

PCD2.W745 and PCD3.W745

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0.1 Document History

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Date	Version	Changes	Remarks
2003-12-01	pEN01	-	Preliminary Edition
2005-05-01	EN01	-	Published Edition
2005-09-19	EN02	-	New picture: 1.4 Block diagram
2012-05-02	EN03	-	Registers for using in PCD3.T760
2012-08-10	EN04	-	Appendix A: Added chapter 4 Configuration on PCD3.T760 RIO Module
2013-10-10	EN05	-	nbew logo and new company name

0.2 Brands and trademarks

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Technical modifications are based on the current state-of-the-art technology.

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Published in Switzerland

1 Hardware

1.1 Introduction

1.1.1 General

The PCDx.W745 is a precision analogue input module for temperature measurement application. Linearization and each kind of compensation as well as conversion into °C, °F and K are carried out on this module. The module has four input channels, which can be configured individually.

Supported temperature sensors are:

- Thermocouples – TC type J, K
- Resistive temperature detectors – RTD's type Pt100, Pt1000, Ni100, Ni1000

Further, the module supports all common measurement techniques:

For RTDs:

- Two wire sensor connection
- Three wire sensor connection
- Four wire sensor connection

For Thermocouples:

- Internal cold junction compensation: The sensors are directly connected to the module I/O terminal.
- External cold junction compensation: An external isothermal block can be used. The temperature of the external junction is measured using channel 0.

The configuration of the four input channels is done by software. Every channel can be used independently of the others.

Diagnostics:

The module PCDx.W745 provides powerful sensor diagnostics:

- Overrange detection
- Underrange detection
- Line break detection
- Short circuit detection for RTD's

Galvanic separation:

The module has galvanic separation between Saia PCD® ground and the sensor interface (500 VDC).

1.1.2 Function and application

The PCDx.W745 module is used to measure temperatures in precision and wide temperature range applications.

On the module, a micro controller controls the acquisition of the input signals. Depending the configuration the controller adjusts the measurement amplifier, multiplexes the current sources to the sensors, and controls the sampling of the input channels.

The linearization curves for the supported temperature sensors are stored on the module. Therefore, the CPU can directly read temperature values from the module.

The powerful sensor diagnostics allows to detect wiring errors. So the module indicates when a sensor line is broken or not connected. Further, over range and under-range diagnostics indicates misuse of the chosen sensor type.

1.1.3 Main characteristics

- High precision temperature acquisition system
- Galvanic separation between Saia PCD® ground and input interface
- The module supports a big number of sensor types
- Thermocouples and RTDs on the same module
- Four input channels, software – configurable
- Built – in reference junction for thermocouples
- Possibility to use external reference junction
- RTD measurement techniques: 2- ,3-, 4- Wire connection
- 4 input clamps per channel

1.1.4 Typical areas of use

- Temperature regulation / supervision in industrial applications
- Measurement of very high temperatures using thermocouples

1.2 Technical Data

Technical specification

All specifications at 25°C ambient temperature, unless otherwise noted.

1

Sensor types	TC Type J	TC Type K	Pt100 Pt1000	Ni100 Ni1000
Input range for temperature sensors	-210...1200°C¹ DIN IEC 584	-270...1372°C¹ DIN IEC 584	-200...850°C DIN IEC 751	-60...250°C DIN IEC 43760
Measurement range	-75 mV...+75 mV		Pt/Ni100: 0...600 Ω Pt/Ni1000: 0...5000 Ω	
Resolution	0.1°C		0.1°C	
	2.5 μV		0.01 Ω (600 Ω range) 0.10 Ω (5000 Ω range)	
Measuring error in % of full scale value²	0.05 %		0.05 %	
Measuring error in °C	Alternative to the “measuring error in %” specification above:			
	-100...+100°C: <0.4°C -150...+500°C: <0.7°C -150...+1000°C: <1.0°C		-100...+100°C: <0.3°C -150...+500°C: <0.4°C -200...+850°C: <0.5°C	
Temperature coefficient of full scale value²	10 ppm/K		80 ppm/K	
Sampling time per channel	250 ms			
Measurement resolution	16 bit			
50Hz rejection	> 75 dB			
60Hz rejection	> 60 dB			
Line break detection	✓	✓	✓	✓
Short circuit detection	x	x	✓	✓
Linearization	on Board			
Compensation of cold junction temperature	on Board		N/A	
Cold junction internal	Yes³		N/A	
Cold junction external	Yes		N/A	
Connection techniques for resistors (RTD's)	N/A		2-wire 3-wire 4-wire	
Galvanic isolation	500 VDC between Saia PCD® and analogue inputs			

¹) For thermocouples, the full measurement range is offered. The specifications of resolution and accuracy are given for temperatures higher than -150°C. For lower temperatures than -150°C, the characteristics of thermocouples become worse. If thermocouples are used in this very low temperature range, the tolerance should be calculated using the tolerance specifications for the ±75 mV range and the thermocouple characteristic.

²) Measuring error in % and temperature coefficient specifications made for the measurement ranges ±75 mV, 600 Ω, 5000 Ω.

³) Technical data of the internal cold junction are specified in the following section.

General specifications

PCD2.W745	Temperature module, supports thermocouples type J, K and RTD's type Pt100, Pt1000, Ni100, Ni1000 → Suitable for PCD1 & PCD2 systems
PCD3.W745	Temperature module, supports thermocouples type J, K and RTD's type Pt100, Pt1000, Ni100, Ni1000 → Suitable for PCD3 systems
Ambient temperature	Operation: 0...+50°C without forced ventilation Storage: -25...+85°C
Power supply:	No external power supply necessary
Internal power consumption from +5 V bus:	200 mA
Wire gauge:	max. 0.5 mm ² (AWG 20)
Wire Stripping:	Remove 10 mm of isolation

1

Internal reference junction (internal cold junction)

The built-in Reference Junction is used when thermocouples are directly connected to the module.

	Built-in Temperature sensor
Operating temperature range:	0...55°C
Resolution:	0.1°C
Measuring error at 25°C:	0.8°C
Drift over operating Temperature Range (0...55°C):	0.05°C/°C
Stabilization time:	5 min.



