

Ezi-STEP[®] II

Micro Stepping System

- CiA 402 Drive Profile Support
- Micro Stepping
- Software Damping
- Torque Improvement

EtherCAT[®]



CE

FASTECH

Fast, Accurate, Smooth Motion



Fast, Accurate, Smooth Motion

Ezi-STEP[®] II EtherCAT[®]
Micro Stepping System

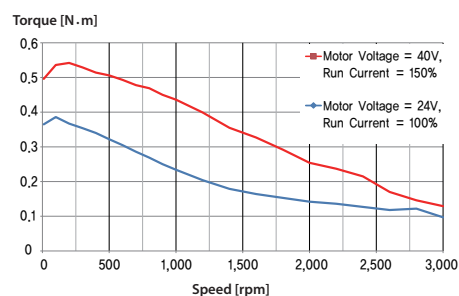


2 Torque Improvement

Motor Voltage Increasing and Motor Current Setting

Ezi-STEP II boosts the voltage supplied to the motor by internal DC-DC Converter. The torque at the high speed is increased. In addition, it is possible to set the Run Current up to 150%, whereby the torque at low speed is increased.

Torque can be improved by about 30% over the entire speed range.



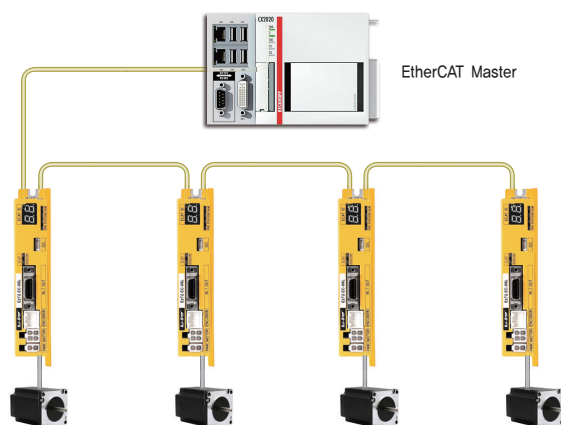
※ The torque at high speed is improved about 30%

Measured Condition : Drive = Ezi-STEP II -EC-42L
Motor Voltage = 40VDC
Input Voltage = 24VDC

1 EtherCAT Based Motion Control

Ezi-STEP II EtherCAT is stepping motor control system using EtherCAT, high speed ethernet (100Mbps Full-Duplex) based fieldbus.

Ezi-STEP II EtherCAT is EtherCAT slave module which support CAN application layer over EtherCAT (CoE). CiA402 Drive profile implemented. Supported modes are Profile Position Mode, Homing Mode, Cyclic Synchronous Position Mode



3 Microstep and Filtering

High precision Microstep function and Filtering

The high-performance MCU operates at step resolutions of 1.8° up to maximum 0.0072° (1/250 steps) and Ezi-STEP II adjusts PWM control signal in every $50\mu\text{sec}$, which makes it possible for more precise current control, resulting in high-precision Microstep operation.

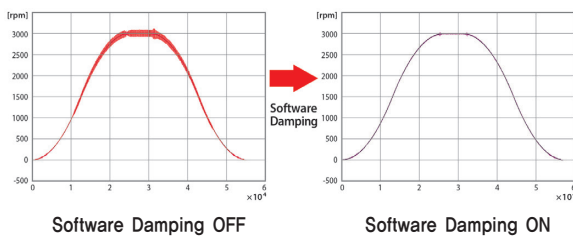
4

Software Damping

Vibration suppression and high-speed operation

Vibration suppression and High-speed operation (Patent pending) Motor vibration is created by magnetic flux variations of the motor, lower current from the drive due to back-emf from the motor at high speeds and lowering of phase voltages from the drive.

Ezi-STEP II drive detects these problems and the MCU adjusts the phase of the current according to the pole position of the motor, drastically suppressing vibration. This allows the smooth operation of the motor at high speeds.



※ This is real measured speed that using 100,000 [pulse/rev] encoder.

5

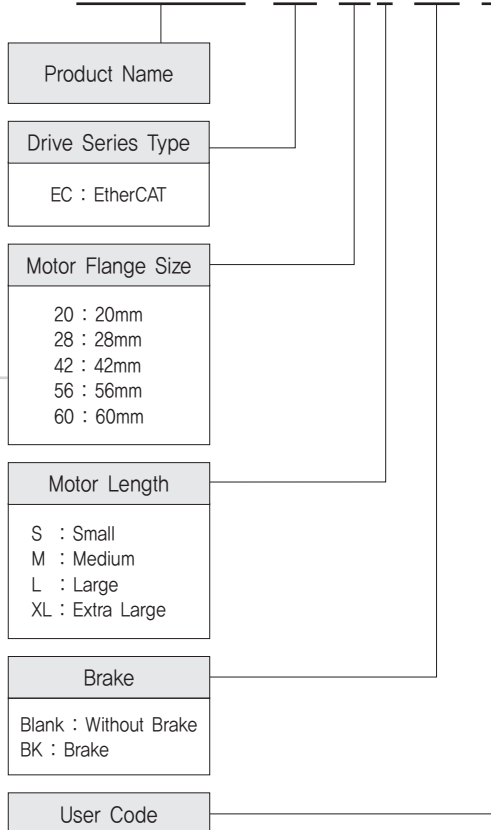
Improvement of High-Speed Driving

Depending on the speed of a stepping motor, Ezi-STEP II automatically increases the supply voltage and prevents the torque lowering due to the low operating voltage to the motor caused by back-emf voltage, this enables high-speed operation. Additionally, the software damping algorithm minimizes the vibration and prevents the loss-of-synchronization at high-speed.

