

Tit.:	Cl.:	F.:
<b>N. 0001165</b>		<b>25/03/2014</b>



## CAPITOLATO TECNICO

per l'affidamento di un servizio relativo ad "Interventi per migliorare le prestazioni dei sistemi di movimentazione delle ottiche montate sulla piastra di ricezione del sistema lidar mobile dell'Istituto di Metodologie per l'Analisi Ambientale del CNR"

CIG: 5334410E60

### 1. OGGETTO DELL'AFFIDAMENTO

Costituisce oggetto del presente capitolato la progettazione e la realizzazione dei seguenti attuatori di rotazione per ottiche:

- Attuatore di rotazione motorizzato per lamina a semionda;
- Attuatore di rotazione manuale per polarizzatore.

Gli attuatori devono poter essere montati su una piastra già realizzata, pertanto, si richiede di rispettare tutti i vincoli di seguito specificati:

- Entrambi gli attuatori dovranno essere realizzati in alluminio anodizzato (colore nero).
- Fatti salvi tutti i vincoli esplicitamente indicati nel presente capitolato tecnico, la progettazione e la realizzazione degli attuatori deve essere mirata ad ottenere dispositivi quanto più compatti possibile.

Allo scopo di una migliore comprensione delle problematiche legate alla realizzazione di entrambi gli attuatori si richiede obbligatoriamente un sopralluogo.

### 2. CONTRATTO D'APPALTO

Fanno parte integrante del contratto:

- Il Disciplinare di gara;
- il presente Capitolato Tecnico;
- la documentazione inerente l'offerta economica presentata dall'impresa aggiudicataria in sede di gara;
- la documentazione inerente l'offerta tecnica fornita dall'impresa aggiudicataria in sede di gara.

### 3. DURATA DEL CONTRATTO

La durata del contratto è fissata in mesi 3 (tre) a decorrere dalla sottoscrizione, con la possibilità per il CNR-IMAA di richiedere un'estensione del servizio alle condizioni di cui al presente capitolato, per un periodo di tempo ritenuto necessario al completamento della procedura di aggiudicazione del nuovo



appalto a sensi dell'art. 125 del D.Lgs. 163/2006 e comunque non superiore a 90 giorni successivi alla scadenza naturale del contratto in essere.

#### 4. IMPORTO DELLA FORNITURA

L'importo complessivo della prestazione per il periodo indicato viene stimato dal CNR-IMAA pari a 2.200,00 (duemiladuecento/00) euro IVA inclusa.

Eventuali aumenti dell'imposta sul valore aggiunto lasceranno inalterato l'importo definito nel contratto. L'impresa aggiudicataria si impegna a rispettare i termini e le condizioni di fornitura previsti dal presente appalto e rinuncia espressamente a qualsiasi correlata pretesa di risarcimento di eventuali danni.

#### 5. REQUISITI E CARATTERISTICHE TECNICHE

##### 1. Attuatore di rotazione per lamina a semionda:

Tale dispositivo deve essere conforme a quanto segue:

- a) deve assicurare la rotazione motorizzata di una un'ottica circolare da 2" di spessore compreso tra 0.2 e 0.5mm;
- b) deve poter alloggiare un motorino passo-passo Phytron ZSS-25 (vedi **Allegato A1** per disegni e specifiche tecniche) che garantisce la rotazione dell'ottica. Si precisa che il motorino passo-passo verrà da noi fornito e quindi non dovrà essere incluso nell'offerta;
- c) deve poter alloggiare un sensore ottico OPTEK OPB770B (vedi **Allegato A2** per disegni e specifiche tecniche) per la determinazione di una posizione di riferimento dell'elemento ruotante. L'elemento ruotante (e l'attuatore in generale) dovrà essere completamente compatibile con l'uso descritto del suddetto sensore ottico. Si precisa che il sensore ottico verrà da noi fornito e quindi non dovrà essere incluso nell'offerta;
- d) deve garantire una rotazione affidabile e ripetibile dell'ottica specificata al punto a) in qualunque condizione di temperatura e con precisione e sensibilità di almeno 0.1°;
- e) deve essere dotato di un sistema meccanico di precisione attraverso il quale l'ottica specificata al punto a) viene fissata (in maniera removibile) all'elemento ruotante;
- f) deve avere dimensioni massime di 16 mm x 100 mm x 96 mm (larghezza x lunghezza x altezza);
- g) deve essere realizzato in maniera tale che la quota del centro dell'ottica specificata al punto a) sia pari a 16 mm;
- h) deve poter essere posizionato e fissato su di una piastra già in dotazione attraverso:
  - due spinette cilindriche in acciaio di diametro pari a 2.50 mm e di altezza 2.50 mm. La distanza tra gli assi delle spinette deve essere pari a 68.0 mm;
  - due viti M4 i cui centri hanno una distanza pari a 90.0 mm. Pertanto l'attuatore deve essere dotato di idonei fori passanti;



## 2. Attuatore di rotazione manuale per polarizzatore:

Tale dispositivo deve essere conforme a quanto segue:

- a) deve poter essere posizionato e fissato su di una piastra (di seguito indicata con **P**) già in dotazione attraverso:
  - due spinette cilindriche in acciaio di diametro pari a 2.50 mm e di altezza 3 mm. La distanza tra gli assi delle spinette deve essere pari a 22.0 mm;
  - due viti M4 i cui centri hanno una distanza pari a 38.0 mm. Pertanto l'attuatore deve essere dotato di idonei fori passanti.
- b) deve ospitare due fogli polarizzatori quadrati (di seguito indicati come **A** e **B**) di dimensioni 40 mm x 40 mm dello spessore di 1 mm (vedi **Allegato A3** per le specifiche tecniche);
- c) Il polarizzatore **A** deve essere posizionato sul supporto in maniera fissa (non ruotante) con un lato parallelo al piano della piastra **P** con un precisione di almeno 0.1°;
- d) deve assicurare una rotazione affidabile e ripetibile a step di 22.5° con precisione di almeno 0.1° del polarizzatore **B** rispetto alla piastra **P**;
- e) deve essere dotato di un sistema meccanico di precisione attraverso il quale i fogli polarizzatori **A** e **B** vengono fissati (in maniera removibile) al supporto;
- f) deve avere dimensioni massime di 28 mm x 60 mm x 65 mm (larghezza x lunghezza x altezza).

## 6. **OBBLIGHI DELL'IMPRESA AGGIUDICATARIA RISPETTO ALLA TRACCIABILITA' DEI FLUSSI FINANZIARI**

L'impresa aggiudicataria è tenuta ad assolvere a tutti gli obblighi derivanti dall'art. 3 della L. 136/2006 e ss.mm.ii. al fine di assicurare la tracciabilità dei movimenti finanziari relativi al presente appalto:

- a) i pagamenti devono avvenire esclusivamente tramite bonifico bancario o postale ovvero con altri strumenti di pagamento idonei a garantire la piena tracciabilità delle operazioni;
- b) i contraenti hanno l'obbligo di comunicare al CNR-IMAA gli estremi identificativi dei conti correnti dedicati entro 7 (sette) giorni naturali e consecutivi dalla loro accensione o nel caso di conti correnti già esistenti, dalla loro prima utilizzazione in operazione finanziarie ad una commessa pubblica;
- c) i contraenti hanno l'obbligo di indicare le generalità ed il codice fiscale delle persone delegate ad operare su di essi nonché provvedono altresì a comunicare ogni modifica relativa ai dati trasmessi: il contraente assume l'obbligo di tracciabilità dei flussi finanziari.

La violazione degli obblighi previsti dal suddetto art. 3 della L. n. 136/2010 determina la risoluzione di diritto del contratto.

## 7. **MODALITA' DI ADDEBITO DEL CORRISPETTIVO COMPLESSIVO**

Il corrispettivo complessivo del servizio oggetto di appalto verrà addebitato tramite presentazione di fattura emessa a seguito di consegna degli attuatori e di sottoscrizione da parte di un tecnico individuato



fra i dipendenti del CNR-IMAA del collaudo e regolare esecuzione della prestazione resa.