The CPUs PCD1/2/3 and the basic units PCD3 provide the following internal supply:

Type	+5 V	V+
PCD3.Mxxxx	600 mA	100 mA
PCD3.C200	1000 mA	100 mA
PCD3.T76x	650 mA	100 mA
PCD2.M1xx	1600 mA	200 mA
PCD2.M48x	2000 mA	200 mA
PCD1.M1xx	750 mA	100 mA

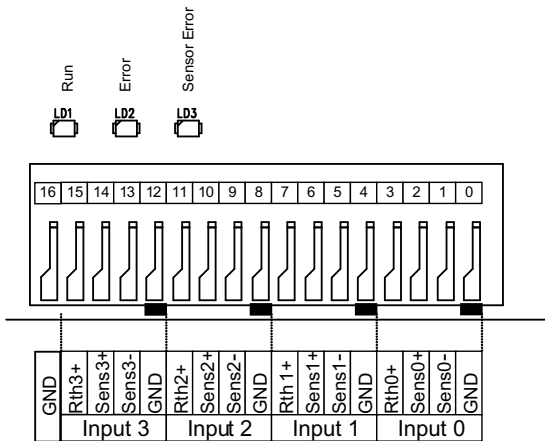
Users of PCDx.W745 modules are urged to check the overall current consumption of all modules in a PCD1/2/3 and in any C100 or T76x expansion units to ensure that this maximum is not exceeded.

When working with an expansion unit and up to 8 W745 modules, it is better to place the PCDx.W745 modules in the base unit and to plug "normal" I/O modules into the expansion unit. This will eliminate any influences such as a possible voltage drop over the connecting cable from the expansion unit to the base unit.

1.3 Terminals and meaning of LEDs

The I/O connector block is numbered from 0 to 16, beginning on the right hand side.

1



Label description

Name	Description
RthX+	Constant current output for RTD measurement
SensX+	Positive line of the differential voltage input (Sense +)
SensX-	Negative line of the differential voltage input (Sense -)
GND	Sensor Ground, galvanic separated from Saia PCD® Ground

X: Input Number 0...3

Meaning of the LEDs:

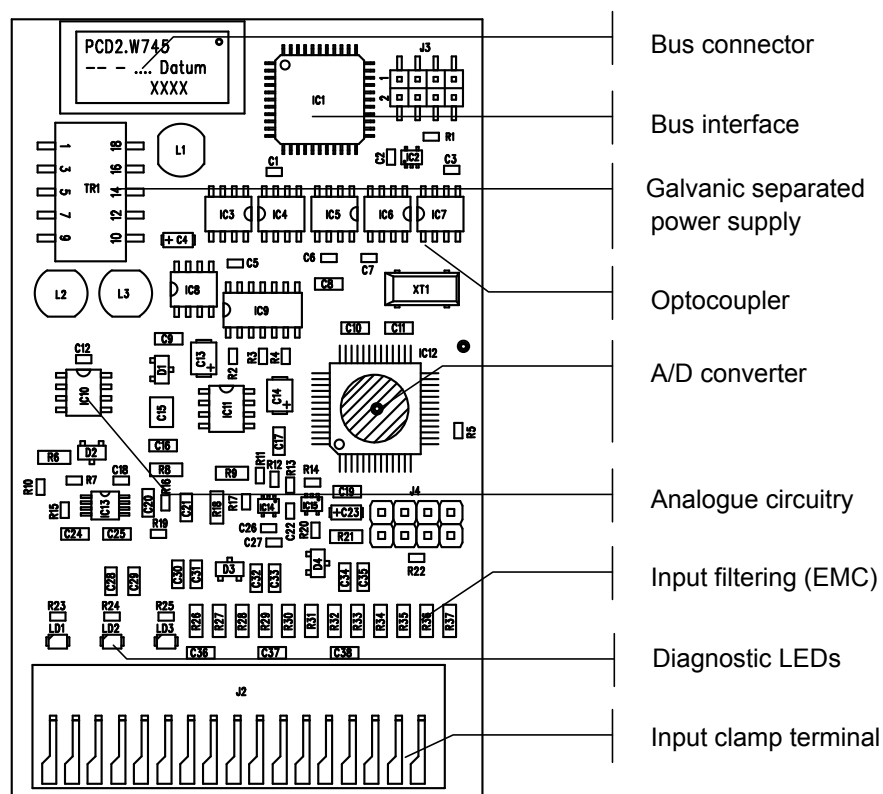
- Run: The Run LED blinks when the data acquisition is running
- Error: The Error LED indicates that the module has no valid configuration.
- Sensor Error: Indicates that at least one of the inputs detects:
- no connection
 - line break
 - short circuit



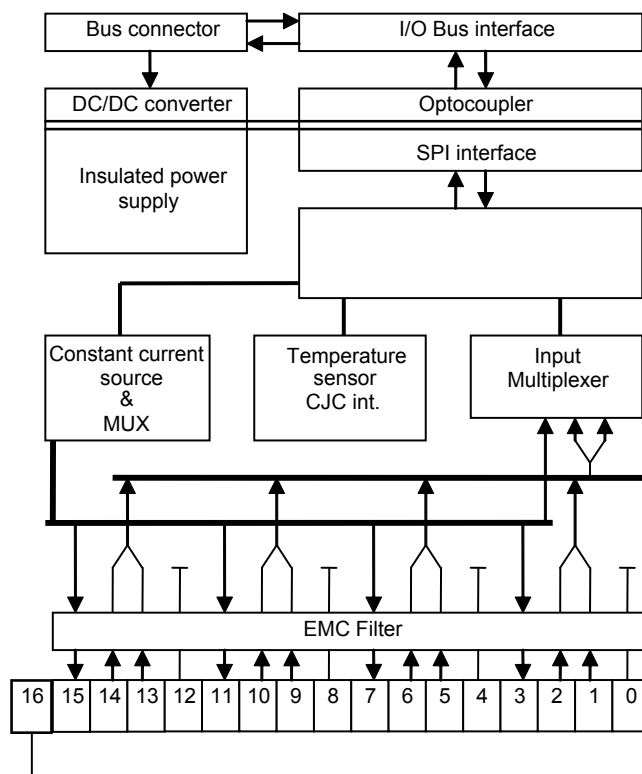
This module includes components that are sensitive to electrostatic discharges.