Applicable model : Ezi-STEP II-EC-42 Series
Ezi-STEP II-EC-56 Series
Ezi-STEP II-EC-60 Series

Ezi-STEP II EtherCAT Part Numbering

Ezi-STEP II-EC-42S-BK-□



Standard Combination

Unit Part Number	Motor Model Number	Drive Model Number
Ezi-STEP II-EC-20M	BM-20M	EzT2-EC-20M
Ezi-STEP II-EC-20L	BM-20L	EzT2-EC-20L
Ezi-STEP II-EC-28S	BM-28S	EzT2-EC-28S
Ezi-STEP II-EC-28M	BM-28M	EzT2-EC-28M
Ezi-STEP II-EC-28L	BM-28L	EzT2-EC-28L
Ezi-STEP II-EC-42S	BM-42S	EzT2-EC-42S
Ezi-STEP II-EC-42M	BM-42M	EzT2-EC-42M
Ezi-STEP II-EC-42L	BM-42L	EzT2-EC-42L
Ezi-STEP II-EC-42XL	BM-42XL	EzT2-EC-42XL
Ezi-STEP II-EC-56S	BM-56S	EzT2-EC-56S
Ezi-STEP II-EC-56M	BM-56M	EzT2-EC-56M
Ezi-STEP II-EC-56L	BM-56L	EzT2-EC-56L
Ezi-STEP II-EC-60S	BM-60S	EzT2-EC-60S
Ezi-STEP II-EC-60M	BM-60M	EzT2-EC-60M
Ezi-STEP II-EC-60L	BM-60L	EzT2-EC-60L

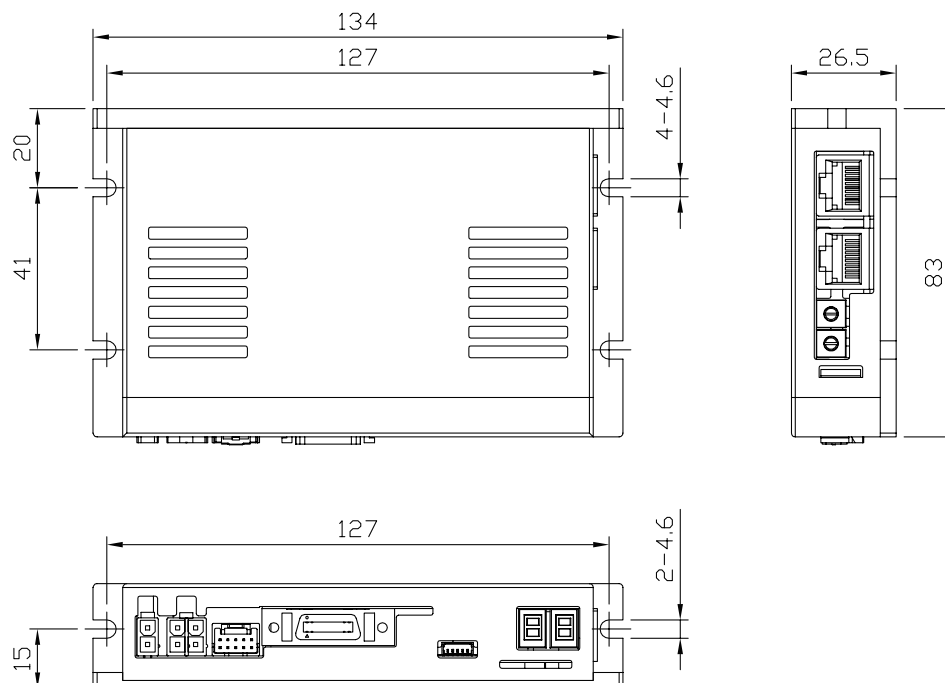
Combination with Brake

Unit Part Number	Motor Model Number	Drive Model Number
Ezi-STEP II-EC-42S-BK	BM-42S-BK	EzT2-EC-42S
Ezi-STEP II-EC-42M-BK	BM-42M-BK	EzT2-EC-42M
Ezi-STEP II-EC-42L-BK	BM-42L-BK	EzT2-EC-42L
Ezi-STEP II-EC-42XL-BK	BM-42XL-BK	EzT2-EC-42XL
Ezi-STEP II-EC-56S-BK	BM-56S-BK	EzT2-EC-56S
Ezi-STEP II-EC-56M-BK	BM-56M-BK	EzT2-EC-56M
Ezi-STEP II-EC-56L-BK	BM-56L-BK	EzT2-EC-56L
Ezi-STEP II-EC-60S-BK	BM-60S-BK	EzT2-EC-60S
Ezi-STEP II-EC-60M-BK	BM-60M-BK	EzT2-EC-60M
Ezi-STEP II-EC-60L-BK	BM-60L-BK	EzT2-EC-60L

● Specifications of Drive

Motor Model		BM-20 series	BM-28 series	BM-42 series	BM-56 series	BM-60 series
Driver Model		EzT2-EC-20 series	EzT2-EC-28 series	EzT2-EC-42 series	EzT2-EC-56 series	EzT2-EC-60 series
Input Voltage		24VDC $\pm 10\%$				
Control Method		Bipolar PWM drive with 32bit ARM				
Current Consumption		Max 500mA (Except motor current)				
Operating Condition	Ambient Temperature	· In Use: 0~50°C · In Storage: -20~70°C				
	Humidity	· In Use: 35~85% RH (Non-Condensing) · In Storage: 10~90% RH (Non-Condensing)				
	Vib. Resist.	0.5g				
Function	Rotation Speed	0~3,000 [rpm] ^{*1}				
	Resolution [ppr]	500 1,000 1,600 2,000 3,200 3,600 4,000 5,000 6,400 8,000 10,000 20,000 25,000 36,000 40,000 50,000 (Selectable with Parameter) * Default: 10,000				
	Protection Functions	Over Current Error, Over Speed Error, Over Temperature Error, Over Regenerated Voltage Error, Motor Connect Error, ROM Error				
	LED Display	Power Status, Alarm Status, Run Status, STEP On Status				
EtherCAT	Supported Protocol	CoE (CiA402 Drive Profile), FoE (Firmware Download)				
	Supported Mode	Profile Position Mode, Homing Mode, Cyclic Synchronous Position Mode				
	Synchronization	Free Run, SM Event, DC SYNC Event				
I/O Signal	Input Signals	3 dedicated inputs (LIMIT+, LIMIT-, ORIGIN), 7 user inputs				
	Output Signals	6 user outputs (Photocoupler), Brake				

● Dimensions of Drive [mm]



