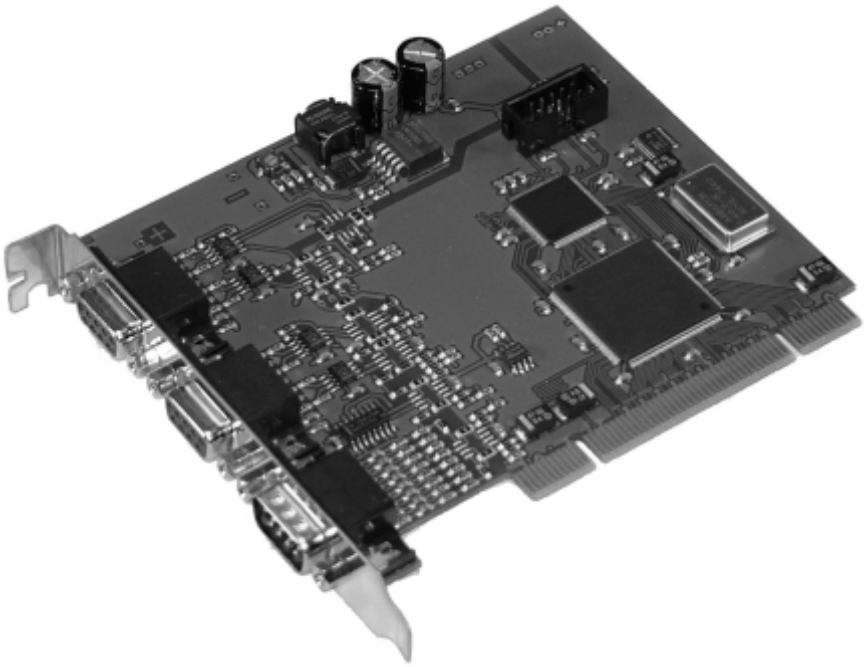
SSI 1417

PCI-Card for SSI-Encoder

Instruction Manual



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Electronic GmbH

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Stand : 03.2010
ssi1417_man_en.vp
Technical subjects to change

1. Safety Instructions

This instrument is produced in accordance with Class II of IEC 348 and VDE 0411. When delivered the intrument has been tested to meet all functions described. Before installing the instrument please read the mounting and servicing instructions. We have no liability or responsibility to customer or any other person or entity with respect to any liablity, loss or damage caused or alleged to be caused directly or indirectly by equipment or software sold or furnished by us. Read the installation instruction carefully. No liability will be assumed for any damage caused by improper installation.
Inspect the instrument module carton for obvious damage. Be shure there are no shipping and handling damages on the module before processing. Do not apply power to the instrument if it has damaged.
The warranty does not apply to defects resulting from action of buyer, such as mishandling, improper interfacing, operation outside of design limits, improper repair or unauthorized modifications.

1.1. Symbol Explanation




Caution **Attention** **Instruction** **Tip**

Caution: Will be used at **dangerous for life and health !**

Attention: Will cause **damage.**

Instruction: If not noticed, **Trouble** may occur.

Tip: Useful hints for **better operation.**

2. General

The SSI 1417 is a PCI-card for evaluation of 2 SSI-encoders. Additionally there are 2 inputs to set the encoders to zero and 2 inputs for triggered data aquisition. The card also contains a timer for time driven data aquisition.

Available options:

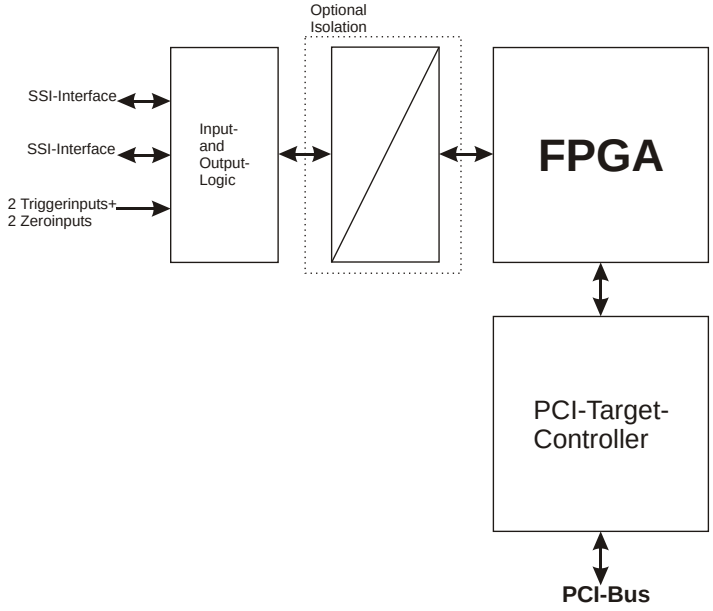
- Opto-isolation

3. Function

The SSI 1417 will use one PCI-slot within the pc. Because the PCI-bus supports plug and play, there are no jumpers or switches to change configuration. The card will use 8 x 32-bit-IO-addresses for the function and 16 x 32-bit-IO-adresses for the PCI-target-controller. You can use any number of SSI 1417 within one pc (depends on number of PCI-slots). The standard drivers supports up to 4 cards. If more than 4 cards should be used, you can ask for a driver for more cards. The card has one 9-pin SUB-D male connector for the inputs and two 9-pin SUB-D female connectors for the encoders.

The functions of the card will be handled in a FPGA. This free programable device makes it possible to support customer specific functions without changing the hardware. It is possible to implement additional special functions or fast controllers within the FPGA.

4. Block diagram



5. Hints against noisy environment

All inputs and outputs are protected against noisy environment and high voltage spikes. Nevertheless the location should be selected to ensure that no capacitive or inductive interference can have an effect on the instrument or connection lines.

It is advisable:

- To use shielded, twisted pair cables.
- The wiring of shields and ground (0V) should be star-shaped.
- The distance to interference sources should be as far as possible. If necessary, protective screen or metal enclosures must be provided.
- Coils of relays must be supplied with filters.
- Parallel wiring of input signals and AC power lines should be avoided.

