⊠RLS®

E201 USB Encoder Interface
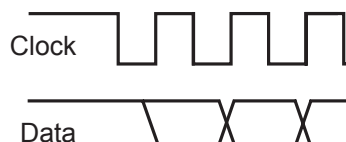

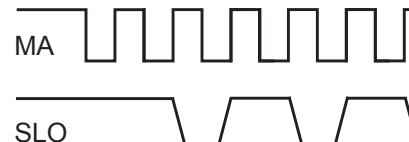**E201-9Q – incremental**

E201-9S – absolute

Absolute SSI

BiSS-C mode (unidirectional)

A

B

Z

Clock

Data

MA

SLO

The E201 is a single channel USB encoder interface suitable for use with a wide variety of 5 V rotary and linear encoders.

It allows encoders to be easily interfaced and powered from a PC using only a USB cable. The E201 is available in 2 versions:

- **E201-9Q supporting incremental encoders**
- **E201-9S supporting absolute SSI and BiSS-C mode (unidirectional) encoders**

Both standard versions are pin compatible with RLS rotary and linear magnetic encoders. The interfaces can also be used with Renishaw encoders.

Two status LEDs are included to indicate USB status and encoder activity.

Demo software installation

Download and install the demo software from www.rls.si/E201. During the installation all necessary drivers are installed.

When installation is completed, connect the E201 interface and configure the software for the encoder you will be using. Encoder supply voltage and current consumption can be read out by the software. Power supply to the encoder can be switched on/off by the software.

For custom development of a software, a detailed explanation of the ASCII commands can be found in this datasheet under the Programming commands section.
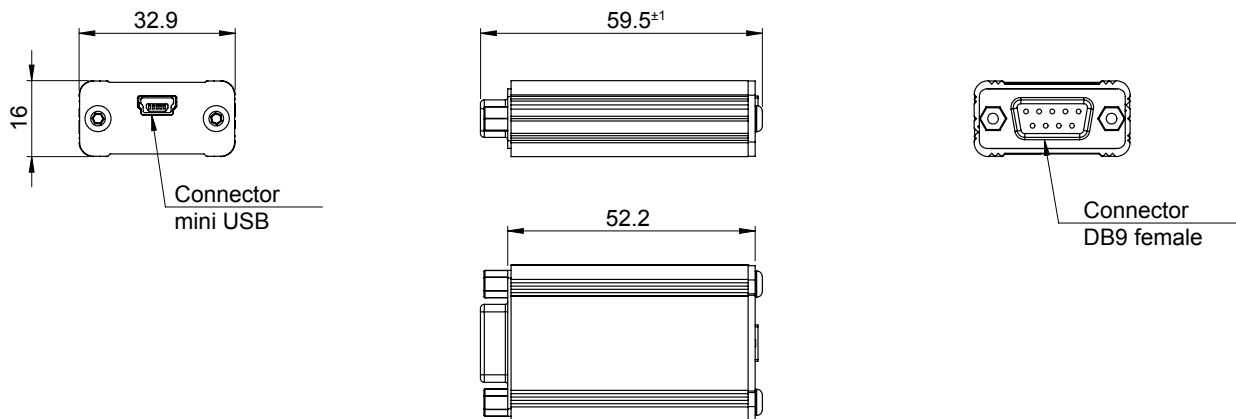
Applications

- **Encoder functional test**
- **Encoder demonstration**
- **Metrology**
- **Gauging**
- **PC based machinery**

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E201-9Q – for 5 V incremental encoders

The E201-9Q counts edges from 5 V incremental encoders and allows the count value to be read by a PC using simple ASCII commands over a USB connection.

Dimensions

Dimensions and tolerance in mm.

