



MANUAL

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ECP Drive Series

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DSM EC drivers feature a compact structure of speed/positioning controllers, sensors and Smart EC motors.

Various operating modes allow an adaptable use in a wide range of drive systems.

Smart EC driver features extensive analog and digital I/O functionality and are being configured via RS485 interface using the graphical user interface "uSMART" for Windows PCs.

A wide range of operating modes allows flexible use in a variety of fields in drive systems, automation, and mechatronics.

Smart EC motors can be configured and ordered online. Fast, easy and online : www.dnj.co.kr (dnj@dnj.co.kr)

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ECP Selection Guide

ECP Model No.	Shaft type	Voltage	Interface	Input		Output		Drawing No.
				Speed set	Position set	(FG)	(encoder)	
PC4 03	Standard Hollow	24	RS485	PWM	Steps	X	X	DSM-701-24V-A-M-ECD
PC4 04	Hollow Disk (F)	24	RS485	PWM	Steps	X	Incremental (12 bit, A,B,Z, OPD)	DSM-701H-24V-A-M-DI-ECD(ENC)
PC4 04A(*)	Hollow Disk (F)	24	RS485	PWM	Angle	X	Incremental (12 bit, A,B,Z, OPD)	DSM-701H-24V-A-M-DI-ECD(ENC)
PC4 05	Hollow Disk	24	RS485	PWM	Steps	O	X	DSM-701H-24V-A-M-DI-ECD
PC4 08	Solid Shaft	24	RS485	PWM	Steps	X	Incremental (12 bit, A,B,Z, OPD)	DSM-701S-24V-A-M-AX-ECD
PC4 09	Solid Shaft	24	RS485	PWM	Steps	X	X	DSM-701S-24V-A-M-AX-ECD
PC2 04	Standard Hollow	24	RS232	PWM	Steps	X	X	DSM-701-24V-A-M-ECD
PC2 05	Hollow Disk (F)	24	RS232	PWM	Steps	X	Incremental (12 bit, A,B,Z, OPD)	DSM-701H-24V-A-M-DI-ECD(ENC)
PC2 06	Hollow Disk	24	RS232	PWM	Steps	O	X	DSM-701H-24V-A-M-DI-ECD
PC2 07	Solid Shaft	24	RS232	PWM	Steps	O	X	DSM-701S-24V-A-M-AX-ECD
PC2 08	Solid Shaft	24	RS232	PWM	Steps	X	Incremental (12 bit, A,B,Z, OPD)	DSM-701S-24V-A-M-AX-ECD

(*) Protocol customizing

Intelligent compact ECP drivers (positioning control)

DSM EC drivers feature a compact structure of speed/positioning controllers, sensors and Smart EC motors.

The use of existing DSM products with an adapted design results in robust, space-saving drive solution with high power density.

ECP drivers are digital positioning controllers internally mounted on Smart EC motors with FG or encoder signals.

EC drive solution is the key to production machinery with many years of maintenance-free operation in a variety of applications.

- Speed control set : PWM (duty %)
- Positioning command set : steps
- Position error : ± 5 step
- Home position return (zero position setting)
- Source Power outage compensation
- RS232, RS485 Interface
- Protocol : MODBUS-RTU
- Protection (over voltage, over current, under voltage, thermal shutdown)
- Switching frequency of power stage : 20kHz
- FG gen, Alarm output
- Incremental encoder A,B,Z output (12-bit, 4096 steps, Open drain)
- Customizing

Standard Hollow		Standard hollow shaft type. The front and rear hollow shafts rotate equally. (Dual hollow shaft)
Hollow Disk		A hollow disc flange (optional) is assembled to the hollow shaft. The inside of the hollow shaft is fixed with a pipe and does not rotate.
Hollow Disk (F)		The rear shaft of the motor is blocked. (Encoder output type). The motor front consists of a hollow disc flange.
Solid shaft		It is assembled as a solid shaft on the front shaft of the hollow standard type smart motor.
Control Input Mode	PC2	RS232 interface type
	PC4	RS485 interface type
FG		FG(Frequency Generator) signal output. FG is the abbreviation of Frequency Generator. It is called square wave. It is a square waveform generated while the motor rotates one cycle. Its signal frequency follows the motor rotating. With this function, your electric control circuit can always read the motor rotation, and then monitor the motor operation. $FG = \text{Motor pole number} \times \text{motor phase}$ $(\text{DSM701 series FG} = 8 [\text{poles}] \times 3 [\text{phase}] = 24 [\text{pulse}])$
OPD		Open drain output

Ø70 mm, 24VDC, Brushless, 2650rpm, 40 Watt, Standard hollow shaft, Positioning control, ECP drive



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Built in Positioning Control ECP drivers

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- Brushless DC (BLDC) motor
- Control IO : RS232, RS485
- Motor speed (duty %), positioning (steps) set
- Source Power outage compensation function
- Home position return (zero position setting)
- Protection (UVLO, OVP, OCP, TSD)
- Hall sensor (5~24Vdc, open-collector)

with Hall sensors

Motor data

Ratings

1 Nominal Voltage	V
2 Current	A
3 Power	W
4 Speed	RPM
5 Torque	N.m

Part numbers

701-24V-40P	701-24V-60P				
24	24				
2.5	3.5				
40	60				
2300	3000				
0.18	0.19				

Electrical characteristics

1 Maximum Operating Voltage	V
2 Maximum Output Power	W
3 No Load Speed	RPM
4 No Load Current	mA
5 Stall Torque	N.m
6 Torque Constant	mN.m/A
7 Back EMF Constant	mV/RPM
8 Terminal resistance phase to phase	Ω
9 Terminal inductance phase to phase	mH
10 Minimum Insulation resistance (dc 500V)	MΩ
11 Noise (Rad.30[cm] DC24V, No load)	dB

Characteristic Curves

Specifications

Mechanical data (preload ball bearing)

