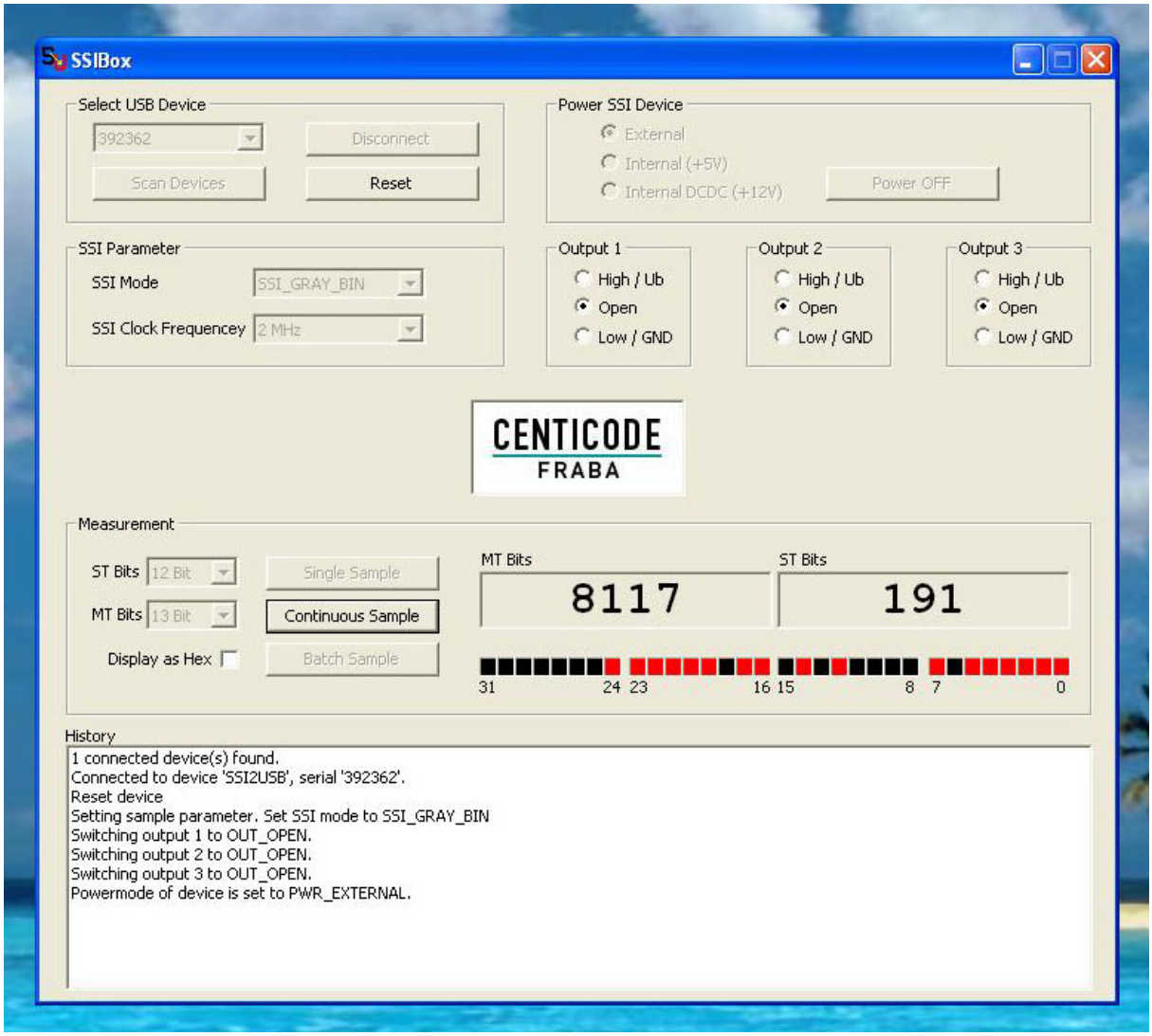
CENTICODE
FRABA

SSI TO USB CONVERTER
SSI2USB

Main Features

- SSI master device for USB connection
- Alternatively SPI master device via TTL level
- Three independent tri-state push-pull outputs
- Compact and robust aluminium housing
- Built in gray code to binary code conversion
- Power supply of SSI device from USB port (12 Volts up to 90 mA or 5 V up to 270 mA)
- External power supply can be connected
- Graphical user interface provided with device