1.4 Presentation

Assembled module



Block diagram



2 Configuration

2.1 Configuration of the module

The module has four input channels, which are individually configurable:

Input ranges / sensor types:

2

Thermocouples (TC)	Type J / K according to IEC584
Resistive Temperature detectors (RTD)	Pt100 / Pt 1000 according to IEC751 Ni100 / Ni1000 according to DIN 43760

	Sensor type	Range	Output value	Units
TC	Type K (NiCr-Ni)	-270...+1372°C -454...+2501°F +3...+1645 K	-2700...+13720 -4540...+25010 +30...+16450	1/10°C 1/10°F 1/10 K
	Type J (Fe-CuNi)	-210...+1200°C -346...+2192°F +63...+1473 K	-2100...+12000 -3460...+21920 +630...+14730	1/10°C 1/10°F 1/10 K
RTD	Pt100	-200...+850°C -328...+1562°F +73...+1123 K	-2000...+8500 -3280...+15620 +730...+11230	1/10°C 1/10°F 1/10 K
	Pt1000	-200...+850°C -328...+1562°F +73...+1123 K	-2000...+8500 -3280...+15620 +730...+11230	1/10°C 1/10°F 1/10 K
	Ni100	-60...+250°C -76...+482°F +213...+523 K	-600...+2500 -760...+4820 +2130...+5230	1/10°C 1/10°F 1/10 K
	Ni1000	-60...+250°C -76...+482°F +213...+523 K	-600...+2500 -760...+4820 +2130...+5230	1/10°C 1/10°F 1/10 K
mV	±75 mV	-75...+75 mV	-30000...+30000	2.5 µV*
Ohm	600 Ω	0...600 Ω	0...60000	10 mΩ
	5000 Ω	0...5000 Ω	0...50000	100 mΩ

* mV range: Output value • 2.5 = voltage in µV

Connection & compensation techniques:

	Connection / compensation techniques
RTD	2 – Wire connection
	3 – Wire connection
Ohm	4 – Wire connection
TC	Internal reference junction (CJC int.)
	External reference junction (CJC ext.)**
mV	Voltage measurement using sense inputs

** In this operating mode, input 0 is used to measure the temperature of the external reference junction.

Measurement unit:

The measurement unit for temperature sensors can be configured per module:

°C:	Temperature output in 1/10 °C
°F:	Temperature output in 1/10 °F
K:	Temperature output in 1/10 K

For voltage and Ohm input ranges, this configuration takes no effect.

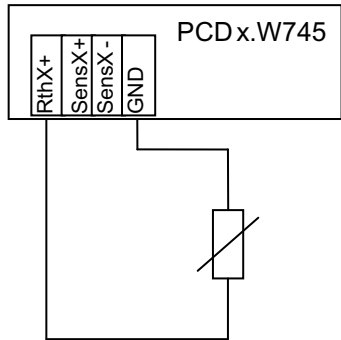
2.2 Operating modes

RTD and resistance measurement

The module supports direct connection of Resistive Temperature Detectors (RTDs). For this purpose, a precision current source supplies the sensors with a measurement current of 250 µA.

2 – Wire connection

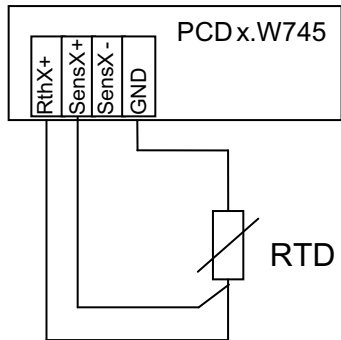
The wiring resistance can not be compensated.



3 – Wire connection

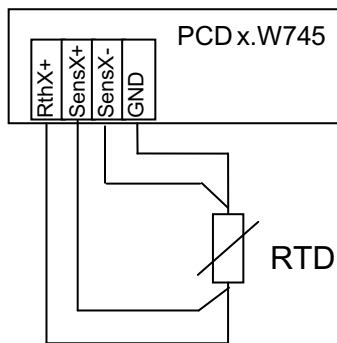
The voltage drop over one of the two supply lines is measured. Assuming that both supply lines have the same resistance, the wiring error is calculated and compensated.

- Use the same wire type for both supply lines
- Be sure that the length / temperature distribution over both supply lines is identical



4 – Wire connection

In this operating mode, the influence of the supply lines is completely eliminated. The effective voltage on the temperature sensor is measured using two high – impedance sense lines.



2

Thermocouple measurement

The module PCDx.W745 can be configured to measure temperature using thermocouples.

Physical principle (Seebeck voltage):

The two different metals of the thermocouple generate a small voltage, when the measurement junction temperature is different from the reference junction temperature. This voltage allows to determine the temperature difference between the two junctions.

To calculate the absolute temperature, the reference junction temperature must be known.

Internal reference junction (CJC int. – Cold Junction Compensation internal)

In this operating mode, the thermocouples are directly connected to the input clamp of the PCDx.W745. The module measures the temperature of the clamp terminal and calculates the temperature of the measurement junction.



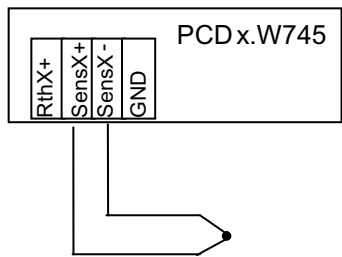
The temperature of the input clamp terminal should not be influenced from externally, for example through forced air ventilation or heat sources close to the clamp terminal.

External reference junction (CJC ext. – Cold Junction Compensation external)

This mode is used when an external isothermal clamp is used. The thermocouples are connected to the isothermal clamp; the voltage signal from the thermocouples is transmitted to the module using copper wires.

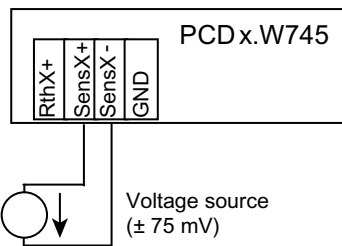
To calculate the absolute temperature at the measurement junction, the temperature of the external isothermal clamp terminal must be measured. On the module PCDx.W745, input 0 is used to acquire this temperature. All selectable temperature sensors can be used for the measurement of the external reference junction temperature.