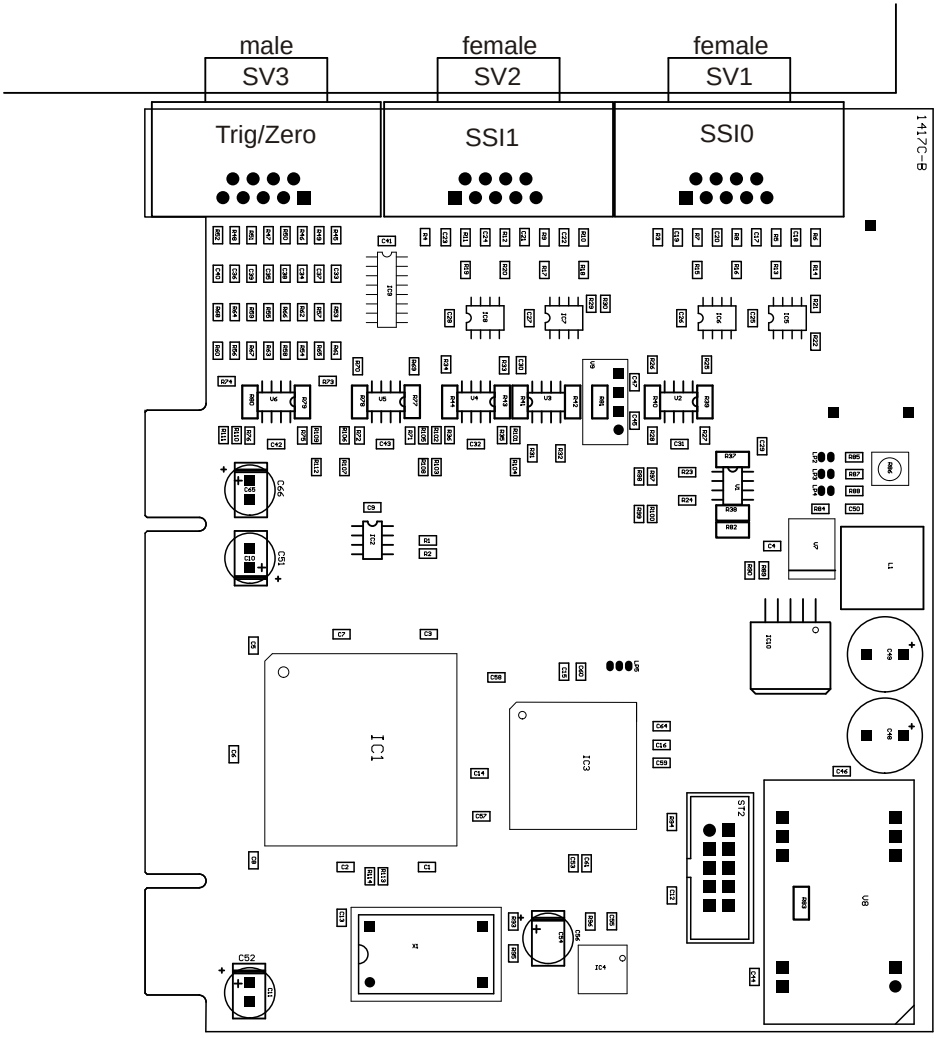
6. Installation

The installation of the card should only be done by qualified personal only. Before installation all components have to be disconnected from power supply. Because within PC's and the peripherals are high voltages it is dangerous to life!

6.1. Hardware configuration

The SSI 1417 uses plug and play and so there is no need for any settings.

6.1.1. Component layout



component layout

6.1.2. Connection of encoders

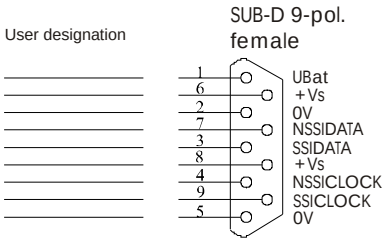


Illustration 3 Pinning of
SSI-female-connector

If external encoder supply is used, don't connect +Vs!

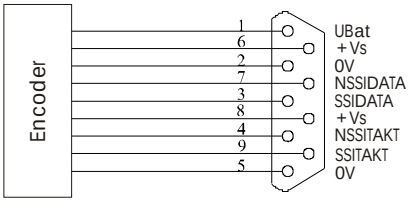


Illustration 1 Connection with
onboard encoder supply

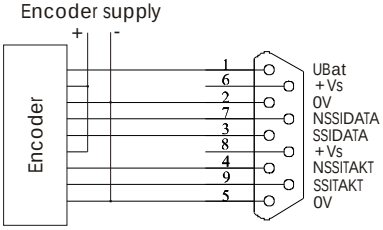
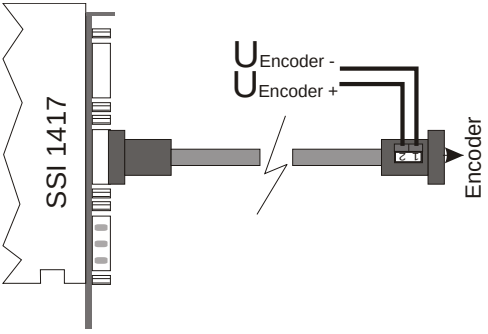


Illustration 2 Connection for
external encoder supply

Configured cable for external encoder suppl **KA 1417**



6.1.3. Connection of inputs

The SSI 1417 contains 2 trigger- and 2 zero-inputs. These inputs are designed as EIA RS422, but can also be used as high- or low-side inputs.

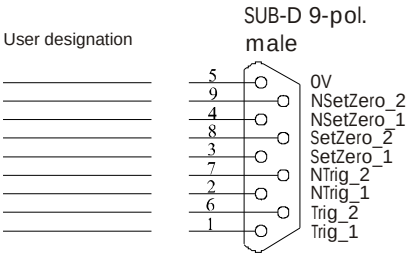
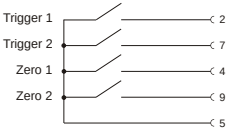
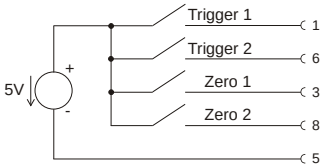


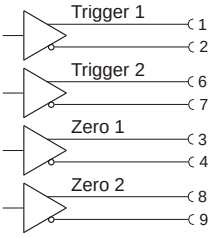
Illustration 4



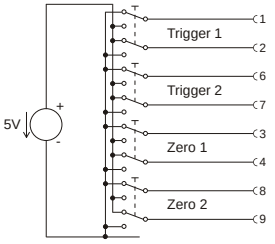
low-side inputs



high-side inputs



differential inputs (RS422)



differential inputs (RS422)

6.2. Open PC

Before opening the pc-case disconnect power supply! The case should be opened as described by the manufacturer of the PC.

