YASKAWA ELECTRIC

TSE-C770-1K
BULLETIN

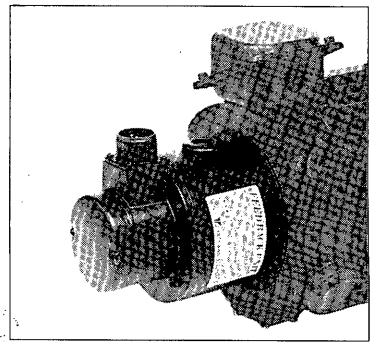
DC TACHOMETER GENERATORS, OPTICAL ENCODERS, FEEDBACK UNITS

DC SERVOMOTOR DETECTORS

WITH HOLDING MAGNETIC BRAKES

Yaskawa DC Servomotor Detectors are speed and positioning detectors exclusively designed for Print™ Motors, Minertia™ Motors, Cup™ Motors and Hi-Cup™ Motors. Since the detectors are easily combined with the motors, they provide a full range of compact, accurate servo motion controls from general-use adjustable speed to high precision servomotor drives.

The DC tachometer generators are applicable for speed control, the optical encoders for position control, and the feedback units for both speed and position controls.



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Feedback Unit (Type TFUE-08ZC7)

1. APPLICABLE DC SERVOMOTORS

Table 1 Applicable DC Servomotors

DC Servomotors		Detectors		
Name	Type	DC tachometer generator type	Optical encoder type*†	Feedback unit type*†
Print Motors	UGPMEN-08DA2	11TG-D027	UTOPE-05ZCL UTOPE-20ZDL UTOPE-25ZDL	—
	(UG) PMES-09A2			MU1000 COUPLING
	(UG) PMES-12A2			
	(UG) PMES-16A2			
Minertia Motors	UGMMEM-06AA1			TFUE-03DC7
	UGMMEM-13AA1			TFUE-05DC7
	UGMMEM-25AA1			
	UGMMEM-50AA1			TFUE-03ZC7
	UGMMEM-1AAA1			TFUE-05ZC7
	UGMMKR-2AAA1			TFUE-08ZC7
Cup Motors	UGCMED-04AA	UGTGIM-7LVC		TFUE-15ZC7
	UGCMED-08AA			TFUE-25ZC7
	UGCMED-15AA			
	UGCMED-22AA			TFUE-15ZD7
	UGCMED-37AA			TFUE-20ZD7
	UGCMED-55AA			TFUE-25ZD7
	UGCMFD-75AA			TFUE-30ZD7
Hi-Cup Motors	UGHMED-03GG1			
	UGHMED-06AA2 UGHMED-06GG1			
	UGHMED-12AA2 UGHMED-12GG2			
	UGHMED-20AA2 UGHMED-20GG2			
	UGHMED-30AA2 UGHMED-30GG2			
	UGHMED-44AA2			
	UGHMFD-60AA2			

* Optional products other than the above are also available.

† Description of optical encoder type and feedback unit type

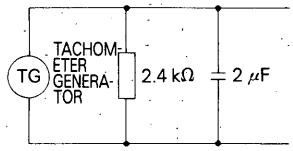
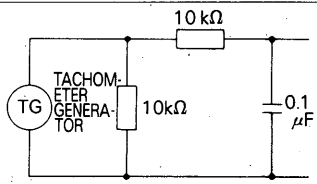
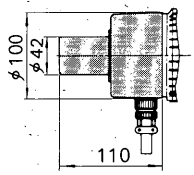
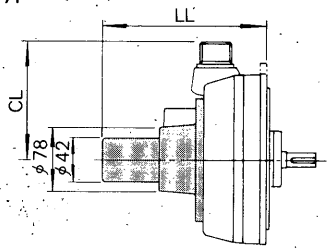
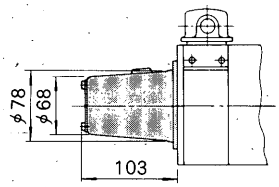
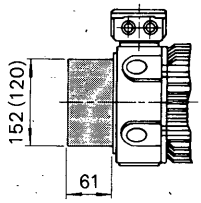
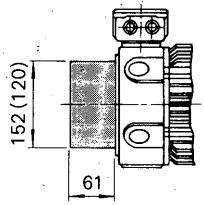
Z□ : With home position signal D□ : Without home position signal

□C : Standard type □D : High-speed response type

Note: Combination of DC tachometer generator and magnetic brake is also available.