Connection of thermocouples



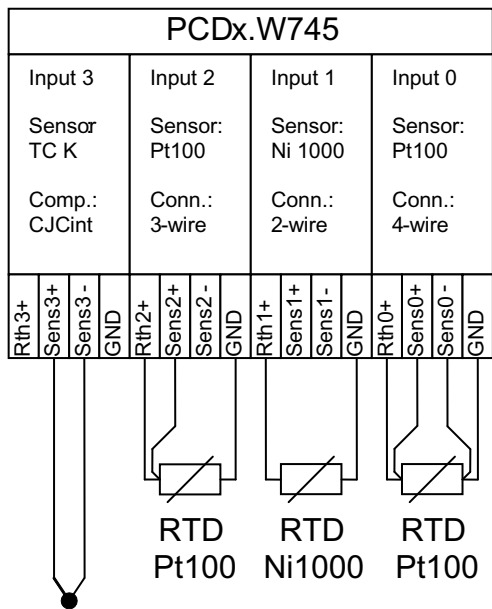
Voltage measurement

Connection of ± 75 mV signal sources

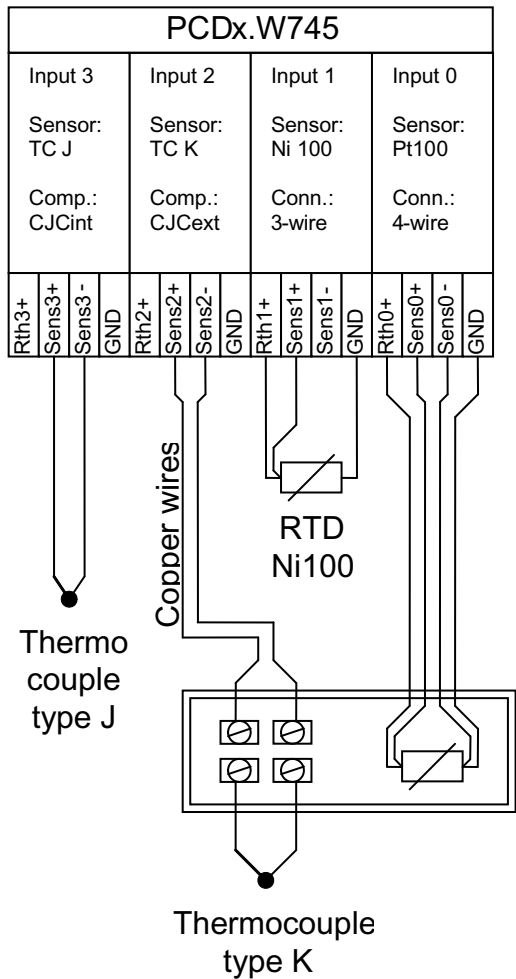


2.3 Configuration & connection examples

General example for RTD and thermocouple connection:



Use of an external isothermal block (CJCext)



Input 0 temperature is used to make the cold junction compensation for all thermocouple inputs configured for CJCext. (In this setup for channel 2)

2

External reference junction (CJC ext.)
Isothermal block
RTD: Pt100 / 4-wire, used to measure the temperature of the isothermal block

3 Programming

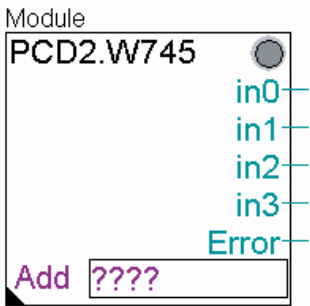
3.1 Programming with Saia PCD® Classic

3.1.1 Programming with Saia PG5® FBoxes



For the easy use of the temperature module, an FBox called PCD2.W745 is included in the standard analogue FBox library of Saia PG5®. First of all, this FBox allows configuring the module according to the individual measurement setup. Once the FBox has configured the module, it switches automatically in data acquisition mode. In addition to the reading of the analogue values from the W745, the FBox delivers powerful diagnostic information about sensor failures.

For correct working, the FBox should be placed in a cyclic organisation block (COB).



FBox name: A name can optionally be given to the FBox.
When several FBoxes are used, FBox must have an individual name.

in0...in3: Analogue input values (Format / Unit: See chapter 2)

Error: Channel errors, one byte per input channel:

Error register																															
Input 3								Input 2								Input 1								Input 0							
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
x	x	x	x					x	x	x	x					x	x	x	x					x	x	x	x				
Comm. error								Comm. error								Comm. error								Comm. error							
Sensor error								Sensor error								Sensor error								Sensor error							
Underrange								Underrange								Underrange								Underrange							
Overrange								Overrange								Overrange								Overrange							

- Overrange: Measured value is too high for selected range
- Underrange: Measured value is too low for selected range
- Sensor error: Line break / Open line / No sensor connected
- Comm. error: Communication error (no response from module W745)
- X: Not used

Add: Module base address

LED: Green: Everything ok
Red: At least one error bit set

Adjust Window:

3

Error	Display of communication errors with the module.
Clear button	Button to clear the error.
Initialize module	Shows module initialization progress.
Init button	Button to force manually a check of the module configuration. If necessary, the module will be reconfigured.
Temperature unit	Selection of temperature unit: -Celsius: Temperature values in 1/10°C -Fahrenheit: Temperature values in 1/10°F -Kelvin: Temperature values in 1/10 K

Channel 0 to 3:

Sensor type	Selection of sensor type.
Configuration / Connection	Selection of input configuration / connection.
Offset	Optional constant temperature offset to correct cabling or sensor error.
Filter T2	Option to insert a T2 filter. The use of the filter requires 5 supplementary registers for each channel
Filter time	Time constant (2 times the same value) of the T2 filter.
Diagnose	Diagnose of the channel. Shows Overrange, Underrange, Sensor failure and Communication error.

		Configuration/Connection					
		Voltage	2 Wires	3 Wires	4 Wires	Internal comp	External comp
Sensor type	Not Used	✓	✓	✓	✓	✓	✓
	Pt100		✓	✓	✓		
	Pt1000		✓	✓	✓		
	Ni100		✓	✓	✓		
	Ni1000		✓	✓	✓		
	R600		✓	✓	✓		
	R5000		✓	✓	✓		
	K					✓	✓
	J					✓	✓
	Voltage	✓					

Remarks:

- When CJCext is configured, the temperature of the external reference junction is measured using channel 0. Therefore, channel 0 can't be configured for CJCext.
- If a wrong configuration is sent to the module, the NoConfig indicator becomes high and the module does not go in data acquisition mode.

For detailed information about connection and use of the different sensor types, please refer to chapter 2.

3.1.2 Programming with FBs



To use the PCDx.W745 in Saia PCD® Classic systems, FBs are delivered in the Saia PG5® package.

