

PRODUCT BROCHURE - RESOLVERS
QUALITY COMBINED WITH HIGH VERTICAL INTEGRATION



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ABOUT US

LTN Servotechnik GmbH is a manufacturer of customized transmission and feedback systems located in the south of Munich. For over 40 years we have continuously specialised in the development, design and series manufacture of components for apparatus, machinery and plant engineering customers worldwide.

Our product range includes slip rings for power, signal and data, resolvers for open & closed-loop control tasks and rotary joints for fibre-optic information systems. Our product portfolio are characterised by extraordinary diversity.



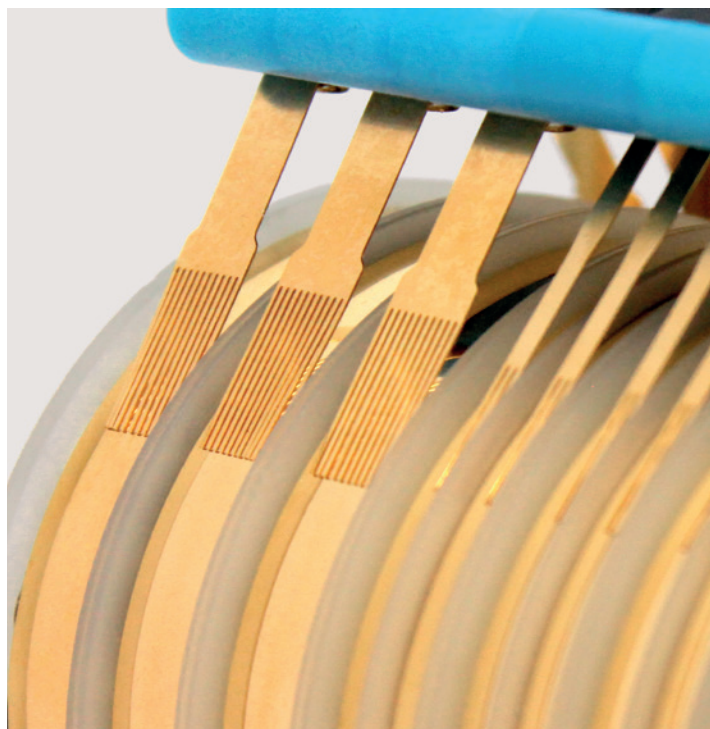
SLIP RINGS

Slip rings are electromechanical components which allow electrical power, signal and data transmission between stationary and rotating systems. The spectrum ranges from just a few mV or mA to many hundreds A and few thousand V. Our slip ring systems withstand harsh environmental influences such as corrosive, salty air or severe vibration. LTN slip ring systems are found in many electrical machines and ensure the reliable functionality of entire machine systems.

LTN slip rings meet all the requirements for error-free transmission of real time fieldbus systems. Of course, all our Fast, Gigabit and 10 Gigabit Ethernet slip rings are certified according to TIA-568 and EN 50173.

Our components conform to the highest standards of durability, sensitivity and reaction time and are therefore an important part of automation, robotics and all other highly dynamic applications.

In addition, we offer fibre-optic rotary joints for contactless transmission of high data rates.



RESOLVERS

Resolvers convert the angular position of a rotor to two voltages. The absolute position can be represented clearly in this way. Modern resolvers are usually brushless and the information is transmitted through induction. Resolvers provide an absolute signal within a single revolution and therefore do not have to be calibrated after switching on.

Resolvers are used for open and closed-loop control tasks such as electric servo drives, positioning drives and machines with interdependent motors. The robustness and availability of the systems are of central importance. Our brushless resolvers operate without wear and are fail-safe – even in the harshest environmental conditions (e.g. extreme temperatures).

In addition, we offer electrical circuits for evaluating the resolver's analogue output signals. Rotary encoder output signals can be emulated, for example. Using our downstream electronics, the analogue signal can also be digitized.





RESOLVERS

Transmission ratio: 0.3 / 0.5 / 1
 Operating temperature: -55 °C ... +155 °C
 Connection: Leads, cables, clamp terminals and length on request

Stated values are standard. Other configurations, customized versions and resolver combinations are available on request. Combinations consisting of slip rings and resolvers on request.

Type		Min. outer diameter	Max. hollow shaft diameter
Housed	R36	36 mm	11 mm
	R58	58 mm	17 mm
	R71	71 mm	20 mm
Frameless	RE15	36 mm	12 mm
	RE21	52 mm	17 mm
	RE27	72 mm	30 mm
	RE35	90 mm	40 mm
	RE43	110 mm	65 mm

Stated values are standard. Other configurations are available on request.