Connector
mini USB

Connector
DB9 female

Technical specifications

Power supply	5 V over USB port
Power consumption	65 mA (without encoder connected)
Encoder power supply	5 V or lower as supplied from the computer. Consider voltage drop over USB cable, USB hubs and encoder cable. Output is fused.
Inputs	RS422 differential A, B, Z, A–, B–, Z– or single ended A, B, Z with 5 V TTL levels
Maximum count rate	5 MHz, if using reference marks 30 MHz, if not using reference marks *
USB connector	USB 1.1 Full Speed; USB 5 pin mini-B connector
Drivers	Virtual Com Port (VCP) drivers available for 32-bit and 64-bit Windows (XP, Vista, 7 and 8/8.1) Linux uses generic CDC drivers.
Cable length	1 m standard A to mini-B USB cable (supplied). Maximum length 5 m.
Operating temperature	0 °C to +45 °C
Environmental sealing	IP20 – indoor use only
Mass	42 g (interface without USB cable)

* Units produced after May 2015 are compatible with high-speed optical encoders

Connections

Pin	Function
1	0 V
2	Z+
3	B+
4	A+
5	5 V
6	Z–
7	B–
8	A–
9	0 V

Encoder input
('D' type connector – 9 way)

NOTE: Connections are directly compatible with the pin-out for RLS encoders. When used with Renishaw encoder, the encoder pin-out might need to be modified.

Status LEDs

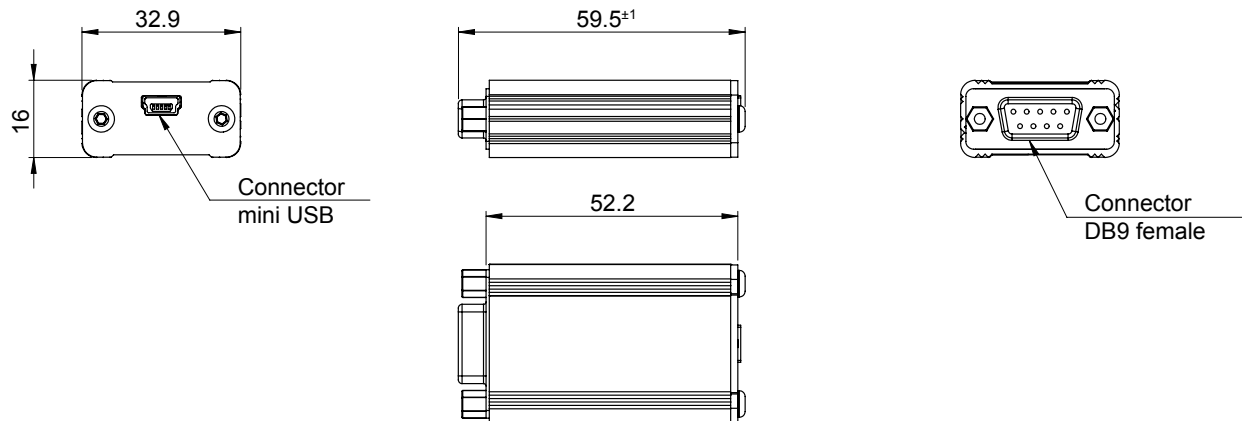| LED colour	USB	Encoder
Red	Disconnected	Reference mark found
Yellow	Connected	Encoder not moving
Green	Communication in progress	Encoder moving

Ordering code

E201-9Q   USB interface for use with **incremental** encoders

E201-9S – for 5 V absolute SSI/BiSS-C mode (unidirectional) encoders

The E201-9S interrogates an SSI/BiSS encoder and allows the data to be read by a PC using simple ASCII commands over a USB connection.

Dimensions

Dimensions and tolerance in mm.

Connector mini USB

32.9

16

59.5±1

52.2

Connector DB9 female

Technical specifications

Power supply	5 V over USB port
Power consumption	65 mA (without encoder connected)
Encoder power supply	5 V or lower as supplied from the computer. Consider voltage drop over USB cable, USB hubs and encoder cable. Output is fused.
Data outputs	Clock/MA (differential pair – RS422)
Data inputs	Data/SLO (differential pair – RS422)
USB connector	USB 1.1 Full Speed; USB 5 pin mini-B connector
Drivers	Virtual Com Port (VCP) drivers available for 32-bit and 64-bit Windows (XP, Vista, 7 and 8/8.1) Linux uses generic CDC drivers.
Cable length	1 m standard A to mini-B USB cable (supplied). Maximum length 5 m.
Operating temperature	0 °C to +45 °C
Environmental sealing	IP20 – indoor use only
Mass	42 g (interface without USB cable)

Connections

Pin	Function	
	SSI encoder	**BiSS encoder**
1	0 V	0 V
2	Clock+	MA+
3	Clock–	MA–
4	NC	NC
5	5 V	5 V
6	Data+	SLO+
7	Data–	SLO–
8	NC	NC
9	0 V	0 V

NOTE: BiSS is hardware compatible to SSI.

