Data sheet
LTA4D01_02
Issue 2, 12th May 2014

LTA4 linear absolute transducer

The LTA4 is a shaft based absolute position transducer comprised of a readhead and an encoded shaft as the information carrier.

The position and status information is output through a USB or SSI interface.

The transducer is available with resolutions up to 1 µm and shaft lengths to 450 mm with an accuracy of ±10 µm over the whole measuring length.

The absolute readhead always “knows” the position of the shaft. Even if the shaft is moved when powered off, the transducer will output the correct position on power up. The readhead is insensitive to the rotation of the shaft during linear translation, as well as to external magnetic fields, shock and vibration.

The LTA4 transducer has a built-in advanced self-monitoring function continually checking several internal parameters. Error reporting, warnings and other status signals are available through a USB or SSI interface.

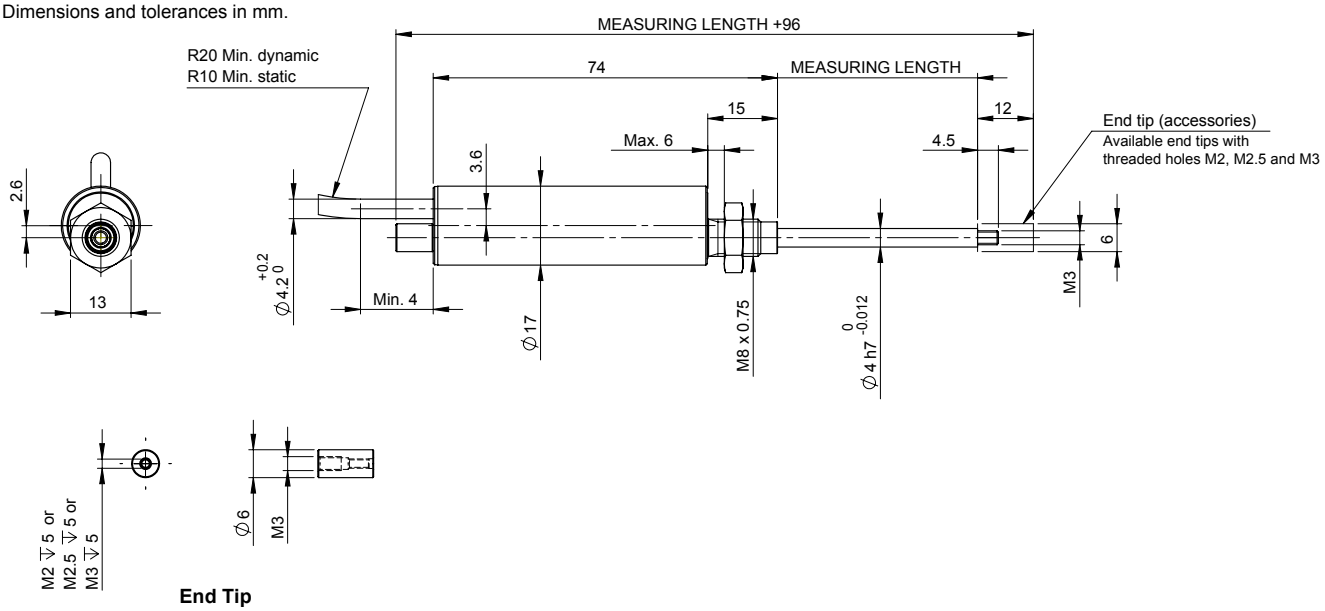
The complete system is sealed to IP40 while the shaft can be removed for cleaning (autoclavable). The LTA4 transducer has been designed as both a “moving readhead” or a “moving shaft” system.

- **True absolute system**
- **No hysteresis**
- **Resolution to 1 µm**
- **Measuring length to 450 mm**
- **System accuracy ±10 µm**
- **USB or SSI interface**
- **Built-in self-monitoring**
- **Corrosion resistant chromed shaft**

Data sheet
LTA4D01_02

LTA4 dimensions

Dimensions and tolerances in mm.