Max. shaft diameter	Pole pairs	Accuracy	Input current (can vary by types)	Page
16 mm	1 ... 5	$\pm 6' / \pm 10'$	65 mA at 7 V & 5 kHz	8
12 mm	1 ... 5	$\pm 6'$	58 mA at 7 V & 5 kHz	10
12 mm	1 ... 5	$\pm 6'$	47 mA at 7 V & 5 kHz	12
16 mm	1 ..5	$\pm 5' / \pm 6' / \pm 7' / \pm 10'$	58 mA at 7 V & 5 kHz	14
26 mm	1 ... 5	$\pm 4' / \pm 6' / \pm 10'$	47 mA at 7 V & 5 kHz	16
30 mm	1	$\pm 10'$	30 mA at 7 V & 10 kHz	18
40 mm	1 ... 4	$\pm 10'$	48 mA at 7 V & 5 kHz	20
30 mm	1 ... 3	$\pm 20'$	55 mA at 7 V & 5 kHz	22



HOUSED RESOLVER

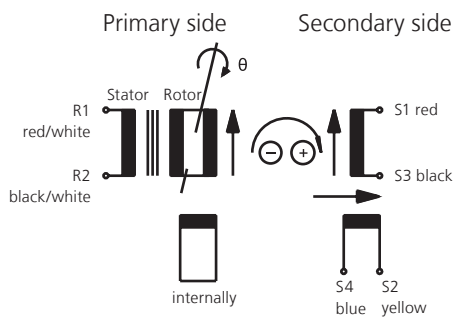
R36

FACTS

- Outer Ø: 36 mm
- Hollow shaft Ø: max. 11 mm
- Length: 16 mm

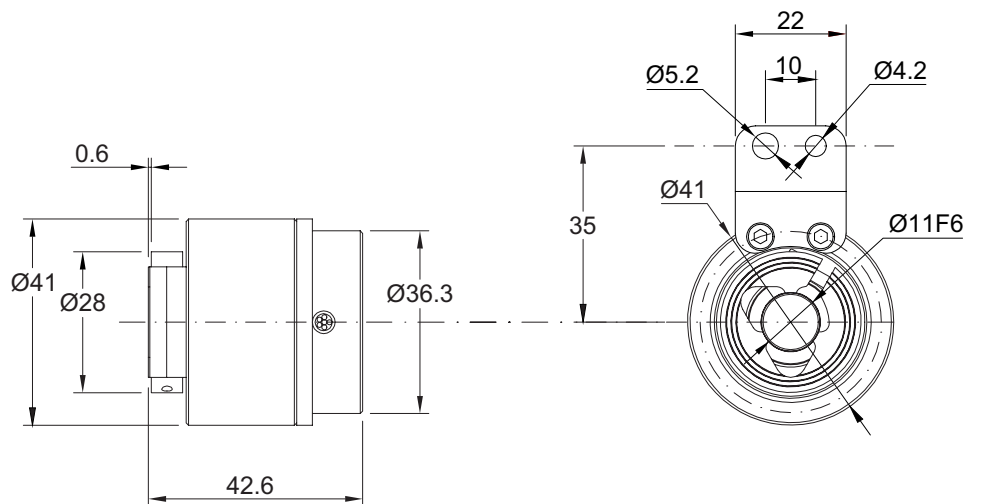


OPERATING PRINCIPLE



Input: $E(R1-R2) = E \cdot \sin(\omega \cdot t)$
 Output: $E(S1-S3) = TR \cdot E(R1-R2) \cdot \cos \theta$
 $E(S2-S4) = TR \cdot E(R1-R2) \cdot \sin \theta$
 TR = Transformation ratio

Positive counting direction:
 Rotor cw as viewed (X →)



ELECTRICAL DATA

Primary side	R1 - R2
Pole Pairs	1
Transformation ratio	0.5 ± 0.05
Input voltage	7 V / 7 V
Input current (typ.)	65 mA / 41 mA
Input frequency	5 kHz / 10 kHz
Phase shift ($\pm 3^\circ$)	$13^\circ/-2$
Null voltage	max. 30 mV
Accuracy	$\pm 10'$, $\pm 6'$ on request
Accuracy ripple	max. 1'
Operating temperature	-40 °C ... +100 °C
Max. permissible speed	5.000 rpm
Hi-pot housing/winding	min. 500 V _{AC}
Hi-pot winding/winding	min. 250 V _{AC}
Rotor / Stator	Completely impregnated