2. DC TACHOMETER GENERATOR SPECIFICATIONS

Table 2 DC Tachometer Generator Specifications

Specifications \ Type	11TG-D027	UGTGIM-7LVC
Output voltage *	7V(±5%)/1000rpm	7V(±10%)/1000rpm
Ripple content ratio †	Max. 5% p-p (600 to 3600rpm)	Max. 0.5% p-p (At 1000rpm)
Linearity †	Max. 1% (0 to 3600rpm)	Max. 1%
Max. Speed	5000rpm	5000rpm
Inner impedance	350Ω	Max. 14Ω, 7mH
Allowable load resistance	Min. 2.4kΩ	Min. 5.1kΩ
Rotor inertia ($GD^2/4$)	Max. 10g·cm²	Max. 380g·cm²
Friction torque	Max. 20g·cm	Max. 120g·cm
Filter circuit		
Dimensions in mm	• Print Motor Type UGPMEN-08DA2  • Print Motor Types (UG) PMES-09A2 to -16A2  Dimensions / Type: LL / CL (UG) PMES-09A2: 142 / 102 (UG) PMES-12A2: 149 / 109 (UG) PMES-16A2: 175 / 124 • Minertia Motor 	• Cup Motor  Dimensions in ( ) are valid only for Type UGCMED-04AA. • Hi-Cup Motor  Dimensions in ( ) are valid only for Type UGHMED-03GG.

* Output voltage is measured directly from the terminals.
† Ripple content ratio and Linearity are measured through the filter circuit in the above table.
Note : Following shows decription of each motor and TG terminal:
- Print Motor terminals A, B: For motor C, D: For DC tachometer generator
- Cup Motor, Hi-Cup Motor terminals A, B: For motor 1, 2: For DC tachometer generator