Technical data

Electrical Data

Device Power Supply	via USB	DO NOT CONNECT DEVICE TO A USB HUB!
Sensor Power Supply (CAUTION: use of internal power mode may depend on computer!)	Internal 5 V mode	typ. > 4,5 V @ 200 mA sourced by USB (SSI2USB issues reset below 4,5 V) CAUTION: internal 5 V mode is not possible with RS422 levels, use external supply for this case)
	Internal 12 V mode	typ. > 10 V @ 90 mA sourced by USB
	External supply	0 – 36 V up to 1 A
Output ports	Tristate push-pull	max +/- 3 mA HI-level equal to sensor supply voltage – 1 V LO-level < 800 mV +/- 1 mA HI-level Ub_Ext – 700 mV LO-level < 600 mV
SSI mode (CAUTION: parameters may exceed SSI protocol specification)	Clock rate	62.5 kHz – 2 MHz
	Word length	1 – 32 bit
	Sample rate	12 µs – 4 ms (Jitter 0,5 µs max)
	No. of contiguous samples	1 – 2E24
	Mask mode	32 bit AND mask
	Gray mask mode	32 bit AND mask
	Clock input	Via opto-coupler
	Data output	Line-driver according to RS 422 or TTL
SPI mode	According to SSI, additional MOSI provided	
	Clock rate	62.5 kHz – 8 MHz
	MOSI word	32 bit
Sensor connector	Sub-D 15 pin female	

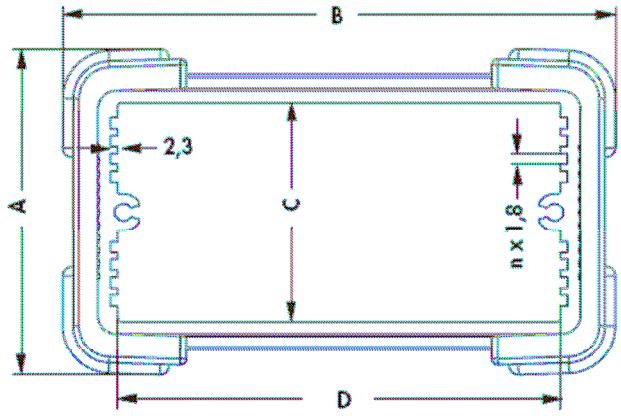
Synchronous Serial Interface (SSI)

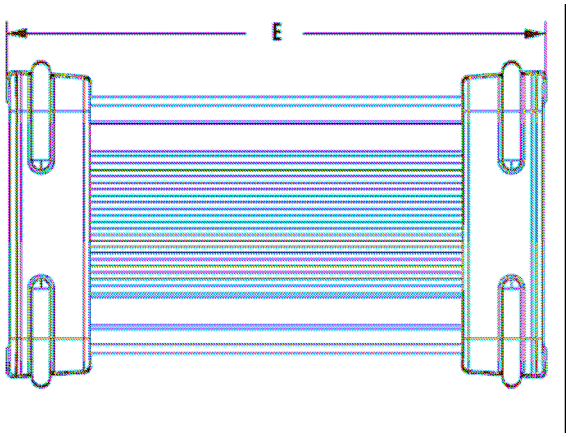
Driver	Driver meets EIA standard RS 422; alternatively TTL transmission
Transfer	Transfer distance up to 1200 m
Transmission	Balanced transmission provides high noise immunity
Pair lines	Shielded and twisted pair lines are essential to attain extremely high noise immunity
Interface	For a detailed description of the synchronous-serial-interface (SSI) refer to SSI description of this document.
SPI mode	Device can be used as SPI master

General Purpose Outputs

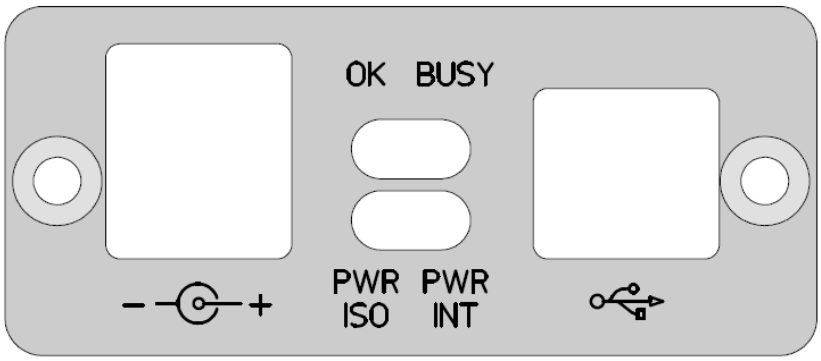
Driver	Tri-state push pull drivers
No. of outputs	3