6.3. Card insertion

While nserting the card you could be hurt. This is because all components on the cards and in the PC have sharp pins. So this work have to be done carefully. Thee SSI 1417 should be placed in a free PCI-Slot. The card should be installed vertically from above. Afterwards the slot plate of the card have to be screwed to the backside of the PC-case.

! The slot plate is used for mounting and also for shielding. Keep in mind that removal of the plate will result in loss of shielding and card and PC will be more sensitive to EMC. Additionaly the card won't be held in slot-position when external force will happen to the connected cables. Then the card could move within the slot and that can result in damage to the SSI 1417 and the PC! So, don't remove the slot plate!

6.4. Close PC

The case should be closed as described by the manufacturer of the PC.

6.5. Driver installation

On most Windows-versions you must have administrator rights to install drivers.

6.5.1. Windows 95 / 98 / ME

Windows will recognize the new card and ask for the driver. The driver is on the disc within the directory Driver\Win9x.

! **ATTENTION:** Windows 95 does not support PCI-SubvendorID. So you can't use different cards with AMCC S5920Q. If that happens, please use Windows 98 instead.

6.5.2. Windows NT4.0

You have to start the program SETUP.EXE. The program is on the disc within the directory Driver\WINNT40. The program will install the driver and the DLL.

6.5.3. Windows 2000

Windows will recognize the new card and ask for the driver. The driver is on the disc within the directory Driver\Win2000.

6.5.4. Windows XP

Windows will recognize the new card and ask for the driver. The driver is on the disc within the directory Driver\WinXP.

6.6. Configure software

All example-programs are shipped as executable and source-code. With the “Conf”-button you can assign encoder-numbers to each encoder. All example-programs will only work with encoders 1 and 2.

6.7. Test of the card

After installation the card could be tested.
Therefor you can use the example-programs on the disc.

7. Programming

7.1. Programming under Windows

To build applications for Windows the disc includes different drivers for all Windows-versions. To keep the programming of the SSI 1417 as easy as possible, all functions of the drivers are handled within one DLL. So all programming of the card is done by using the DLL.
The file ERMA_SSI.DLL should be copied to the Windows system directory or the application directory.

7.2. Programming with ERMA_SSI-DLL

The DLL ERMA_SSI.DLL includes all functions necessary for the work with the SSI 1417.

The return value of all functions reports an error-code. A return value of **SSI_ERR_OK** will show successful execution. Otherwise the code will show the type of error.

The encoder numbers are bitwise coded. So it is possible to call some special functions for more than one encoder at a time. For example it is possible to trigger all encoders with one function call. All encoders of one card will be triggered at the same time, encoders on different cards will be triggerred after a very small time.

The position values can be up to 44-bit. Therefore all programming languages should have 64-bit integer types. But that is not possible so a structure of 2 x 32-bit integer is used. The structure is devided into a multiturn-part (number of revolutions) and a signleturn-part (position within one revolution).

Programs written for use with ERMA_SSI-DLL will run under Windows 9x / ME, Windows NT 4.0 / 2000 / XP. Therefor only the DLL and the corresponding driver is necessary.

7.2.1. Functions

General functions

SSIInit
The function SSIInit must be called once at the beginning of the program. The function initialises the DLL and the drivers and afterwards all connected encoder will be searched (AutoConf).

SSIDeInit
The function SSIDeInit must be called once at the end of the program. All pending datas will be erased and all interrupts closed.

SSISetLanguage
This function sets the language of the configuration dialogs. You can choose german, english or automatic. Automatic means that the dialogs will apear in german on german operating systems and english on all other. The following parameters were used:

- 0 = Automatic
- 1 = German
- 2 = English

SSIConfEncoder
This function opens a dialog for easy configuration of all encoders. The encoder numbers can be assigned to each encoder, the type of encoder can be set manually and the encoders can be completely configured. The input parameter should be **0** for future functions.