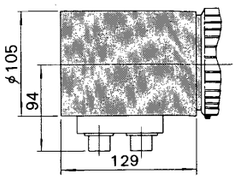
3. OPTICAL ENCODER SPECIFICATIONS

Table 3 Optical Encoder Specifications

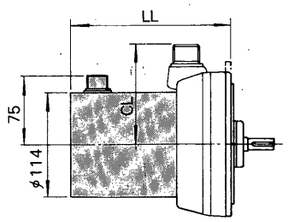
Specifications \ Type		Standard Type		High-Speed Response Type	
		Without home position signal	With home position signal	Without home position signal	With home position signal
		UTOPE-□DCL	UTOPE-□ZCL	UTOPE-□DDL	UTOPE-□ZDL
Number of output pulses * (p/rev)	240	UTOPE-02DCL	UTOPE-02ZCL	UTOPE-02DDL	UTOPE-02ZDL
	300	UTOPE-03DCL	UTOPE-03ZCL	UTOPE-03DDL	UTOPE-03ZDL
	360	UTOPE-360DCL	UTOPE-360ZCL	UTOPE-360DDL	UTOPE-360ZDL
	400	UTOPE-04DCL	UTOPE-04ZCL	UTOPE-04DDL	UTOPE-04ZDL
	450	UTOPE-450DCL	UTOPE-450ZCL	UTOPE-450DDL	UTOPE-450ZDL
	500	UTOPE-05DCL	UTOPE-05ZCL	UTOPE-05DDL	UTOPE-05ZDL
	600	UTOPE-06DCL	UTOPE-06ZCL	UTOPE-06DDL	UTOPE-06ZDL
	720	UTOPE-07DCL	UTOPE-07ZCL	UTOPE-07DDL	UTOPE-07ZDL
	750	UTOPE-08DCL	UTOPE-08ZCL	UTOPE-08DDL	UTOPE-08ZDL
	1000	UTOPE-10DCL	UTOPE-10ZCL	UTOPE-10DDL	UTOPE-10ZDL
□:Standard Others: Optional	1500	UTOPE-15DCL	UTOPE-15ZCL	UTOPE-15DDL	UTOPE-15ZDL
	1800	UTOPE-18DCL	UTOPE-18ZCL	UTOPE-18DDL	UTOPE-18ZDL
	2000	UTOPE-20DCL	UTOPE-20ZCL	UTOPE-20DDL	UTOPE-20ZDL
	2500	UTOPE-25DCL	UTOPE-25ZCL	UTOPE-25DDL	UTOPE-25ZDL
	3000	UTOPE-30DCL	UTOPE-30ZCL	UTOPE-30DDL	UTOPE-30ZDL
Input power voltage		+12V DC ±5% (Ripple voltage within 10% pp)		+5V DC ±5% (Ripple voltage within 10% pp)	
Consumed current		Max. 200mA			
Number of output signals		Main signal 2 (for all types), home position 1 (only for type UTOPE-□ZL)			
Output wave form		Rectangular waveform			
Max. response frequency		50 kHz		100 kHz	
Output signal level		L_{HI}:Min. 10V, L_{LO}:Max. 1.5V		Balanced line driver output † (SN75174NG)	
Output waveform rise time		Max. 1 μs			
Ourput waveform fall time		Max. 0.5 μs			
Output circuit		1 kΩ, +12 V, Isink, OUTPUT Isink MAX 20 mA			
Output mutual phase error		ϕ:25 ±10%			
Flutter		Max. 2% p-p			
Pulse duty cycle		50 ± 10%			
Light-emitting element		LED			
Light-receiving element		Photo transistor			
Max. revolutions		Instantaneous:12,500rpm, Continuous:5000rpm			
Rotor inertia ($GD^2/4$)		21g•cm² (45g•cm² for type UTOPE-15□L to -30□L.)			
Friction torque		12g•cm			
Thrust direction load		Max. 1kg			
Radial direction load		Max. 2kg			
Ambient temp		0 to 60℃ (operating), −20 to 80℃ (not operating)			
Humidity		20 to 80% RH			
Vibration proof(in operation)		2.5G Max. (20 to 400Hz)			

Dimensions in mm (With cover)

• Print Motor Type UGPMEN-08DA2

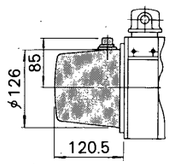


• Print Motor Type (UG) PMES-09A2 to 16A2

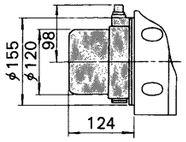


Type \ Dimensions	LL	CL
(UG) PMES-09A2	167	102
(UG) PMES-12A2	174	109
(UG) PMES-16A2	200	124

• Minertia Motor



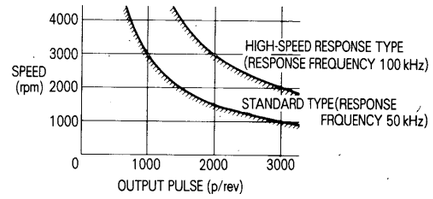
• Cup Motor
• Hi-Cup Motor



* The relation among speed (rpm), response frequency (Hz) and the number of output pulses (p/rev) is as shown below:

$$\text{Speed (rpm)} = \frac{\text{Response frequency (Hz)}}{\text{Number of output pulses (p/rev)}} \times 60$$

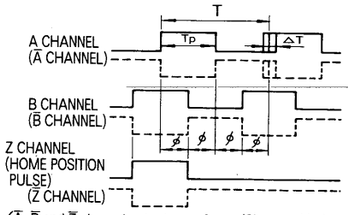
Response Zone shown below must be observed. Especially when a high pulse encoder is used, take applicable speed into consideration.