LTA4 technical specifications

System data	
Maximum shaft overall length	530 mm
Maximum measuring length	450 mm
Shaft diameter	4 mm
Shaft linear expansion coefficient	~11 × 10^{-6}/K
Maximum speed	0.25 m/s
System accuracy	±10 µm at 20 °C
Hysteresis	Less than unit of resolution
Repeatability	Better than unit of resolution
Electrical data	
Supply voltage	4 V to 6 V – voltage on readhead *
Set-up time	10 ms (first data ready after switch-on, for SSI interface only)
Power consumption	Typ. 115 mA, max. 150 mA
Voltage drop over cable	~ 55 mV/m – without load
Mechanical data	
Shaft material	EN 1.1203 / AISI 1055 or EN 1.0601 / AISI 1060
Readhead housing material	EN AN-6082 / ALMgSi1
Sliding bearing	PET
Environmental data	
Operating temperature	0 °C to +50 °C
Humidity	90 % (non-condensing)
Environmental sealing	IP40 (according to IEC 60529)

* Note: Consider voltage drop over cable.

Electrical connections

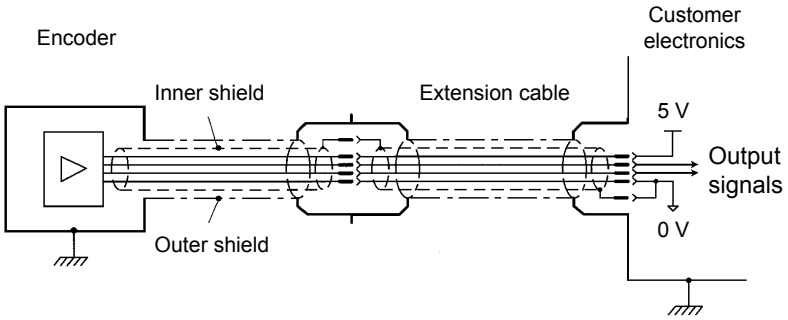
Pin	Wire Colour	SSI
1	Outer shield	Encoder / machine case (Earth connection)
2	Inner shield	0 V (GND)
3	Red	Clock +
4	Blue	Clock -
5	Grey	-
6	Brown	5 V supply
7	Green	Data +
8	Yellow	Data -
9	Pink	-
10	White	0 V (GND)

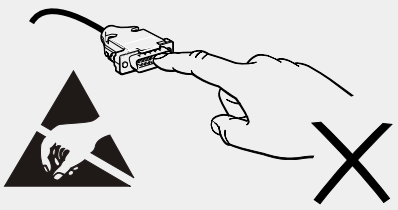
Voltage difference between Ground (white and inner shield) and Outer shield (encoder housing) should not exceed 10 V_{pp}.

For USB interface, the encoder is provided with a certified USB cable and type A connector. Wire colors conform to the IEC 60304.

Cable specifications (for SSI interface only)

Outer diameter	4.2 mm ±0.2 mm
Jacket material	Extruded polyurethane (PUR)
White wire	0.9 mm ±0.07 mm diameter, 26 AWG (19 strands REF 6), 0.13 Ω/m
Other wires	0.6 mm ±0.07 mm diameter, 30 AWG (7 strands REF 6), 0.35 Ω/m
Power supply lines resistance	0.48 Ω/m at 20 °C
Durability	20 million cycles at 20 mm bend radius
Bend radius	Dynamic 25 mm, static 10 mm (internal radius)
Weight	34 g/m nominal





WARNING!

ESD protection
Readhead is ESD sensitive - handle with care. Do not touch wires or sensor area without proper ESD protection or outside of ESD controlled environment.