NOTE: Connections are directly compatible with the pin-out for RLS encoders. When used with Renishaw encoder, the encoder pin-out might need to be modified.

Status LEDs

LED colour	USB	Encoder
Red	Disconnected	Encoder not connected
Yellow	Connected	-
Green	Communication in progress	Encoder connected

Ordering code

E201-9S   USB interface for use with **absolute** SSI and BiSS-C mode (unidirectional) encoders

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Programming commands

> **NOTE**: Note this section is only needed if you wish to develop your own software. The E201 is provided with simple display software.

This section contains detailed information on the communication between the E201 interface and PC which is needed to develop a customised software.

Installation of USB Drivers

Download the E201 software which includes the USB drivers from www.rls.si/E201 and follow the installation steps. The drivers will be installed during the software installation. The E201 interface will appear as a new Virtual COM port on the computer. The actual port number assigned depends on how many COM ports are already in use on the PC.

In Windows 7 this can be found under:

Control Panel > System > Device Manager > Ports (COM & LPT)

Supported operating systems: 32-bit and 64-bit Windows (XP, Vista, 7 and 8/8.1) and Linux.

The E201 USB interface should be automatically recognized on the Linux system.
It uses the »Communication Device Class driver (CDC)«.
VID = 0483 & PID = 5740

Communications

The E201 interface responds to ASCII commands received over the USB acting as a virtual serial port. No CR character is required after any command. Speed settings of the virtual serial port can be any value.

Command set   E201-9Q

ASCII COMMAND	ACTION	INTERFACE RESPONSE (with example)
v	E201-9Q returns software version + CR	E201-9Q V1.18 + CR
s	Interface serial number in 8 Hex numbers	aaaaaaaa : bbbbbbbb : cccccccc + CR
r	Interface product serial number (6 characters; written on Interface housing)	51X499 + CR nnnnnn + CR where: n = product serial number
?	Encoder position E201-9Q returns 3 decimal values (width not fixed) separated by colons and terminated with CR	3412:2596:1 + CR nnnn:rrrr:ssss + CR where: n = encoder count r = count value when reference/index was last seen s = status (status value of 1 shows that a reference was detected – use 'c' command to clear)
!	Encoder position E201-9Q returns 4 decimal values (width not fixed) separated by colons and terminated with CR	3412:2596:1:3574 + CR nnnn:rrrr:ssss:tttt + CR where: n = encoder count r = count value when reference/index was last seen s = status (status value of 1 shows that a reference was detected – use 'c' command to clear) t = timestamp of position in µs Note: available in E201 interface version 1.18 (and later)
>	Encoder position E201-9Q returns 24 character hexadecimal string + CR comprising 3 sets of 8 character hexadecimal strings	00000d5400000a2400000001 + CR nnnnnnnnrrrrrrrrssssssss + CR where: n = encoder count (signed 32 bit) r = count value when reference/index last seen (signed 32 bit) s = status (status value of 1 shows that a reference was detected – use 'c' command to clear)
<	Encoder position E201-9Q returns 32 character hexadecimal string + CR comprising 4 sets of 8 character hexadecimal strings	0000000000000000000000003425fcd8 + CR nnnnnnnnrrrrrrrrssssssssstttttttt + CR where: n = encoder count r = count value when reference/index was last seen s = status t = timestamp of position in µs Note: Available in E201 interface version 1.18 (and later)
I	Begin Index mode. On every reference/index E201-9Q returns position as 8 character hexadecimal string	On command: no response On index: I = 00000ec9 + CR I = nnnnnnnn + CR where: n = encoder count on reference/index
i	Stop Index mode (stops returning position on every reference/index)	-
c	E201-9Q clears reference status flag	-
z	E201-9Q sets current count value to zero (this also affects reference mark position)	-
a	E201-9Q clears zero offset value stored by 'z' command	-
e	Read encoder supply status, voltage and current consumption (fixed width)	1 : 4.975 V : 0070 mA + CR s : a.aaa V : bbbb mA + CR
n	Turn on power supply to encoder (default at power-up)	ON + CR
f	Turn off power supply to encoder	OFF + CR
p	Status of hardware input pins on interface (0 or 1)	110 + CR abz + CR
1	Begin auto transmission of encoder position in decimal form at 1 kHz rate	1234 + CR nnnn + CR
0	Stop auto transmission	-