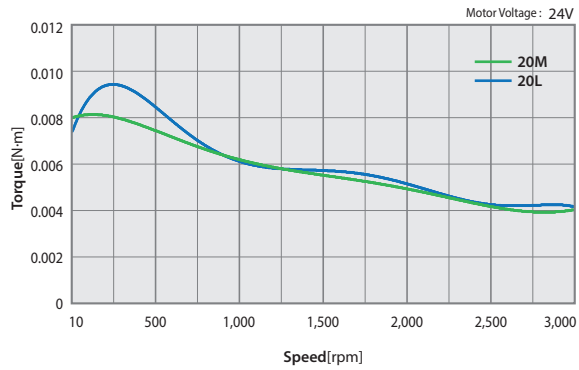
● Specifications of Motor

MODEL		BM-20 series		BM-28 series			BM-42 series				
		UNIT	20M	20L	28S	28M	28L	42S	42M	42L	42XL
DRIVE METHOD		—	BI-POLAR								
NUMBER OF PHASES		—	2	2	2	2	2	2	2	2	
VOLTAGE		VDC	2,75	3,0	3,0	3,0	3,0	3,36	4,32	4,56	7,2
CURRENT per PHASE		A	0,5	0,5	0,95	0,95	0,95	1,2	1,2	1,2	1,2
RESISTANCE per PHASE		Ohm	5,5	6,0	3,2	3,2	3,2	2,8	3,6	3,8	6,0
INDUCTANCE per PHASE		mH	2,0	2,6	2,0	2,7	3,2	5,4	7,2	8,0	15,6
HOLDING TORQUE		N·m	0,016	0,025	0,069	0,10	0,12	0,32	0,44	0,5	0,65
ROTOR INERTIA		g·cm ²	2,5	3,3	9	13	18	35	54	77	114
WEIGHTS		g	50	80	110	140	200	250	280	350	500
LENGTH(L)		mm	28	38	32	45	50	34	40	48	60
PERMISSIBLE OVERHUNG LOAD (DISTANCE FROM END OF SHAFT)	3mm	N	18	18	30	30	30	22	22	22	22
	8mm		30	30	38	38	38	26	26	26	26
	13mm		—	—	53	53	53	33	33	33	33
	18mm		—	—	—	—	—	46	46	46	46
PERMISSIBLE THRUST LOAD		N	Lower than motor weight								
INSULATION RESISTANCE		Mohm	100 MIN.(at 500VDC)								
INSULATION CLASS		—	CLASS B(130℃)								
OPERATING TEMPERATURE		℃	0 to 55								

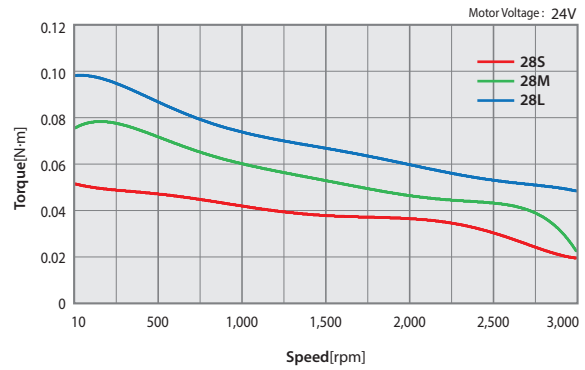
MODEL		BM-56 series			BM-60 series			
		UNIT	56S	56M	56L	60S	60M	60L
DRIVE METHOD		—	BI-POLAR					
NUMBER OF PHASES		—	2	2	2	2	2	2
VOLTAGE		VDC	1,56	1,62	2,64	1,32	1,48	2,2
CURRENT per PHASE		A	3,0	3,0	3,0	4,0	4,0	4,0
RESISTANCE per PHASE		Ohm	0,52	0,54	0,88	0,33	0,37	0,55
INDUCTANCE per PHASE		mH	1,2	2,0	4,0	0,75	1,1	2,7
HOLDING TORQUE		N·m	0,64	1,0	1,5	0,88	1,28	2,4
ROTOR INERTIA		g·cm ²	180	280	520	240	490	690
WEIGHTS		g	500	720	1150	600	1000	1300
LENGTH(L)		mm	46	55	80	47	56	85
PERMISSIBLE OVERHUNG LOAD (DISTANCE FROM END OF SHAFT)	3mm	N	52	52	52	70	70	70
	8mm		65	65	65	87	87	87
	13mm		85	85	85	114	114	114
	18mm		123	123	123	165	165	165
PERMISSIBLE THRUST LOAD		N	Lower than motor weight					
INSULATION RESISTANCE		Mohm	100 MIN.(at 500VDC)					
INSULATION CLASS		—	CLASS B(130℃)					
OPERATING TEMPERATURE		℃	0 to 55					