## 8. PAGAMENTO

La fattura sarà pagata entro 45 (quarantacinque) giorni dal verificarsi delle condizioni sopracitate, e dovrà contenere i seguenti elementi:

- il codice CIG: 5334410E60;
- l'esatta indicazione del servizio reso.

Il pagamento avverrà tramite bonifico bancario su conto corrente dedicato comunicato al CNR-IMAA in ottemperanza a quanto previsto dalla L. 136/2010.

## 9. ULTERIOI RIFERIMENTI NORMATIVI

Per quanto non previsto nel presente capitolato si fa riferimento alle disposizioni di legge vigente in materia di contratti pubblici.

Il Responsabile del Procedimento  
Dott. Vincenzo Lapenna

# ZSS 19 to 56

photron

## 2-Phase Hybrid Stepper Motor

### ZSS Precision Stepper Motors

The proven series of ZSS two-phase hybrid stepper motors come into operation in many different application ranges: mechanical engineering, positioning and handling, food and packaging, etc.

The holding torques amount from 3.8 to 700 mNm.

The ZSS stepper motor's standard number of steps/rev. is 200, depending on the motor size 8, 24, 56, 72 or 500 steps/rev. are available.

When installed appropriately and wired correctly, the ZSS stepper motors contribute to fulfill the EMC requirements of the entire system.

### Overview: Extensions

- Stepper motor
- Geared stepper motor
  - GPL low-backlash planetary gears
  - PLG planetary gears <sup>1)</sup>
  - HD Harmonic Drive gears <sup>1)</sup>
  - GSR worm gears <sup>1)</sup>
- Stepper motor with motor brake <sup>1)</sup>
  - Permanent magnet brake for 24V<sub>DC</sub> supply voltage
- Stepper motor with encoder <sup>1)</sup>
  - Standard resolution 500 lines
  - 3-channel optical incremental encoder

<sup>1)</sup> Separate data sheets being prepared.

### Types / Mechanical Characteristics

Size	Type	Number of steps					Standard windings A	Holding torque		Rotor mass inertia 10 <sup>-4</sup> kg m <sup>2</sup>	Permissible bearing load		Weight kg	Electrical connection		
		8	24	56	72	200		500	mNm		mNm	axial N		radial N	Free wire ends	Protective cover
19	ZSS 19	<input type="checkbox"/>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	0.3 / 0.6 / 1.2	3.8	0.9	0.0009	3	3	0.04	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	ZSS 20					<input checked="" type="checkbox"/>	0.3 / 0.6 / 1.2	5	1	0.0016	3	3	0.065	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
25	ZSS 25	<input type="checkbox"/>	<input type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	0.3 / 0.6 / 1.2	13	2	0.0025	5	5	0.07	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	ZSS 26				<input checked="" type="checkbox"/>	<input type="checkbox"/>	0.3 / 0.6 / 1.2	25	2.2	0.006	5	5	0.11	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
32	ZSS 32				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	0.6 / 1.2 / 2.5	50	3	0.01	5	15	0.15	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
	ZSS 33				<input type="checkbox"/>	<input checked="" type="checkbox"/>	0.6 / 1.2 / 2.5	75	3.3	0.018	5	15	0.23	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
42	ZSS 41				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	0.6 / 1.2 / 2.5	100	4	0.025	20	40	0.26	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	ZSS 41/1				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	0.6 / 1.2 / 2.5	100	4	0.025	20	40	0.26	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	ZSS 42				<input type="checkbox"/>	<input checked="" type="checkbox"/>	0.6 / 1.2 / 2.5	140	5	0.045	20	40	0.32	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	ZSS 42/1				<input type="checkbox"/>	<input checked="" type="checkbox"/>	0.6 / 1.2 / 2.5	140	5	0.045	20	40	0.32	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	ZSS 43				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	0.6 / 1.2 / 2.5	260	7	0.077	20	40	0.47	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	ZSS 43/1				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	0.6 / 1.2 / 2.5	260	7	0.077	20	40	0.47	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
52	ZSS 52			<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1.2 / 2.5	450	13	0.15	25	70	0.65	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
56	ZSS 56				<input checked="" type="checkbox"/>	<input type="checkbox"/>	1.2 / 2.5	500	30	0.17	40	80	0.7	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	ZSS 57				<input checked="" type="checkbox"/>	<input type="checkbox"/>	1.2 / 2.5	700	50	0.24	40	80	0.9	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

<sup>2)</sup> ZSS 41/1, 42/1, 43/1, 52, 56, 57: Terminal plate with earthing screw