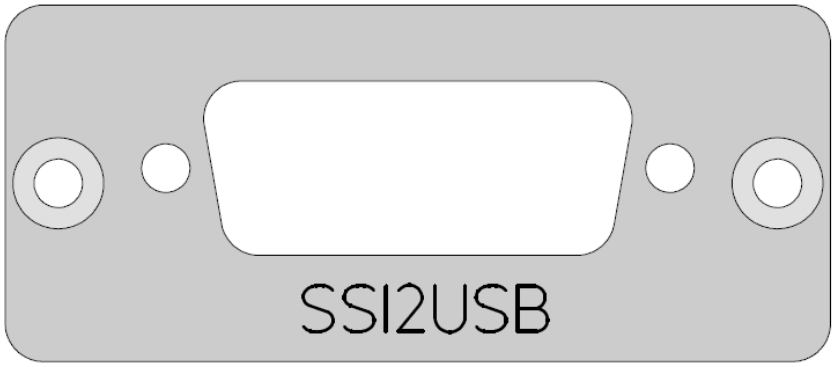
Mechanical data





Dimensions / [mm]	
A	33
B	63.6
C	20
D	48.7
E	114





Synchronous Serial Interface (SSI)

The SSI transmits data synchronously to the clock signal of the master device starting with the most significant bit (MSB).

When non-operational, clock and data line levels are high. As soon as the clock signal of a sequence changes for the first time from high (H) to low (L), data is latched for transmission.

Data bits are shifted on rising clock edges starting with the most significant bit (MSB). Transmission ends on the last rising clock edge and is terminated after expiration of the SSI delay time (latch is cleared after at least 20 µs).

The maximum data word length with SSI2USB is 32 bits. The device is capable of gray to binary code conversion during process of sampling. For this purpose, the data word may be masked by a 32 bit word (AND mask) to cut status bits that are not object of conversion.

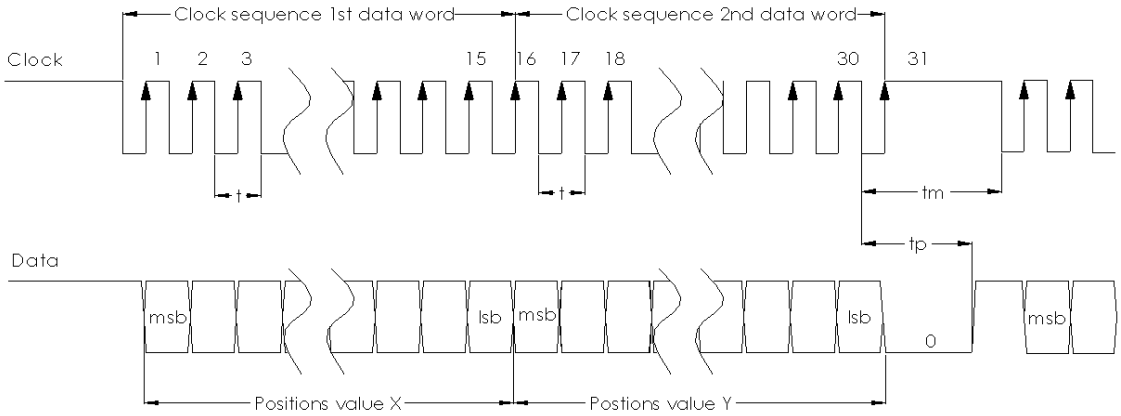
Additionally, the overall data may be masked by another 32 bit word (AND mask) to cut out data that is of no interest.

Especially the sample time (time interval between two consecutive transmissions of a single data batch) can be selected to be shorter than the actual SSI pause time for development purposes. This setting may cause the device under test to send the same data over and over again, since the latch may not be released between succeeding transmissions.

Please be aware that SSI2USB's capabilities go beyond the SSI protocol specification.

Signal diagram

t_p < 20µs t_m > 12µs (!)



Serial Peripheral Interface (SPI)

SSI2USB can be used to interface a SPI via TTL levels, providing the additional data master output (MOSI) and framing signals (NSL (Shift-NotLoad), SNL (NotShift-Load)). MOSI allows the transmission of a single 32 bit word towards the slave; this word will be sent with EVERY transmission of a contiguous batch (array of data acquired by SSI2USB with single operation).

The word transmitted towards the slave is sent MSB first from a 32 bit shift register; in case the transmission does not comprise 32 bits, the word has to be aligned in the register.

Of course, as a special case a SSI communication with TTL level rather than RS422 may be a special case of SPI mode.