● Torque Characteristics of Motor

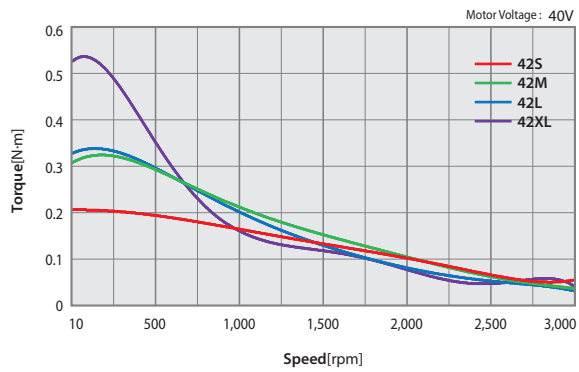
Ezi-STEP II-EC-20 series



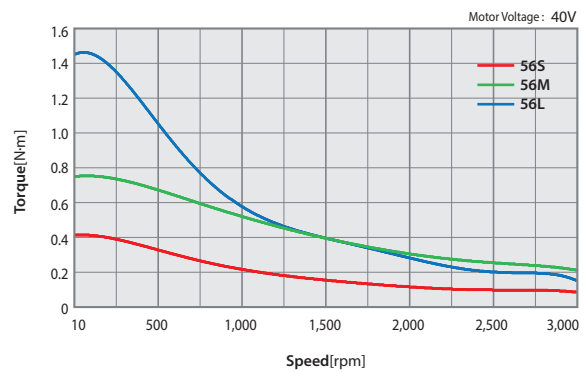
Ezi-STEP II-EC-28 series



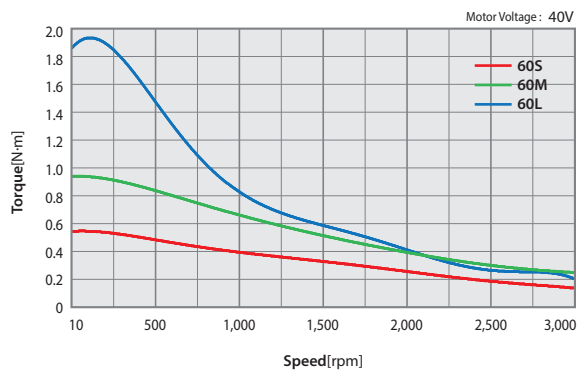
Ezi-STEP II-EC-42 series



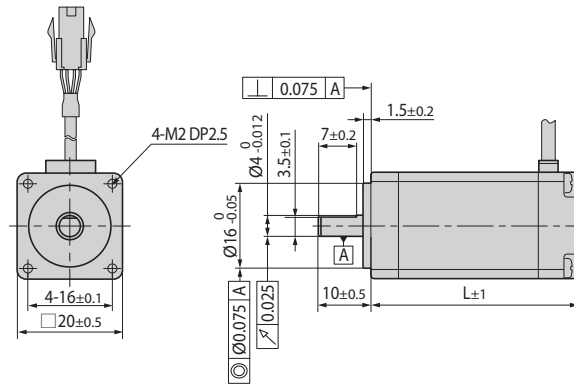
Ezi-STEP II-EC-56 series



Ezi-STEP II-EC-60 series

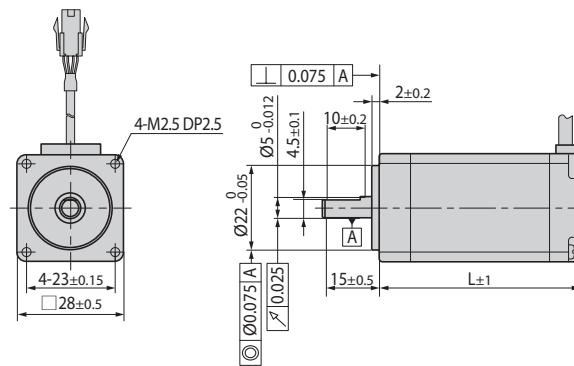


● Dimensions of Motor [mm]



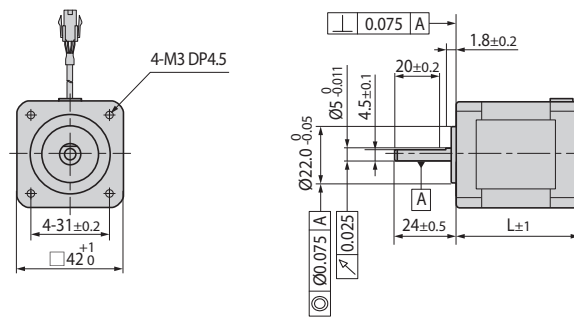
20mm

Model name	Length(L)
BM-20M	28
BM-20L	38



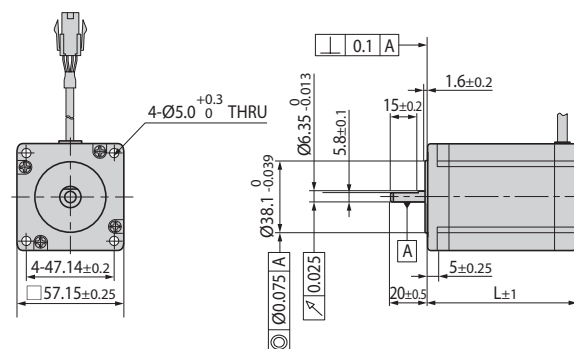
28mm

Model name	Length(L)
BM-28S	32
BM-28M	45
BM-28L	50



42mm

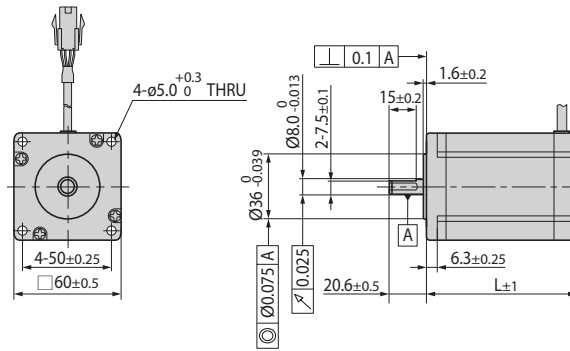
Model name	Length(L)
BM-42S	34
BM-42M	40
BM-42L	48
BM-42XL	60



56mm

Model name	Length(L)
BM-56S	46
BM-56M	55
BM-56L	80

● Dimensions of Motor [mm]



60mm

Model name	Length(L)
BM-60S	47
BM-60M	56
BM-60L	85

● Specifications of Motor with Brake

Unit Part Number	Motor Model Number	Electronic Brake					Motor Unit Weight [g]	Permitted Overhung Load [N]				Permitted Thrust Load [N]
		Type	Voltage Input [V]	Rated Current [A]	Power Con- sumption [W]	Statical Friction Torque [N·m]		Length from Motor Point [mm]				
								3	8	13	18	
Ezi-STEP II -EC-42S-BK	BM-42S-BK	Non- excita- tion run Type	24VDC ±10%	0.2 ±10%	5	0.2	510	22	26	33	46	Must be Lower than Unit's Weight
Ezi-STEP II -EC-42M-BK	BM-42M-BK						570					
Ezi-STEP II -EC-42L-BK	BM-42L-BK						640					
Ezi-STEP II -EC-42XL-BK	BM-42XL-BK						770					
Ezi-STEP II -EC-56S-BK	BM-56S-BK			0.27 ±10%	6.6	0.7	870	52	65	85	123	
Ezi-STEP II -EC-56M-BK	BM-56M-BK						1190					
Ezi-STEP II -EC-56L-BK	BM-56L-BK						1380					
Ezi-STEP II -EC-60S-BK	BM-60S-BK				7.5	0.7	1150	70	87	114	165	
Ezi-STEP II -EC-60M-BK	BM-60M-BK						1350					
Ezi-STEP II -EC-60L-BK	BM-60L-BK						1960					

* Electronic Brake cannot be used for braking. Position hold purpose only when power OFF.