HOUSED RESOLVER

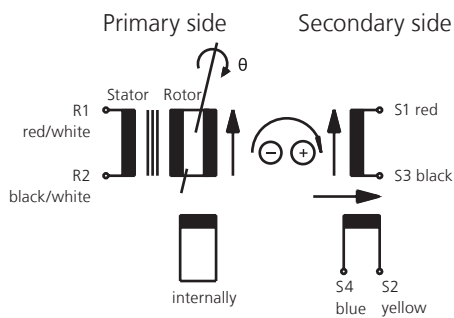
R58

FACTS

- Shaft Ø: max. 12 mm
- Hollow shaft Ø: max. 17 mm
- Outer Ø: 58 mm

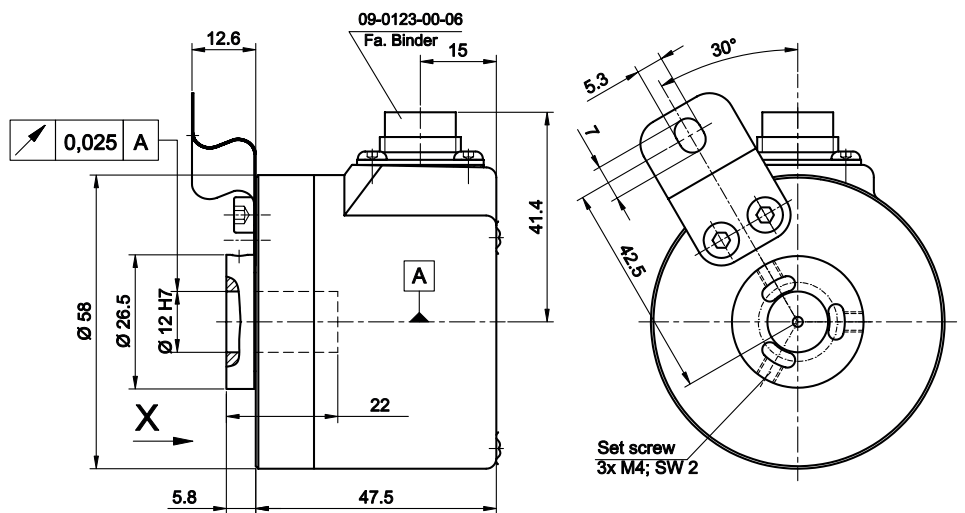


OPERATING PRINCIPLE



Input: $E(R1-R2) = E \cdot \sin(\omega \cdot t)$
 Output: $E(S1-S3) = TR \cdot E(R1-R2) \cdot \cos \theta$
 $E(S2-S4) = TR \cdot E(R1-R2) \cdot \sin \theta$
 TR = Transformation ratio

Positive counting direction:
 Rotor cw as viewed (X →)



ELECTRICAL DATA

Primary side	R1 - R2	R1 - R2
Pole Pairs	1	1
Transformation ratio	0.5 ± 10%	0.5 ± 10%
Input voltage	7 V	7 V
Input current (typ.)	58 mA	36 mA
Input frequency	5 kHz	10 kHz
Phase shift	8° ± 3°	-6° ± 3°
Null voltage	max. 30 mV	max. 30 mV
Impedance		
Zro	75 Ω + j · 98 Ω	110 Ω + j · 159 Ω
Zrs	70 Ω + j · 85 Ω	96 Ω + j · 150 Ω
Zso	180 Ω + j · 230 Ω	245 Ω + j · 400 Ω
Zss	170 Ω + j · 200 Ω	216 Ω + j · 370 Ω
D.C. resistance		
Rotor	40 Ω ± 10% at 20 °C	40 Ω ± 10% at 20 °C
Stator	102 Ω ± 10% at 20 °C	102 Ω ± 10% at 20 °C
Accuracy		
Accuracy ripple	± 6'	± 10'
Operating temperature	max. 1'	max. 1'
Max. permissible speed	-55 °C ... +155 °C (-67 °F ... +311 °F)	-55 °C ... -155 °C (-67 °F ... +311 °F)
Weight rotor/stator	5.000 rpm	5.000 rpm
Hi-pot housing/winding	350 g	350 g
Hi-pot winding/winding	min. 500 V _{AC}	min. 500 V _{AC}
Rotor / Stator	min. 250 V _{AC}	min. 250 V _{AC}
	Completely impregnated	Completely impregnated