1 Max. axial load (dynamic)	kgf.cm	455
2 Max. force for press fits (static)	kgf.cm	600

Refer to bellow T-I, T-N drawing

Thermal data

Temperature ratings

1 Max. permissible winding temp.	°C	+160
2 Max. permissible bearing temp.	°C	+110

Ambient condition

1 Operation condition	°C	-10~50
2 Storage condition	°C	-10~60

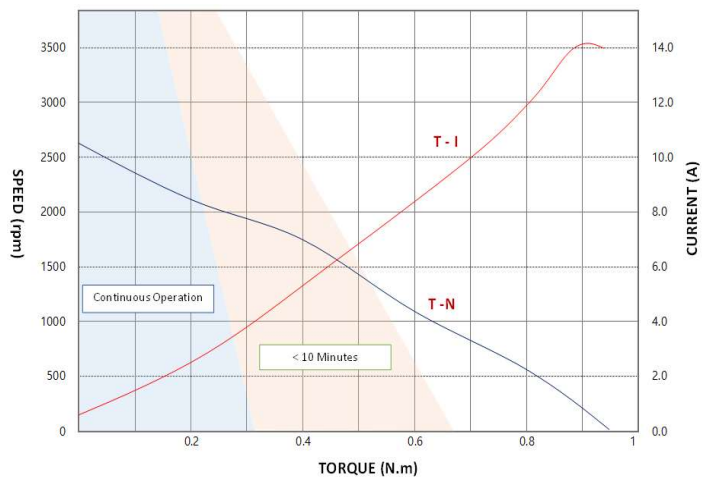
Other specifications

1 Number of pole pairs	pole	8
2 Number of phases	phase	3
3 Weight	gram	465

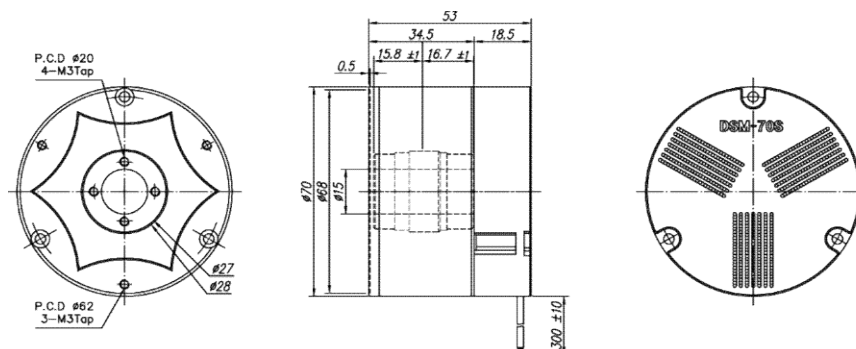
Pin Allocation

1 Red	VM (24 Vdc)	UL1061
2 Black	GND	AWG22
3 Orange	D+ / Tx	
4 White	D- / Rx	UL1061
5 Green	FG GEN	AWG28
6 Black	GND	
7 Brown	ENC A OUT	UL1061
8 Gray	ENC B OUT	AWG28
9 Yellow	ENC C OUT	

701-24V-40P T-N-I curve



Dimensions in [mm]



Ø70 mm, 24VDC, Brushless, 2650rpm, 40 Watt, Hollow disc flange option, Positioning control, ECP drive



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6 Torque Constant	mN.m/A
7 Back EMF Constant	mV/RPM
8 Terminal resistance phase to phase	Ω
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10 Minimum Insulation resistance (dc 500V)	MΩ
11 Noise (Rad.30[cm] DC24V, No load)	dB

30	30				
80	110				
2650	3500				
320	450				
0.96	0.86				
81	61				
8.72	6.60				
1.45	0.82				
2.15	1.27				
10	10				
50.0	50.4				

Specifications**Mechanical data (preload ball bearing)**

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Refer to bellow T-I, T-N drawing

Thermal data**Temperature ratings**

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Ambient condition

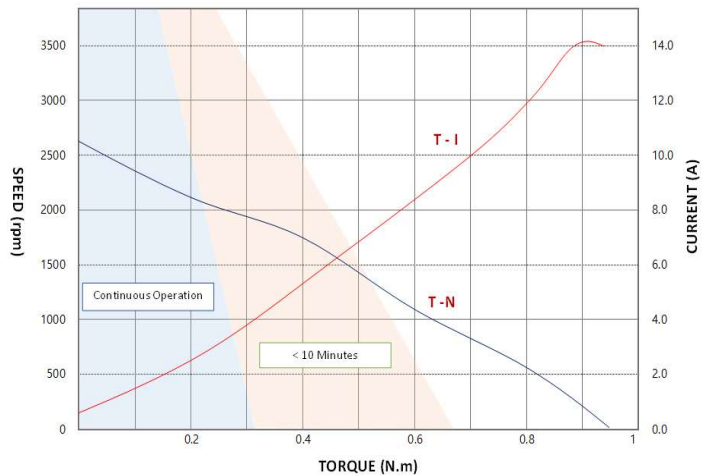
1 Operation condition	°C	-10~50
2 Storage condition	°C	-10~60

Other specifications

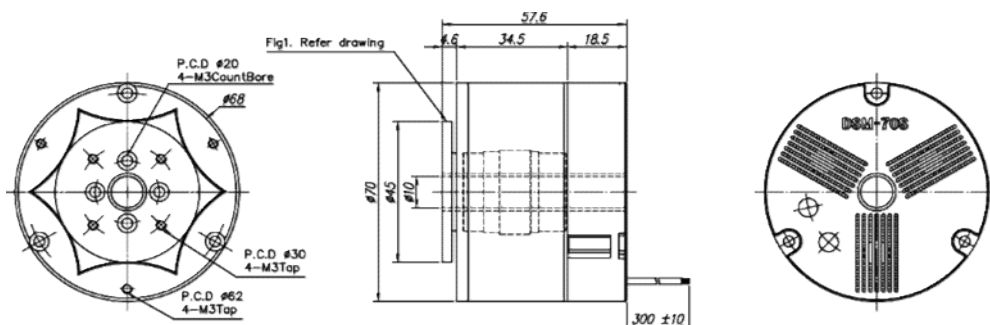
1 Number of pole pairs	pole	8
2 Number of phases	phase	3
3 Weight	gram	505