<sup>3)</sup> Bipolar mode

<sup>4)</sup> red = popular types

standard  optional

ZSS 19 to 33 Stepper Motors with Free Wire Ends

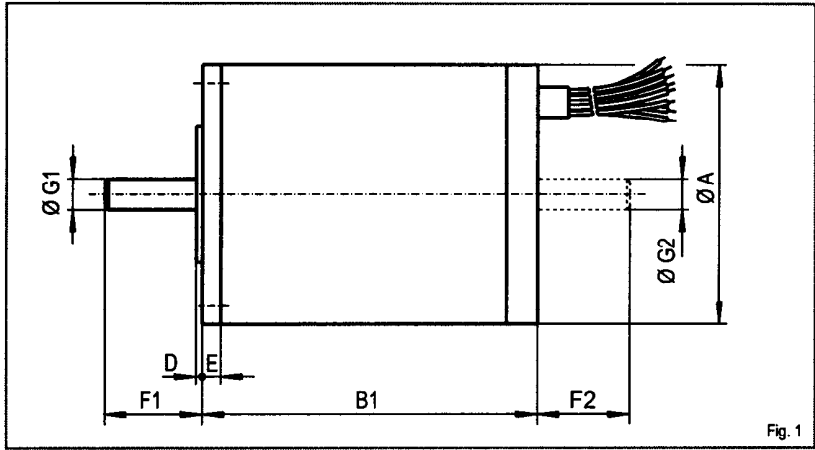


Fig. 1

ZSS Designs



ZSS 42 with Protective Cover

ZSS 19 with Free Wire Ends

Fig. 5

ZSS 41 to 57 Stepper Motors with Protective Cover

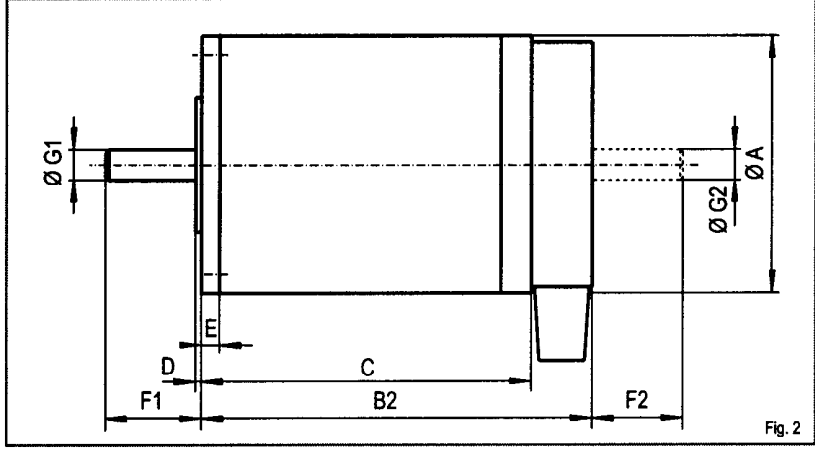


Fig. 2

ZSS Standard Motor Flange

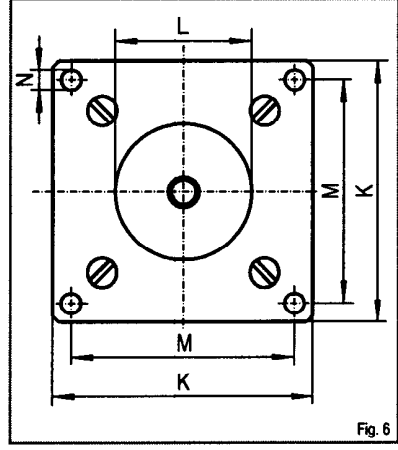


Fig. 6

K1 Heat Sink for ZSS 19 to 57

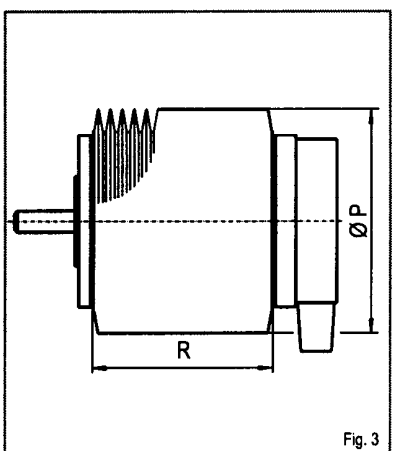


Fig. 3

K2 Heat Sink for ZSS 19 to 57

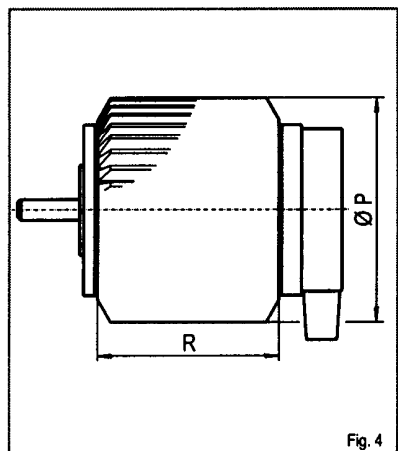


Fig. 4

Optional Heat Sink

The ZSS stepper motors are also available with a mounted heat sink. Depending on the motor's mounting position, a heat sink with radial fins (K1) or axial fins (K2) can be selected. The use of a K1 heat sink increases the stepper motor's thermal dissipation surface by a factor of approx. 3.9. With a K2 heat sink, it is increased by a factor of approx. 3.4. A heat sink can be mounted subsequently, preferable by phytron.

Dimensions Stepper Motor / Heat Sink

Size	Type	Dimensions in mm															
		A	B1	B2	C	D	E	F1	F2	G1 <sup>1)</sup>	G2 <sup>1)</sup>	K	L <sub>ge</sub>	M	N	P	R
19	19	19	23			1	2	7.5									
		19	23			1	2	7.5									
26	26					1	2.5	9									
						1	2.5	9									
32/33	32/33					1	3	11									
						1	3	11									
41/1	41/1			40	39	1	3	16	14								
				46	39	1	3	16	14								
43/1	43/1			64	64	1	3	16	15								
				64	64	1	3	16	15								
52	52			68	68	1	3	16	15								
				70	68	1	3	16	15								
57	57			77	65	1.5	3.5	17.6	16								
				77	65	1.5	3.5	17.6	16								
57	57			68.1	67.1	1.5	3.5	22									
				68.1	67.1	1.5	3.5	22									

<sup>1)</sup> Shaft diameter tolerances: ZSS 19 to 26: -0.005 to -0.009, from ZSS 32: g5

**Leads / Cables**

**Motors with free wire ends**

- ZSS 19 to 26  
8 x AWG 28, free wire ends 300 mm
- ZSS 32/33  
8 x AWG 26, free wire ends 300 mm

**Motors with protective cover**

- ZSS 41 to 43, ZSS 41/1 to 43/1  
Cable outlet diameter max. 4.5 mm
- ZSS 52 to 57  
Cable outlet diameter max. 5 mm

**Optional Motor Brake**

For vertical positioning units, ZSS 32 to 57 stepper motors with built-in 24 V<sub>DC</sub> permanent magnet motor brake are optionally available.

- ZSS 32 to 43: KEB 01  
Power 8 W / Nominal torque 0.4 Nm  
Electrical connection: free wire ends
- ZSS 52 to 57: KEB 02  
Power 10 W  
Nominal torque 1 Nm  
Electrical connection: circular connector

See data sheet: ZSS Stepper Motor with KEB Permanent Magnet Motor Brake (being prepared).

**Optional Encoder**

The ZSS 32 – 57 stepper motors with built-in incremental encoders are specially adapted for applications with variable speed drives or system monitoring.

- Motor connection with free wire ends
- Encoder connection with flat cable with 10-point connector
- Protection mode IP 20

See data sheet: ZSS Stepper Motor with HEDL 5540 Incremental Encoder (being prepared).

# Stepper Motor with GPL Low-backlash Planetary Gear

## ZSS Stepper Motor with GPL Gear

- Stepper motor mounted gear
- 1- to 3-stage planetary gear
- Low gear backlash
  - Standard: 20 to 50 arcmin
  - Low-backlash: 6 to 15 arcmin
- Maximum permanent torque 0.1 to 38 Nm
- 100% permissible short-term overload
- Adapted for permanent, alternate or intermittent operation
- Ideal for combinations with toothed belt modules
- 4:1 to 256:1 reduction ratios (depending on the gear type)
- High efficiency
- Low gear inertia
- Permissible temperature range -30 to +90 °C
- Maintenance-free permanent lubrication

### Gear Material

- Gear housing
  - GPL 22: stainless steel
  - GPL 26 to 52: rustproof for normal environmental conditions
- Output shaft: 2 deep groove ball bearings

### Gear Operating Modes

#### S1: Continuous operation

The gear box's operating time exceeds 15 minutes without a break or the duty cycle is more than 60%. In no case the gear box housing temperature may exceed 70 °C.

#### S5: Cyclical operation

The gear box's duty cycle is less than 60%. The number of operations per hour can range anywhere from a few to several thousand.

If the number of operations exceeds 1000 per hour, the maximum torque occurring has to be multiplied by a shock factor (fig. 9) to take into account the additional dynamic load.

The data in this publication are based on software models and empirical values and on a shock factor of 1.25.

## Mechanical Characteristics

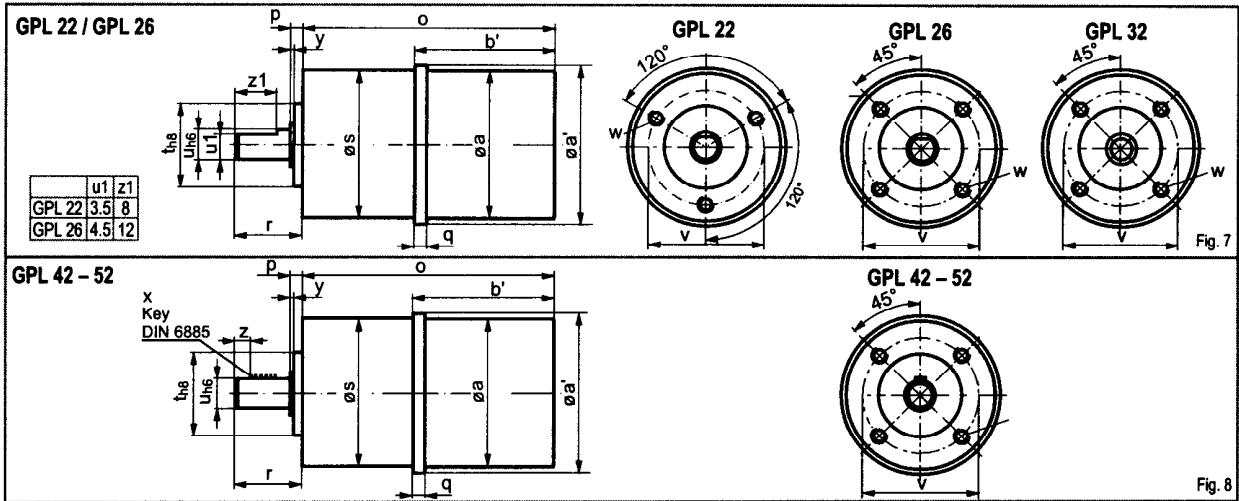
Gear	Stepper motor	Stages	Reduction ratios	Mechanical gear characteristics							Average mass inertia at output	Efficiency	
				Standard			Low-backlash			Torsional stiffness			
				No-load backlash	Nominal torque S1	Emergency stop torque	No-load backlash	Nominal torque S5	Emergency stop torque				
GPL 22	ZSS 18 ZSS 20 ZSS 22	1	1:1										
GPL 26	ZSS 24 ZSS 26	1	1:1										
GPL 28	ZSS 28 ZSS 30	1	1:1										
GPL 30	ZSS 32 ZSS 34	1	1:1										
GPL 42	ZSS 44 ZSS 46 ZSS 48	2	1:6										
GPL 52	ZSS 54 ZSS 56 ZSS 58	2	1:12										

