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PARTNER FÜR PRÄZISION

Function Description

BiSS-Master

APCIe-1711 and CPCIs-1711
Multifunction counter board, galvanically isolated

DIN EN ISO 9001:2015 certified

Edition: 02.11-01/2022

Product information

This manual contains the technical installation and important instructions for correct commissioning and usage, as well as production information according to the current state before printing.
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Trademarks

Warning!

The following risks result from the improper implementation of the board and from use contrary to the regulations:

Personal injury

Damage to the board, the PC and peripherals

Pollution of the environment.

- Protect yourself, others and the environment!
- Read the safety precautions (yellow leaflet) carefully!

  If this leaflet is not enclosed with the documentation, please contact us and ask for it.
- Observe the instructions of this manual!

  Make sure that you do not forget or skip any step!
  We are not liable for damages resulting from the wrong use of the board.
- Pay attention to the following symbols:

NOTICE!
Designates hints and other useful information.

NOTICE!
Designates a possibly dangerous situation.
If the instructions are ignored, the board, the PC and/or peripherals may be **destroyed**.

WARNING!
Designates a possibly dangerous situation.
If the instructions are ignored, the board, the PC and/or peripherals may be **destroyed** and persons may be **endangered**.

Contents

Figures

Tables

Chapter overview

In this function manual, you will find the following information:

Chapter	Content
1	Function description including block diagram and pin assignment
2	Standard software: Information on the API software functions
3	Appendix with index
4	Contact and support address

This document solely describes the function “BiSS-Master”.

For general information on the **APCIe-1711** or **CPCIs-1711**, please read the Technical Description of these boards (see PDF link). It contains, for example, the chapter “Inserting and installing the board” that supports you in commissioning.

1 Function description

In the following chapters, the most important features of the “BiSS-Master” function are described. If you wish to get more detailed information on this function, please go to the website www.biss-interface.com.

The BiSS sensor interface enables sensor data to be read out quickly (sensor mode), or registers in single addressable sensors to be written and read out (register mode).

NOTICE!
Not every type of sensor allows for register access.
Please refer to the sensor manufacturer’s datasheet to see if the register mode is supported, which registers can be accessed and which kind of data these registers contain.

The BiSS-Master function modules of the **APCIe-1711** or **CPCIs-1711** support the BiSS protocol versions B and C mode.

1.1 Board versions with “BiSS-Master” function

NOTICE!
The “BiSS-Master” function **cannot** be used with the 24 V version of the **APCIe-1711** or **CPCIs-1711**.

Table 1-1: Board versions with “BiSS-Master” function

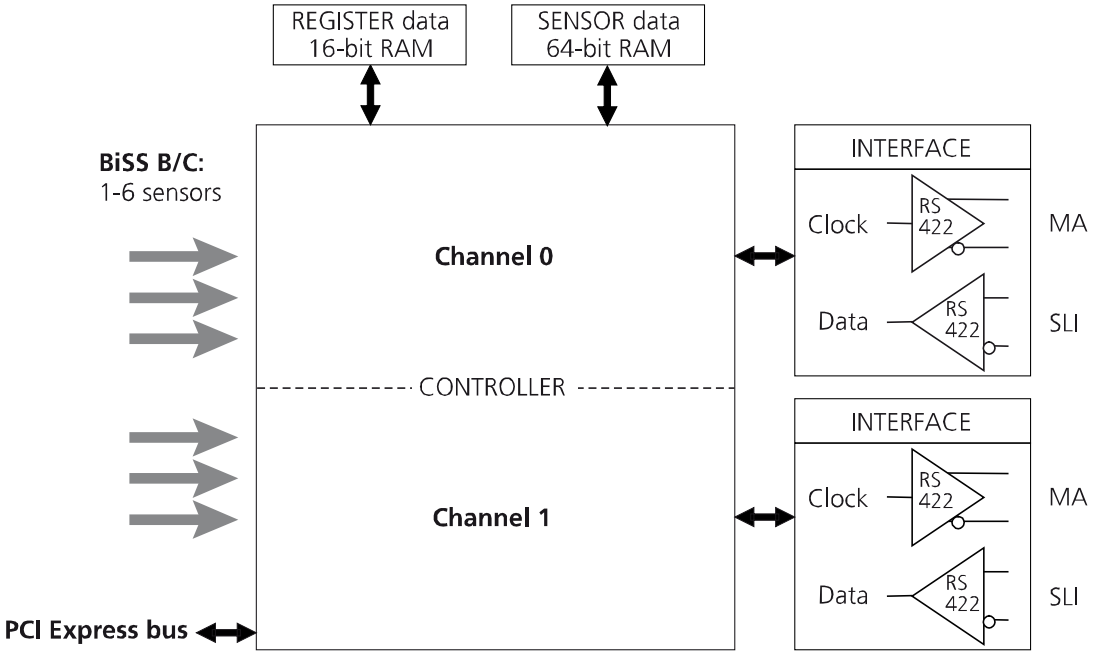
Board version	“BiSS-Master” function
APCIe-1711	x
APCIe-1711-24V	-
APCIe-1711-5V-I	x
CPCIs-1711	x
CPCIs-1711-24V	-
CPCIs-1711-5V-I	x