HOUSED RESOLVER

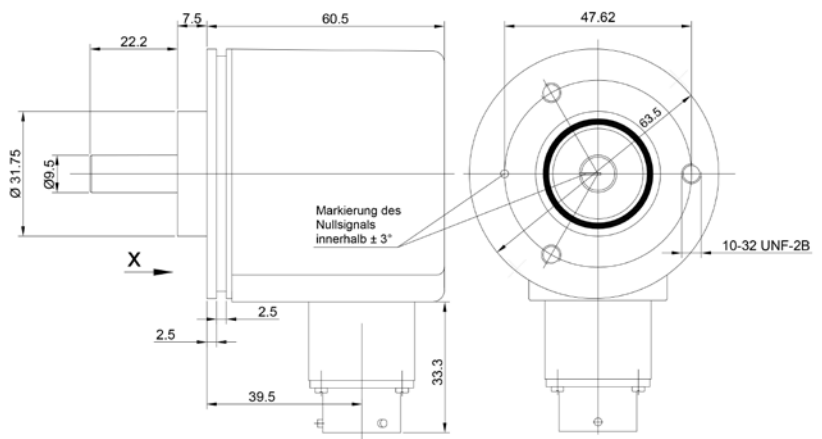
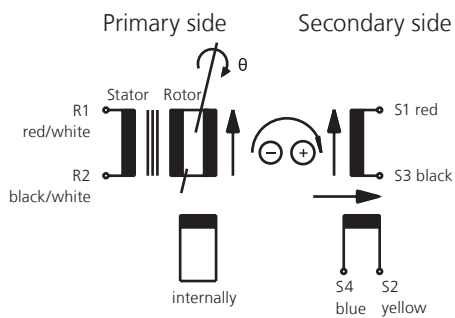
R71

FACTS

- Shaft Ø: max. 12 mm
- Hollow shaft Ø: max. 20 mm
- Outer Ø: 71 mm



OPERATING PRINCIPLE



Input: $E(R1-R2) = E \cdot \sin(\omega \cdot t)$

Output: $E(S1-S3) = TR \cdot E(R1-R2) \cdot \cos \theta$

$E(S2-S4) = TR \cdot E(R1-R2) \cdot \sin \theta$

TR = Transformation ratio

Positive counting direction:

Rotor cw as viewed (X →)

ELECTRICAL DATA

Primary side	R1 - R2	R1 - R2
Pole Pairs	1	1
Transformation ratio	$0.5 \pm 10\%$	$0.5 \pm 10\%$
Input voltage	7 V	7 V
Input current (typ.)	47 mA	35 mA
Input frequency	5 kHz	8 kHz
Phase shift	$8^\circ \pm 3^\circ$	$-3^\circ \pm 3^\circ$
Null voltage	30 mV max.	30 mV max.
Impedance		
Zro	$92 \Omega + j \cdot 120 \Omega$	$110 \Omega + j \cdot 170 \Omega$
Zrs	$82 \Omega + j \cdot 100 \Omega$	$95 \Omega + j \cdot 153 \Omega$
Zso	$154 \Omega + j \cdot 275 \Omega$	$210 \Omega + j \cdot 387 \Omega$
Zss	$140 \Omega + j \cdot 240 \Omega$	$178 \Omega + j \cdot 347 \Omega$
D.C. resistance		
Rotor	$56 \Omega \pm 10\%$ at 20 °C	$56 \Omega \pm 10\%$ at 20 °C
Stator	$53 \Omega \pm 10\%$ at 20 °C	$53 \Omega \pm 10\%$ at 20 °C
Accuracy	$\pm 6'$	$\pm 6'$
Accuracy ripple	10'	10'
Operating temperature	-55 °C ... +155 °C	-55 °C ... +155 °C
Max. permissible speed	5.000 rpm	5.000 rpm
Weight rotor/stator	350 g	350 g
Hi-pot housing/winding	500 V _{AC}	500 V _{AC}
Hi-pot winding/winding	250 V _{AC}	250 V _{AC}
Rotor / Stator	Completely impregnated	Completely impregnated