† Use either SN75115N or SN75175N for optical encoder signal receiving circuit.

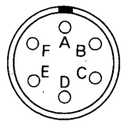
(Notes)

1. Relations with output waveform are as follows (counterclockwise from the shaft side):
   - Output mutual phase error (ϕ) = ϕ/T × 100(%)
   - Flutter = △T/T × 100(%)
   - Pulse duty cycle (PDC) = TP/T × 100(%)



(A, B and Z channel output waveforms (Shown with dotted line) are contained only in high-speed response type.)

2. Optical encoder connector wiring
   (1) Optical encoder terminals (standard type)
   Connector : MS3102A14S-6P receptacle
   MS3106B14S-6S plug (attachment)
   MS3057-6A cable clamp (attachment)



Terminal A: A Channel output
Terminal B: B Channel output
Terminal C: Z Channel output
Terminal D: Common
Terminal E: +12 VDC
Terminal F: 0 V
(Terminal C is not used in type UTOPE-□DCL.)

(2) Optical encoder terminals (High-speed response type)
Connector : MS3102 A20-29P receptacle
MS3108 B20-29S angle plug (attachment)
MS3057-12A cable clamp (attachment)

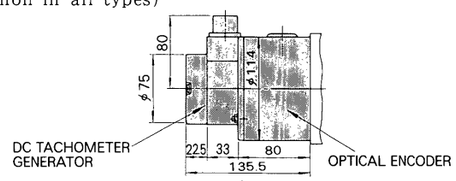
Terminal A: A Channel output
Terminal B: Ā Channel output
Terminal C: B Channel output
Terminal D: B̄ Channel output
Terminal F: F.G (frame ground)
Terminal G: 0 V
Terminal H: +5 VDC
Terminal N: F.G (frame ground)
Terminal R: Z Channel output
Terminal S: Z̄ Channel output
(Terminals R and S are not used in type UTOPE-□DDL.)

3. Precautions
- Wrong wiring may cause damage.
- Wrong wiring of A and B channels forward/reverse for rotating direction may make the units uncontrollable.
- Do not give any vibration or impact to encoder unit or output shaft since this detector is accurate.
- Use a power supply with insulation transformer. Do not use any power supply with automatic transformer (single-phase transformer).
- If surge voltage is generated in power line, provide a surge absorber to power supply before operation.
- Provide separate wiring to the optical encoder and high-voltage switching power supply, such as motor power supply, in order to prevent malfunction or damage.
- Use as short a lead as possible.
- When photo coupler is used for signal receiving circuit, pay attention to time delay or use a high-operation photo coupler since the characteristics such as duty cycle or output mutual error are changed by the photo coupler time delay to cause a control circuit malfunction.
- When the encoder is used with noise filter in the receiving circuit, the characteristics may be changed by the filter time constant.

