-LED indicates the alarm error code.

Error code	Protection function	Description
1	Overcurrent	Excessive current has flown through the drive. Overload or rotor locked.
2	Overload	Exceeding the rated load for more than 5 sec. Exceeding the torque limit for X sec (X may vary depends on the parameter setting).
3	Motor feedback fault	Hall or Encoder signal abnormal or disconnected.
4	Overvoltage	The input voltage exceeds the upper limit of the drive. It may be caused by regenerative braking voltage.
5	Under voltage	The input power supply voltage is under the low limit.
6	Drive overheat	The temperature of the drive is over its maximum limit.
7	Startup fault	The motor failed to start. The motor cable is not connected correctly.
8	EEP data error	Error in EEPROM data. (Can NOT be reset by ALM_RST input).
10	Motor overheat	The temperature of the motor is too high. (The MOT-OT terminal has been set to ON state.)
12	Over speed	The motor speed exceeds the set upper limit.
13	Encoder signal fault	(1) Encoder was not connected, cannot be reset with ALM-RST (2) Encoder position exceeds the range (Overflow). Before using ALM-RST to clear the alarm, CS command should be used to reset the current position
14	Prevention of operation at power on	The main power supply was cycled when the FWD input or REV input was set to ON.
15	External stop	EXT-ERROR input is ON. When parameter “05-32 Channel Alarm Mode” is set to 1, and the other channel alarms.
20	Hall sequence fault	The hall sequence was incorrect.
21	Communication error	RS232 or RS485 communication timeout. The parameter setup value exceeds its limit or the communication command was not supported.
22	Parameter error	The parameter setup value was incorrect.

Revision history

REV	Date	Remark
1.0	20230902	Preliminary.