* The weight means Motor Unit Weight including Motor and Electronic Brake.

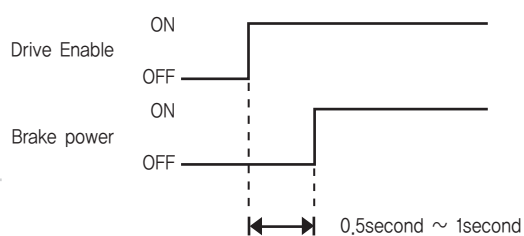
* Motor Model Name is combined model name of Motor and Brake.

* Motor specification and torque characteristic are same as Standard Motor.

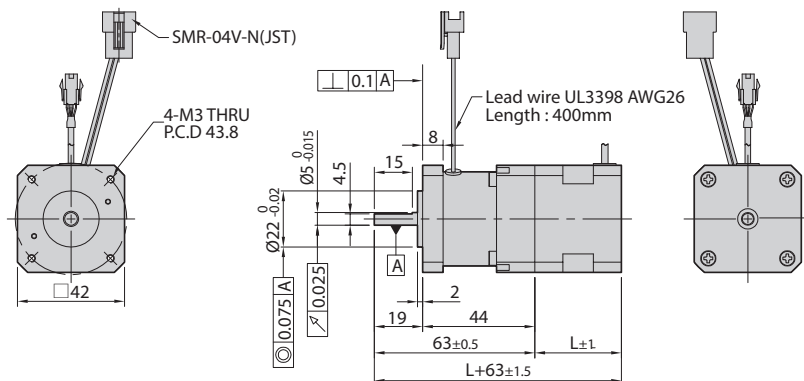
* Brake Operation Timing Chart

Ezi-STEP II EtherCAT control Brake by Drive automatically.

Please refer to below Timing Chart when control Brake from upper controller other than using Ezi-STEP II EtherCAT Brake control. Otherwise, Drive malfunctioning and loads can be fall down. Also, please do not operate Brake while motor operation to prevent damage. Also, please do not operate Brake while motor operation to prevent damage.

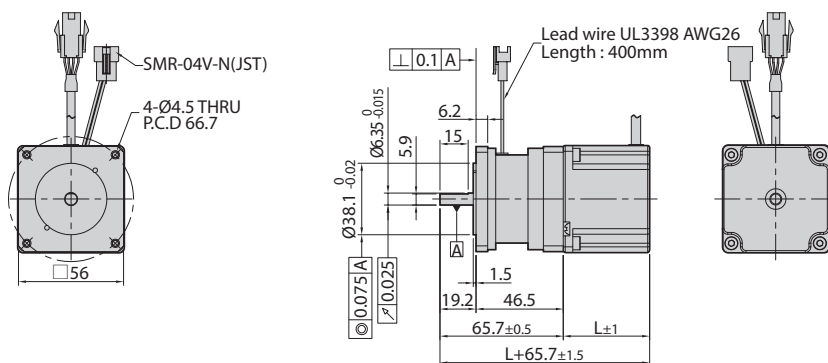


● Dimensions of Motor with Brake [mm]



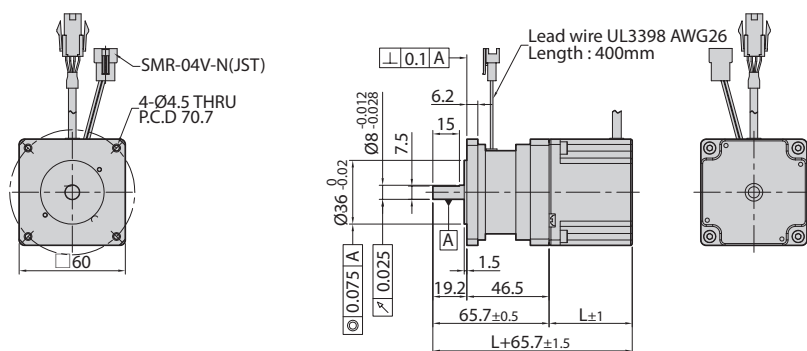
42mm

Model Name	Length(L)	Weight(kg)
BM-42S	34	0.44
BM-42M	40	0.51
BM-42L	48	0.58
BM-42XL	60	0.70



56mm

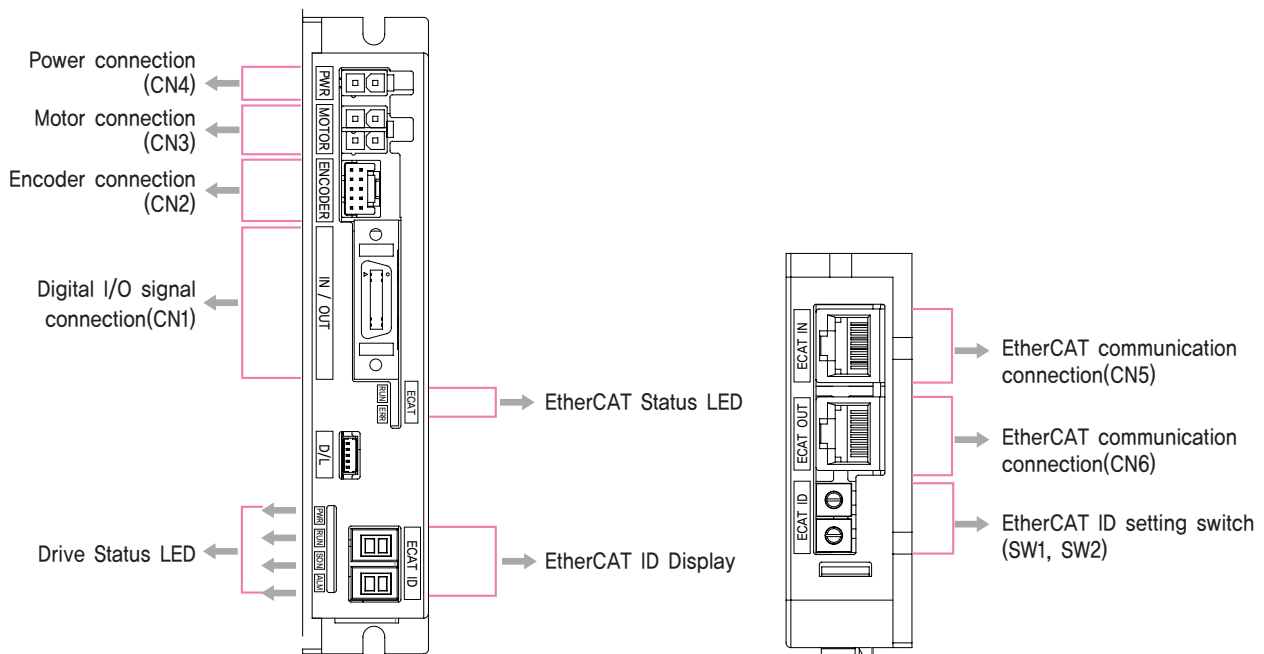
Model Name	Length(L)	Weight(kg)
BM-56S	46	0.97
BM-56M	55	1.13
BM-56L	80	1.55