LTA4 communication interfaces

SSI *		
	Maximum clock frequency	500 kHz
	Update rate	4 kHz
	Resolution	0.5 µm, 1 µm, 2 µm, 5 µm, 10 µm
	Latency	250 µs to 500 µs
	Timeout (monoflop time)	20 µs

* Note: Slave type interfaces might not be suitable for high-speed closed control loops because of the variable latency time.

USB - Universal serial bus

Encoder identification, position data and temperature are available over the request-response type of communication over the Universal Serial Bus (USB). The encoder is recognised by a computer as a virtual COM port. This type of communication can be used for direct connection to a measuring station powered by an (industrial) PC. Drivers are available for Windows XP and Windows 7 operating systems. Both 32-bit and 64-bit versions are supported. The encoder may not be correctly recognised if plugged into a USB 3.0 port. Please use USB 2.0 port or USB hub. The encoder can be accessed from any software that supports connection to a virtual COM port (for example C++, Delphi, Labview, etc.).

Electrical connection
USB cable with A type USB connector is provided. Cable length is 1.8 meter. It can be extended to 5 meters with certified USB extension cords capable of carrying higher supply currents (200 mA minimum).

USB drivers
USB drivers for the virtual COM port are available on the RLS website: **www.rls.si/LTA4**

Communication parameters
Settings of baud rate, character length and parity bits do not affect the communication. Any value can be used.

Output type variant does not affect the USB interface. Use default value "B".

Command set

Command "v" (small character "v")
Response - version info and serial number
8 bytes ASCII Serial number
1 byte binary Firmware version (42)
1 byte binary ASIC revision (31)
1 byte binary Resolution (factor 0.1 µm)
6 bytes ASCII code description

Command "1" (ASCII one)
Response - position and status, transmitted once
1 byte constant header 0xEA
4 bytes binary absolute position, big-endian, right aligned
2 bytes encoder status – see table on next page
1 byte constant footer 0xEF
The next request should not be sent sooner than 250 µs after the end of the previous response from the readhead to allow refreshing of the position data. If request is sent sooner, data will arrive on the end of the refresh cycle.

Command "2" (ASCII two)
Response - position and status, transmitted continuously
1 byte constant header 0xEA
4 bytes binary absolute position, big-endian, right aligned
2 bytes encoder status – see table on next page
1 byte constant footer 0xEF

Command “0” (ASCII zero)
Stop continuous transmission

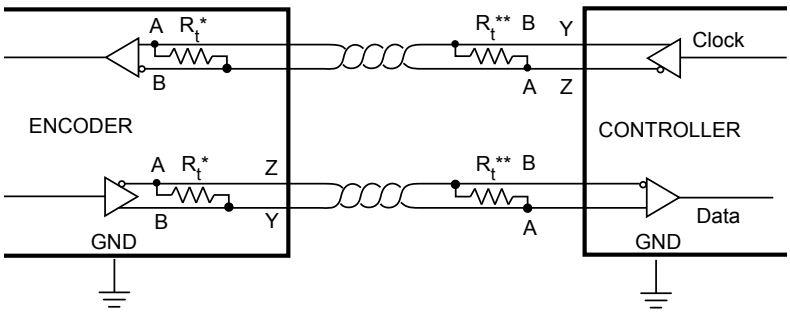
Encoder status data

Encoder status (two bytes):		
	b15:b10	Reserved; always zero
General status		
	b9	Error. If bit is set, position is not valid.
	b8	Warning. If bit is set, encoder is near operation limits. Position is valid. Resolution and/or accuracy might be lower than specified.
	Error and Warning bits can be set at the same time; in this case Error bit has priority. Those two bits are synchronised to the LED indicator on the housing of the encoder: Red = Error, Orange = Warning, Green = Normal operation, No light = No power supply. The general warning or error status is more closely defined by the Detailed status bits.	
Detailed status		
	b7	Warning - Signal amplitude too high. The readhead is too close to the shaft.
	b6	Warning - Signal amplitude low. The distance between the readhead and the shaft is too high.
	b5	Error - Signal lost. The readhead is too far away from the shaft.
	b4	Warning - Temperature. The readhead temperature is out of range.
	b3	Error - Power supply error. The readhead power supply voltage out of specified range.
	b2	Error - System error. Malfunction detected inside the circuitry or inconsistent calibration data is detected. To reset the System error bit try to cycle the power supply while the rise time is kept below 20 ms.
	b1	Error - Wrong code. Shaft might be inserted in the wrong direction.
	b0	Error - Acceleration error. The position data changed too fast. Shaft might be inserted in the wrong direction.