Pin Allocation

1 Red	VM (24 Vdc)	UL1061
2 Black	GND	AWG22
3 Orange	D+ / Tx	
4 White	D- / Rx	UL1061
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701-24V-40P T-N-I curve

Dimensions in [mm]



Ø70 mm, 24VDC, Brushless, 2650rpm, 40 Watt, Solid shaft option, Positioning control, ECP drive



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7 Back EMF Constant	mV/RPM
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10 Minimum Insulation resistance (dc 500V)	MΩ
11 Noise (Rad.30[cm] DC24V, No load)	dB

30	30				
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Specifications

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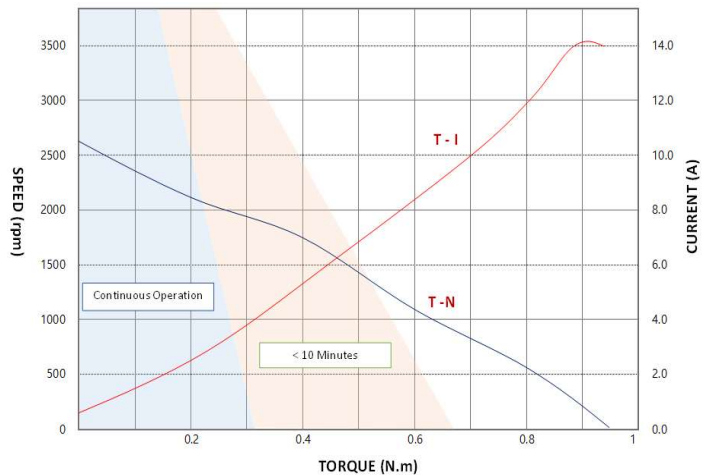
Other specifications

1 Number of pole pairs	pole	8
2 Number of phases	phase	3
3 Weight	gram	520

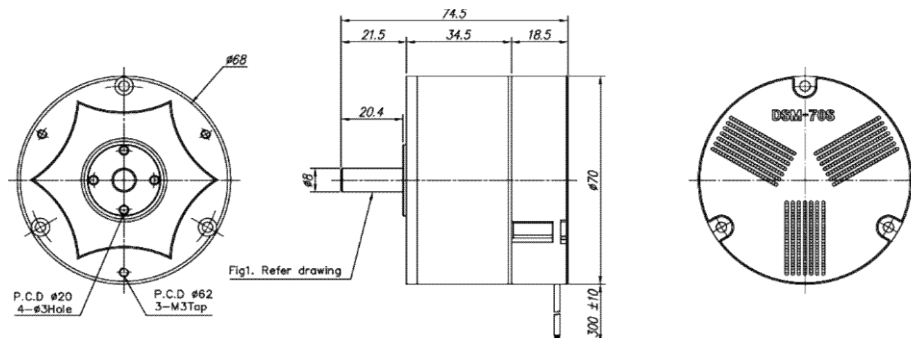
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1 Red	VM (24 Vdc)	UL1061
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6 Black	GND	
7 Brown	ENC A OUT	UL1061
8 Gray	ENC B OUT	AWG28
9 Yellow	ENC C OUT	

701-24V-40P T-N-I curve



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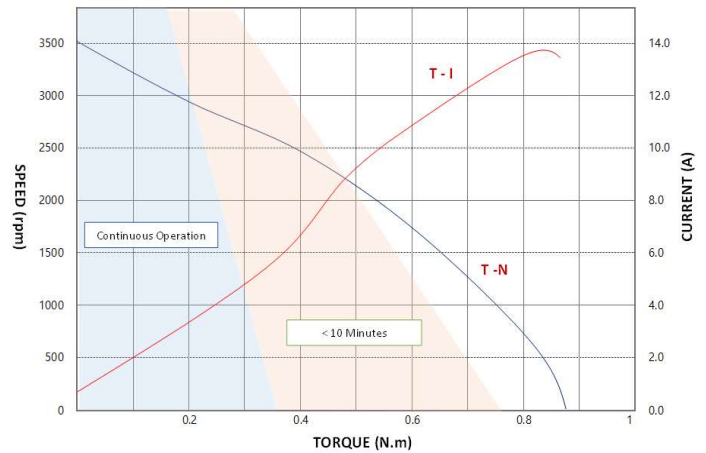
1 Operation condition	°C	-10~50
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Other specifications

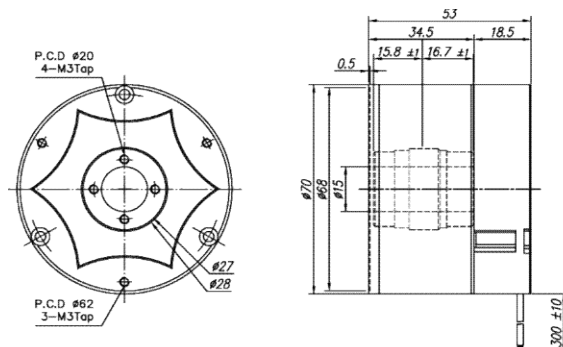
1 Number of pole pairs	pole	8
2 Number of phases	phase	3
3 Weight	gram	460

Pin Allocation

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2 Black	GND	AWG22
3 Orange	D+ / Tx	
4 White	D- / Rx	UL1061
5 Green	FG GEN	AWG28
6 Black	GND	
7 Brown	ENC A OUT	UL1061
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701-24V-60P T-N-I curve

Dimensions in [mm]



