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INDRAMAT PERMANENT MAGNET DIRECT-CURRENT SERVO DRIVES LINE MDC 5

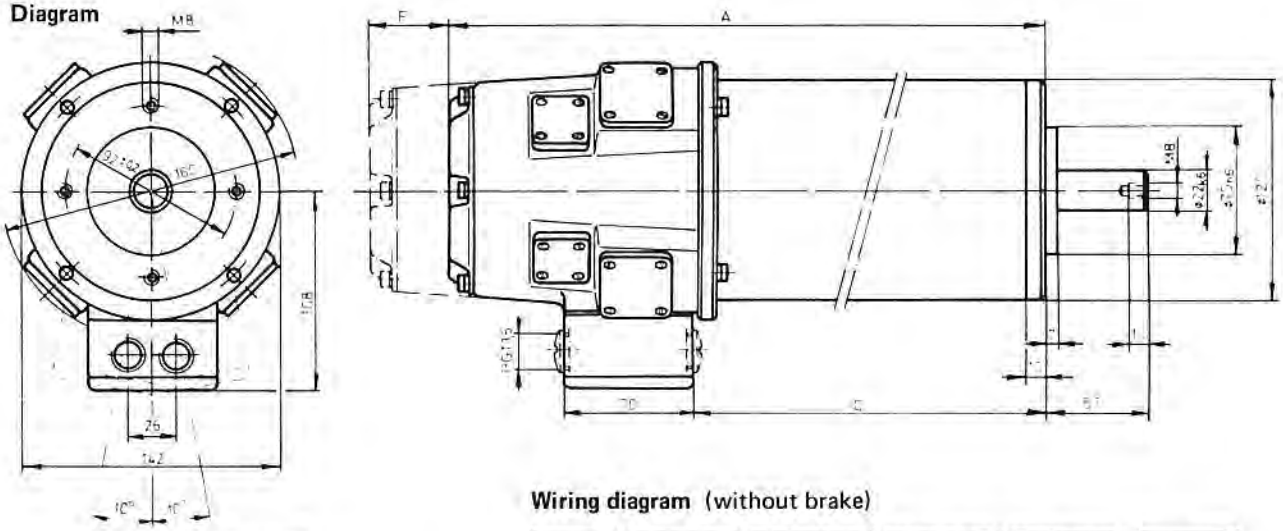
The MDC 5 INDRAMAT direct-current servo drives are quickly responding direct-current control drives with torques from 2.5 to 7.5 Nm and useful speeds up to 2 000 rpm.

The MDC 5 motor line has been developed for operation with INDRAMAT thyristor or SELEKTOR control amplifier, and in particular as a fully controllable feed drive for numerically controlled machine tools.

With the exception of the face-end shaft penetrations, the drives are designed in protective system IP 65 for use in the chip area of machine tools.

As additional feedbacks for position control, built-in incremental transducers up to 2 000 pulses (including quadruplication) per revolution are supplied.

Diagram



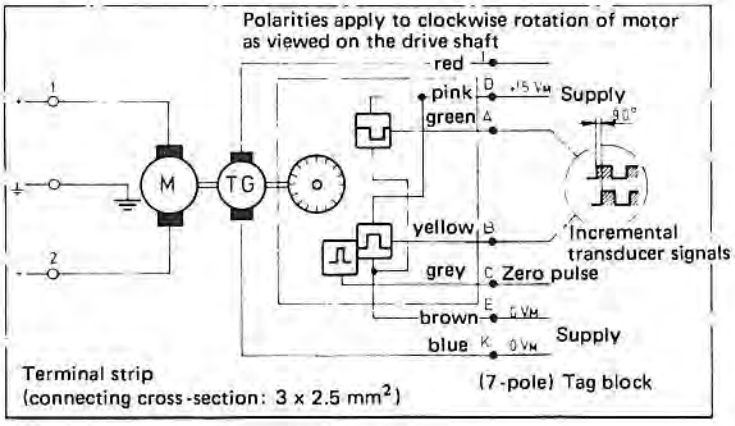
Motor dimensions without additional feedback

Motor size	A	C
MDC 5.1	259	128
MDC 5.2	325	194
MDC 5.3	391	260

Additional feedback: Incremental transducer

Pulses per revolution including quadruplication	Dimension F
1200	44
2000	44

Wiring diagram (without brake)



Design features:

The field
is a four-pole field made of permanent magnets of a proven material.