Binary synchronous serial output SSI

The encoder position, in 21 bit natural binary code, and the encoder status are available through the SSI protocol. The position data is right aligned. After the position data there are two general status bits followed by the detailed status information.

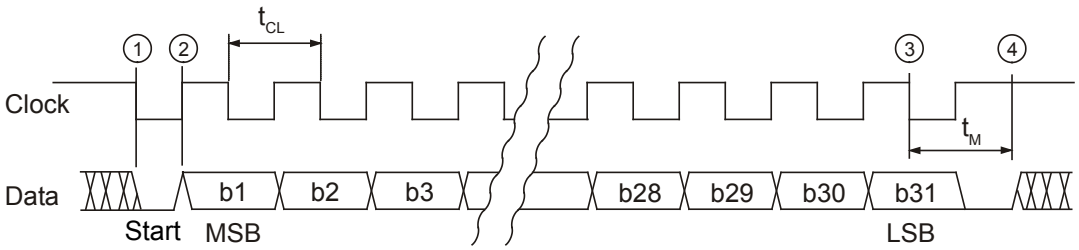
Electrical connection



Line signals	
A	Receiver, + input
B	Receiver, - input
Y	Transmitter, + output
Z	Transmitter, - output

*The Command and Data signals are 5 V RS422 compatible differential pairs with RC termination inside the readhead.
** Termination at the controller is required if cable is longer than 5 m.

SSI timing diagram

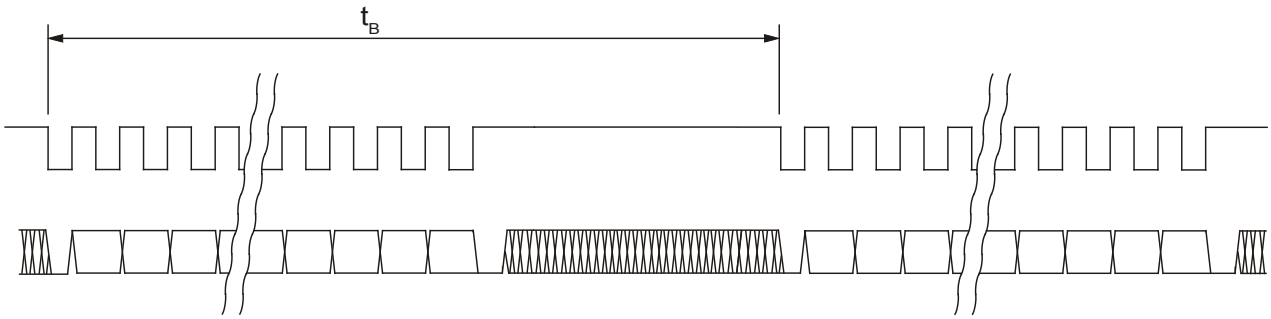


The controller interrogates the readhead for its position and status data by sending a pulse train to the Clock input. The Clock signal always starts from high. The first falling edge ① latches the current position data and on the first rising edge ② the most significant bit (MSB) of the position is transmitted to the Data output. The Data output should then be latched on the following falling edge. On subsequent rising edges of the Clock signal the next bits are transmitted.

After the transmission of the last bit ③ the Data output goes to low. When the t_M time expires, the Data output is undefined ④. The Clock signal must remain high for at least t_M before the next reading can take place.

While reading the data, the period t_{CL} must always be less than t_M. However, reading of the encoder position can be terminated at any time by setting the Clock signal to high for the duration of t_M.