CABLE LAYOUT

RESOLVER	LEADS
R1	brown
R2	orange
S1	red
S3	black
S2	yellow
S4	green

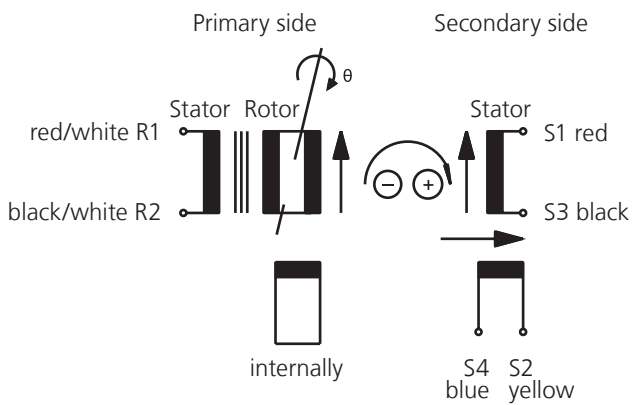


FACTS

- Hollow shaft Ø: max. 12 mm
- Outer Ø: 36 mm
- Length: 16 mm

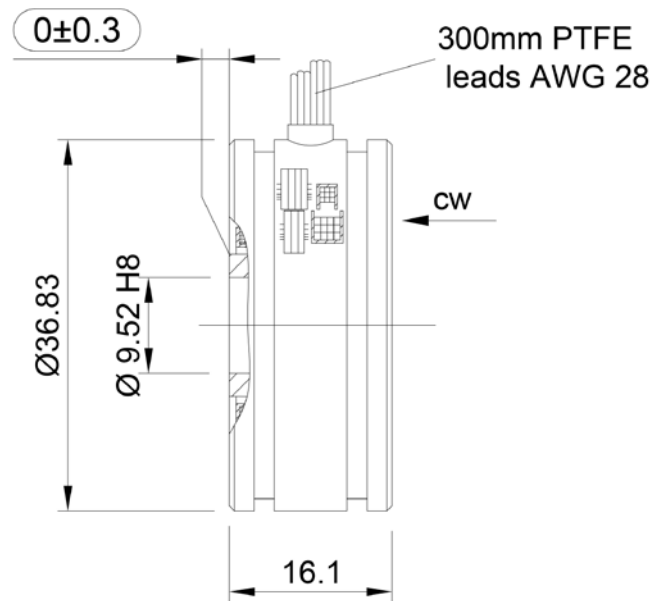


OPERATING PRINCIPLE



Input: $E(R1-R2) = E \cdot \sin(\omega \cdot t)$
 Output: $E(S1-S3) = TR \cdot E(R1-R2) \cdot \cos \theta$
 $E(S2-S4) = TR \cdot E(R1-R2) \cdot \sin \theta$
 TR = Transformation ratio

Positive counting direction: Rotor cw as viewed (X →)