The rotor
is iron-doped and has been optimized in accordance with the field properties. It has a high heat capacity for transient overloads.

The rotor bearings
are maintenance-free anti-friction bearings. The face-end flanged bearing is designed for overhung arrangement of straight-toothed spur gears or toothed-belt pulleys.

The tachogenerator
is a four-pole permanent magnet hollow-shaft tachogenerator with a high e.m.f. and a low interfering voltage. It has been mounted to the motor shaft with a tensioner so that it is non-positive and absolutely rigid.

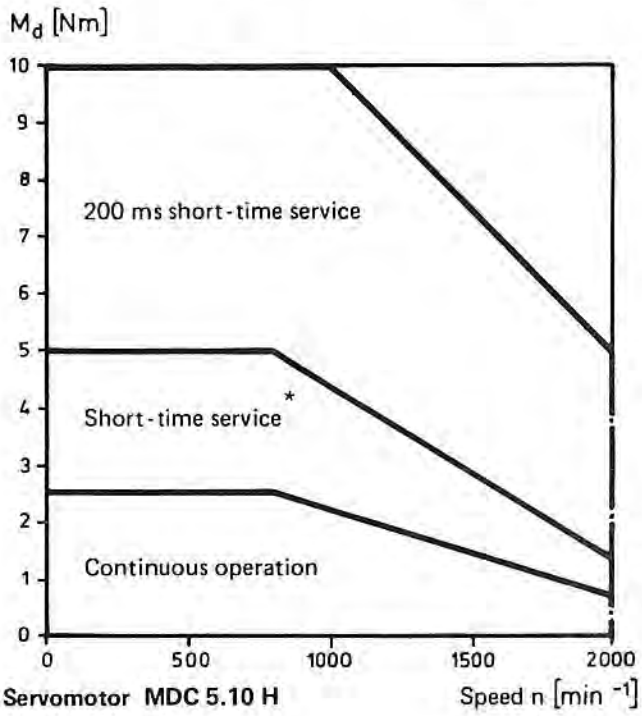
TECHNICAL DATA OF DIRECT-CURRENT SERVOMOTOR AND TACHOGENERATOR

MDC 5 Direct-Current Servomotor	Symbol and unit	Motor size		
		10. H	20. F	30. D
Permissible continuous effective current	$I_{eff.\ zul.}$ (A)	10,75	13,5	20
Maximum peak pulse current	$\hat{I}$ (A)	50	70	100
Torque constant	Km (Nm/A)	0,27	0,4	0,4
Voltage constant (e.m.f.)	C_ω (Vs/rad)	0,27	0,4	0,4
Armature resistance at 20°C	Ra (Ω)	0,5	0,43	0,2
Armature inductance	LA (mH)	4,2	2,4	1,2
Rotor moment of inertia	J (kgm^2)	0,003	0,005	0,0075
Mechanical time constant	Tm (ms)	20	14	10
Maximum useful speed	n (min^{-1})	2 000	2 000	2 000
Permissible max. peak voltage	U (V)	170	170	170
Insulation class		F	F	F
Maximum ambient temperature	ϑ (°C)	40	40	40
Thermal time constant	T_{th} (min)	45	60	90
Weight	G (kg)	10,5	18,5	26,5
Short-circuit torque	Md_k (Nms)	0,145	0,37	0,8
Tachogenerator				
Voltage constant (e.m.f.)	C_ω (Vs/rad)	0,317 + 10 %		
Armature resistance at 20°C	R_A (Ω)	60		
Minimum terminating resistance	R_L (Ω)	15 k		
VSWR	(%)	0,5		