To allow updating of the position data at least t_B should pass between two subsequent readings. If the reading request arrives earlier than t_B after the previous reading, the encoder position will not be updated.



Communication parameters

Parameter	Symbol	Min	Typ	Max
Clock period	t_{CL}	2 µs		20 µs
Clock frequency	f_{CL}	50 kHz		500 kHz
Monoflop time	t_M		20 µs	
Update time	t_B	250 µs		

Start bit and idle line value are defined by the *Output type variant*.

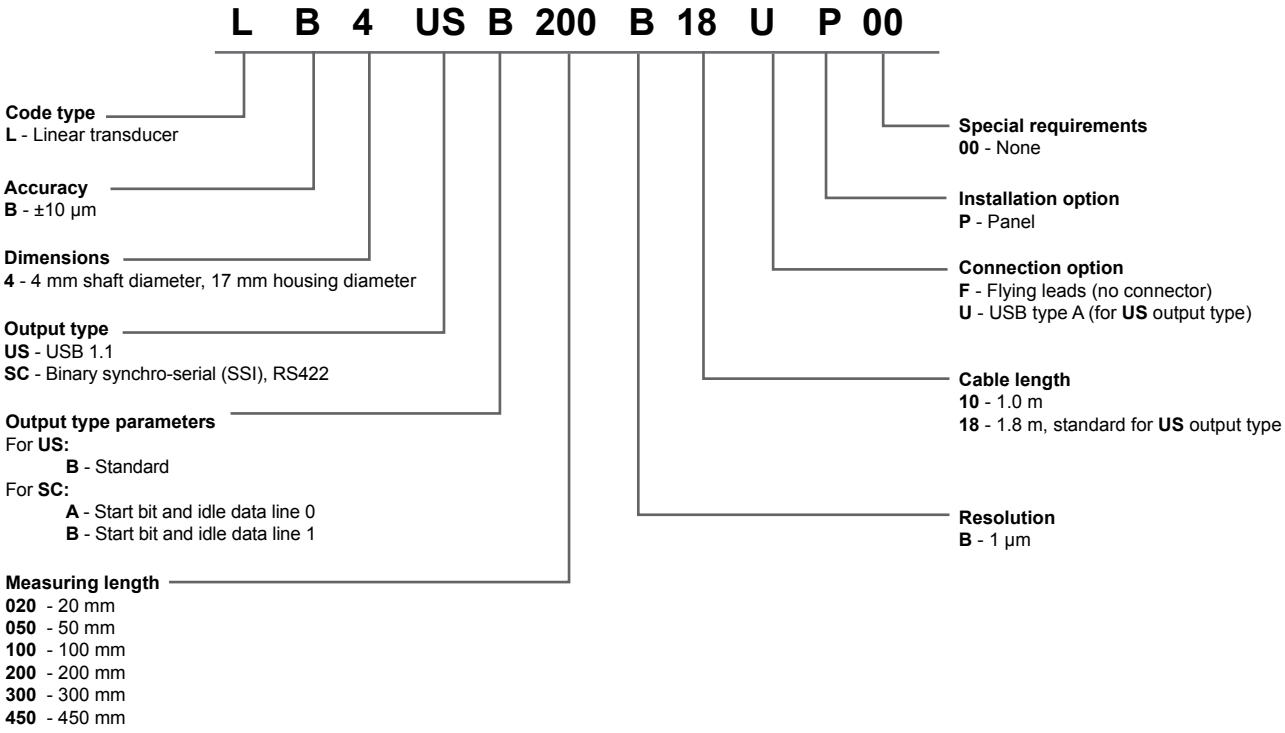
Output type variant	Line state selection
A	Start bit = 0; idle line = 0
B	Start bit = 1; idle line = 1

Structure of data packet

Bit	b1 : b21	b22 : b23	b24 : b31
Data length	21 bits	2 bits	8 bits
Meaning	Encoder position	General status	Detailed status