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7 Back EMF Constant	mV/RPM
8 Terminal resistance phase to phase	Ω
9 Terminal inductance phase to phase	mH
10 Minimum Insulation resistance (dc 500V)	MΩ
11 Noise (Rad.30[cm] DC24V, No load)	dB

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Ambient condition

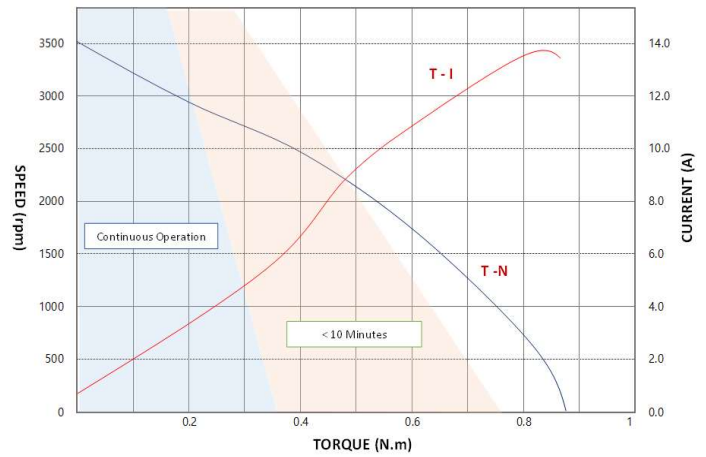
1 Operation condition	°C	-10~50
2 Storage condition	°C	-10~60

Other specifications

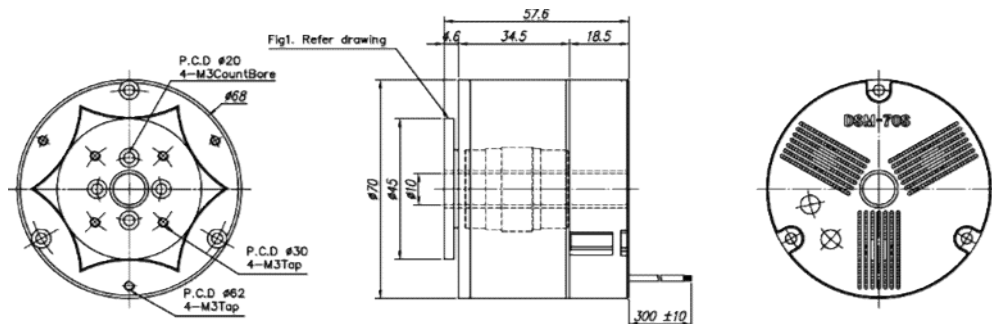
1 Number of pole pairs	pole	8
2 Number of phases	phase	3
3 Weight	gram	500

Pin Allocation

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2 Black	GND	AWG22
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4 No Load Current	mA
5 Stall Torque	N.m
6 Torque Constant	mN.m/A
7 Back EMF Constant	mV/RPM
8 Terminal resistance phase to phase	Ω
9 Terminal inductance phase to phase	mH
10 Minimum Insulation resistance (dc 500V)	MΩ
11 Noise (Rad.30[cm] DC24V, No load)	dB

30	30				
80	110				
2650	3500				
320	450				
0.96	0.86				
81	61				
8.72	6.60				
1.45	0.82				
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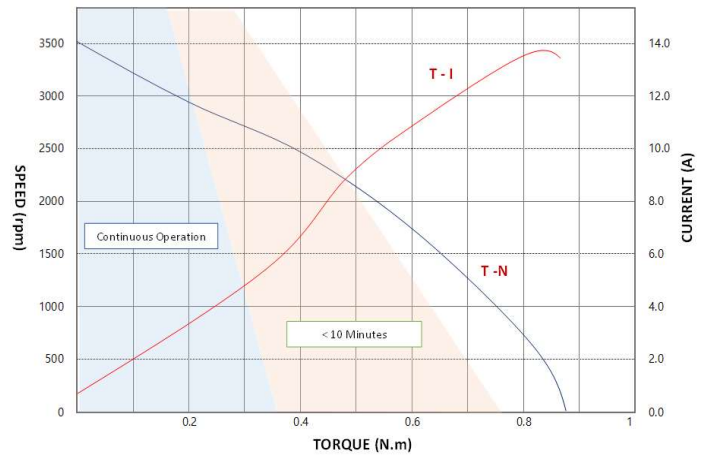
Other specifications

1 Number of pole pairs	pole	8
2 Number of phases	phase	3
3 Weight	gram	515

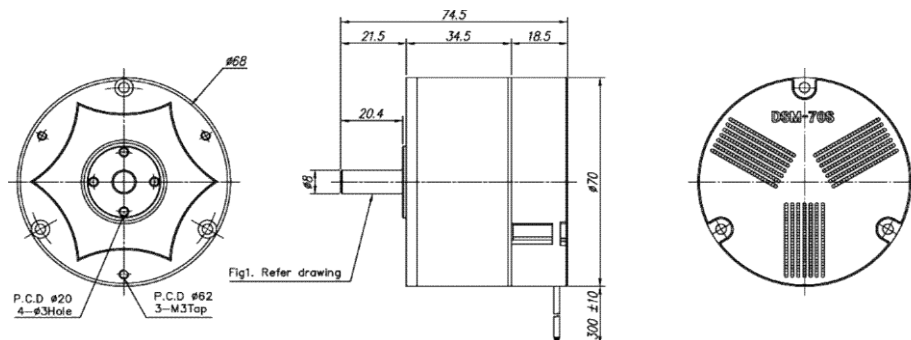
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7 Brown	ENC A OUT	UL1061
8 Gray	ENC B OUT	AWG28
9 Yellow	ENC C OUT	

701-24V-60P T-N-I curve



Dimensions in [mm]