Data sheet
E201D01_04

Command set   E201-9S

ASCII COMMAND	ACTION	INTERFACE RESPONSE (with example)	SSI encoder	BiSS encoder
v	E201-9S returns software version + CR	E201-9S V1.18 + CR	✔	✔
s	Interface serial number in 8 Hex numbers	aaaaaaaa : bbbbbbbb : cccccccc + CR	✔	✔
r	Interface product serial number (6 characters; written on Interface housing)	78J077 + CR nnnnnn + CR where: n = product serial number	✔	✔
?	Encoder position E201-9S returns encoder position in decimal representation (width not fixed)	1234 + CR nnnn + CR where: n = encoder count	✔	
>	Encoder position E201-9S returns 8 Hex digits with encoder position	00000d54 + CR nnnnnnnn + CR where: n = encoder count (signed 32 bit)	✔	
!	Encoder position E201-9Q returns 2 decimal values (width not fixed) separated by colon and terminated with CR	1234:5678 + CR nnnn:tttt + CR where: n = encoder count t = position timestamp in μs	✔	
4	Encoder position E201-9S returns 16 character hexadecimal string + CR comprising 64 SLO bits, synchronised to 64 MA clocks Used for BiSS C-mode (unidirectional) encoders Note: Available in E201 interface version 1.16 (and later)	c004c9ba71753000 + CR nnnnnnnnnnnnnnnn + CR where: n = SLO bits in 16 Hex digits, comprising Ack, Start, Cds (always '0') in BiSS C mode (unidirectional), Position, Status and CRC bits.*		✔
b	Read current word width that is read from encoder	31 bit + CR nn bit + CR	✔	
Bnn+CR	Set word width; n can be one or two characters	OK 31 bit + CR or B param error + CR OK nn bit + CR N = 1 to 31	✔	
m	Read current encoder clock frequency	3 = 140 kHz + CR or 9 = ERROR n = xxx kHz + CR	✔	✔
Mn	Set SSI and BiSS clock frequency: 8 = 4.4 MHz 7 = 2.2 MHz 6 = 1.1 MHz 5 = 560 kHz 4 = 280 kHz 3 = 140 kHz (default) 2 = 70 kHz 1 = 35 kHz	frequency 5 + CR or M param error + CR frequency n + CR where: n = 1 to 7	✔	✔
e	Read encoder supply status, voltage and current consumption (fixed width)	1 : 4.975 V : 0070 mA + CR s : a.aaa V : bbbb mA + CR	✔	✔
n	Turn on power supply to encoder (default at power-up)	ON + CR	✔	✔
f	Turn off power supply to encoder	OFF + CR	✔	✔
p	Status of hardware input pins on interface	_11 + CR xcd + CR x = space character c = clock pin (0 or 1), should be 1 d = data pin (0 or 1), should be 1	✔	✔
1	Begin auto transmission of encoder position in decimal form at 1 kHz rate	1234 + CR nnnn + CR	✔	
0	Stop auto transmission	-	✔	

* The user must decode the SLO bits into Position, Status and CRC according to the corresponding bit lengths. Eg.: If the Position, Status and CRC length is 26 bits, 2 bits and 6 bits respectively, the response c004c9ba71753000 is decoded as 0x19374E2 (Position), 0x03 (Status) and 0x2A (CRC, $x^6 + x + 1$ polynomial, inverted).

Additional information can be found in the document E201D02 "E201-9S Application note: Decoding the BiSS information" available for download at www.rls.si/E201

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Document issues

Issue	Date	Page	Corrections made
1	12. 4. 2011	-	New document
2	14. 3. 2013	5 and 6	Added BiSS - C mode and Command set in E201-9S and E201-9Q
3	14. 7. 2014	2, 3, 4	Dimension drawings added; windows compatibility updated
4	24. 8. 2015	2, 5, 6	Minor text changes in Command set tables, 4.4 MHz added on the E201-9S interface, E201-9Q count frequency amended. Cable length added. Linux support added.

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