1) Valid for 21 °C ambient temperature



# Stepper Motor with GPL Low-backlash Planetary Gear

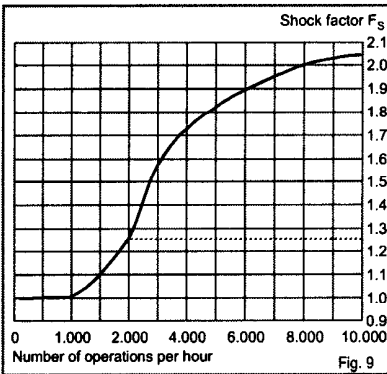
## ZSS Stepper Motor with GPL Gear



### Dimensions

Gear	Stepper Motor	Dimensions in mm																
		a	a'	b'	1 stage	2 stages	3 stages	p	q	r	s	l	u	y	w	x	y	z
GPL 22	ZSS 25	25	26	33.5	59	67	75	2.5	5	17	26	14	5	20	M2x4	-	0.5	-
	ZSS 26	25	26	49.5	75	83	91	2.5	5	17	26	14	5	20	M2x4	-	0.5	-
GPL 26	ZSS 31	26	27	40.5	66.5	76.5	87.5	4	5	22.5	32	14	8	20	M2x4	-	0.5	-
	ZSS 32	26	27	59.5	80.5	97.5	106.5	4	5	22.5	32	14	8	20	M2x4	-	0.5	-
GPL 42	ZSS 41	42	43	53	88	100.5	113	4	7	22.5	42	25	8	32	M4x8	3x3x14	1	225
	ZSS 42	42	43	68	103	115.5	128	4	7	22.5	42	25	8	32	M4x8	3x3x14	1	225
	ZSS 43	42	43	83	118	130.5	143	4	7	22.5	42	25	8	32	M4x8	3x3x14	1	225
GPL 52	ZSS 51	52	53	62.5	100	113	127	4	7	22.5	42	25	8	32	M4x8	3x3x14	1	225
	ZSS 52	52	53	82.5	120	133	147	4	7	22.5	42	25	8	32	M4x8	3x3x14	1	225

### Shock Factor for Cyclical Operation



### Weight / Permissible Loads / Protection Modes

Gear	Weight without motor			Permissible Radial load (Center of shaft)	Permissible Axial load	Protection mode Gear	Protection mode Coupling shaft
	1 stage	2 stages	3 stages				
	g			N	N		
GPL 22	50	76	100	30			
GPL 26	71	91	110	30			
GPL 32	100	130	160	30			
GPL 42	175	250	320	30			
GPL 52	275	350	420	30			

**Electrical Connection**

Type ZSS phytron stepper motors are 8-lead versions.

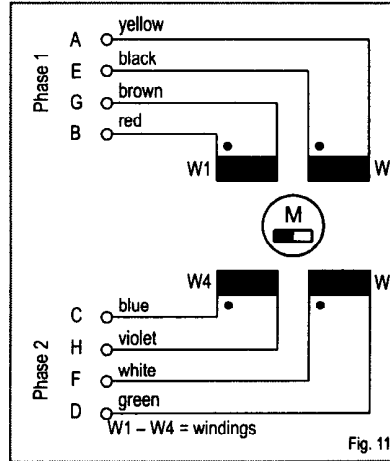
The motors can be used with unipolar or bipolar control mode, as the windings can be differently connected.

5- lead or 6-lead connection is applicable for the unipolar control mode.

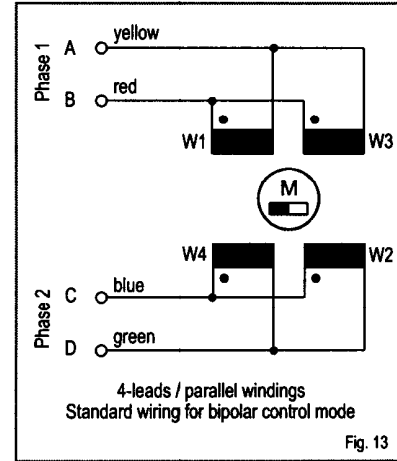
In the bipolar control mode, 4-lead motor wiring is required, windings connected in parallel or in series.

The information in the ZSS motor connection leaflet (delivered with each motor) must be regarded when wiring the motor in order to provide for EMC compliant wiring. The motor connection leaflets are also available by download from the phytron homepage.

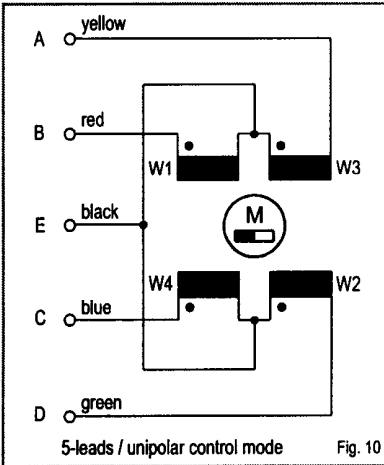
**Stepper Motor ZSS with Free Wire Ends**



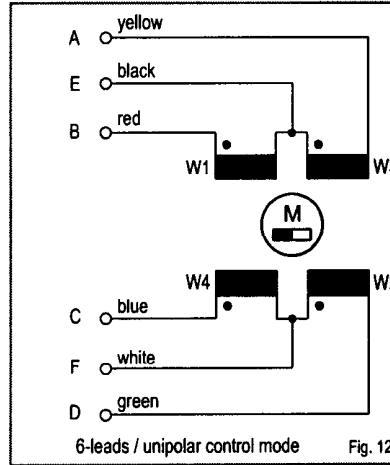
**Connection Type 4-leads / parallel**



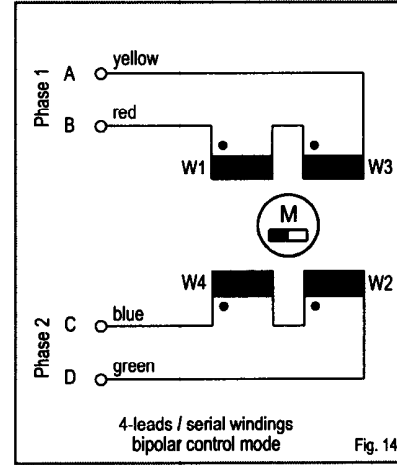
**Connection Type 5-leads**



**Connection Type 6-leads**



**Connection Type 4-leads / serial**



**Phase Currents**

For ZSS phytron stepper motors, the rated current [A] per motor phase is printed on the rating plate. The last digits of the motor's type number define the rated current.

Example: ZSS 32.200.1,2

The **rated current** is defined for full step operation, at bipolar control mode, with parallel connected motor windings.

According to the connection mode, the motor windings receive different currents. Therefore, for identical power dissipation in the motor, the allowable **phase current** is determined by the connection mode. For short time, double current overload is acceptable.