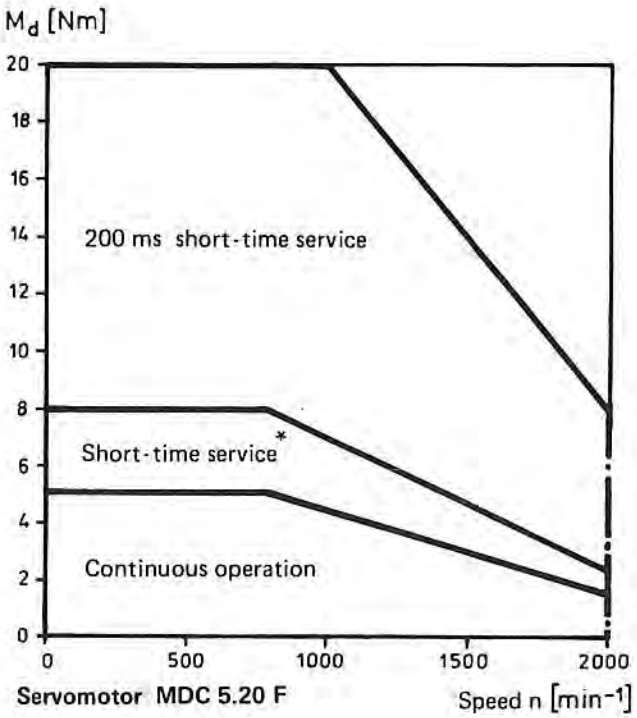
Excessive transient torques with correspondingly reduced duty cycle are permissible up to a maximum cycle time of 15 minutes in accordance with the following table.

Servomotor, Type	40	60	80	100	duty cycle %
MDC 5.10	4	3,25	2,8	2,5	Nm
MDC 5.20	8	6,5	5,6	5,0	Nm
MDC 5.30	12	9,7	8,4	7,5	Nm

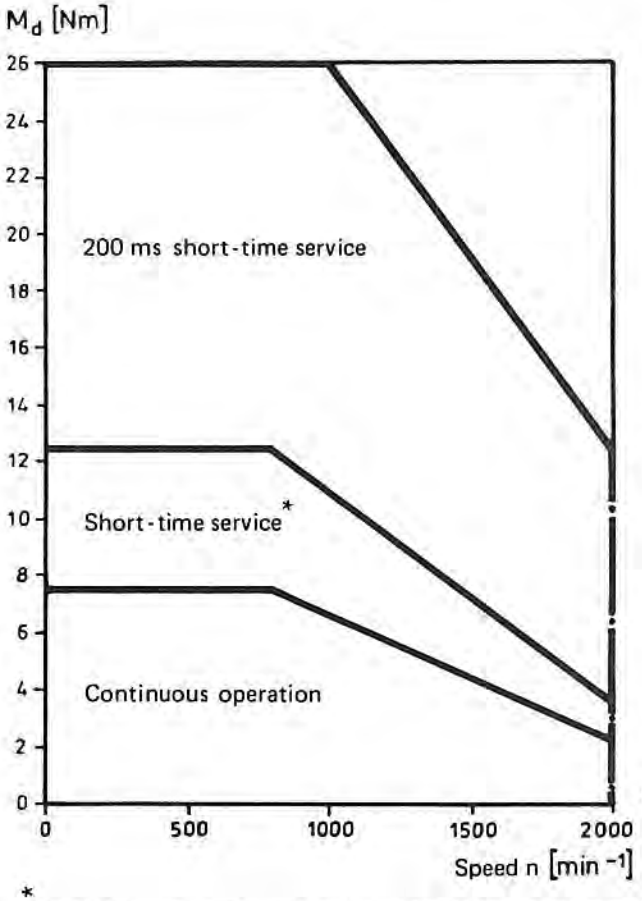
Operating Characteristics of MDC 5 Direct-Current Servomotors with INDRAMAT SELEKTOR Control Amplifier



Servomotor MDC 5.10 H



Servomotor MDC 5.20 F



Servomotor MDC 5.30 D

* (short-time operation, intermittent operation, continuous operation with intermittent loading)

TYPE CODE OF THE DIRECT-CURRENT SERVOMOTOR

Brief name

Quote when ordering: MDC5. 20F / MM – 0 / WI 296 / So...