RS485 type built in positioning control driver ECP series

- DSM EC Drivers feature a compact structure of speed & positioning controllers, sensors and Smart EC motors.
- ECP drives are digital positioning controllers internally mounted on DSM EC motors with FG or encoder signals.
- The use of existing DSM products with an adapted design results in robust, space-saving drive solution with high power density.
- EC drive solution is the key to production machinery with many years of maintenance-free operation in a variety of applications.
- Interface I/O protocol : RS485 (MODBUS RTU)

Interface

[VM] (red)

[GND] (black)

[RS485] (D+ : orange, D- : white)
MODBUS RTU

VM	24 [Vdc] ± 25%	Operating Voltage
GND	Power Ground	DC power ground

Baudrate	115,200 bps
Data	8 bit
Parity bit	None
Stop bit	1
Flow control	None
Address No.	Current Direction : 0x0008 Current Speed : 0x007
Read	0x03 (Read holding registers)
Write	0x06 (Write single registers)

*** Positioning set value : Steps**

position error : about ±5 step

Step is the number of feedback Hall sensor signals (FG signals) of the smart EC motor.

[Step = Number of motor Poles x motor phase x reduction ratio]

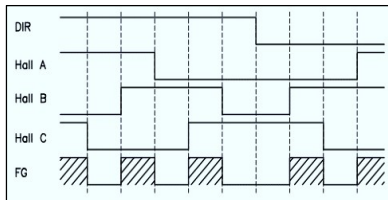
ex) Brushless dc geared motor 4 pole, 3 phase, reduction ratio 50 : 1

4 (pole) * 3 (phase) * 50 (reduction) = 600 steps

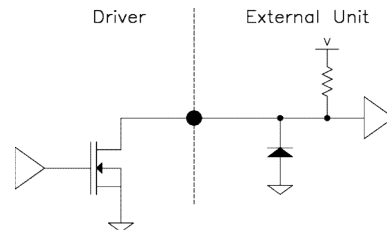
[FG GEN out] (green)

1FG puts into toggle-operation in which the logic reverses every time when excitation phase is switched by hall input.

* FG output pulse (DSM701) = 24 pulse / round

**Open Drain**

VH : 30Vdc max
VL : 0.5Vdc max
Sink current : 100mA max



You need to pull up for FG terminal, so that the terminal is open-drain output.

[Alarm out]**Fault output : RS485**

Error status (0: Normal / 1: Fault)

Fault reset

See the protocol data

UVLO (undervoltage lockout)

TSD (thermal shutdown)

OCP (overcurrent protection-peak current limit)

Reset High & Brake ON (REMOTE_RESET: 1 & REMOTE_BRAKE: 1)

Reset Low (REMOTE_RESET: 0)

Reset High (REMOTE_RESET: 1)

[Encoder out] (A: brown, B: gray, Z: yellow)**Optional Model : IC403, IC404**

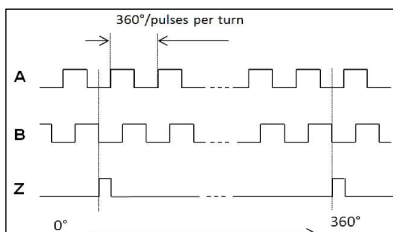
Incremental quadrature signals A, B

Reference mark(index) Z

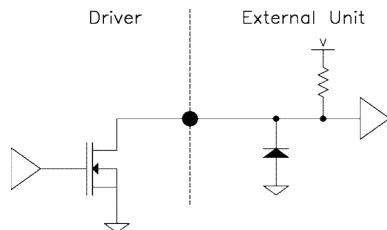
Cycles per Shaft Turn

: 12 bit (4096 Steps / 0.0879°)

Open drain output

**Open Drain**

VH : 30Vdc max
VL : 0.5Vdc max
Sink current : 100mA max



You need to pull up for encoder terminal, so that the terminal is open-drain output.

Motor protection

- * Maximum permissive IC surface temperature 110 [°C]
- * Maximum permissive FET temperature 110 [°C]

Parameters	Typ.	Description
Current limit (OCP)	10 [A]	
Thermal shutdown (TSD)	160±15 [°C]	(IC temperature/Design specification) When the driver IC and MOSFET reaches the defined temperature, the motor current automatically cuts off. Component reliability can't be ensured when motor is used in exceeded 150[°C]. There is no guarantee of proper operation when thermal shutdown motor is reused.
Undervoltage Lockout (UVLO)	8.5 [Vdc]	Driver protects when the power state reaches down to normally operable voltage value or less. Normal operation resumes when the VM undervoltage condition is removed.
Over-voltage protection (OVP)		Built-in ceramic surge absorbers (varistor 7D-470K)

Service life and product safety

1. Bearings and service life

- Service life is affected by maximum speed, residual imbalance and bearing load.
- Exceeding maximum torque can lead to excessive wear.
- Bearings designed for ones of thousands of hours (more than 5000[hrs], no load, rated, 20±5°C)
- Exposure of bearing to corrosive gas may cause corrosion, which may affect the motor's characteristics and durability

2. Locked motor

- No burning after locked rotor condition at rated voltage by using a specified drive circuit

3. Circuit Protect

- This motor does not have the protect circuit for surge voltage and wrong connection.
So, don't apply surge voltage such as over rated voltage and wrong connection.



The Smart EC drivers are features extensive analog and digital I/O functionality and are being configured via RS485 interface using the graphical user interface "uSMART" for Windows PCs.