60mm

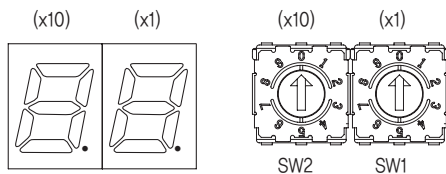
Model Name	Length(L)	Weight(kg)
BM-60S	47	1.08
BM-60M	56	1.28
BM-60L	85	1.88

● Settings and Operation



1. EtherCAT ID Display and Setting Switch (SW1, SW2)

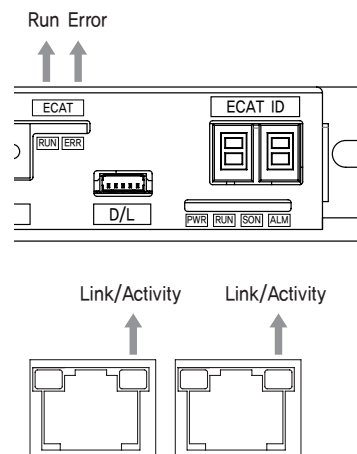
There are two Rotary Switches to set value of EtherCAT ID (ECAT Device ID). Switch on the right side indicates the ones' place (x1) and Switch on the left side indicates the tens' place (x10).



2. EtherCAT Status LED

LED indicates communication status of EtherCAT. Link/Activity LED exists on each port of EtherCAT.

Name	Color	Status	Explanation
Run	Green	OFF	State INIT or Power OFF
		Blinking	State PRE-OPERATIONAL
		Single Flash	State SAFE-OPERATIONAL
		ON	State OPERATIONAL
		Flickering	State BOOTSTRAP
Name	Color	Status	Explanation
Error	Red	OFF	No Error or Power OFF
		Blinking	Invalid Configuration
		Single Flash	Local Error
		Double Flash	Watchdog Time Out
Name	Color	Status	Explanation
Link/ Activity	Green	OFF	Link not Established
		ON	Link Established
		Flickering	Link Established and in Operation



3. Drive Status LED

Indication	Color	Function	ON/OFF Condition
PWR	Green	Power input indication	LED is turned ON when power is applied
RUN	Yellow	Motor running indication	LED is turned ON while motor is rotating
SON	Orange	STEP On / Off indication	STEP On: Lights On, STEP Off: Lights Off
ALM	Red	Alarm indication	Flash when protection function is activated (Identifiable which protection mode is activated by counting the blinking times)

◆ Protection functions and LED flash times

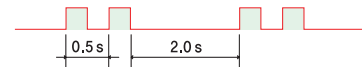
Times	Error Code ^{*3}	Protection	Conditions
1	E-001	Over Current Error	The current through power devices in drive exceeds the limit value ^{*1}
2	E-002	Over Speed Error	Motor speed exceed 3,000 [rpm]
5	E-005	Over Temperature Error	Inside temperature of drive exceeds 85℃
6	E-006	Over Regenerative Voltage Error	Back-EMF more high limit value ^{*2}
7	E-007	Motor Connect Error	The power is ON without connection of the motor cable to drive
12	E-012	ROM Error	Error occurs in parameter storage device(ROM)

^{*1} : Limit value depends on motor model. (Refer to the Manual)

^{*2} : Voltage limit of Back-EMF depends on motor model. (Refer to the Manual)

^{*3} : When an alarm occurs, error code is displayed on the 7-segment instead of EtherCAT ID.

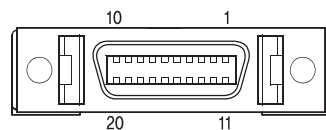
※ Please refer to user Manual for the details of protection functions.



Alarm LED Flash
(Ex, Over Speed Error)

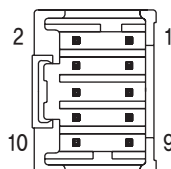
4. Input/Output Signal Connector(CN1)

NO.	Function	I/O
1	LIMIT+	Input
2	LIMIT-	Input
3	ORIGIN	Input
4	Digital In1	Input
5	Digital In2	Input
6	Digital In3	Input
7	Digital In4	Input
8	Digital In5	Input
9	Digital In6	Input
10	Digital In7	Input
11	Digital Out1	Output
12	Digital Out2	Output
13	Digital Out3	Output
14	Digital Out4	Output
15	Digital Out5	Output
16	Digital Out6	Output
17	BRAKE+	Output
18	BRAKE-	Output
19	EXT_GND	Input
20	EXT_24VDC	Input



5. Encoder Connector(CN2)

NO.	Function	I/O
1	A+	Input
2	A-	Input
3	B+	Input
4	B-	Input
5	Z+	Input
6	Z-	Input
7	5VDC	Output
8	GND	Output
9	F_GND	----
10	F_GND	----



6. Motor Connector(CN3)

NO.	Function	I/O
1	A Phase	Output
2	B Phase	Output
3	/A Phase	Output
4	/B Phase	Output