SSIAutoConf
This function will try to identify the selected encoders and get all parameters of them. The input parameter is a single encoder number or a summed/ored value of multiple encoder numbers. The function SSIInit uses this function with all possible encoder numbers to find all encoders.
Example: SSIAutoConf (EncoderNr2)
SSIAutoConf (EncoderNr1 or EncoderNr2 or EncoderNr10)

SSIGetEncoderType
This function is used to get the type of an encoder. There are the following return values:

- NO_ENCODER
  There is no encoder connected.
- GENERIC_SSI
  Connected encoder is a generic SSI-encoder

SSISetEncoderType
This function should be used to manually set the type of an encoder. The possible parameters are described in SSIGetEncoderType. Keep in mind, that all changes are lost with the next start of the program.

SSIGetStatus
This function returns the status of one encoder. The status is bitwise coded. The following bits are used:

- PRESENT
  If this bit is set, an encoder is connected to the port corresponding to the encoder number.
- STARTED
  The data aquisition for that encoder is started when set. Data will only be saved if trigger-modes are set.
- STOPPED
  If set, data aquisition for that encoder is stopped.
- SSIVALUES
  If set, this bit indicates saved data in FIFO. Use SSIGetSSIValues to get the values.
- SSIOV
  This bit indicates an overflow in the FIFO for SSI-values. Datas will be lost. This happens if the data is read to slowly with the function SSIGetSSIValues (too few calls to SSIGetSSIValues or too small buffer) or the trigger speed is to high. The maximum trigger speed depends on the used operating system, running threads and speed of the PC.
- ZEROED
  Not used at the moment.

SSIGetResolution
This function returns the resolution of an encoder. The structure contains separate bitcounts for revolutions (MT) and position (ST).
Expl.: Resolution.MT = 0, Resolution.ST = 17 -> 17-Bit-Singleturn-Encoder
Resolution.MT = 12, Resolution.ST = 13 -> 25-Bit-Multiturn-Encoder

SSISetResolution
This function will set the resolution of one encoder (see datasheet of encoder).

SSILatch
With this function one or more encoders where triggered. The software trigger must be set (SSISetTrigger). Get the values with SSIGetSSIValues when transmission is ready.

SSIStop
This function will stop data aquisition of one or more encoders. All encoders connected to one card are stopped at the same time, encoders on different cards with a little delay.

SSIStart
This function will start data aquisition of one or more encoders. All encoders connected to one card are started at the same time, encoders on different cards with a little delay.

SSIGetSSIClock
This function returns the divider of the SSI-clock generator. The frequency can be calculated as:

Frequency = 5 MHz / Divider

SSISetSSIClock
This function will set th divider for the SSI-clock generator. The divider can be calculated as:

Divider = Frequency / 5 MHz

Only integer values are possible. Not all values are possible for each encoder. See the datasheet of the encoders for possible clock rates.

SSIGetTrigger
This function returns the triggermodes of an encoder. The mode is bitwise coded, so multiple trigger are possible. Bits are coded as follows:

- TRIGGERSOFT
  This is the software trigger. Is this bit set, the encoder can be triggered using the function SSILatch.
- TRIGGERTIME
  If this bit is set, the encoder is triggered by the card's timer. So timed data aquisition is possible.
- TRIGGEREXT1
  TRIGGEREXT2
  These bits activate triggering with digital inputs Trig1 and/or Trig2. So data aquisition on external events is possible.
- TRIGGERNULL1
  TRIGGERNULL2
  These bits activate the zero inputs.

SSISetTrigger
This function will set the trigger modes for one encoder. Remember, on generic SSI-encoders the external zero setting is impossible. The bits are coded as seen at SSIGetTrigger.

SSIGetTimer
This function returns the divider of the timer. The frequency can be calculated as:

Frequency = 1 / (Divider * 5 µs)

SSISetTimer
This function will set the divider for the timer of one encoder. The divider can be calculated as:

Divider = 1 / (Frequency * 5 µs)

Only integer values are possible. Care should be taken that the time between 2 transmissions has to be shorter than the timer frequency or you will loose some trigger events.