The I/O specifications of the different board versions are available in the Technical Description of the **APCIe-1711** and **CPCIs-1711** (see PDF link).

1.2 Block diagrams

On one board, you can operate a maximum of 4 BiSS-Masters with two channels (0 and 1) each, i.e. 1 BiSS-Master per function module.

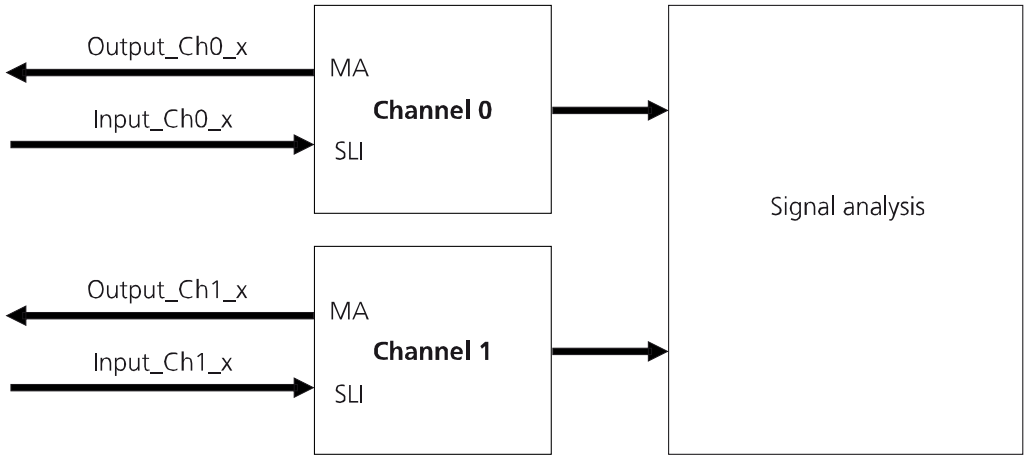
Fig. 1-1: Block diagram: "BiSS-Master" function



A maximum of 3 BiSS B or C sensors can be connected to each of channels 0 and 1.

MA = Clock output
SLI = Data input

Fig. 1-2: Simplified block diagram: "BiSS-Master" function



MA = Clock output
SLI = Data input

1.3 Used signals

With each function module, the “BiSS-Master” function uses two differential inputs (B and D) and two differential outputs (A and C).