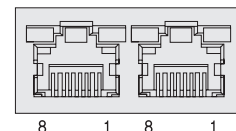
7. Power Connector(CN4)

NO.	Function	I/O
1	24VDC	Input
2	GND	Input

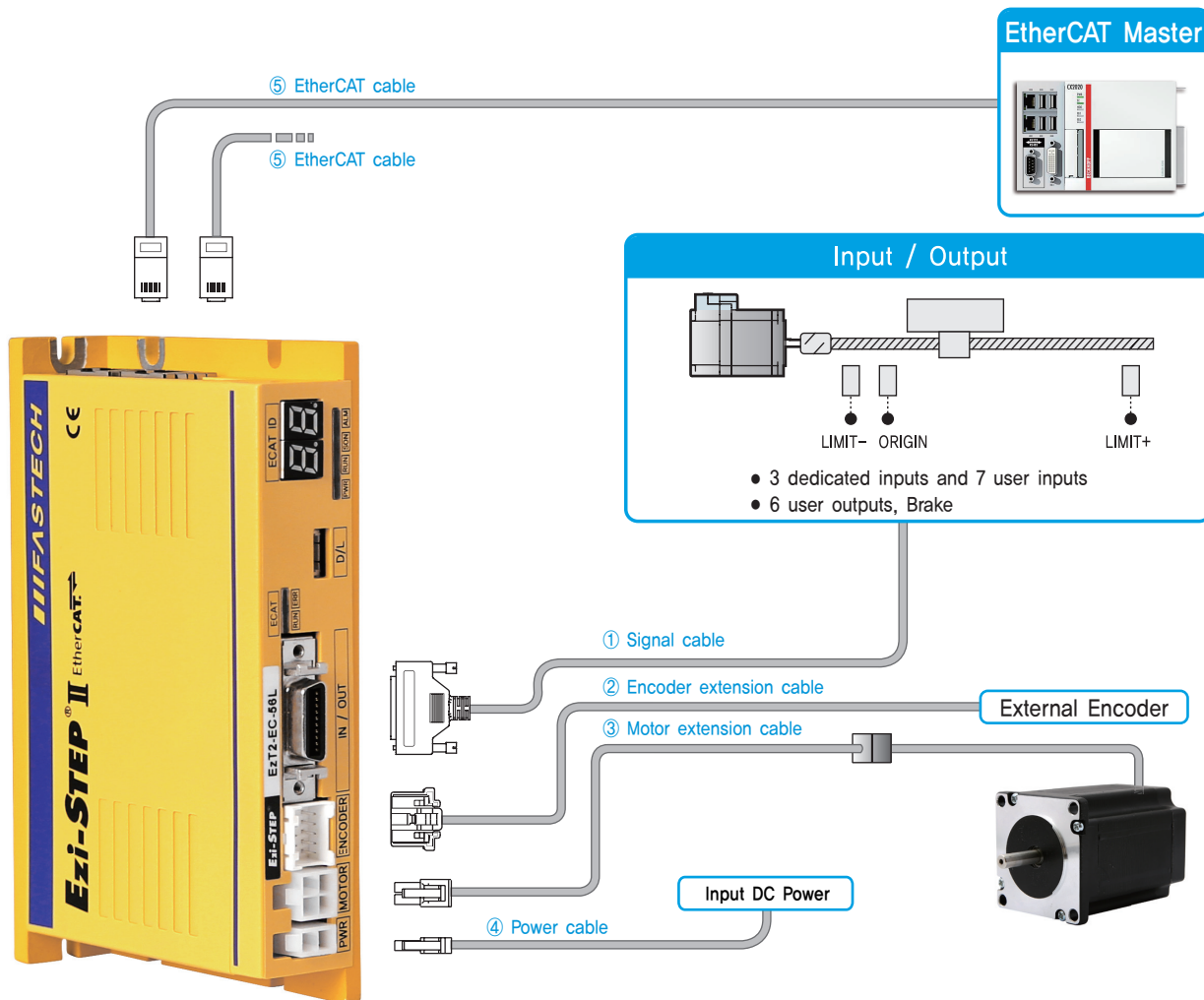


8. EtherCAT Communication Connector(CN5, CN6)

NO.	Function	NO.	Function
1	TD+	6	RD-
2	TD-	7	----
3	RD+	8	----
4	----	Connection hood	
5	----		
		F_GND	



● System Configuration



Type	Signal Cable	Motor Cable	Power Cable	EtherCAT Cable
Length supplied	—	30cm	—	—
Max. Length	20m	20m	2m	100m

1. Options

① Signal Cable

Available to connect between Input/Output signals and Ezi-STEP II EtherCAT.

Item	Length [m]	Remark
CSVN-S-□□□F	□□□	Normal Cable
CSVN-S-□□□M	□□□	Robot Cable

□ is for Cable Length. The unit is 1m and Max. 20m length.

② Encoder Extension Cable

Available to extended connection between Encoder and Ezi-STEP II EtherCAT.

Item	Length [m]	Remark
CSVO-E-□□□F	□□□	Normal Cable
CSVO-E-□□□M	□□□	Robot Cable

□ is for Cable Length. The unit is 1m and Max. 20m length.

③ Motor Extension Cable

Available to connect between motor and Ezi-STEP II EtherCAT.

Item	Length [m]	Remark
CSVO-M-□□□F	□□□	Normal Cable
CSVO-M-□□□M	□□□	Robot Cable

□ is for Cable Length, The unit is 1m and Max. 20m length.

④ Power Cable

Available to connect between Power and Ezi-STEP II EtherCAT.

Item	Length [m]	Remark
CSVO-P-□□□F	□□□	Normal Cable
CSVO-P-□□□M	□□□	Robot Cable

□ is for Cable Length, The unit is 1m and Max. 2m length.

⑤ EtherCAT Cable

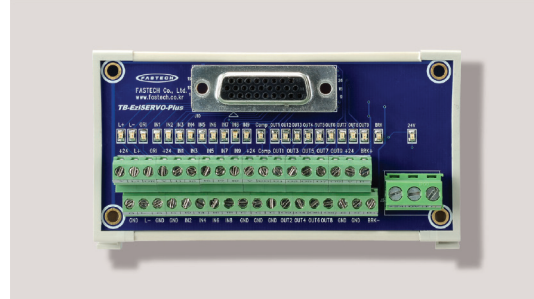
STP(Shielded twisted pair) cable of category 5e or higher.