SSIGetMfTime
This function returns the monofloptime of one encoder. Possible values are 2 to 63 µs):

- MFTIME2US = Monofloptime 2 µs
- MFTIME3US = Monofloptime 3 µs
- ...
- MFTIME62US = Monofloptime 62 µs
- MFTIME63US = Monofloptime 63 µs

SSISetMfTime
This function will set the monofloptime of one encoder. On generic SSI-encoders the monofloptime will only be set in the SSI 1417. Possible Values are shown in SSIGetMfTime.

SSIGetSSIValues
With this function saved position values of an encoders could be read out of the FIFO blockwise. .

SSIGetConversion
This function returns the conversion mode of one encoder. Possible values are:

- 0 = no conversion
- 1 = conversion gray to binary

SSISetConversion
This function will set the conversion mode of one encoder. Possible values are shown at SSIGetConversion.

SSIGetMasterSlave
This function returns the mode of operation. Possible values are:

- MASTERMODE
- SLAVEMODE

SSISetMasterSlave
This function will set the mode of one encoder. Possible values are shown above.

7.3. Usage within own applications

7.3.1. Visual Basic

Within directory Include\VB on the cd there is the file ERMA_SSI.BAS. If this file is included within a VisualBasic-project, all DLL functions for SSI 1417 are available in the project.

7.3.2. Visual C++ / LabWindowsCVI

For C/C++ applications there are an import library ERMA_SSI.LIB and an header-file ERMA_SSI.H. The library has to be inserted in the linker-options of the project-settings (see documentation of VisualC++/LabWindowsCVI). Include the header-file in all source-files where SSI 1417 functions are needed.

An additional method is to use the Windows-function LoadLibrary to connect the application to the DLL. See documentation of VisualC++ / LabWindowsCVI for further information.

7.3.3. Delphi

In the directory Include\Delphi of the cd there is a Delphi unit source file ERMA_SSI.PAS. If this file is inserted within a Delphi-project all DLL-functions of the SSI 1417are available. Insert this unit to all uses-declarations where SSI 1417 functions are needed.

7.4. Direct programming

For use of the SSI 1417on other operting systems or to get faster reaction times or special reactions other drivers should be implemented. Therefore all needed information follows.

Addresses and interrupts of the card

The SSI 1417 uses 2 IO-addressranges and 1 interrupt. Because of the plug-and-play of the PCI-bus these data should be found out. Therefore functions of the BIOS has to be used like described in "PCI BIOS SPECIFICATION Revision 2.1".

The SSI 1417 uses a configuration space header type 00h. The datas could be found in the PCI-configuration space on BaseAddress0, BaseAddress1 and InterruptLine. With BIOS-function the data could be read out of the configuration space. BaseAddress0 is used for the PCI-target controller, BaseAddress1 for the SSI-functions of the card.

For the BIOS-functions the following informations are necessary:

- VendorID = 0x10E8 (AMCC)
- DeviceID = 0x5920 (S5920Q)
- SubVendorID = 0x1485 (ERMA - Electronic GmbH)
- SubSystemID = 0x0005 (SSI 1417)

Functions of the PCI-target

Initialisation of the PCI-target

Write value 0x87878787 to address BaseAddr0 + 0x60

Enable interrupts

Write value 0x00002C0C to address BaseAddr0 + 0x38

Disable interrupts

Write value 0x00000C0C to address BaseAddr0 + 0x38

Reset interrupts

Read a value from address BaseAddr0 + 0x38
First reset the interrupt of the card, then the interrupt of the PCI-target.

7.4.1. Registers of SSI 1417

Position-register

read only

BaseAddr1 + 0x00	Position Encoder0 Low-DWord
BaseAddr1 + 0x04	Position Encoder0 High-DWord
BaseAddr1 + 0x08	Position Encoder1 Low-DWord
BaseAddr1 + 0x0C	Position Encoder1 High-DWord

Status-register

Read/Write BaseAddr1 + 0x10

Bit 0	Encoder0 : Encoder present
Bit 1	Encoder0 : Changes on “Encoder present” (Interrupt)
Bit 2	Encoder0 : Interrupt, position values present
Bit 3	Encoder0 : Interrupt, overflow
Bit 4 + 7	not used
Bit 8	Encoder1 : Encoder present
Bit 9	Encoder1 : Changes on “Encoder present” (Interrupt)
Bit 10	Encoder1 : Interrupt,pPosition value present
Bit 11	Encoder1 : Interrupt, overflow
Bit 12 - 29	not used
Bit 30	Global interrupt-status
Bit 31	Global interrupt-enable

Only interrupt-enable bit is writeable, all other read only.