4. FEEDBACK UNIT SPECIFICATIONS

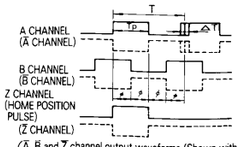
Table 4 Feedback Unit Specifications

Specifications \ Type		Standard Type: Without home position signal TFUE□DC7	Standard Type: With home position signal TFUE□ZC7	High Speed Response Type: Without home position signal TFUE□DD7	High Speed Response Type: With home position signal TFUE□ZD7
Number of output pulses (p/rev)	240	TFUE-02DC7	TFUE-02ZC7	TFUE-02DD7	TFUE-02ZD7
	300	TFUE-03DC7	TFUE-03ZC7	TFUE-03DD7	TFUE-03ZD7
	360	TFUE-360DC7	TFUR-360ZC7	TFUE-360DD7	TFUE-360ZD7
	400	TFUE-04DC7	TFUE-04ZC7	TFUE-04DD7	TFUE-04ZD7
	450	TFUE-450DC7	TFUE-450ZC7	TFUE-450DD7	TFUE-450ZD7
	500	TFUE-05DC7	TFUE-05ZC7	TFUE-05DD7	TFUE-05ZD7
	600	TFUE-06DC7	TFUE-06ZC7	TFUR-06DD7	TFUE-06ZD7
	720	TFUE-07DC7	TFUE-07ZC7	TFUE-07DD7	TFUE-07ZD7
	750	TFUE-08DC7	TFUE-08ZC7	TFUE-08DD7	TFUE-08ZD7
	1000	TFUE-10DC7	TFUE-10ZC7	TFUE-10DD7	TFUE-10ZD7
	1500	TFUE-15DC7	TFUE-15ZC7	TFUE-15DD7	TFUE-15ZD7
	1800	TFUE-18DC7	TFUE-18ZC7	TFUE-18DD7	TFUE-18ZD7
	2000	TFUE-20DC7	TFUE-20ZC7	TFUE-20DD7	TFUE-20ZD7
	2500	TFUE-25DC7	TFUE-25ZC7	TFUE-25DD7	TFUE-25ZD7
	3000	TFUE-30DC7	TFUE-30ZC7	TFUE-30DD7	TFUE-30ZD7
□: Standerd, Others: Optional Standard					
Component		TG-7SVC (DC tachometer generator)		UTOPE-02□L to -30□L (Optical encoder)	
		Output voltage*1 : 7V(±10%)/1000rpm		Refer to Table 3 for the characteristics other than in Tables 1 and 2.	
		Ripple content ratio*2 : Max. 1.5% p-p (when 1000rpm)			
		Linearity*2 : Max. 1% (200 to 4000rpm)			
		Inner impedance : 150Ω, 38mH			
		Allowable load resistance : 5.1kΩ			
Max. Speed		5000rpm			
Rotor inertia (GD²/4)		Max. 60g·cm²			
Friction torque		Max. 150g·cm			
Thrust direction load		Max. 1kg			
Radial direction load		Max. 2kg			
Ambient temp.		0 to 06℃ (Operating), −20 to 80℃ (Not operating)			
Humidity		20 to 80% RH			
Vibration proof (in operation)		Less than 2.5G (20 to 400Hz)			
Weight		1.4kg			
Filter Circuit		1.5kΩ, TG (TACHOMETER GENERATOR), 1μF, 5.1kΩ, 0.22μF, 0.47μF			
Dimensions in mm		• Servomotor (common in all types)			



*1: Output voltage is measured directly from the terminals.
*2: Ripple content ratio and linearity are measured through the filter circuit in the table.

(Notes)
1. Z channel synchronizes to A channel in the feedback unit output waveform.
Relations with output waveform are as follows (counterclockwise from the shaft side):
- Output mutual phase error (φ) = φ 1T × 100 (%)
- Flutter = △T/T × 100(%)
- Pulse duty cycle (PDC) = Tp/T × 100 (%)



(A, B and Z channel output waveforms (Shown with dotted line) are contained only in high-speed response type.)

2. Feedback unit connector wiring
(1) Feedback unit terminals
Connector: MS3102A20-18P receptacle
MS3108B20-18S angle clamp (attachment)
MS3057-12A cable clamp (attachment)

Terminal A: A Channel output
Terminal B: B Channel output
Terminal C: Z Channel output
Terminal D: Common
Terminal E: +12 VDC
Terminal F: 0 V
Terminal G: DC tachometer generator (+)
Terminal H: DC tachometer generator (−)
(Terminal C is not used in type TFUE-□DC7.)

(2) Feedback unit terminals
(High-speed response type)
Connector: MS3102A20-29P receptacle
MS3108B20-29S angle clamp (attachment)
MS3057-12A cable clamp (attachment)

Terminal A: A Channel output
Terminal B: Ā Channel output
Terminal C: B Channel output
Terminal D: B̄ Channel output
Terminal F: F.G (frame ground)
Terminal G: 0 V
Terminal H: +5 VDC
Terminal L: DC tachometer generator (+)
Terminal M: DC tachometer generator (−)
Terminal N: F.G (frame ground)
Terminal R: Z Channel output
Terminal S: Z̄ Channel output
(Terminals R and S are not used in type TFUE-□DD7.)