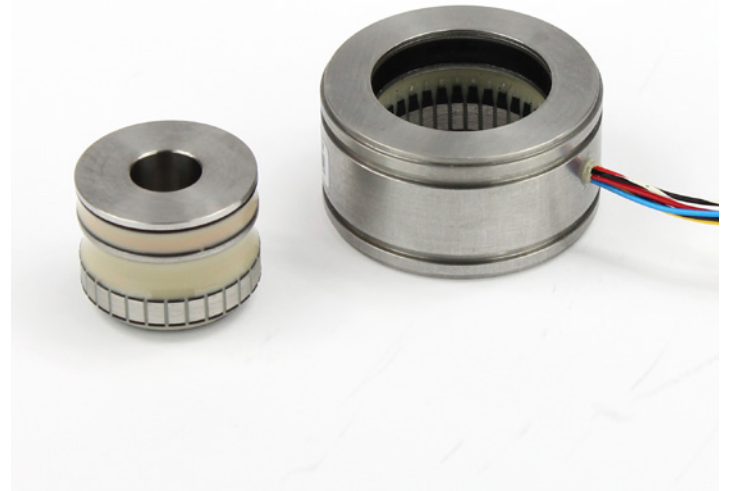
ELECTRICAL DATA

Basic Model	RE 15-1-A15	RE 15-1-K01	RE 15-3-D04	RE 15-4-D04				
Primary Side	R1 - R2							
Pole Pairs	1		3	4				
Transformation ratio	0.5 ± 0.05							
Input voltage	7 V _{rms}	7 V _{rms}	5 V _{rms}	5 V _{rms}	7 V _{rms}	7 V _{rms}	7 V _{rms}	7 V _{rms}
Input current (typ.)	58 mA	36 mA	48 mA	17 mA	50 mA	24 mA	20 mA	10 mA
Input frequency	5 kHz	10 kHz	1 kHz	4.5 kHz	4 kHz	10 kHz	5 kHz	10 kHz
Phase shift (± 3°)	13°	-2°	26°	0°	15°	0°	8°	3°
Null voltage	max. 30 mV							
Accuracy	± 10', ± 4' and ± 6' on request			± 5'	± 7'			
Accuracy ripple	max. 1'			max. 3'				
Operating temperature	- 55 °C ... + 155 °C							
Max. permissible speed	20.000 rpm							
Hi-pot housing/winding	min. 500 V _{AC}							
Hi-pot winding/winding	min. 250 V _{AC}							
Rotor/Stator	Completely impregnated							

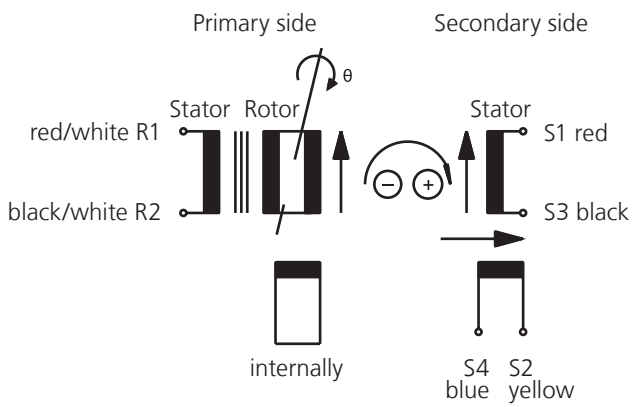


FACTS

- Hollow shaft Ø: max. 17 mm
- Outer Ø: 52 mm
- Length: 26 mm

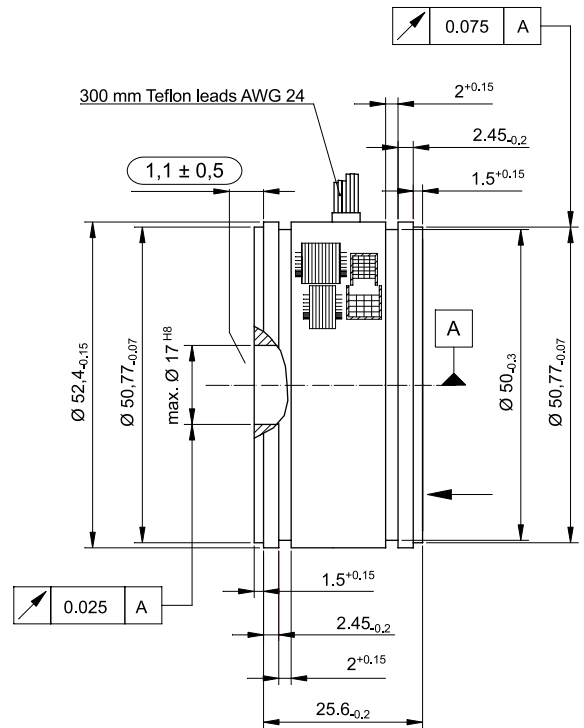


OPERATING PRINCIPLE



Input: $E(R1-R2) = E \cdot \sin(\omega \cdot t)$
 Output: $E(S1-S3) = TR \cdot E(R1-R2) \cdot \cos \theta$
 $E(S2-S4) = TR \cdot E(R1-R2) \cdot \sin \theta$
 TR = Transformation ratio

Positive counting direction: Rotor cw as viewed (X →)



ELECTRICAL DATA

Basic Model	RE 21-1-A01	RE 21-1-A05	RE 21-1-A06	RE 21-1-K05	RE 21-3-A03					
Primary Side	R1 - R2									
Pole Pairs	1				3					
Transformation ratio	1.0 ± 0.1		0.5							
Input voltage	7 V _{rms}	7 V _{rms}	7 V _{rms}	7 V _{rms}	7 V _{rms}	7 V _{rms}	5 V _{rms}	5 V _{rms}	7 V _{rms}	7 V _{rms}
Input current (typ.)	40 mA	30 mA	70 mA	56 mA	45 mA	27 mA	32 mA	17 mA	70 mA	40 mA
Input frequency	5 kHz	10 kHz	5 kHz	7 kHz	5 kHz	10 kHz	1 kHz	4.5 kHz	5 kHz	10 kHz
Phase shift (± 3°)	11°	-7.5°	8°	0°	8°	-8°	26°	-6°	12°	1°
Null voltage	max. 30 mV									
Accuracy	± 10', ± 4' on request									
Accuracy ripple	max. 1'									
Operating temperature	- 55°C ... + 155°C									
Max. permissible speed	20.000 rpm									
Hi-pot housing/winding	min. 500 V _{AC}									
Hi-pot winding/winding	min. 250 V _{AC}									
Rotor/Stator	Completely impregnated									



RESOLVER TO ENCODER CONVERTER

The LTN-REC is a position data converter.