Control mode	Bipolar control mode Full step operation		Unipolar control mode Full step operation	
Motor connection	4-leads parallel windings standard wiring for bipolar control mode	4-leads serial windings	5-leads	6-leads
Allowable phase current for identical power dissipation	Rated current	Rated current x 0.5	Rated current x 0.707	Rated current x 0.707

**Phytron, Inc.**

600 Blair Park Rd, Suite 220, Williston, VT 05495 USA  
Tel 802-872-1600 Fax 802-872-0311 info@phytron.com www.phytron.com

ZSS / 09-1 US / 6

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# Electrical Characteristics / Standard Motor Windings

## Electrical Characteristics / Phase Currents / Resistance / Inductivity

Size	Type	Standard winding 1				Standard winding 2				Standard winding 3			
		Phase current		resistance per winding	Inductivity per winding <sup>1)</sup>	Phase current		resistance per winding	Inductivity per winding <sup>1)</sup>	Phase current		resistance per winding	Inductivity per winding <sup>1)</sup>
		unipolar operation	bipolar operation			unipolar operation	bipolar operation			unipolar operation	bipolar operation		
		A	A	Ω	mH	A	A	Ω	mH	A	A	Ω	mH
			0.2	14.5	2.2								
25	ZSS 25	0.21	0.3	24	6	0.42	0.6	6.5	1.6	0.84	1.2	1.9	0.4
	ZSS 26			43	12			11.7	3.2			3.4	1
			0.6	6.3	5.3								
			0.6	15	3								
42	ZSS 41			10.2	7.6			2.7	2			0.55	0.4
	ZSS 41/1 <sup>2)</sup>			10.2	7.6			2.7	2			0.55	0.4
	ZSS 42	0.42	0.6	14.5	11	0.84	1.2	3.2	3	1.75	2.5	0.7	0.7
	ZSS 42/1 <sup>2)</sup>			14.5	11			3.2	3			0.7	0.7
	ZSS 43			19	22.9			5.2	5.2			1	1.2
	ZSS 43/1 <sup>2)</sup>			19	22.9			5.2	5.2			1	1.2
56	ZSS 56 <sup>2)</sup>	0.84	1.2	5.7	6.7	1.75	2.5	1.3	1.7				
	ZSS 57 <sup>2)</sup>			7.8	7.8			1.6	2.4				

Remarks:  
<sup>1)</sup> The inductivity values apply for each single winding as well as for parallel connected windings.  
 In the bipolar mode, the windings can also be connected in series. In this case, the inductivity is multiplied by 4.  
<sup>2)</sup> ZSS 41/1, 42/1, 43/1, 52, 56, 57 with earthing screw on the terminal board

# Frequency Characteristics

## Frequency Characteristics

The curves correspond to the limit values of the operational characteristics (M) as a function of the control pulses (frequency/speed), for two different supply voltages ( $U_b$ ).

The motor connection type is 4-leads with parallel windings. The motors are controlled by phytron stepper motor power stages in the half-step mode.

## Power Characteristics

For each frequency curve, the power characteristic (P) indicates the power delivered by the output shaft.

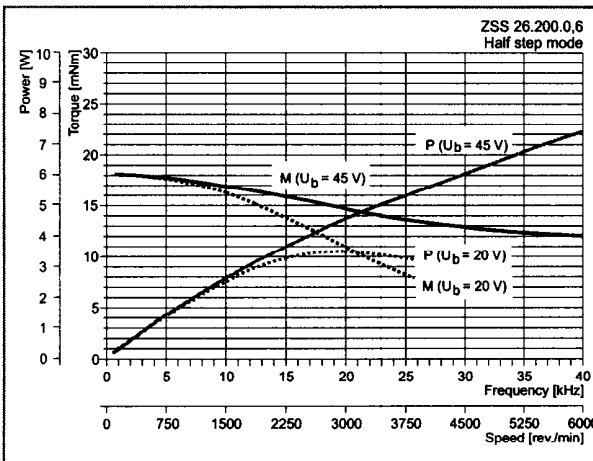


Fig. 17

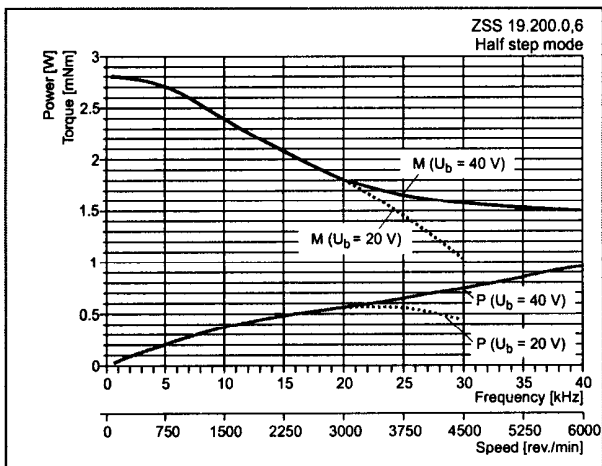


Fig. 15

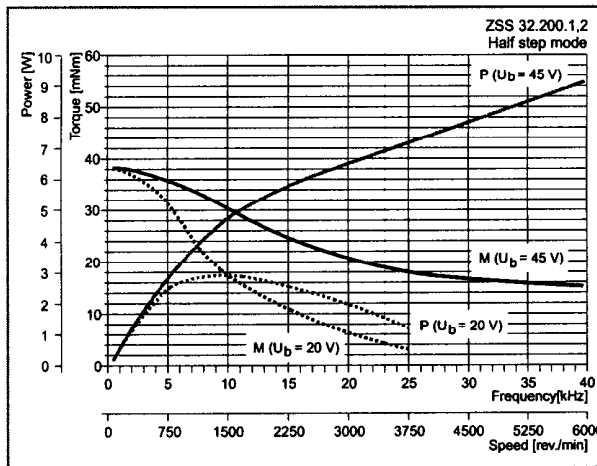


Fig. 18

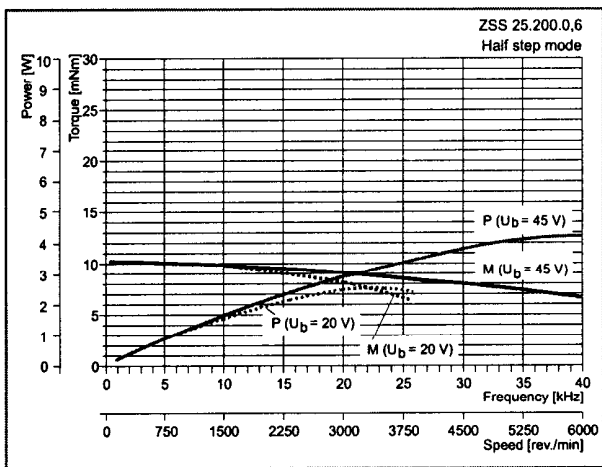


Fig. 16

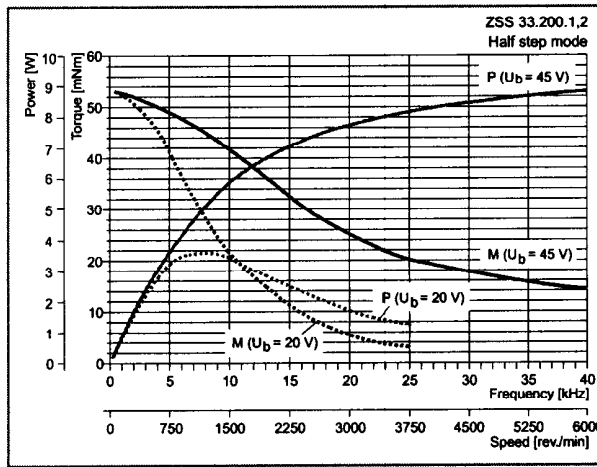


Fig. 19

Phytron, Inc.