SPI mode signals	Description
OUT 3	Push pull output
OUT 1	Push pull output
UB_EXT	Sensor power supply
MISO	Master In Slave Out path
SPI NSL	SPI frame signal: Not-Shift Load (high on idle SPI)
MOSI	Master Out Slave In (single 32 bit word for ALL transmissions of a contiguous data batch)
OUT 2	Push pull output
GND_ISO	Gnd level of supply
GND	Internal device gnd level DO NOT CONNECT
SPI CLK	SPI clock signal
SPI SNL	SPI frame signal (Shift Not-Load signal, high on active SPI)
GND_ISO	Cable shield

Please note that in case of using SPI mode rather than SSI mode different pins for clock and data transmission have to be connected to the sensor (see pin assignment for details).

Moreover, please connect GND and GND_ISO to avoid floating potentials.

All specifications for the SSI mode are valid in SPI mode as well.

General handling

Please do not connect SSI2USB to a hub, since this connection might not provide the SSI device with enough power or might limit the data transfer.

The USB connection cable should have a cable diameter specification of at least:

Length / m	Cable specification
1	24 AWG / 2C
2	20 AWG / 2C

SSI2USB: Principle of Operation

The main unit for data transfer within the SSI2USB device is a 32 bit shift register.

The register's content is shifted with every clock cycle, which explains the necessity of defining a binary mask: all bits occupying storage places higher than the MSB of the actual data transfer belong to the previous communication or the SSI leading high level. Since this data is of no interest the binary mask simply cancels these bits.

In all cases, specify one clock cycle more than the actual desired word length indicates to accommodate for the leading high level of the SSI transmission (refer to SSI specification for this issue).

Additionally, the data word may be patched by extra bits (alarm bits) that have to be cut out before doing a gray to binary code conversion; the gray code mask cancels these bits before the process of conversion and the cut bits are attached afterwards again.

SSI2USB is capable of issuing 63 clock cycles, enabling the device of shifting through a longer data word than 32 bits (of course only 32 bits of the data word are caught and transferred to the USB interface).

Longer data words than 32 bits may be read out by using a batch trick: define a batch of two 32 bit samples and a sample rate resulting in a delay between the two samples not exceeding the SSI pause time. This allows to split a long data word into two smaller 32 bit sections.

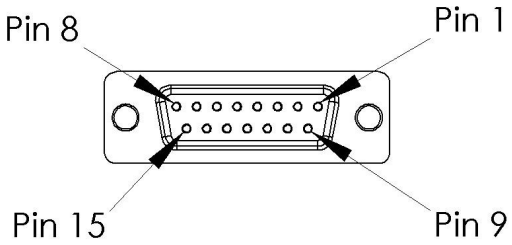
Using SPI mode, the line drivers for communication with the target device are bypassed. With this mode, the target is directly connected to the internal FPGA of SSI2USB; please be aware that this might harm the device.

With SPI mode, the 32 bit shift register is filled with the a word before transmission which will be sent to the slave (within one batch, the same word is sent with every transmission). When using shorter transmissions than 32 bits, the word sent to the slave has to be MSB aligned in the register, because the transmission works MSB first.

Pin Assignment

15 pin Female D-Sub Connector

Pin No.	Signal Name	Comment
1	SSI DAT-	RS422 data negative path
2	SSI CLK-	RS422 clock negative path
3	OUT 3	Push pull output
4	OUT 1	Push pull output
5	UB_EXT	Sensor power supply
6	MISO	TTL data line
7	SPI NSL	SPI frame signal
8	MOSI	SPI output data word
9	SSI DAT+	RS422 data positive path
10	SSI CLK+	RS422 clock positive path
11	OUT 2	Push pull output
12	GND_ISO	Gnd level of external supply
13	GND	Internal device gnd level
14	SPI CLK	SPI clock signal
15	SPI SNL	SPI frame signal
Shield	GND_ISO	Cable shield



For single-ended (TTL) transmission:

- connect GND and GND_ISO
- use transmission lines for SPI mode

Status LEDs

Four status LEDs indicate different modes:

Name	Colour	Description
OK	green	Device ready for operation
Busy	yellow	Device busy, user has to wait
PWR INT	red	Indicates usage of internal (USB) power
PWR ISO	red	Indicates usage of high power voltage (either 11V internal or external supply)

Accessories and Documentation

Description	Article number
External power supply	
USB cable	included
SSI2USB graphical user interface (*)	-
SSI2USB graphical user interface Visual Studio MFC sources (*)	-
	-

(*) Visit our homepage www.fraba.com. All files can be downloaded free of charge from our homepage.

We do not assume responsibility for technical inaccuracies or omissions. Specifications are subject to change without notice.

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