FB Init

The Init FB has the following parameter structure:

3

FB Init	Parameter	Type	Description
	K 1...16	[K] input	module Number according to file D2W745_B.mba
	TC_K*	[K] input	Sensor type CH0
	CJCint*	[K] input	Configuration / connection CH0
	TC_K*	[K] input	Sensor type CH1
	CJCint*	[K] input	Configuration / connection CH1
	TC_K*	[K] input	Sensor type CH2
	CJCint*	[K] input	Configuration / connection CH2
	TC_K*	[K] input	Sensor type CH3
	CJCint*	[K] input	Configuration / connection CH3
	Celsius*	[K] input	Measurement unit
	InitError	[F] output	Initialization error indicator
	WrongConfig	[F] output	No or wrong configuration indicator
	NoCalibration	[F] output	Internal module calibration check

* See table below for predefined configuration codes.

Predefined configuration codes for the supported temperature sensors:

		Configuration / Connection						
		CJCint	CJCext	R2wire	R3wire	R4wire	Voltage	NotUsed
Input range	TC_K	✓	✓					
	TC_J	✓	✓					
	Pt100			✓	✓	✓		
	Ni100			✓	✓	✓		
	Pt1000			✓	✓	✓		
	Ni1000			✓	✓	✓		
	U75mV						✓	
	R600			✓	✓	✓		
	R5000			✓	✓	✓		
	NotUsed							✓



- When CJCext is configured, the temperature of the external reference junction is measured using channel 0. Therefore, channel 0 can't be configured for CJCext.
- If a wrong configuration is sent to the module, the NoConfig indicator becomes high and the module does not go in data acquisition mode.

Predefined configuration codes for the measurement unit:

Celsius	Temperature value in 1/10°C	The module converts the measured value in the selected measurement unit.
Fahrenheit	Temperature value in 1/10°F	
Kelvin	Temperature value in 1/10 K	

The temperature unit has no influence to voltage / ohm measurement ranges.

FB Exec

Parameter structure:

FB Exec	Parameter	Type	Description
	K 1...16	[K] input	Module Number accord. to file D2W745_B.mba
	ValueCH0	[R] output	Measured value CH0
	OverR_0	[F] output	OverRange indicator for input 0
	UnderR_0	[F] output	UnderRange indicator for input 0
	SnsFail_0	[F] output	Sensor fail indicator for input 0
	T CH1	[R] output	Temperature value input 1 in 1/10 [Unit]
	OverR_1	[F] output	OverRange indicator for input 1
	UnderR_1	[F] output	UnderRange indicator for input 1
	SnsFail_1	[F] output	Sensor fail indicator for input 1
	T CH2	[R] output	Temperature value input 2 in 1/10 [Unit]
	OverR_2	[F] output	OverRange indicator for input 2
	UnderR_2	[F] output	UnderRange indicator for input 2
	SnsFail_2	[F] output	Sensor fail indicator for input 2
	T CH3	[R] output	Temperature value input 3 in 1/10 [Unit]
	OverR_3	[F] output	OverRange indicator for input 3
	UnderR_3	[F] output	UnderRange indicator for input 3
	SnsFail_3	[F] output	Sensor fail indicator for input 3
	NoResponse	[F] output	Module not ready indicator

3

Temperature value:

Signed Integer, represents the measured value according to the selected input range.

Diagnostic flags:

Overrange / Underrange indicators become active when the measurement value is outside of the specified range for the chosen sensor type.

Sensor fail indicates errors in sensor connection. For RTDs, shorts and opens can be detected on both, supply lines and sense lines. For thermocouples, the flag indicates line break.

No Response:

No response from W745. Check if the module is present on the chosen base address.

FB Status

Parameter structure:

FB Status	Parameter	Type	Description
	K 1...16	[K] input	module Number accord. to file D2W745_B.mba
	MeasRun	[F] output	High when data acquisition is running
	DiagRun	[F] output	High when sensor diagnostic is running
	ComRun	[F] output	High when communication to W745 ok

MeasRunning:

High state indicates that the data acquisition is running.

After start-up, this indicator stays low during the first sampling cycle. At the time it goes high, all of the four input channels have an actual value which can be read out.

DiagRunning:

High state means that the sensor diagnostic is running (Overrange / Underrange / SensorFail)

After start-up, the DiagRunning flag stays low during the first sensor fail check cycle. When it switches to high state, all sensors are checked and the channel diagnostics are valid.

ComRunning:

This flag becomes high when the communication to the module is ok.

Installation of the FBs

The following 3 files are necessary:

- D2W745_B.src
- D2W745_B.equ
- D2W745_B.mba

Saia PG5® library files:

The *.src and the *.equ files should be in the Saia PG5® FB library:

C:\...\SBC\PG5xxx\Libs\FB\...

Module Base Address definition:

The *.mba file must be added to the Saia PG5® project. This file can be modified by the user according to the number of used W745 modules and the corresponding base addresses.

Include the FBs:

The file D2W745_B.equ must be included in the program file before the FBs can be called:

```
$INCLUDE D2W745_B.equ
```

Use in a cyclic organisation structure

The sampling time of the PCDx.W745 module is 250 ms per channel. To achieve best system performance, it is recommended to implement a 'NoCommunication' timer.

In the example in the Appendix a 100 ms timer is implemented. So the FBs Exec and Status are executed in maximum every 100 ms. This reduces unnecessary data transfers on the I/O Bus and improves the system performance.

3.2 Programming with series xx7



The access from Step[®]7 via the local I/O bus (LIO) to the thermomodule PCDx.W745 is done with direct peripheral commands. The module is using 4 input bytes and 4 input words (together 12 bytes). All possible accesses through this peripheral window are described here. The configuration of the module is done with the peripheral definition (Hardware-DB). It is not possible to change configuration in run.



The PCD3.W745 can be used as well in a local extension (LIO) as in a Profibus-DP extension (RIO). The PCD2.W745 can only be used via the local I/O-bus

3

Using the modules with Profibus-DP RIO the 4 temperature values are sent to the master as words. The status registers are transferred as 4 bytes. The configuration of the PCD3.W745 is done in the DP configuration. It is not possible to change configuration in run.



Due to technical reasons it is not possible to have access to the module within the start up OB 100. All access during this phase is forbidden. This restriction is valid for the CPUs PCD1 and PCD2.M1x7. The PCD2.M487 allows to have access during the start up.

Peripheral Bios: Identification and error detection

The data block with the peripheral definition of the PCDx.W745 can be easily created by using the I/O-Builder (Version 2.002 or higher). This software tool can be downloaded free of charge from the web page:

www.sbc-support.com

The identification (Kennung) of the PCDx.W745 is 22 (h). Additionally to that only a range of 12 input bytes has to be defined in the peripheral definition of the local I/O bus (DB 1, DB 511 or DB 1023). When this range is within the process image the data are refreshed automatically every cycle.