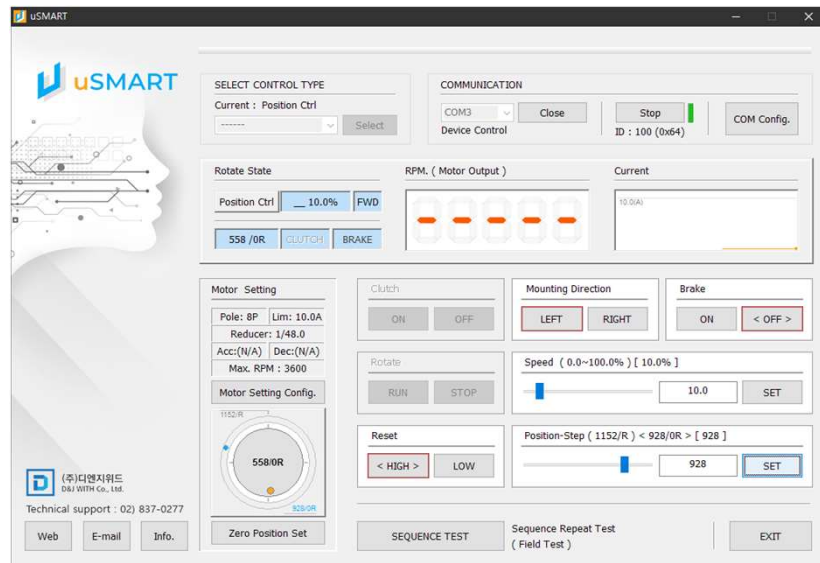
Installation Program : uSMART

Language : English

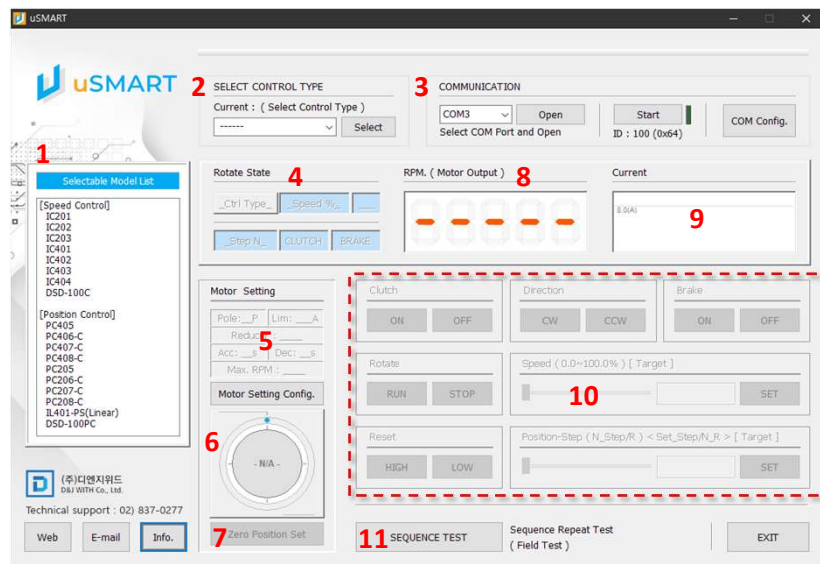
Operating System : Window 10, Windiw 8, Window 7

Communication interface : Serial (use USB to serial converter)

Program – Layout



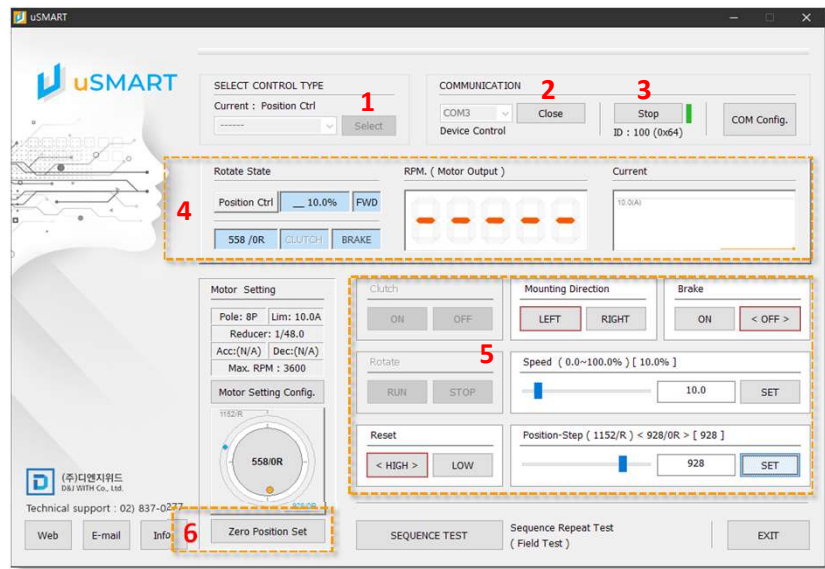
Program – Component



1	[Info]	Displays model information of the motor that can be controlled.
2	[Select control type]	Select the control mode of the motor. You can check the model information of the product in [Info]. The control items for the selected mode are activated.
3	[Communication]	Set the COM(serial) port for communication.
	[Start]	Start communication with the motor.
	[Com Config]	Set the device ID, COM Port Baudrate
4	[Rotate State]	The control status of the connected motor is displayed.
5	[Motor Setting]	The set value of the motor is displayed. (Number of poles, current limit, reduction ratio, acceleration / deceleration time, maximum rotation speed)
	[Motor Setting Config]	Change motor settings.
6	[Jog & shuttle]	The position control angle of the motor can be set directly.
7	[Zero Position Set]	Zero position value of positioning control motor can be set. You can change the current position to the zero position.
8	[RPM]	Displays the rotation speed of the motor.
9	[Current]	The current of the motor is displayed.
10	[Control set value]	Set the control value of the motor. The input button is activated according to the selected mode. The selected control item is indicated by a red border.
11	[Sequence test]	The motor can be operated repeatedly with the set value.