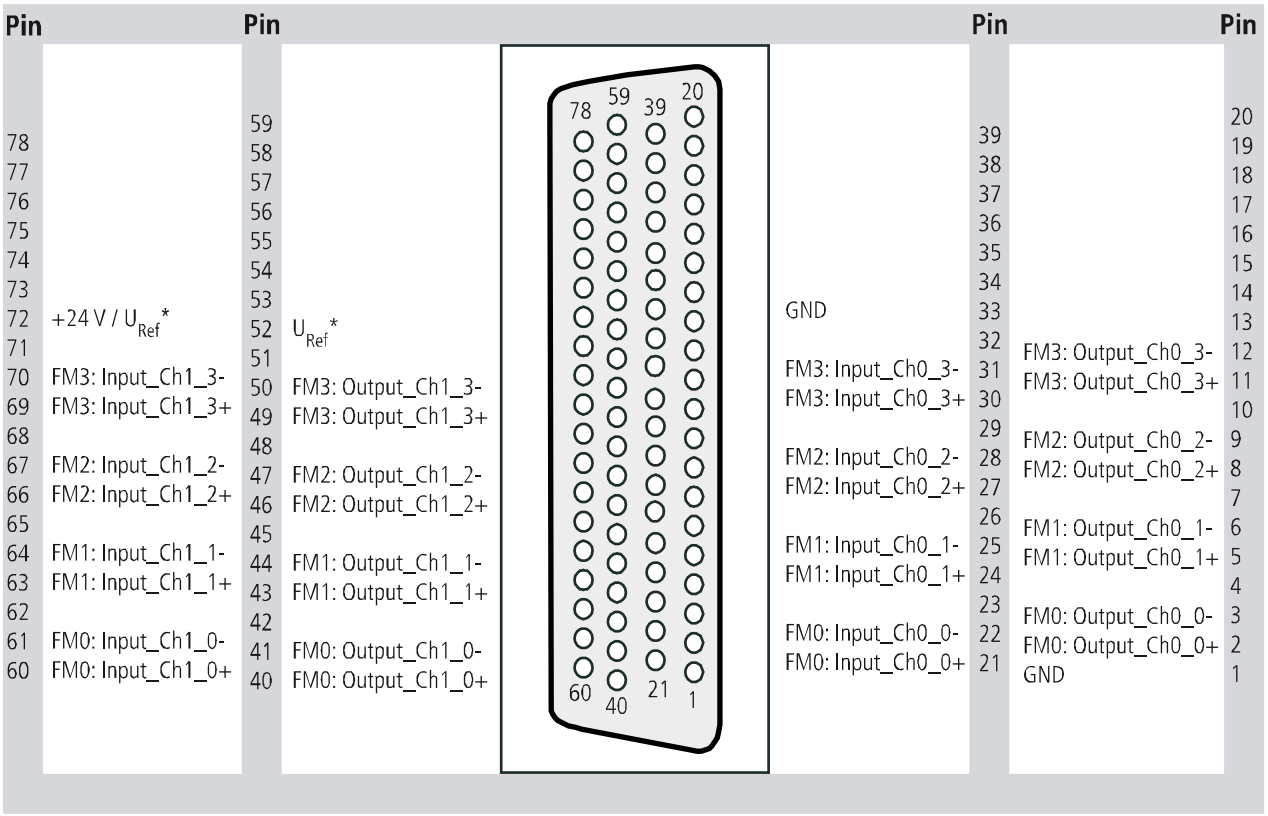
Table 1-2: Used signals

Signal name	Pin name	Signal type	Function
Output_Ch0_x+/-	Ax+/-	Differential	Channel 0: digital output (clock line from the master to the slave)
Input_Ch0_x+/-	Bx+/-	Differential	Channel 0: digital input (data line from the slave to the master)
Output_Ch1_x+/-	Cx+/-	Differential	Channel 1: digital output (clock line from the master to the slave)
Input_Ch1_x+/-	Dx+/-	Differential	Channel 1: digital input (data line from the slave to the master)

x = Number of the function module (0-3)