1. Motor size: (1 ÷ 3)

2. Enclosed design = 0

3. Letter for armature winding:
ω (H; F; D)

4. Connection:

Flange alignment:	Standard design	= M
	Other	= S
Shaft end:	Standard design	= M
	Other	= S

5. Brake:

with brake	= 1 *)
without brake	= 0

6. Additional feedback: *)

6.1 Feedback connection

without (type code ends after 6.)	
second shaft end	= W
sensor gear	= G

6.2 Connected sensor systems

without (type code ends after 6.1 or 6.)	
incremental transducer	= I
other	= S

Number of the additional feedback

(It designates the exact design of the additional feedback and is identical with the Group No. of the relevant design documents. Standard models see page 1).

7. Special model:

This number (So-Nr.) is laid down by the manufacturer. (It is identical with the So-Nr. of the relevant parts list).

*) The servomotors are available with brake (item 5.) or with additional feedback (item 6.). Both are standard.

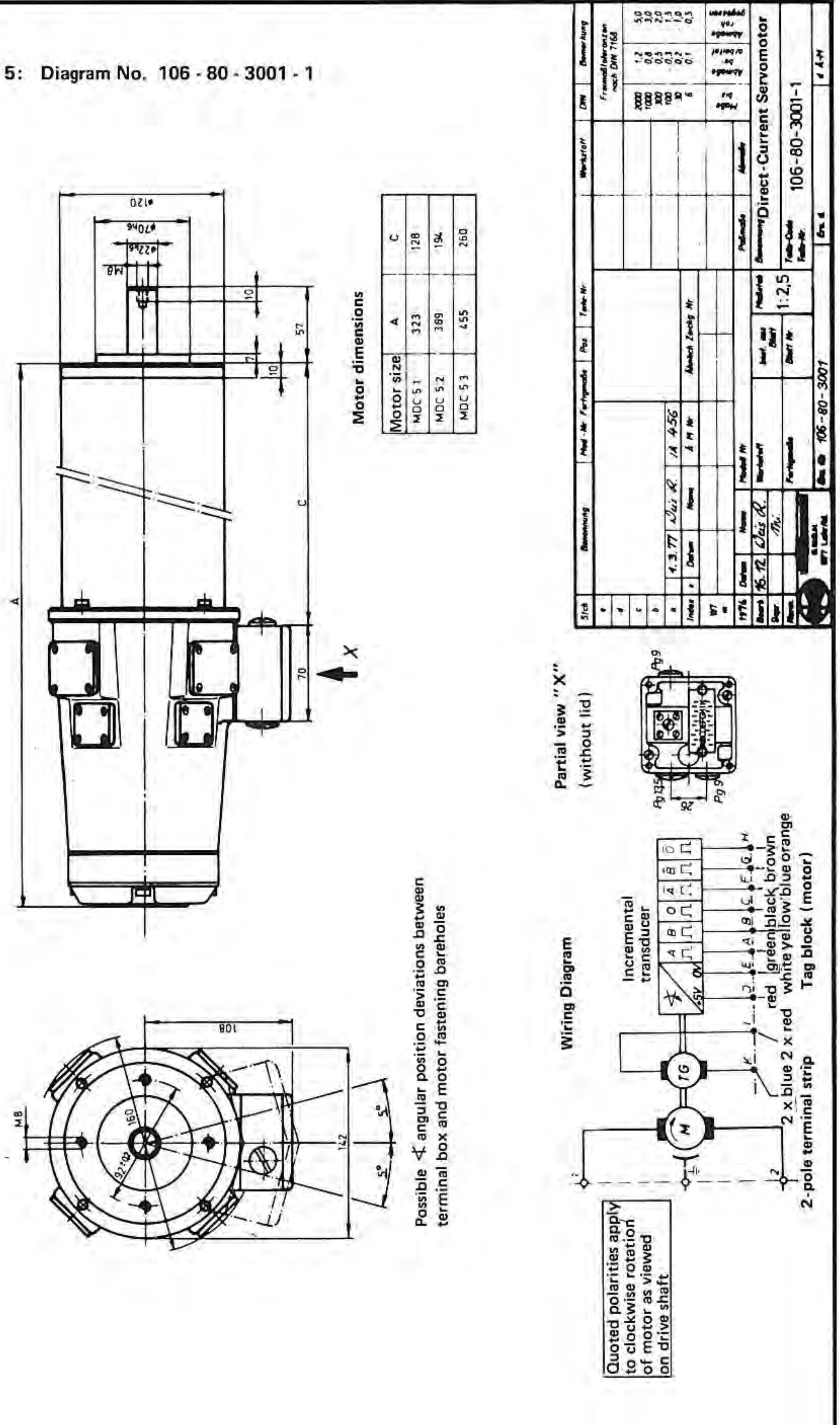
Supplementary systems

The INDRAMAT drive system is supplemented by proven electronic controls and control assemblies which allow an easy solution of recurrent drive problems.

Standard solutions are e.g.

- precision feed by means of preset frequency
- positioning
- position synchronization control
- remote position transmission
- computer control

2. Servomotor MDC 5: Diagram No. 106 - 80 - 3001 - 1



Motor dimensions

Motor size	A	C
MDC 5.1	323	128
MDC 5.2	389	194
MDC 5.3	455	260

3. Replacement Instructions for Incremental Transducer

The following text should be read in connection with Assembly Drawing No. 106 - 80 - 1501.

3.1 Disassembly of the old incremental transducer

3.1.1 Loosen screws **1** and **2**. Remove lid with attached spacer **3** and terminal box lid **4**. Incremental transducer **5** and cable connections are now accessible.

3.1.2 Rotate motor shaft until the slot of clutch plate **14** is visible through borehole **17**. Retain motor shaft in this position until the replacement process has been finished.