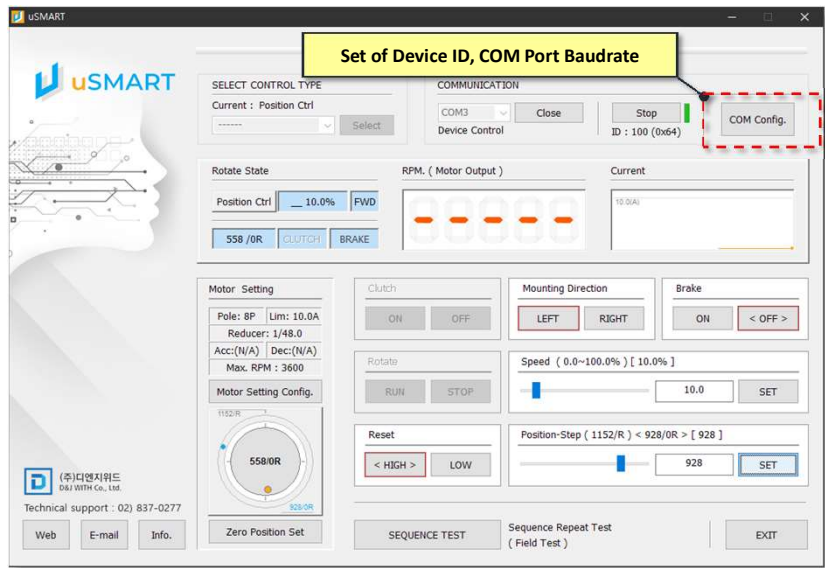
Program – Usage

Basic use of the control program



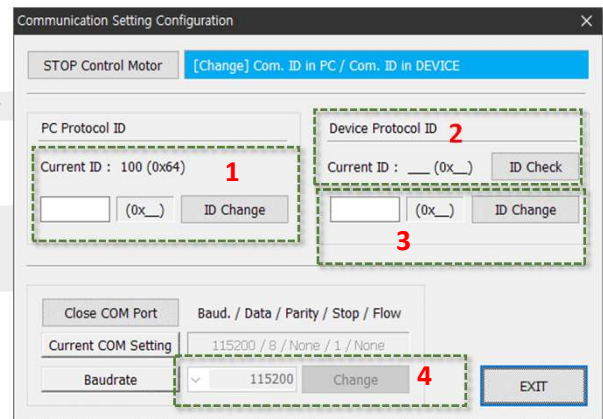
1	[Select]	Select the control mode.
2	[Open / Close]	Open COM Port (Serial)
3	[Start / Stop]	Start communication with motor
4	[Monitoring]	Check connected motor status, rotation speed, current graph
5	[Control Setting]	Input setting value to control the motor Input button activated (depends on selection mode) The selected control item is indicated by a red border on the button
6	[Zero Position Set]	home position return Set the zero position value of the control motor. Change current position to zero position.

Program – Setting



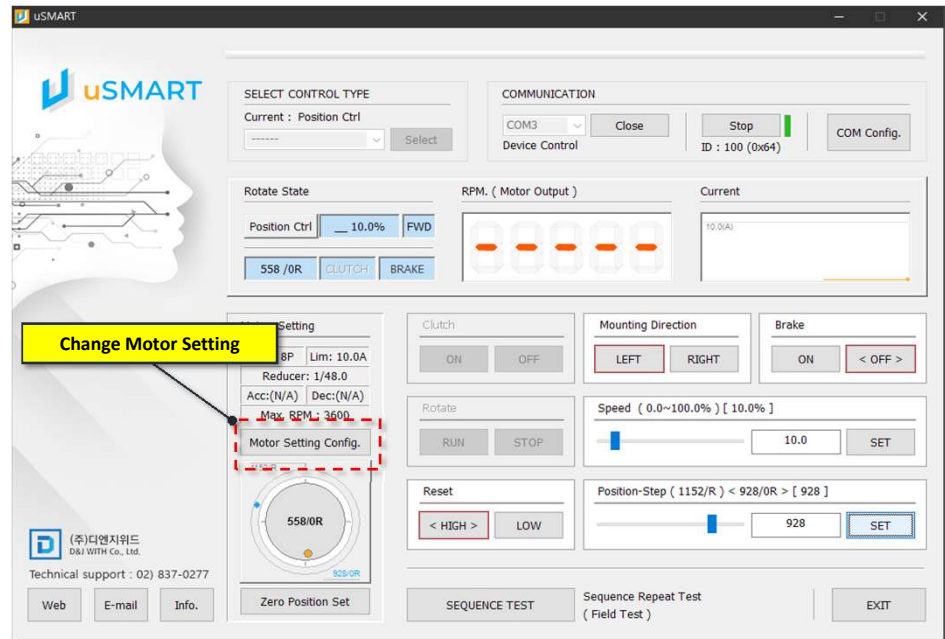
Program – Setting / COM Config.

- Communication ID set in the PC program.
 - Enter ID to change
 - "ID Change" button
- Check the device ID of the connected motor
- Change device ID.
 - Enter ID to change
 - "ID Change" button
- Change communication speed
 - Select speed to change
 - "Change" button