1.4 Pin assignment: Function modules

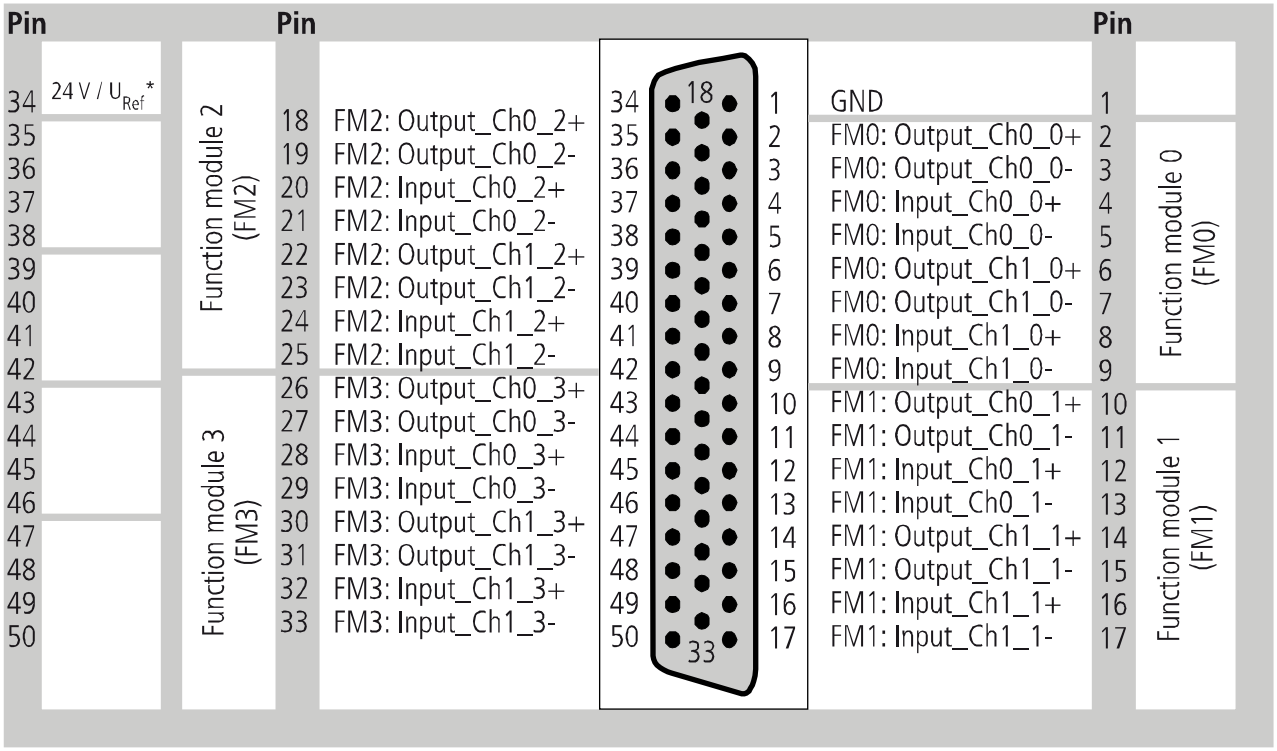
Fig. 1-3: Pin assignment: 78-pin D-Sub female connector (4 BiSS-Master modules)



FM = Function module
* Pins 52 and 72: see Technical Description of the board

The following pin assignment applies only if the cable **ST1711-50** is connected to the 78-pin D-Sub female connector of the board. For further information on this, please refer to the Technical Description of the **APCIe-1711** and **CPCIs-1711** (see PDF link).

Fig. 1-4: Pin assignment: 50-pin D-Sub male connector (ST1711-50 cable)



* Pin 34: see Technical Description of the board

1.5 Connecting the sensors

1.5.1 Connection to the screw terminal panel

On the screw terminal panel **PX8001**, the pins of the 50 pin D-Sub female connector and the terminals connected to them are numbered in the same way. Thus, the terminal assignment of the screw terminal panel is identical with the pin assignment of the 50-pin D-Sub male connector on the cable **ST1711-50**.

The following table is to serve as a help for you when connecting the sensors to the screw terminal panel. The blank fields in the “Sensor” column can be filled in on the basis of the selected sensor type.

Table 1-3: Connection of the sensors to the screw terminal panel

Sensor			Screw terminal panel PX8001 (50-pin)							
Pin No.	Pin name	Lead colour (cable)	Signal name	Terminal name	Signal type	Terminal No.				Terminal function
						FM0	FM1	FM2	FM3	
	+24 V / U_{Ref}		+24 V / U_{Ref}	+24 V / U_{Ref}	-	34	34	34	34	see Technical Description of the board
	GND		GND	GND	-	1	1	1	1	Ground
			Output_Ch0_x+	Ax+	Diff.	2	10	18	26	Channel 0: digital output (clock line from the master to the slave)
			Output_Ch0_x-	Ax-	Diff.	3	11	19	27	
			Input_Ch0_x+	Bx+	Diff.	4	12	20	28	Channel 0: digital input (data line from the slave to the master)
			Input_Ch0_x-	Bx-	Diff.	5	13	21	29	
			Output_Ch1_x+	Cx+	Diff.	6	14	22	30	Channel 1: digital output (clock line from the master to the slave)
			Output_Ch1_x-	Cx-	Diff.	7	15	23	31	
			Input_Ch1_x+	Dx+	Diff.	8	16	24	32	Channel 1: digital input (data line from the slave to the master)
			Input_Ch1_x-	Dx-	Diff.	9	17	25	33	
			-	-	-	-	-	-	-	-
			-	-	-	-	-	-	-	-
			-	-	-	-	-	-	-	-
			-	-	-	-	-	-	-	-

x = Number of the function module (0-3)

1.5.2 Connection to the channels

With BiSS B and C mode, two channels (0 and 1) are available for each function module. To each channel, a maximum of 3 sensors can be connected.