3.1.3 Unsolder 8 transducer control wires **6** from tag block connections A – H **7**; twist with each other (strip anew if necessary) and resolder to auxiliary cable **8**.

3.1.4 Remove tag block fastening nuts **9** and tilt tag block **7** up so that the connection cables in the transparent guard **10** are exposed.

3.1.5 Remove screws **11** and carefully pull transducer **5** with plate **12** back until transducer control wires **6** can be unsoldered from auxiliary cable **8**.

(**Note:** Auxiliary cable **8** must still be seizable from the terminal box side so that the new transducer cable can be passed through to tag block **7**).

3.1.6 Unsolder auxiliary cable **8**.

3.1.7 Loosen headless screws **13**, carefully withdraw dog plate **14** from the transducer shaft (use extractor to avoid damage to transducer bearings) and disconnect incremental transducer **5** from plate **12** by removing screws **15**.

3.2 Assembly of the new incremental transducer

3.2.1 Fasten incremental transducer **5** on plate **12** by means of screws **15**. Fastening of dog plate **14** on the transducer shaft (take care to assure flush fit of face ends of plate collet and shaft) is done by tightening (T = 1.3 Nm) the two headless screws **13** which are then secured in position by a dot of varnish.

3.2.2 Strip control wires **6** of the transducer cable, twist with each other and solder to the end of auxiliary cable **8** that projects from the motor.

3.2.3 Insert plate **12** with transducer **5** into the motor while at the same time carefully pulling auxiliary cable **8** to the front and engaging dog plate **14** in accordance with the following instructions and the partial view "X" in the assembly drawing:

Insert plate **12** with transducer **5** into the motor case so that slot **18** of dog plate **14** is visible through borehole **17** (Position A).
Dog plate **18** which is now in contact with the tip of tappet **20** is turned clockwise with a screw driver against the spring resistance of spring rod **19** until tappet **20** will engage in slot **18** through slight axial pressure of the transducer (Position B).