Encoder position	
b1 : b21	Encoder position – Right aligned, MSB (b1) first, LSB (b21) last.
General status	
b22	Error bit. If set, the position is not valid.
b23	Warning bit. If set, the encoder operation is close to its limits. The position is still valid, but the resolution and/or accuracy might be out of specification.
The Error and Warning bits can be set at the same time, in this case the Error bit has priority. Those two bits are synchronised to the LED indicator on the housing of the encoder: Red = Error, Orange = Warning, Green = Normal operation, No light = No power supply. The general warning or error status is more closely defined by the Detailed status bits.	
Detailed status	
b24	Warning - Signal amplitude too high. The readhead is too close to the shaft.
b25	Warning - Signal amplitude low. The distance between the readhead and the shaft is too high.
b26	Error - Signal lost. The readhead is too far away from the shaft.
b27	Warning - Temperature. The readhead temperature is out of range.
b28	Error - Power supply error. The readhead power supply voltage out of specified range.
b29	Error - System error. Malfunction detected inside the circuitry or inconsistent calibration data is detected. To reset the System error bit try to cycle the power supply while the rise time is kept below 20 ms.
b30	Error - Wrong code. Shaft might be inserted in the wrong direction.
b31	Error - Acceleration error. The position data changed too fast. Shaft might be inserted in thewrong direction.

LTA4 part numbering



LTA4 accessories

ET20 - End tip with threaded hole M2
ET25 - End tip with threaded hole M2.5
ET30 - End tip with threaded hole M3

RLS merilna tehnika d.o.o.
Poslovna cona Žeje pri Komendi
Pod vrbami 2
SI-1218 Komenda
Slovenia

T +386 1 5272100
F +386 1 5272129
E mail@rls.si
www.rls.si

Document issues

Issue	Date	Page	Corrections made
1	7. 1. 2013	-	New document
2	12. 5. 2013	2, 3	IP protection and electrical connections amended
		6, 7	SSI data added
		8	Part numbering amended

RENISHAW is our worldwide sales support partner for Magnetic Encoders.

Australia
T +61 3 9521 0922
E australia@renishaw.com

Austria
T +43 2236 379790
E austria@renishaw.com

Brazil
T +55 11 4195 2866
E brazil@renishaw.com

Canada
T +1 905 828 0104
E canada@renishaw.com

The People's Republic of China
T +86 10 8448 5306
E beijing@renishaw.com

Czech Republic
T +420 5 4821 6553
E czech@renishaw.com

France
T +33 1 64 61 84 84
E france@renishaw.com

Germany
T +49 7127 9810
E germany@renishaw.com

Hong Kong
T +852 2753 0638
E hongkong@renishaw.com

Hungary
T +36 23 502 183
E hungary@renishaw.com

India
T +91 20 6674 6751
E india@renishaw.com

Italy
T +39 011 966 10 52
E italy@renishaw.com

Japan
T +81 3 5366 5316
E japan@renishaw.com

The Netherlands
T +31 76 543 11 00
E benelux@renishaw.com

Poland
T +48 22 577 11 80
E poland@renishaw.com

Russia
T +7 495 231 1677
E russia@renishaw.com

Singapore
T +65 6897 5466
E singapore@renishaw.com

Slovenia
T +386 1 52 72 100
E mail@rls.si

South Korea
T +82 2 2108 2830
E southkorea@renishaw.com

Spain
T +34 93 663 34 20
E spain@renishaw.com

Sweden
T +46 8 584 90 880
E sweden@renishaw.com

Switzerland
T +41 55 415 50 60
E switzerland@renishaw.com

Taiwan
T +886 4 2473 3177
E taiwan@renishaw.com

UK
T +44 1453 524524
E uk@renishaw.com

USA
T +1 847 286 9953
E usa@renishaw.com

For all other countries
Please contact RLS' head office

T +386 1 52 72 100
E mail@rls.si