600 Blair Park Rd, Suite 220, Williston, VT 05495 USA  
Tel 802-872-1600 Fax 802-872-0311 info@phytron.com www.phytron.com

ZSS / 09-1 US / 8

# Frequency Characteristics

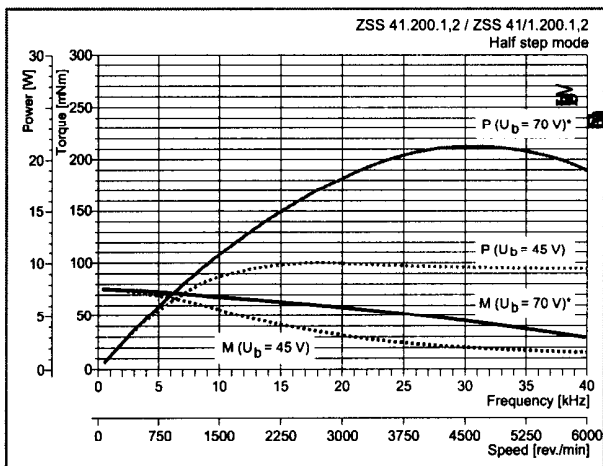


Fig. 20

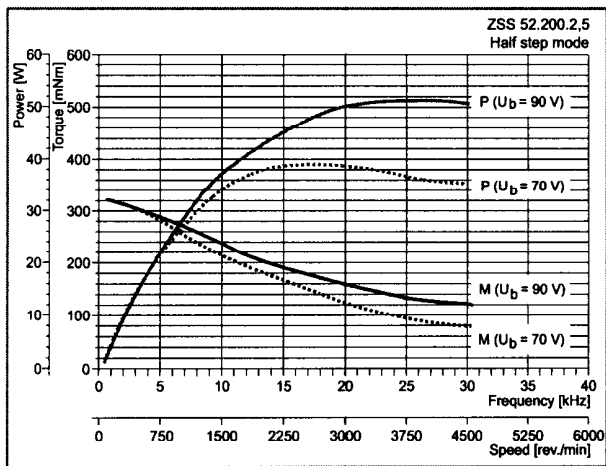


Fig. 23

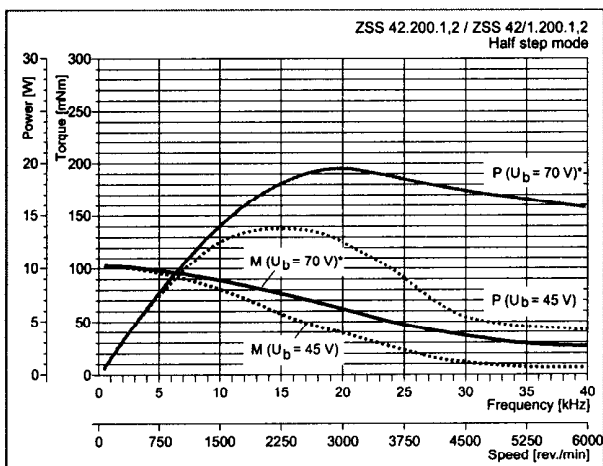


Fig. 21

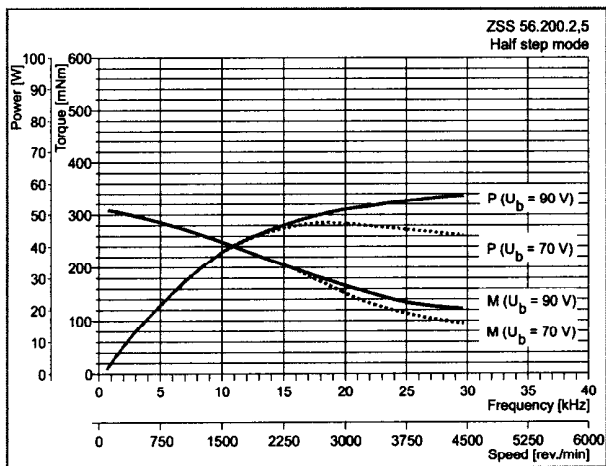


Fig. 24

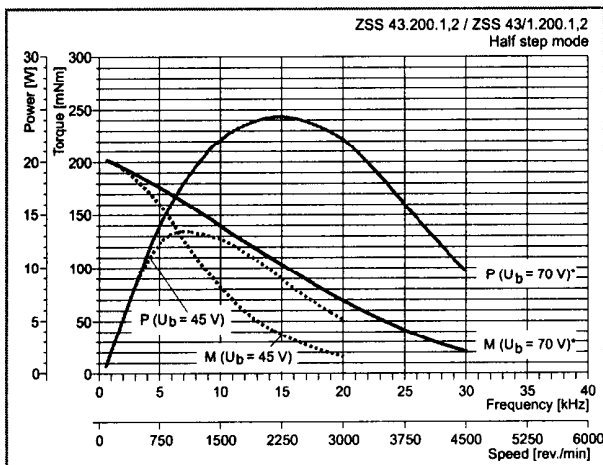


Fig. 22

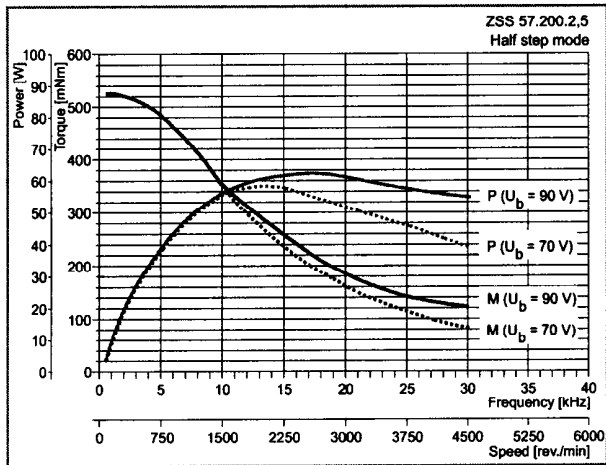


Fig. 25

\*  $U_b = 70 \text{ V}$  permissible for motors with earthing screw

**Optional:  
PLG Planetary Gears**

The use of a gear box is recommended if a higher resolution of the system or a lower output speed is required. With a planetary gear mounted, the output torque of the system is increased with reduced mass inertia.

- 1-, 2- or 3-stage gears with reduction ratios from 4.5:1 to 512:1
- Input and output rotation are in the same direction
- Output torque up to 24 Nm depending on size
- Low gear backlash: 1°
- High permissible axial and radial shaft loads
- Temperature range -15 to +70 °C
- Lifetime lubrication
- With mounted stepper motor ZSS 32 to 57

Dimensions and mechanical characteristics:  
Stepper Motor with PLG Gear data sheet

**Optional:  
HD Harmonic Drive Gears**

Harmonic Drive gear is based on a specific operating principle. The transmission force is exerted by a resilient deformable toothed steel cylindre flexspline. The drive shaft transmits the geared down motor rotation to the output shaft. The drive shaft and the output shaft rotate in opposite directions.

- High reduction ratio in a small volume: 50:1 to 100:1 (depending on gear size)
- Very low weight
- Very low mass inertia
- Permissible torque up to 7.8 Nm depending on motor size
- Very low backlash: 0.4 to 2 angular minutes
- High efficiency
- Standard ambient temperature range 0 to 40 °C
- With mounted stepper motor ZSS 25 to 52

Dimensioned drawings and further information:  
Stepper Motor with HD Gear data sheet

**Optional:  
GSR Worm Gears**

ZSS stepper motors with GSR worm gears are specially adapted for installation on smallest area.

- Drive and output shaft are set up at a 90° angle to another
- Various mounting positions
- 2nd shaft end
- Reduction ratios 7:1 to 40:1
- <30 angular minutes torsional backlash
- High torsional stiffness: 0.26 to 1.3 Nm/arcmin
- With mounted stepper motor ZSS 32 to 52

Dimensioned drawings and further information  
on request

**EU Directives and CE**

The phytron stepper motors type ZSS 19 to 43 (42 V design voltage) are not marked CE, because they are not subject to the Low Voltage Directive.

ZSS 41/1, 42/1, 43/1, 52 and 57 (100 V design voltage) are marked CE. When wired correctly, these motors fulfill the requirements of the Low Voltage Directive and comply with EN 60034-1 European standard.