INSTALLED HOLDING MAGNETIC BRAKES

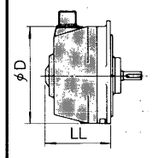
Specifications \ Type		PMFB-3	PMFB-8	PMFB-24	SCFB/90-30	SCFB/90-60	SCFB/90-150	SCFB/90-420
Applicable sevometer name	Print Motor type (UG) PMES-	09A2	12A2	16A2	—	—	—	—
	Cup Motor type UGCMED	—	—	—	04AA	08AA	15AA 22AA	37AA 55AA 75AA
	Hi-Cup Motor type UGHMED	—	—	—	—	06AA 06GG	12AA 12GG 20AA 20GG	30AA 30GG 44AA 60AA
Nominal braking torque kg·m		0.024	0.064	0.19	0.25	0.5	1.2	3.5
Static friction torque kg·m		0.03	0.08	0.24	0.3	0.6	1.5	4.2
Consumed power supply W	Momentary	8	8	12	14.4	15.4	27	35.8
	Continuous	6.3	6.3	9.4	—	—	20.7	24.8
Rated current A		0.10	0.10	0.15	0.16	0.17	0.3	0.36
Brake GD² kg·cm²		0.5	0.5	0.8	3.4	6.7	36	43
Weight kg		0.9	0.9	0.9	0.97	2.1	5.3	7.3
Allowable work-load kg·m×10³	Per hour	4	4	7	7	7	40	63
	Per braking	0.15	0.15	0.27	0.27	0.27	1.2	2.1
Braking delay time s*		0.11	0.04	0.03	0.03	0.07	0.01	0.07
Brake release time s †		0.02	0.03	0.04	0.04	0.04	0.06	0.12
Operation method		Non-exciting operation type (spring braking)						
Power supply		DC 90V			DC 90V			
Magnetic break power supply unit		Cell pack (Input voltage 100VAC or 200VAC)			Type HO-CMM11 (Input voltage 100VAC or 110VAC) Type HO-CMM2 (Input voltage 200VAC or 220VAC)			

* Braking delay time shows electrical delay time from turning off the switch to the brake starting.
† Brake release time shows electrical delay time from turning off the switch to the brake released.

Note:
1. Holding magnetic brake, exclusive use for holding and position, is provided with brake frame. Thus maintenance is not needed. Holding torque cannot be adjusted.
2. Dimensions of Print Motor with holding magnetic brake is partially included in the dimensions of the brake unit. For details, contact your YASKAWA representative.
3. Motor terminals are A and B: Brake terminals are P and N.

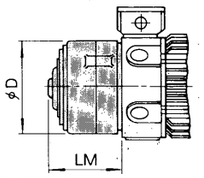
Dimensions in mm (with cover)

• Print Motor



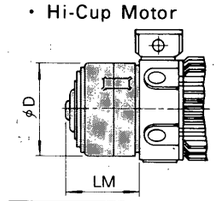
Print Motor \ Dimensions	D	LL
(UG) PMES-09A2	125	111
(UG) PMES-12A2	157	115
(UG) PMES-16A2	208	137

• Cup Motor



Cup Motor \ Dimensions	D	LM
UGCMED-04AA	152	119
UGCMED-08AA	152	119
UGCMED-15AA	178	126
UGCMED-22AA	178	126
UGCMED-37AA	202	142
UGCMED-55AA	202	142
UGCMFD-75AA	202	142

• Hi-Cup Motor



Hi-Cup Motor \ Dimensions	D	LM
UGHMED-03GG1 UGHMED-06AA2 UGHMED-06GG1	152	119
UGHMED-12AA2 UGHMED-12GG2	178	126
UGHMED-20AA2 UGHMED-20GG2	178	126
UGHMED-30AA2 UGHMED-30GG2	202	142
UGHMED-44AA2	202	142
UGHMFD-60AA2	202	142

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Due to ongoing product modification/improvement, data subject to change without notice.