Additional initialization values like sensor type, measurement type and measurement unit are set in the peripheral definition. A detailed description about that follows in chapter 'peripheral definition'.

The initialization values in the peripheral definition are sent to the module when changing from stop mode to start up mode and the module will be initialised.

If an error occurs during the initialization the diagnostic interrupt OB 82 is called up. The reason for the error can be read from the local data.

The following table describes the temporarily variables of the diagnostic interrupt OB 82:

Variable	Data type	Description
OB82_EV_Class	byte	Event class and identifier: • B#16#39: incoming event
OB82_FLT_ID	byte	Fault identification code (B#16#42)
OB82_PRIORITY	byte	Priority class (priority of OB execution)
OB82_OB_Numbr	byte	OB No. (82)
OB82_RESERVED_1	byte	Reserved
OB82_IO_FLAG	byte	Input module: B#16#54
OB82_MDL_ADDR	word	Logical base address of module with fault.
OB82_MDL_DEFECT	bool	not relevant (0)
OB82_INT_FAULT	bool	not relevant (0)
OB82_EXT_FAULT	bool	not relevant (0)
OB82_PNT_INFO	bool	not relevant (0)
OB82_EXT_VOLTAGE	bool	not relevant (0)
OB82_FLD_CONNCTR	bool	not relevant (0)
OB82_NO_CONFIG	bool	not relevant (0)
OB82_CONFIG_ERR	bool	No configuration: Shows that the checksum of the actual configuration is wrong.
OB82_MDL_TYPE	byte	not relevant (0)
OB82_SUB_MDL_ERR	bool	User module is wrong or missing
OB82_COMM_FAULT	bool	Communication fault
OB82_MDL_STOP	bool	not relevant (0)
OB82_WTCH_DOG_FLT	bool	not relevant (0)
OB82_INT_PS_FLT	bool	not relevant (0)
OB82_PRIM_BATT_FLT	bool	not relevant (0)
OB82_BCKUP_BATT_FLT	bool	not relevant (0)
OB82_RESERVED_2	bool	not relevant (0)
OB82_RACK_FLT	bool	not relevant (0)
OB82_PROC_FLT	bool	not relevant (0)
OB82_EPROM_FLT	bool	not relevant (0)
OB82_RAM_FLT	bool	not relevant (0)
OB82_ADU_FLT	bool	No compensation: Shows that the checksum of the actual compensation data is wrong.
OB82_FUSE_FLT	bool	not relevant (0)
OB82_HW_INTR_FLT	bool	not relevant (0)
OB82_RESERVED_3	bool	not relevant (0)
OB82_DATE_TIME	date and time	Date and time the OB started.



If you do not program OB82, the CPU changes to stop mode when a diagnostic interrupt is triggered.

Interface STEP®7 ↔ PCDx.W745

The following address information are meant as offsets in each input or output window. E.g. if the input range definition starts at **PEB 300** (German Mnemonics) an access to offset 1 means **L PEx 301** where x can be B or W. All further absolute access within the xx7 programming relate to the above definition.

Overview

The module needs in the peripheral input range 4 bytes for status and 4 words for values (together 12 bytes). Each channel uses 1 byte for status and 1 word for the temperature value. If a user tries to access to the grey fields in the below table a I/O access error (OB122) occurs.

The following table shows the peripheral range:

Offset	L PEB	L PEW	PED
0	Status CH0		
1	Status CH1		
2	Status CH2		
3	Status CH3		
4		Value CH0	
5			
6		Value CH1	
7			
8		Value CH2	
9			
10		Value CH4	
11			

3

Description of the peripheral inputs

Value CH0...3: (PEW offset 4, 6, 8 ,10)

These peripheral input words contain the temperature values of each channel. The temperature can be read in 1/10 unit (unit depending on the module configuration in Kelvin, °C or °F). The value occurs as two's complement with sign.

If the address range is not within the process image the status has to be read first before the temperature value can be read. If bit 6 of the status is set a new value will be read, otherwise the last one is read.

CHx status / diagnostic (PEB offset 0...3)

With this peripheral input byte the status of each temperature measurement can be read. If the address range is not within the process image the status has to be read first before the temperature value can be read in order to have an updated value. If the address range is within the process image first the status byte and then the temperature value is read automatically from the module.

Bit	Description
0	Over range: The measured value is over the allowed range of the sensor. The read value in the appropriate PEW (CH0...3) is set to 0xFFFF.
1	Under range: The measured value is under the allowed range of the sensor. The read value in the appropriate PEW (CH0...3) is set to 0..
2	Reserved (0)
3	Sensor fail: At least one wire connected to this channel is broken. The read value in the appropriate PEW (CH0...3) is set to the last valid measured value.
4	Reserved (0)
5	Reserved (0)
6	New value: a new measured value is available. This bit is set to 0 when reading the status byte. *)
7	Reserved (0)

*) If the address range is within the process image this bit is always set to 0, i.e. it is not relevant. This is also valid using the module with Profibus-DP RIO.

The diagnostic bits stay to 1 until the error does not exist any more.

Example

The access time to the module is quite long (ca. 1 ms for 4 channels). In order to read only an updated actual value see the following Step[®]7-Example:

```
// Read status byte before the temperature value will be read
L PEB 300          // Status byte CH0
T MB 300          // save in auxiliary variable

// Temperature value
U M 300.6         // New value available
SPBN NoRd

L PEW 304         // Actual value CH0
T MW 304         // save in MW

NoRd: NOP 0
```

3

Peripheral definition

The configuration of the peripheral modules is done in the peripheral definitions data block (DB1, DB511 or DB1023). The structure is as follows:

```
Modulx : STRUCT //PCD2.W745
    kenn: WORD:= W#16#0122;
    PANr: INT:= 0;
    InCnt:    INT:= 12;
    OutCnt:   INT:= 0;
    InBase:   INT:= 300;
    OutBase:  INT:= 300;
    Conf_0:   BYTE:= B#16#0;
    Conf_1:   BYTE:= B#16#0;
    Conf_2:   BYTE:= B#16#0;
    Conf_3:   BYTE:= B#16#0;
END_STRUCT;
```

The following table shows the meaning of the entries:

Name	Format	Description
kenn	word	Low byte: Identification of the module: 0x22 High byte: Measurement unit: 1 = 1/10 °C 2 = 1/10 °F 3 = 1/10 K
PaNr	int	No meaning, stays at 0
InCnt	int	No. of input bytes: 12
OutCnt	int	No. of output bytes: 0
InBase	int	Base address of the cassette/module in the peripheral input range.
OutBase	int	0
Conf_0	Byte	Configuration of channel 0 Bit 0...4: sensor type: 0 = reserved 1 = PT 100 2 = PT 1000 3 = NI 100 4 = NI 1000 5 = R 160 (display of the resistor value 0xFFFF corresp. to 640) 6 = R 1280 (display of the resistor value 0xFFFF corresp. to 640) 7...28 = Reserved 29 = Thermo element Type K 30 = Thermo element Type J 31 = U_80 (display of the voltage value 0x7FFF corresp. to +80mV, 0x8000 corresp. to -80mV) Bit 5...7: Measurement type: 0 = Reserved 1 = 2- wire Measurement (only for RTD) 2 = 3- wire Measurement (only for RTD) 3 = 4- wire Measurement (only for RTD) 4 = Reserved 5 = Internal cold junction compensation (only for thermo elements) 6 = External cold junction compensation (only for thermo elements) 7 = Reserved
Conf_1	Byte	Configuration of channel 1 Possible settings see channel 0
Conf_2	Byte	Configuration of channel 2 Possible settings see channel 0
Conf_3	Byte	Configuration of channel 3 Possible settings see channel 0






The data block with the peripheral definition of the PCDx.W745 can be easily created by using the I/O-Builder (Version 2.002 or higher).

This software tool can be downloaded free of charge from the web page:

www.-support.com

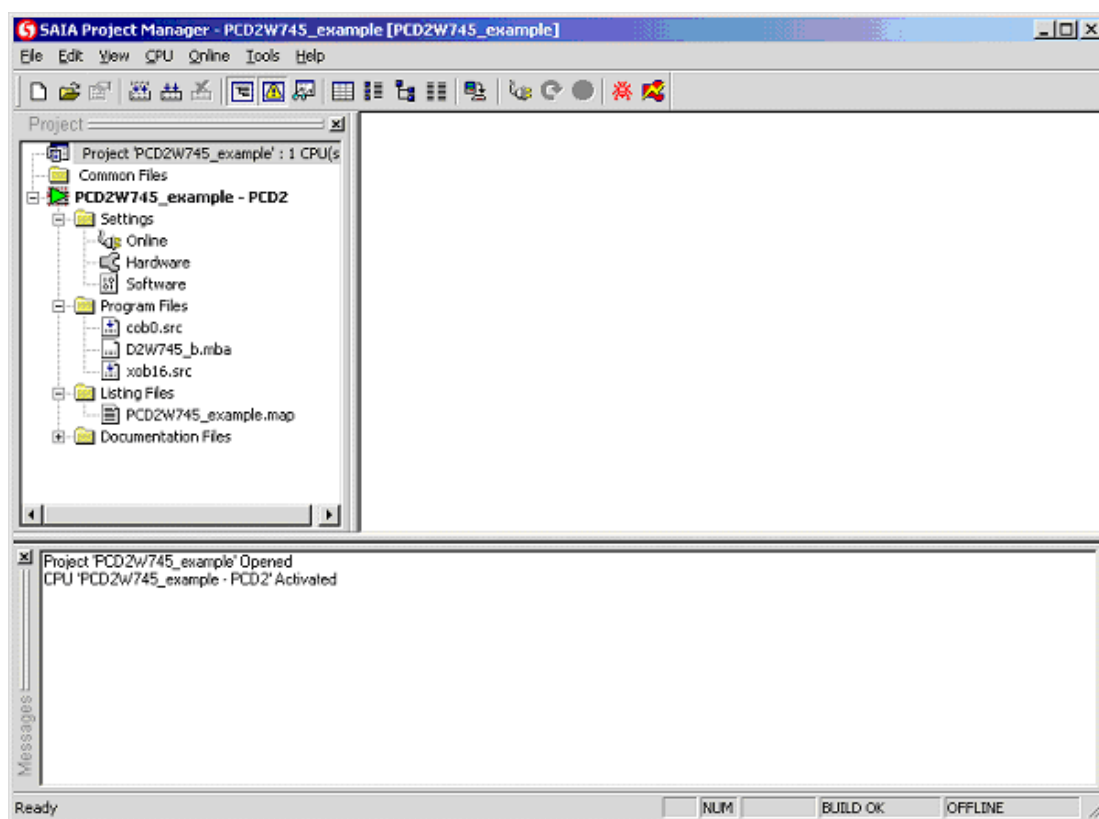
A **Appendix**

A.1 Icons

	<p>In manuals, this symbol refers the reader to further information in this manual or other manuals or technical information documents.</p> <p>As a rule there is no direct link to such documents.</p>
	<p>This symbol warns the reader of the risk to components from electrostatic discharges caused by touch.</p> <p>Recommendation: at least touch the Minus of the system (cabinet or PGU connector) before coming in contact with the electronic parts. Better is to use a grounding wrist strap with its cable attached to the Minus of the system.</p>
	<p>This sign accompanies instructions that must always be followed.</p>
	<p>Explanations beside this sign are valid only for the Saia PCD® Classic serie.</p>
	<p>Explanations beside this sign are valid only for the Saia PCD® xx7 serie.</p>

A.2 Programming examples for Saia PCD® Classic systems

Saia PG5® project structure:



A

D2W745_b.mba:

One module PCDx.W745 is defined on base address 96.

```
;
; This file can be modified by the user
;
; Basis addresses defined by the user
; -----
$GROUP W745
NbrModules EQU 1 ; No. of W745 modules used (0...16)
;
; Module base addresses (only the used modules must be defined)
BA_1 EQU 96 ;Base address of module 1
BA_2 EQU 0 ;Base address of module 2
BA_3 EQU 0 ;Base address of module 3
BA_4 EQU 0 ;Base address of module 4
BA_5 EQU 0 ;Base address of module 5
BA_6 EQU 0 ;Base address of module 6
BA_7 EQU 0 ;Base address of module 7
BA_8 EQU 0 ;Base address of module 8
BA_9 EQU 0 ;Base address of module 9
BA_10 EQU 0 ;Base address of module 10
BA_11 EQU 0 ;Base address of module 11
BA_12 EQU 0 ;Base address of module 12
BA_13 EQU 0 ;Base address of module 13
BA_14 EQU 0 ;Base address of module 14
BA_15 EQU 0 ;Base address of module 15
BA_16 EQU 0 ;Base address of module 16
$ENDGROUP
```