The LTN-REC drives autonomously a resolver sensor and converts its output signals to encoder incremental (square wave) output signals (emulates encoder signals).



SPECIFICATIONS - ENCODER OUTPUT

Output Signals:	incremental A+, A-, B+, B-, Z+, Z-
Resolution:	12 bit / 1024 incremental steps per revolution
Output Voltage Level:	5 V (TTL), 14-36 V (HTL) limited by the supply voltage
Output Current:	100 mA limited, short circuit proof
Dynamic Peak Current:	1500 mA max.
Accuracy:	+/- 0.184° (+/- 11 arcmin)
Repeatability:	+/- 1/4 of incremental step
Rotational speed:	up to 1000 s ⁻¹

RESOLVER OUTPUT / INPUT

Output Ref. Signal:	2.8 V _{rms} 100 mA max. 10 kHz
Input SIN / COS:	1.4 V _{rms} (diff.)
Transformation Ratio:	K = 0.5 +/- 10%

POWER SUPPLY

Supply Voltage (+V _s):	+8 to +15 V _{DC} or +14 to +36 V _{DC}
Power Consumption:	~1 W (e.g. 40 mA at 24V)
Operating Temperature:	0 to +85 °C

The supply voltage can be supplied via the power connector or optionally via the encoder connector (from the encoder decoding unit). The G-REC is protected against the wrong polarity and transient overvoltage of power supply and short circuit proof on output terminals.

Housing:	Phoenix Contact „ME 22,5“ for top hat rail mounting
Dimensions:	l=114.5 mm; h = 99 mm, w = 22.5 mm

CONNECTOR TERMINALS

Encoder Out (Default): Sub-D, 9-pole male -> mating connector: female	
Pin 1	GDN
Pin 2	Z-
Pin 3	Z+
Pin 4	A-
Pin 5	A+
Pin 6	NC
Pin 7	+Vs (Opt.)
Pin 8	B-
Pin 9	B+
Screen	PE

Encoder Out (DX): Sub-D, 25-pole female > mating connector: male	
Pin 1	NC
...	NC
Pin 16	NC
Pin 17	A-
Pin 18	B-
Pin 19	Z-
Pin 20	A+
Pin 21	B+
Pin 22	Z+
Pin 23	+Vs (Opt.)
Pin 24	GND
Pin 25	GND
Screen	PE

Resolver IN: Sub-D, 9-pole female -> mating connector: male	
Pin 1	Ref-
Pin 2	NC
Pin 3	NC
Pin 4	NC
Pin 5	SIN+
Pin 6	SIN-
Pin 7	Ref+
Pin 8	COS+
Pin 9	COS-
Screen	PE

Power connector: 4-pole plug, screw wire connection, included	
Pin 1 (left)	+Vs
Pin 2	+Vs
Pin 3	GND
Pin 4	GND
Max. loopthroughed current:	
+Vs	Pin 1 - Pin 2: 3A
GND	Pin 3 - Pin 4: 3A

The PE connection (protective earth) is implemented over the mounting clamp to the top hat rail.

ORDERING INFORMATION

Type	Supply Voltage (+V _s)	Output Voltage Level	Rotational Speed	Part Number	Reference Frequency
G-RECLDBI1024-5X1-15	+8 to +15 V _{DC}	5V	up to 1000 s ⁻¹	3933542	10kHz
G-RECLDBI1024-5X1-24	+14 to +36 V _{DC}	5V		3931647	10kHz
G-RECKIBI1024-5X1-24	+14 to +36 V _{DC}	Vs		3932553	10kHz
G-RECKIBI1024-5X1-24CX	+14 to +36 V _{DC}	Vs		3932553-01	10kHz
	Adjusted for long cable lengths. Optimised for 130 m cable.				
G-RECKIBI1024-5X1-24DX	+14 to +36 V _{DC}	Vs	up to 500 s ⁻¹	1340804-01	5kHz
	Adjusted for long cable length, tested up to 260 m				



RESOLVER TO DIGITAL CONVERTER

The LTN G-RDC is a position data converter.
The LTN G-RDC drives autonomously a resolver sensor and converts its output signals to digital position data.