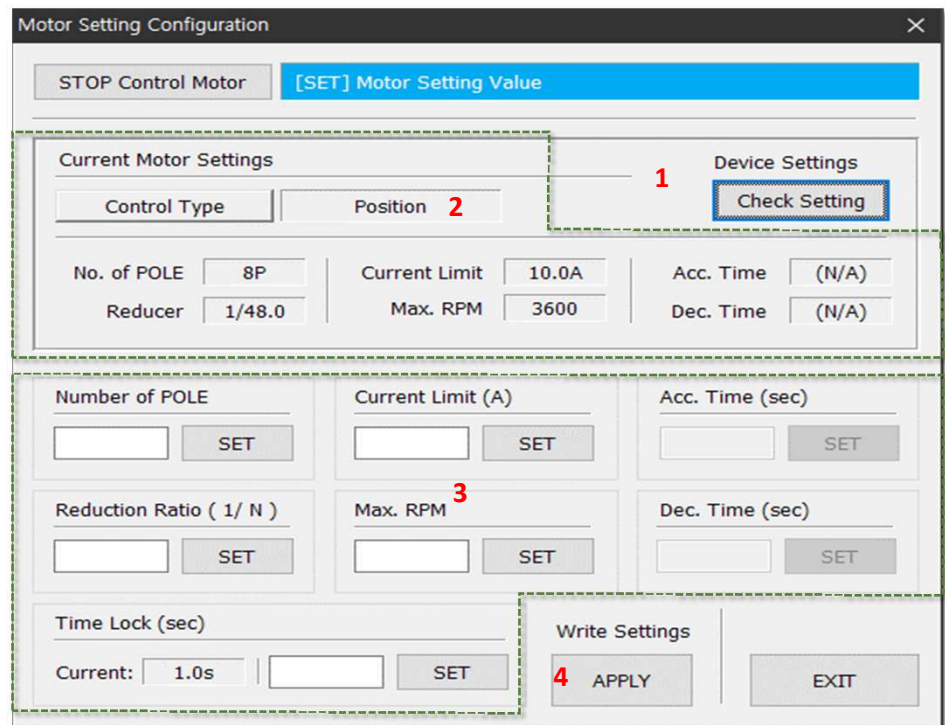


- Caution
- ID can be changed while communication is connected.
 - It cannot be changed while the motor is running.
 - Baudrate can be changed only when the port is "Close".

Program – Setting



Program – Setting / Motor setting config.

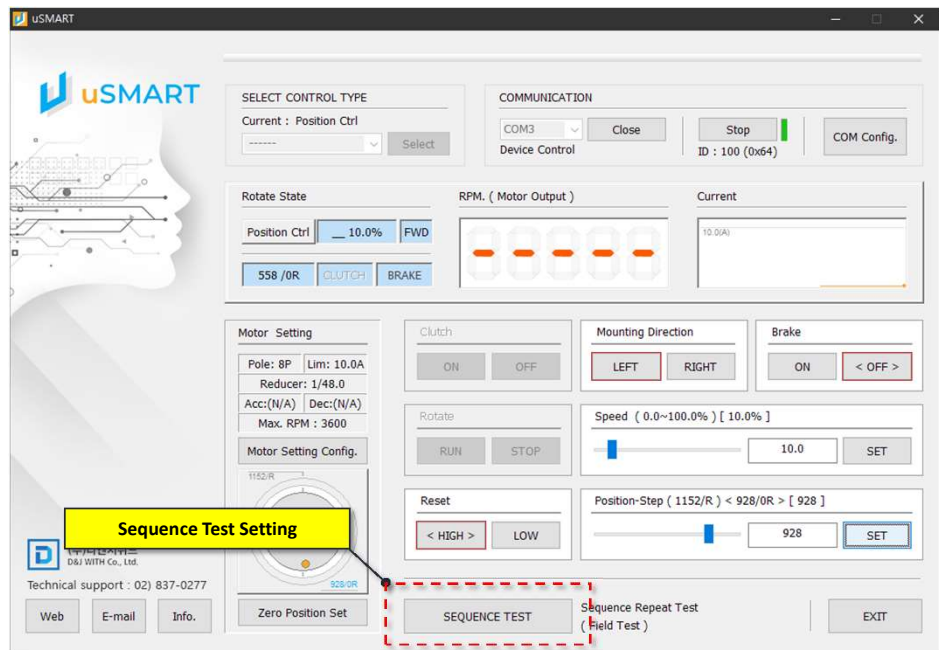


- 1 Check default setting of connected motor
- 2 Display of control settings
- 3 Control settings
- 4 Apply settings

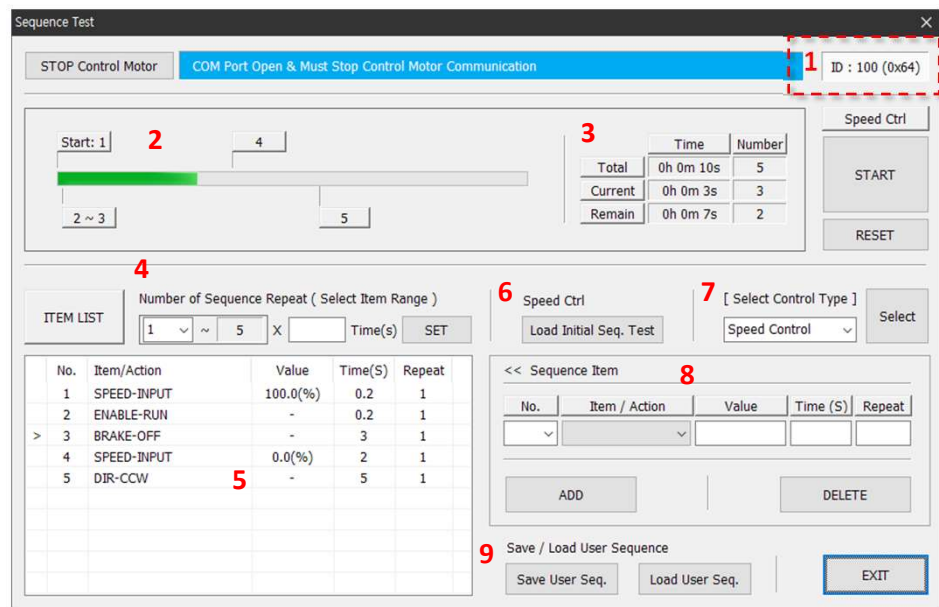
Caution

- 1 The set value can be changed only when communication is connected.
- 2 It cannot be changed while the motor is running.

Program – Setting



Program – Setting / Sequence Test Setting



- 1 Display the set communication ID
- 2 Display the set test item order and progress
- 3 Display setting time and test repeat count
- 4 Set the number of test repetitions
- 5 Sequential display of test setting items
- 6 Load default settings
- 7 Control mode selection
- 8 Test Item Settings
 - 1) Run / Time / Repeat: Setting
"Add" Button : Add Item
 - 2) Sequential Selection
"Delete" Button : Delete Item
- 9 Save the setting items
Load saved setting items

- Caution
- 1 Sequence test item can be changed only when communication is connected.
 - 2 It cannot be changed while the motor is running.