Item	Length [m]	Remark
CGNR-EC-□□□F	□□□	Normal Cable

□ is for Cable Length, The unit is 1m and Max. 100m length.

⑥ TB-Plus(Interface Board)

Available to connect more conveniently between Input/ Output signal and Ezi-STEP II EtherCAT.



⑦ Interface Cable for TB-Plus

Available to Connect between TB-Plus Interface Board and Ezi-STEP II EtherCAT.

Item	Length [m]	Remark
CIFN-S-□□□F	□□□	Normal Cable
CIFN-S-□□□M	□□□	Robot Cable

□ is for Cable Length, The unit is 1m and Max. 20m length.

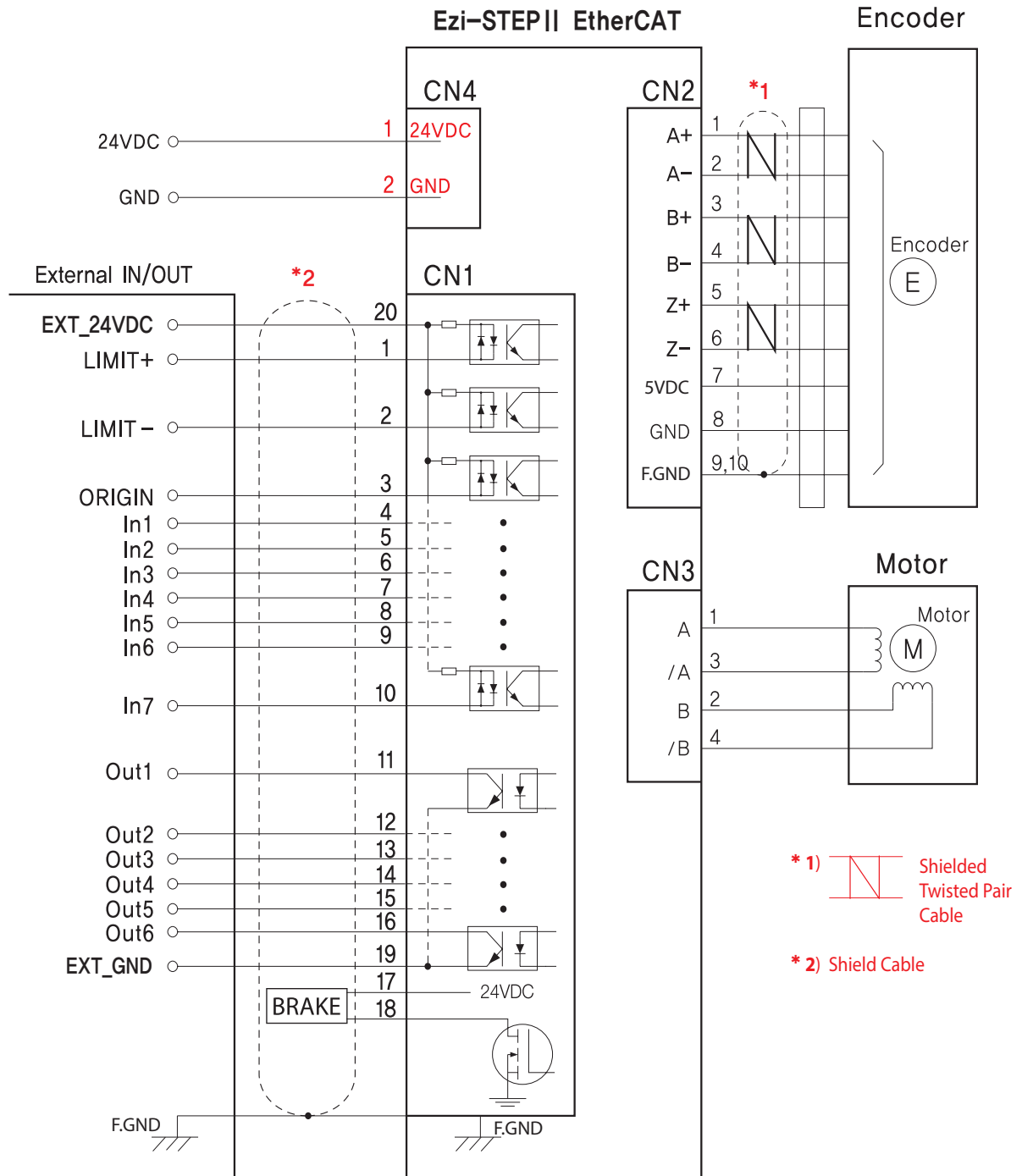
2. Connector Specifications

Connector specifications for cabling to drive.

Purpose		Item	Part Number	Manufacturer
Power (CN4)		Housing Terminal	5557-02R 5556T	MOLEX
Motor	Drive Side (CN3)	Housing Terminal	5557-04R 5556T	MOLEX
	Motor Side	Housing Terminal	5557-04R 5556T	MOLEX
Encoder	Drive Side (CN2)	Housing Terminal	51353-1000 56134-9000	MOLEX
Signal (CN1)		Connector Backshell	10120-3000PE 10320-52A0-008	3M

※ Above connector is the most suitable product for the drive applied. Another equivalent connector can be used.

● External Wiring Diagram



CAUTION

Please refer to the Manual when connects motor extension cable.
Careful connection will be required to protect the drive from any damages.

※ When connects I/O cable between controller and drive, please turn off the power of both controller and drive, in order to protect the drive from any damage.

MEMO

MEMO

MEMO



Fast, Accurate, Smooth Motion

FASTECH Co., Ltd.

Rm#1202, 401-dong, Bucheon Techno-Park,
655, Pyeongcheon-ro, Bucheon-si Gyeonggi-do,
Republic of Korea (Zip:14502)
TEL : +82-32-234-6300 FAX : +82-32-234-6302
E-mail : fastech@fastech.co.kr
Homepage : www.fastech.co.kr