SPECIFICATIONS - CONVERTER OUTPUT / CONTROL

Output Signals:	10 bit, 12 bit, 16 bit binary position data, parallel, H-active 1 bit: /BIT (Error), L-active
Input Signals:	1 bit: /Inhibit, L-edge-active 1 bit: /Enable, L-edge-active (Both Inputs can be put together)
Resolution:	10-bit / 1024 steps per revolution 12-bit / 4096 steps per revolution 16-bit / 65536 steps per revolution
Output Voltage Level:	TTL (5 V)
Output Current:	30 mA
Input Voltage Level:	TTL (5 V)
Accuracy:	0.072° (4 arcmin +1LSB max.)
Repeatability:	+/- 1 LSB
Rotational speed:	10 bit: up to 1152 s ⁻¹ 12 bit: up to 520 s ⁻¹ 16 bit: up to 18 s ⁻¹ (to be specified on order)

RESOLVER OUTPUT / INPUT

Output Ref. Signal:	4 V _{rms} 100 mA max. 5 kHz
Input SIN / COS:	2 V _{rms}
Transformation Ratio:	K = 0.5 +/- 10%

POWER SUPPLY

Supply Voltage (+Vs):	+10 to +36 V _{DC}
Power Consumption:	~1,5 W (e.g. 60 mA at 24 V)
Operating Temperature:	0 to +85°C

The supply voltage can be supplied via the power connector or optionally via the encoder connector (from the encoder decoding unit).
The G-RDC is protected against the wrong polarity and transient overvoltage of power supply and short circuit proof on output terminals.

Housing:	Phoenix Contact „ME 22,5“ for top hat rail mounting
Dimensions:	l = 114,5 mm; h = 99 mm, w = 22,5 mm

CONNECTOR TERMINALS

10 bit

Data Out /Controll I/O: Sub-D, 25-pole female -> mating connector: male	
Pin 1	Out DB1 (MSB)
Pin 2	Out DB2
Pin 3	Out DB3
Pin 4	Out DB4
...	...
...	...
Pin 10	Out DB10 (LSB)
Pin 11	NC
...	...
Pin 16	NC
Pin 17	Out /BIT (Error)
Pin 18	IN /Inhibit
Pin 19	IN /Enable
Pin 20	NC
Pin 21	NC
Pin 22	NC
Pin 23	V _s (Opt.)
Pin 24	GND
Pin 25	GND
Screen	PE

16 bit

Data Out /Controll I/O: Sub-D, 25-pole female -> mating connector: male	
Pin 1	Out DB1 (MSB)
Pin 2	Out DB2
Pin 3	Out DB3
Pin 4	Out DB4
...	...
...	...
Pin 13	Out DB13
Pin 14	Out DB14
Pin 15	Out DB15
Pin 16	Out DB16 (LSB)
Pin 17	Out /BIT (Error)
Pin 18	IN /Inhibit
Pin 19	IN /Enable
Pin 20	NC
Pin 21	NC
Pin 22	NC
Pin 23	V _s (Opt.)
Pin 24	GND
Pin 25	GND
Screen	PE

Resolver IN: Sub-D, 9-pole female -> mating connector: male	
Pin 1	Ref-
Pin 2	-
Pin 3	-
Pin 4	-
Pin 5	SIN+
Pin 6	SIN-
Pin 7	Ref+
Pin 8	COS+
Pin 9	COS-
Screen	PE

Power connector: 4-pole plug, screw wire connection, included	
Pin 1 (left)	+V _s
Pin 2	+V _s
Pin 3	GND
Pin 4	GND
Max. loopthroughed current:	
+V _s :	Pin 1 - Pin 2: 3A
GND:	Pin 3 - Pin 4: 3A

The PE connection (protective earth) is implemented over the mounting clamp to the top hat rail.

ORDERING INFORMATION

Part Number	Type	Supply Voltage (+V _s)	Output Voltage Level
3938524	10 bit: G-RDCTLSC01024-0XX-24	+10 to +36 V _{DC}	TTL (5V)
1185043-01	12 bit: G-RDCTLSC04096-0XX-24	+10 to +36 V _{DC}	TTL (5V)
3933425	16 bit: G-RDCTLSC65536-0XX-24	+10 to +36 V _{DC}	TTL (5V)

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