Latch-register (software-trigger)

Write only BaseAddr1 + 0x00

Bit 0	Trigger Encoder0
Bit 1	Trigger Encoder1
Bit 2 - 31	not used

Configuration-registers

Read/Write BaseAddr1 + 0x14

- Switch to Encoder0-configuration-register:
  Write value 0x00000000 to BaseAddr1 + 0x08
- Switch to Encoder1-configuration-register:
  Write value 0x40000000 to BaseAddr1 + 0x08
- Switch to timer-configuration-register:
  Write value 0x80000000 to BaseAddr1 + 0x08

Encoder0/1-configuration-register

Bit 0 - 5	Resolution bitcount (max. 44)
Bit 6 - 7	not used
Bit 8 - 14	SSIClock (Frequency = 5 MHz / this value)
Bit 15 - 20	Monofloptime (2 to 63 µs)
Bit 21 - 24	not used
Bit 25	Master/Slave-Mode (0 = Master, 1 = Slave)
Bit 26	Enable trigger input 1 for this encoder
Bit 27	Enable trigger input 2 for this encoder
Bit 28	Enable zero input 1 for this encoder
Bit 29	Enable zero input 2 for this encoder
Bit 30	Enable software trigger (Latch-register)
Bit 31	Enable timer trigger (timer-configuration-register)

Timer-configuration-register

Bit 0 - 15	Timervalue = 1 / (Frequency * 5 µs)
Bit 16	Enable timer
Bit 17 - 31	not used

7.4.2. Tips and Tricks

- While programming interrupts keep in mind:
  - Set global interrupt enable.
    (is done by SSIStart of ERMA_SSI.DLL when used)
  - Set used interrupt-enables

- If drivers are developed, the following points should be considered:
  - While writing to registers, set all unused bits to 0
  - While reading registers, mask out all unused bits.
  This will safe compatibility with future changes.

8. Troubleshooting

All PC-boards of ERMA-Electronic GmbH are tested during manufacturing as well as when delivered. Nevertheless it can occur that a new board doesn't work. That must not be a failure of the board. There are many minor details when a new board doesn't work. In that case at first some points should be paid attention to.

- One of the most frequent failures are dirty slots. It is recommended to clean the connector of the board with a cloth and a little spirit.

- Further it can happen that the board doesn't fit correctly into the slot or into the PC case. The dimensions of the board are standardized. But the dimension of the PC cases are sometimes out of the prescribed dimensions.

- The cable of the peripherie should be tested.

If you have observed the hints above and the board doesn't work at all call the ERMA - Team. The ERMA-Team will help you.

9. Technical datas

Interfaces	: 2 x SSI
Supported Encoders	: Generic-SSI-Encoder
Inputs	: EIA RS422
Max. Resolution	: 44 Bit, programable separately for each interface
Clock Outputs	: EIA RS422
Max. Clock	: 5 MHz, programmable seperately for each interface
Timer	: 5 µs to 200 ms programmable
Trigger Inputs	: 2 x EIA RS422, low- and high-side also possible
Zero Inputs	: 2 x EIA RS422, low- and high-side also possible
Encoder Power Supply	: Optional 5 V / 2 x 300 mA or 12 V / 2 x 125 mA or 24 V / 2 x 60 mA
Isolation	: 500 VDC (only with option galv. isolation)
Connectors	: 2 x 9-pol. SUB-D-female for SSI 1 x 9-pol. SUB-D-male for Trigger- and Zero-Inputs
EMC	: corresponding to 2004/108/EG
Operating Temperature	: 0 bis 40 °C
Storage Temperature	: -25 bis +85°C
Dimensions	: 132 x 105 mm

10. Ordering information

SSI 1417/	**x/**	**0/**	**xx**	
			Encoder Power Supply	
		0	**00**	Without power supply
		0	**05**	With 5 V power supply
		0	**12**	With 12 V power supply
		0	**24**	With 24 V power supply
	Galvanic (opto) Isolation			
	0	Without galvanic isolation		
	1	With galvanic isolation		

Accessory cable for external encoder supply (1 for each encoder)

KA 1417

11. Notices

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