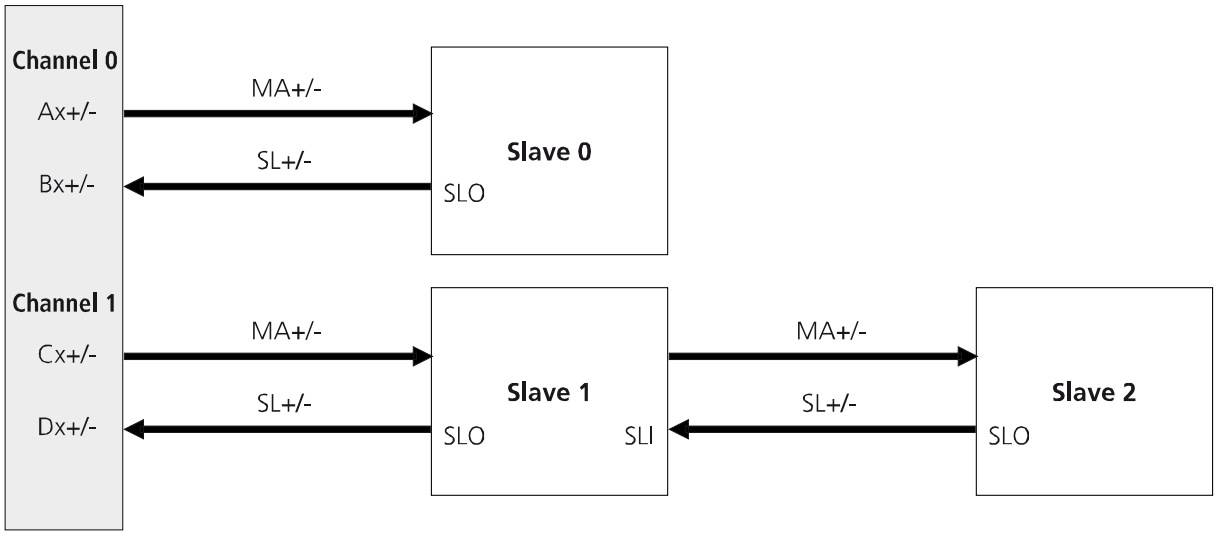
If only 1 sensor is connected to a function module, it has to be connected to channel 0.
To each channel, 2 or 3 sensors are connected by cascading them. For this purpose, the sensors must have a data input (SLI) and a data output (SLO). If a sensor only has a data output, this sensor needs to be connected to the end of the cascade (see Fig. 1-5).

The maximum frequency of the clock or data line is 5 MHz.

1.5.3 Connection example

In this example, three sensors (slaves) are connected to a function module.

Fig. 1-5: BiSS-Master connection example



MA = Clock output
SLI = Data input
SLO = Data output
x = Number of the function module (0-3)

1.6 Function relations

In this chapter, the relations between the individual "BiSS-Master" functions are explained in more detail, with the software functions being indicated accordingly.

1.6.1 Initialisation

Every time before the BiSS-Master is used, the necessary initialisations should be carried out.

For the initialisation of the master, the frequency of the master clock, the sensor protocol (BiSS B or C mode) and the number of sensors (slaves) have to be set so that the sensor data can be read and the registers be accessed.

For the initialisation of the sensor, information that is required for the communication with the sensor needs to be defined, for example the data length, the polynomial and the transfer type of a potential CRC check. This information varies according to the sensor type and can be found on the sensor manufacturer's datasheet.
With some types of sensor it is possible to retrieve this information from www.biss-interface.com using the sensor ID. In order to read this ID from the BiSS sensor's register, the maximum length has to be used as data length for the initialisation and the CRC polynomial has to be set to 0.

Master and sensor are initialised by means of the software function "i_PCIe1711_BissMasterInitSingleCycle".

Example

Fig. 1-6: BiSS sensor (Renishaw, type: RL32BAS001C05A)

The BiSS sensor is connected to channel 0.