3.2.4 Fasten plate **12** with screws **11** in the motor case. Unsolder auxiliary cable **8** and solder control wires **6** (strip anew if necessary) to tag block **7** in accordance with the wiring diagram.

4. Instructions for Disassembly and Assembly of the Tacho Armature

Note:

Take care to avoid damaging the winding when working on the tacho armature. It is neither admissible to loosen the field magnets of the tachogenerator in the yoke, since this will cause neutral plane displacement which cannot easily be corrected.

4.1 Disassembly of the tacho armature

4.1.1 Remove tacho carbon brush **21** and mark separately so that subsequent assembly will be in the same holder and in the same position. (See also page 9).

4.1.2 Remove clutch flange **22** by unscrewing the two M5 x 12 countersunk screw **26**.

4.1.3 Screw tie rod into the empty M5 boreholes to pull tacho armature **23** from the shaft. Use armature shaft **25** as a support to extract tacho armature **23**.

4.2 Assembly of the tacho armature

4.2.1 Place new (!) clearance ring **24** on armature shaft **25**.
(Each clearance ring can only be used once).

4.2.2 Place tacho armature **23** on shaft **25** and push as far as the stop with the aid of an M5 threaded rod screwed into the end of armature shaft **25**.

4.2.3 Insert carbon brushes **21**. Adhere to instructions on page 9.

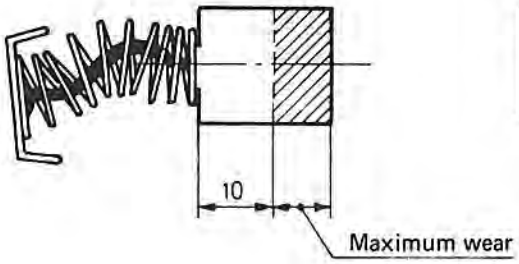
5. Inspection and Replacement of Carbon Brushes

The carbon brushes of both motor and tachogenerator are subject to wear.
They require to be checked at regular intervals for smooth run, wear and spring tension and must be replaced if approaching the wear limits depicted below.

When inspecting the carbon brushes make sure that each brushes is reassembled in the same holder and in the same position.
Make sure that the sealing caps are located properly and tightly on the holders so that a perfect contact between spring collar and holder is warranted.

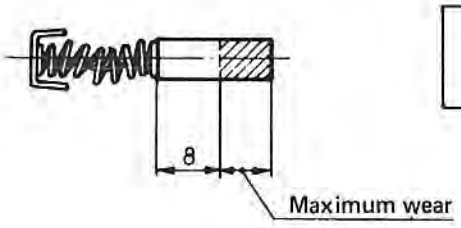
Carbon brushes will always have to be replaced in complete sets. Only the original qualities should be used.