Use of FB Init in XOB 16:

(Located in xob16.src)

```

$INCLUDE D2W745_b.equ          ;makes the FB's available in the file
xob16.src

      XOB      16
;      ...      ;Other code in XOB 16
;      ...

$GROUP W745                    ;References the W745 group
      CFB      Init
      K 1          ;[K] Module Number
      TC_K        ;[K] Sensor Type CH0
      CJ Cint     ;[K] Connection CH0
      TC_K        ;[K] Sensor Type CH1
      CJ Cint     ;[K] Connection CH1
      TC_K        ;[K] Sensor Type CH2
      CJ Cint     ;[K] Connection CH2
      TC_K        ;[K] Sensor Type CH3
      CJ Cint     ;[K] Connection CH3
      Celsius     ;[K] Measurement Unit
      F 13        ;[F] Return InitError
      F 14        ;[F] Return WrongConfig
      F 15        ;[F] Return NoCalibration

$ENDGROUP                      ;End W745 group

;      ...      ;Other code in XOB 16
;      ...
;      ...

      EXOB

```

Use of FB Exec in COB 0: (with 100 ms timer example)

(Located in cob0.src)

```

$INCLUDE D2W745_b.equ          ;makes the FB's available in the .le
cob0.src

      COB      0
      0
;
;      ...      ;Other code in COB 0
;
;----- Example to implement a 100ms timer
      STL      T 0          ;if time elapsed, ACC:=1
      JR      L go_on      ;ACC=0 -> No access to the W745
      LD      T 0          ;Set timer 0 to 100ms
      T#100MS
;----- W745 access
      CFB      W745.Status  ;Check W745 Status
      K 1      ;[K] Module Number
      F 20     ;[F] MeasRunning
      F 21     ;[F] DiagRunning
      F 22     ;[F] ComRunning

      CFB      W745.Exec    ;Read Measurement values and diag from
W745
      K 1      ;[K] Module Number
      R 0      ;[R] Temperature CH0
      F 0      ;[F] Overrange CH0
      F 1      ;[F] Underrange CH0
      F 2      ;[F] SensorFail CH0
      R 1      ;[R] Temperature CH1
      F 3      ;[F] Overrange CH1
      F 4      ;[F] Underrange CH1
      F 5      ;[F] SensorFail CH1
      R 2      ;[R] Temperature CH2
      F 6      ;[F] Overrange CH2
      F 7      ;[F] Underrange CH2
      F 8      ;[F] SensorFail CH2
      R 3      ;[R] Temperature CH3
      F 9      ;[F] Overrange CH3
      F 10     ;[F] Underrange CH3
      F 11     ;[F] SensorFail CH3
      F 12     ;[F] ModuleNoResponse
;-----
go_on:
;      ...      ;Other code in COB 0
;
      ECOB

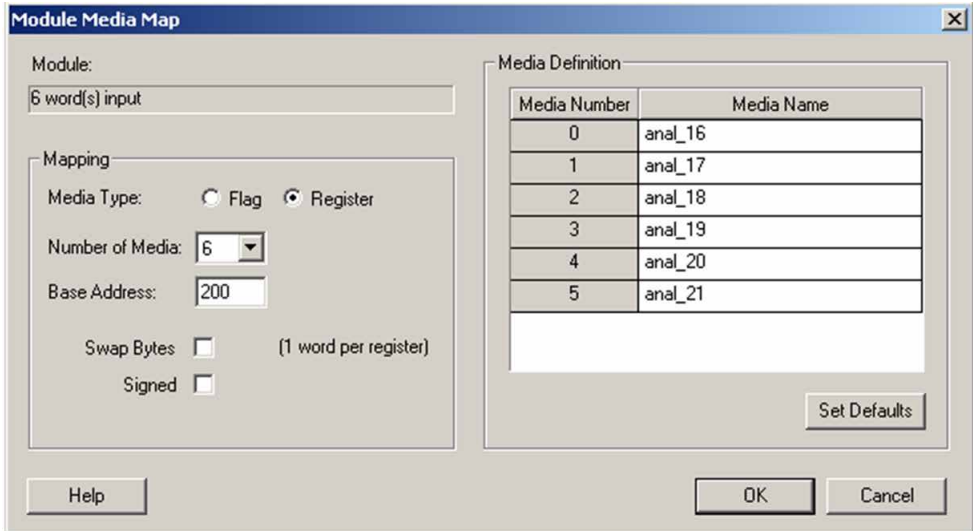
```

A.3 Programming examples for xx7 series (in preparation)



A.4 Configuration on PCD3.T760 RIO Module

When the PCD3.W745 is used on PCD3.T760 RIO station, 6 registers are available in the Profi S-IO or Profibus DP configurator.



The 2 first registers (anal_16 , anal_17) contain the diagnostic bits of the 4 inputs channels.

The first 2 bytes (low bytes) gives the diagnostic bit of 2 analog channels (1 byte per channel) as indicated in the following screenshot:

Symbol	Address	Value	
anal_16	R 200	0000-0000-0000-0000-0000-0000-1001	Channel 0
anal_17	R 201	0000-0000-0000-0000-0000-1001-0000-1001	Channel 1
anal_18	R 202	63575	
anal_19	R 203	8532	
anal_20	R 204	4332	
anal_21	R 205	2235	

Symbol	Address	Value	
anal_16	R 200	0000-0000-0000-0000-0000-0000-1001	
anal_17	R 201	0000-0000-0000-0000-0000-1001-0000-1001	Channel 2
anal_18	R 202	63575	
anal_19	R 203	8532	
anal_20	R 204	4332	
anal_21	R 205	2235	Channel 3

Signification of each 8 bits (from right to left) as explained in chapter 3.2.

Bit	Description
0	Over range: The measured value is over the allowed range of the sensor. The read value in the appropriate PEW (CH0...3) is set to 0xFFFF.
1	Under range: The measured value is under the allowed range of the sensor. The read value in the appropriate PEW (CH0...3) is set to 0..
2	Reserved (0)
3	Sensor fail: At least one wire connected to this channel is broken. The read value in the appropriate PEW (CH0...3) is set to the last valid measured value.
4	Reserved (0)
5	Reserved (0)
6	New value: a new measured value is available. This bit is set to 0 when reading the status byte. *)
7	Reserved (0)

A.5 Contact

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