Table 1-4: Sensor information

Sensor information	Value	Parameter	Value	Remarks
Sensor data frequency	1 MHz	w_SensorDataFreqDivisor	23	
Register data frequency	1 MHz	w_RegisterDataFreqDivisor	0	
Channel 0 selection: BiSS or SSI	BiSS	b_Channel0BISSSSIMode	0	
Channel 0 selection: BiSS B or C mode	C	b_Channel0BISSMode	1	
Channel 1 selection: BiSS or SSI	BiSS	b_Channel1BISSSSIMode	0	

Sensor information	Value	Parameter	Value	Remarks
Channel 1 selection: BiSS B or C mode	C	b_Channel1BISSMode	1	
Number of connected BiSS sensors	1	b_NbrOfSlave	1	
BiSS sensor connection (slave 0): channel 0 or 1	0	pb_Channel[0]	0	pb_Channel[1], [2], [3], [4], [5] = 0
Data format of the BiSS sensor (slave 0)	32	pb_DataLength[0]	34	Renishaw transfers 2 additional error bits. pb_DataLength[1], [2], [3], [4], [5] = 0
Optional parameter for potential future extensions	0	pb_Option[0]	0	pb_Option[1], [2], [3], [4], [5] = 0
CRC test polynomial	67	pb_CRCPolynom[0]	67	Renishaw-specific; pb_CRCPolynom[1], [2], [3], [4], [5] = 0
CRC test sum: inverted or not inverted	1	pb_CRCInvert[0]	1	pb_CRCInvert[1], [2], [3], [4], [5] = 0

The parameters must be used in the initialisation function:

```
_INT_i_PCIe1711_BissMasterInitSingleCycle ( HANDLE h_DeviceHandle,
                                            BYTE_   b_ModuleIndex,
                                            WORD    w_SensorDataFreqDivisor,
                                            WORD    w_RegisterDataFreqDivisor,
                                            BYTE_   b_Channel0BISSSSIMode,
                                            BYTE_   b_Channel0BISSMode,
                                            BYTE_   b_Channel1BISSSSIMode,
                                            BYTE_   b_Channel1BISSMode,
                                            BYTE_   b_NbrOfSlave,
                                            BYTE_   pb_Channel[6],
                                            BYTE_   pb_DataLength[6],
                                            BYTE_   pb_Option[6],
                                            BYTE_   pb_CRCPolynom[6],
                                            BYTE_   pb_CRCInvert[6]
                                          )
```

Table 1-5: Sensor data frequency calculation

Sensor division factor (SensorDataFreqDivisor)	Sensor data frequency (kHz)
0	2000
1	1000
2	6666.666667
3	5000
4	4000
5	3333.333333
6	2857.142857
7	2500
8	2222.222222
9	2000
10	1818.181818
11	1666.666667
12	1538.461538
13	1428.571429
14	1333.333333
15	1250
(16: not possible)	-
17	1000
18	666.6666667
19	500
20	400
21	333.3333333
22	285.7142857
23	250
24	222.2222222
25	200
26	181.8181818
27	166.6666667
28	153.8461538
29	142.8571429

Sensor division factor (SensorDataFreqDivisor)	Sensor data frequency (kHz)
30	133.3333333
31	125

Register data frequency calculation:

$$\text{Register data frequency} = \text{Sensor data frequency} / 2^{\text{RegisterDataFreqDivisor}}$$

1.6.2 Commands

Sensor data is read via the software function “i_PCIe1711_BissMasterSingleCycleDataRead”.
Only the slave index used with the initialisation has to be indicated.

The sensor registers can be written and read out with the following software functions:
“i_PCIe1711_BissMasterSingleCycleRegisterRead” and
“i_PCIe1711_BissMasterSingleCycleRegisterWrite”.

With both commands, the address and the number of bytes have to be indicated as well as only the slave index used with the initialisation. With the “Write” command, also the data has to be specified.

NOTICE!
Not every type of sensor allows for register access.
Please refer to the sensor manufacturer’s datasheet to see if the register mode is supported, which registers can be accessed and which kind of data these registers contain.

2 Standard software

The API software functions supported by the board are listed in an HTML document. A description of how to access the respective file can be found in the document “Quick installation PC boards” (see PDF link), in the chapter “Standard software”.

3 Appendix

3.1 Index

4 Contact and support

Do you have any questions? Write or call us:

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Manual and software download from the Internet:

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