Motor carbon brush No. 106 - 69 - 4215



Inspection
every 6 months

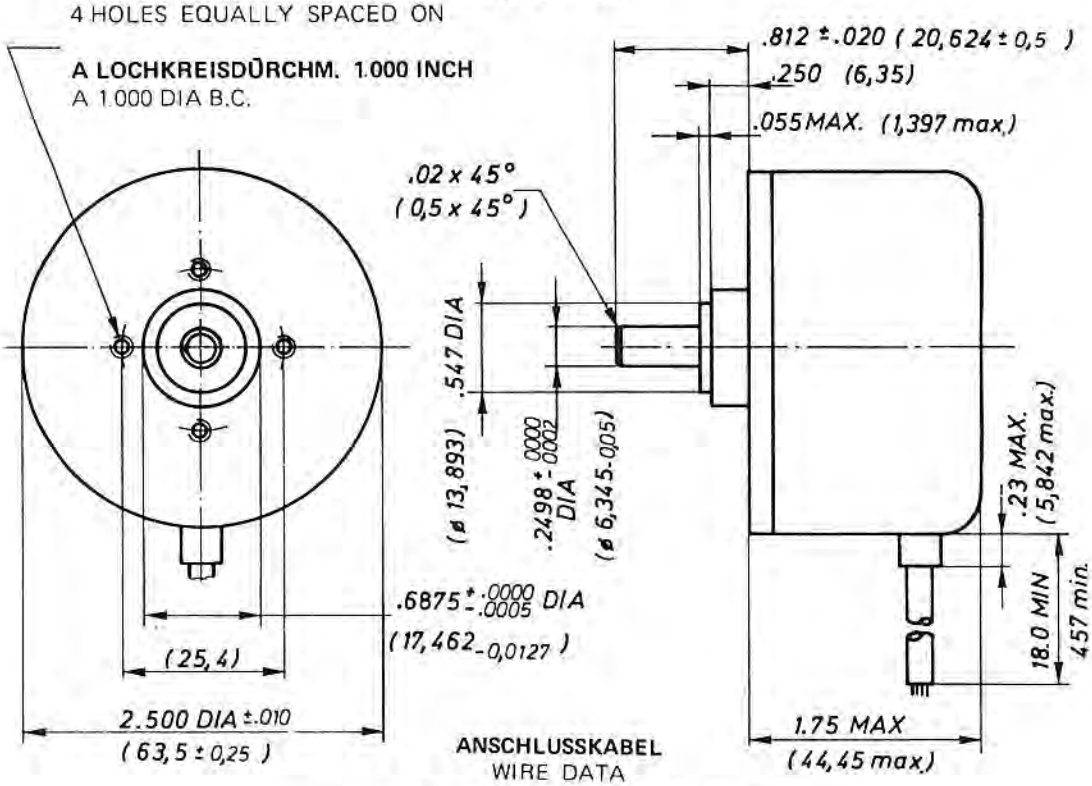
Tacho carbon brush No. 105 - 251 - 4207



Inspection
every 12 months

7. Maß- und Datenblatt Inkrementalgeber

7.1 Typenbezeichnung: HBI 25 – 1250 G7 – E



ANSCHLUSSKABEL
WIRE DATA

FARBE COLOR	**FUNKTION** FUNCTION
GRÜN GREEN	**KANAL 'A'** CHANNEL 'A'
GELB YELLOW	**KANAL 'B'** CHANNEL 'B'
SCHWARZ BLACK	**NULLIMPULS** ZERO INDEX
ROT RED	**+5 V** +5 VDC
WEISS WHITE	**ERDE** GND
SCHIRM SHIELD-(DRAIN)	**GEHÄUSE** CASE GND
BLAU BLUE	**KANAL 'A'** CHANNEL 'A'
BRAUN BROWN	**KANAL 'B'** CHANNEL 'B'
ORANGE ORANGE	**NULLEITER** ZERO

7.3.16	Lichtquelle, Lebensdauer *Illumination Source, Life*	100 000 Stunden *100 000 hours*
7.3.17	Drehrichtung *Shaft Rotation*	beliebig *Continuous and reversible*
7.3.18	Einbaulage *Mounting Position*	beliebig *any*
7.3.19	Wellenbelastung axial *Shaft Loading, Axial*	*2.0 lbs. max.*
7.3:20	Wellenbelastung radial *Shaft Loading, Radial*	*3.0 lbs. max.*

7.4 Elektrische Charakteristik
Electrical characteristics

7.4.1 Eingang
Input

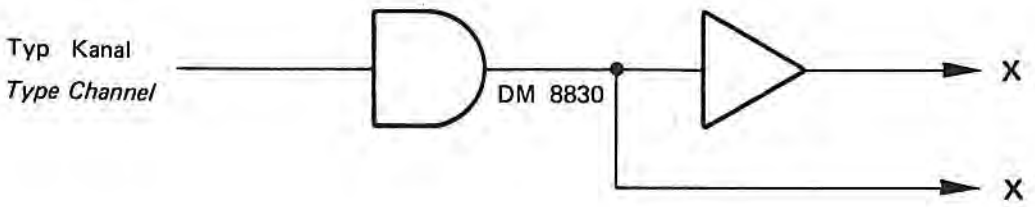
7.4.1.1 Stromversorgung
Power Input

Spannung *Voltage*	zul. Regelabweichung *Required Regulation*	Maximal Strom *Maximum Current*
+ 5 VDC	± 5 %	200 ma