According to the Machine Directive, the stepper motor is only part of a machine. The machine manufacturer must take appropriate measures to ensure that the entire system fulfills the requirements of the applicable EU Directives.

Information for EMC-compliant cabling is given in the motor connection leaflet<sup>1</sup> and the user's manuals of the control unit.

<sup>1</sup>A motor connection leaflet is enclosed to every delivery of stepper motors. PDF files are available for download from the phytron homepage.

**Ordering Code**

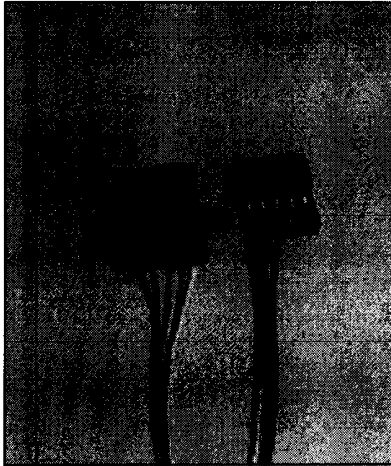
	42 - 1,2 - K1 - FD
Stepper motor series	ZSS
Type <sup>1</sup>	19, 20, 25, 26, 32, 33 41, 42, 43, 41/1, 42/1, 43/1 52, 56, 57
Number of steps	200, 400
Winding	Standard windings
Optional:	
2nd shaft	all types
Encoder	ZSS 25 to 57
Motor brake	ZSS 32 to 57
Heat sink	ZSS 19 to 57
Gear/reduction ratio	GP PLG HD ZSS GSR
Free wire ends	Optional: ZSS 41 to 57 (Standard for ZSS 19 to 33)
	<sup>1</sup> ZSS 41/1 to 57: with earthing screw

# Allegato A2

Product Bulletin OPB770T  
January 2006



## Photologic® Reflective Object Sensors Types OPB770T, OPB771T, OPB772T, OPB773T



### Features

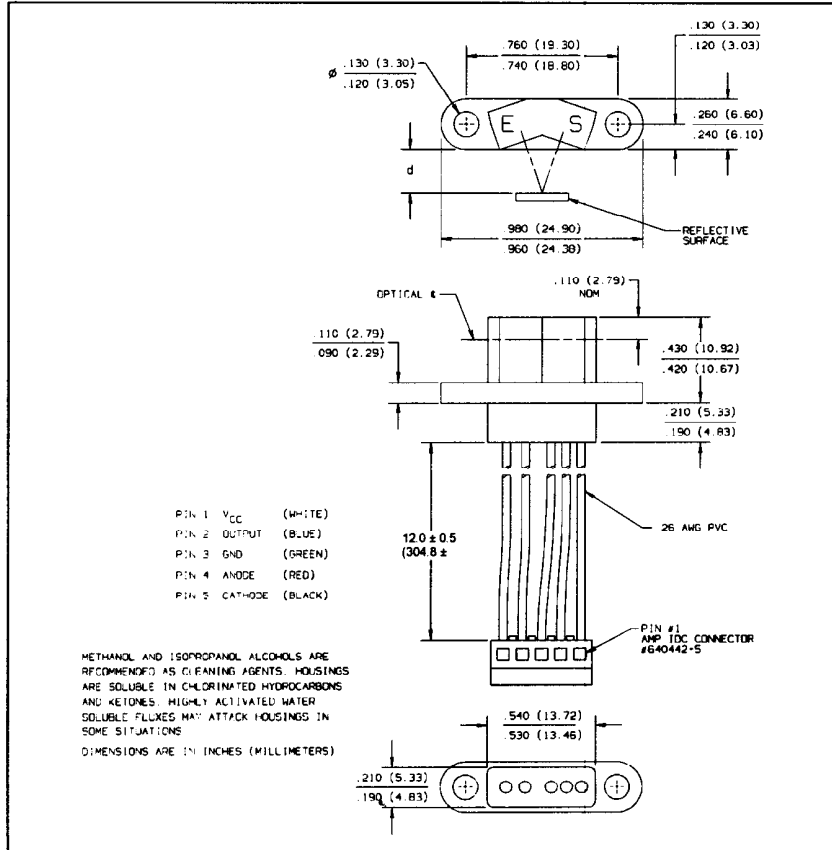
- Choice of mounting configurations
- Choice of output configurations

### Description

The OPB770T series of reflective assemblies feature Photologic® output. This electrical output can be specified as either TTL Totem Pole or TTL Open Collector. Either may be supplied with inverter or buffer output polarity. All have the added stability of a built-in hysteresis amplifier.

### Mounting Options

- OPB760N series PC board mount, without mounting tabs
- OPB760T series PC board mount, with two mounting tabs
- OPB770N series wire leads with connector, without mounting tabs
- OPB770T series wire leads with connector, with two mounting tabs



### Absolute Maximum Ratings (T<sub>A</sub> = 25° C unless otherwise noted)

Supply Voltage, V <sub>CC</sub> (Not to exceed 3 sec.)	10 V
Storage Temperature Range	-40° C to +85° C
Operating Temperature Range	-40° C to +70° C
Input Diode Power Dissipation	100 mW <sup>(1)</sup>
Output Photologic® Power Dissipation	200 mW <sup>(2)</sup>
Total Device Power Dissipation	300 mW <sup>(3)</sup>
Voltage at Output Lead (Open Collector Output)	35 V
Diode Forward D.C. Current	40 mA
Diode Reverse D.C. Voltage	3 V

### Notes:

- (1) Derate linearly 2.22 mW/° C above 25° C.
- (2) Derate linearly 4.44 mW/° C above 25° C.
- (3) Derate linearly 6.66 mW/° C above 25° C.
- (4) The OPB770T thru OPB773T series are terminated with 12 inches of 7 strand 26 AWG, UL1429 insulated wire on each terminal. A standard AMP No. 640442-5 connector has been attached to the lead wires to ease connection to wire harnesses.
- (5) Normal application would be with light source blocked, simulated by I<sub>F</sub> = 0 mA.
- (6) Tested at d = 0.080" from a 90% diffuse white test surface.
- (7) Tested at d = 0.080", 0.150" and 0.220" from a 90% diffuse white test surface. Reference: Eastman Kodak, Catalog #1257795.
- (8) Tested at d = 0.080", 0.150" and 0.220" from a 5% diffuse black test surface.
- (9) All parameters tested using pulse technique.



For RoHS compliant devices add "Z" to the end of the part number: OPB770TZ

Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (972) 323-2200 Fax (972) 323-2396

# Types OPB770T, OPB771T, OPB772T, OPB773T

Electrical Characteristics ( $T_A = -40^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$  unless otherwise noted)