7.4.2 Ausgang: Logik Pegel
Output: Logic Levels

7.4.2.1 Ausgang Signal-Amplitude: Entspr. National DM 8830
Output Signal Amplitude: Per National DM 8830

7.4.2.2 Ausgangsschaltung: Leitungstreiber
Output Circuit Configuration: Line Driver



7.4.3 Arbeitsgeschwindigkeit
Operating Speed

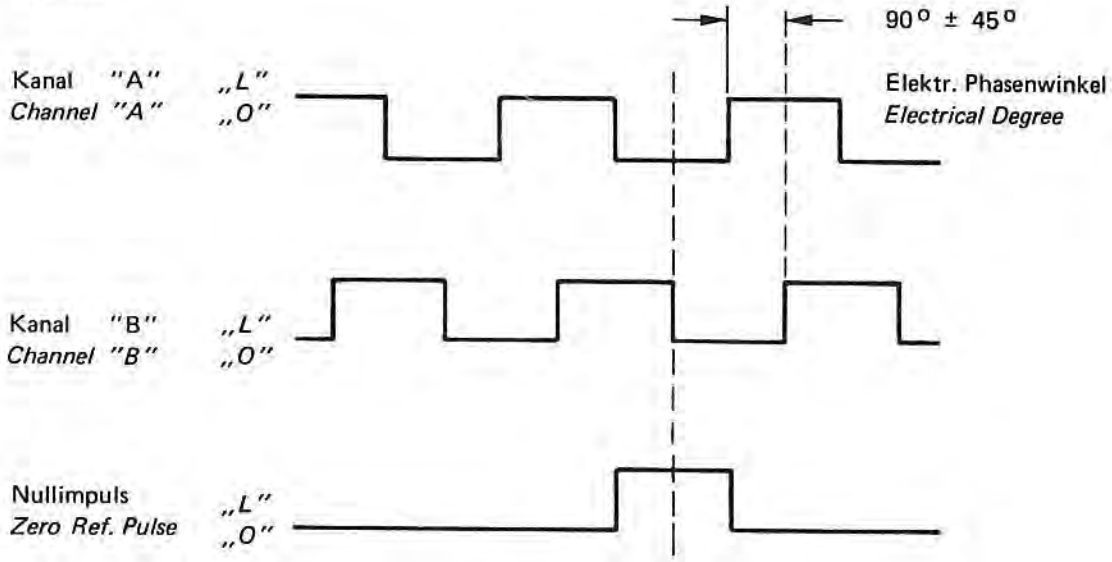
$\frac{100\ kHz}{Zykl./360^o} \times 60 =$ UPM max. Signal

$\frac{100\ kHz}{Cycle/360^o} \times 60 =$ RPM Max. Data

$\frac{100\ kHz}{Zykl./360^o} \times 60 =$ UPM max. Nullimpuls

$\frac{100\ kHz}{Cycle/360^o} \times 60 =$ RPM Max. Zero

7.5 Genauigkeit
Accuracy



Bei Drehrichtung der Welle im Uhrzeigersinn
C.W. Rotation of shaft as viewed from shaft end.

7.6 Umweltbedingungen
Environment

7.6.1	Temperatur, Betrieb *Temperature, Operating*	0 °C bis +80 °C *0 °C to +80 °C*
7.6.2	Temperatur, Lagerung *Temperature, Storage*	−25 °C bis +90 °C *−25 °C to +90 °C*
7.6.3	Schock *Shock*	50 G für die Dauer von 11 ms *50 Gs for 11 ms duration*
7.6.4	Vibration *Vibration*	5 bis 20.00 Hz mit 20 G *5 to 20.00 Hz a 20 Gs*
7.6.5	Feuchtigkeit *Humidity*	bis 98% relative Luftfeuchtigkeit *up to 98% RH*