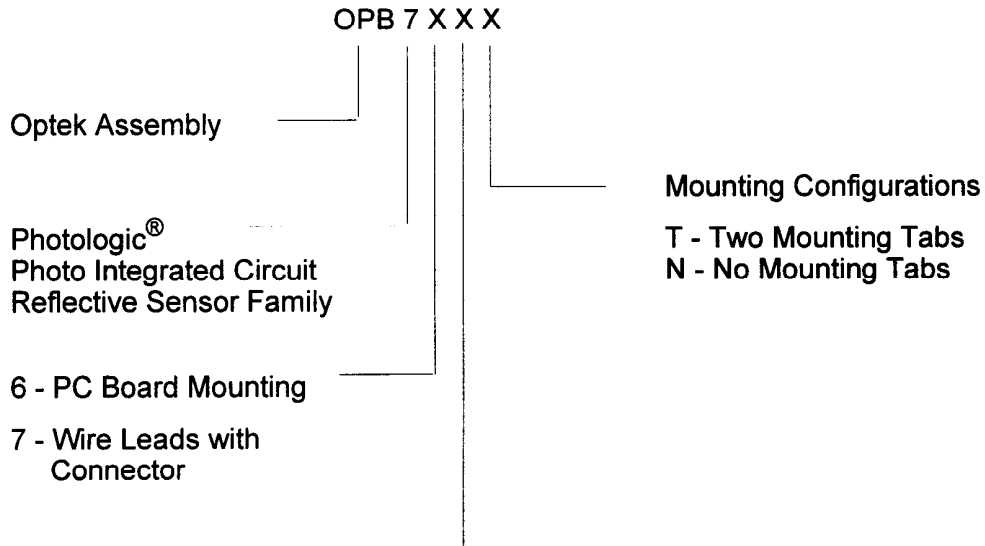
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
<b>Input Diode</b>						
$V_F$	Forward Voltage			1.8	V	$I_F = 40\text{ mA}$ , $T_A = 25^{\circ}\text{C}$
$I_R$	Reverse Current			100	$\mu\text{A}$	$V_R = 2\text{ V}$ , $T_A = 25^{\circ}\text{C}$
<b>Output Photologic<sup>®</sup> Sensor</b>						
$V_{CC}$	Operating D.C. Supply Voltage	4.75		5.25	V	
$I_{CCL}$	Low Level Supply Current: Buffered Totem-Pole Output Buffered Open-Collector Output			10	mA	$V_{CC} = 5.25\text{ V}$ , $I_F = 0\text{ mA}^{(5)(6)}$ Output Open
	Inverted Totem-Pole Output Inverted Open-Collector Output			10	mA	$V_{CC} = 5.25\text{ V}$ , $I_F = 25\text{ mA}^{(6)}$ Output Open
$I_{CCH}$	High Level Supply Current: Buffered Totem-Pole Output Buffered Open-Collector Output			10	mA	$V_{CC} = 5.25\text{ V}$ , $I_F = 25\text{ mA}^{(6)}$ Output Open
	Inverted Totem-Pole Output Inverted Open-Collector Output			10	mA	$V_{CC} = 5.25\text{ V}$ , $I_F = 0\text{ mA}^{(5)(6)}$ Output Open
$I_{OH}$	High Level Output Voltage: Buffered Open-Collector Output			100	$\mu\text{A}$	$V_{CC} = 4.75\text{ V}$ , $V_{OH} = 30\text{ V}$ $I_F = 25\text{ mA}$ , $T_A = 25^{\circ}\text{C}$
	Inverted Open-Collector Output			100	$\mu\text{A}$	$V_{CC} = 4.75\text{ V}$ , $V_{OH} = 30\text{ V}$ , $I_F = 0\text{ mA}$ , $T_A = 25^{\circ}\text{C}$
$I_F(+)$	LED Positive-Going Threshold Current			25	mA	$V_{CC} = 5\text{ V}$ , $T_A = 25^{\circ}\text{C}^{(7)}$
$I_F(+)/I_F(-)$	Hysteresis					$V_{CC} = 5\text{ V}^{(7)}$
$I_{OS}$	Short Circuit Output Current: Buffered Totem-Pole Output	-15		-100	mA	$V_{CC} = 5.25\text{ V}$ , $I_F = 25\text{ mA}^{(6)}$ Output = GND
	Inverted Totem-Pole	-15		-100	mA	$V_{CC} = 5.25\text{ V}$ , $I_F = 0\text{ mA}^{(6)}$ Output = GND
$V_{OL}$	Low Level Output Voltage: Buffered Totem-Pole Output Buffered Open-Collector Output			0.4	V	$V_{CC} = 4.75\text{ V}$ , $I_{OL} = 12.8\text{ mA}$ $I_F = 0\text{ mA}^{(5)(6)}$
	Inverted Totem-Pole Output Inverted Open-Collector Output			0.4	V	$V_{CC} = 4.75\text{ V}$ , $I_{OL} = 12.8\text{ mA}$ $I_F = 25\text{ mA}^{(5)(6)}$
$V_{OL}$	Low Level Output Voltage: Buffered Totem-Pole Output Buffered Open-Collector Output			0.4	V	$V_{CC} = 4.75\text{ V}$ , $I_{OL} = 12.8\text{ mA}$ $I_F = 30\text{ mA}^{(8)}$
$V_{OH}$	High Level Output Voltage: Buffered Totem-Pole Output	2.4			V	$V_{CC} = 4.75\text{ V}$ , $I_{OH} = -800\text{ }\mu\text{A}$ $I_F = 25\text{ mA}^{(6)}$
	Inverted Totem-Pole Output	2.4			V	$V_{CC} = 4.75\text{ V}$ , $I_{OH} = -800\text{ }\mu\text{A}$ $I_F = 0\text{ mA}^{(5)(6)}$
$V_{OH}$	High Level Output Voltage: Inverted Totem-Pole Output Inverted Open-Collector	2.4			V	$V_{CC} = 4.75\text{ V}$ , $I_{OH} = -800\text{ }\mu\text{A}$ $I_F = 30\text{ mA}^{(8)}$

REFLECTIVE OBJECT CHARACTER

Optek reserves the right to make changes at any time in order to improve design and to supply the best product possible.  
Optek Technology, Inc. 1215 W. Crosby Road Carrollton, Texas 75006 (972) 323-2200 Fax (972) 323-2396



## PART NUMBER GUIDE



### Electrical Specification Variations

- 0 - Buffered Totem-Pole Output
- 1 - Buffered Open-Collector Output
- 2 - Inverted Totem-Pole Output
- 3 - Inverted Open-Collector Output



## LPG23 Linear Polarisator / Linear Polarizer

Der LPG 23 Linear Polarisator ist nur im Verbund mit optisch hochwertigen, spannungsarmen Gläsern verfügbar. Er bietet das höchste, mit Polarisatoren auf Folienbasis erreichbare Polarisationsvermögen und Kontrastverhältnis. Typischerweise ein Filter zur Anwendung in Mikroskopen.

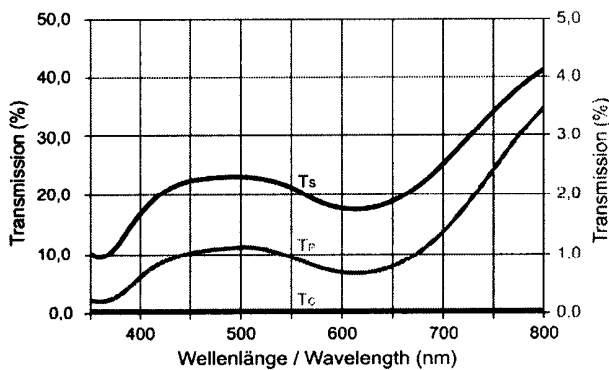
*The LPG23 linear polarizer provides the highest contrast and the highest polarization possible in any PVAL application by being sandwiched between stress free optical glass. The typical application for the LPG23 is in microscopes, for example.*

### Spezifikation / Specification

Wert / Item	Einheit / Unit	Wert / Value
Transmission / Transmission Single, TS	%	23+/-2 (400-700nm)
Transmission / Transmission Parallel, TP*	%	11
Transmission / Transmission Crossed, TC*	%	<0,0001
Kontrast / Extinction Ratio	-	>1:100.000
Polarisationsgrad / Polarizing efficiency, P	%	> 99,99

### Haltbarkeit / Durability

Wärme Stabilität / Heat resistance	-	70°x240h
Kälte Stabilität / Cold resistance	-	-20°x240h
Feuchte Stabilität / Humidity resistance	-	40°x90%RHx240h
Änderung der Transmission / Transmission variance	%	< +/-10



#### Abmessung:

Bis 70x70mm  
 Dicken: 2,6mm

Weitere Abmessungen siehe Preisliste

#### Dimension:

Up to 70x70mm  
 Thickness: 2,6mm

For more information please check our pricelist.

Ts = Transmission eines Polarisators / single polarizer

TP = Transmission zweier Polarisator parallel / two parallel polarizers

TC = Transmission zweier Polarisatoren gekreuzt / two crossed polarizers

\*Typische, gemessene Werte, keine Garantiewerte / \*numbers are typical and are not guaranteed

Technische Daten können sich ändern / Subject to technical change without notice



A010DE