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PB1651ADC1 A/D Module

User's Guide

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1 Introduction

This User's Guide contains the description of the PB1651ADC1 A/D Module.

It consists of the following chapters:

- Introduction
  - Applications and Features (section 1.1 on page 5)
  - Block Diagram (section 1.2 on page 7)
- Hardware Features (chapter 2 on page 8)
  - Configuration (section 2.2 on page 10)
  - LEDs (section 2.3 on page 10)
- Pin Assignment (chapter 3 on page 12)
- Technical Data (chapter 4 on page 14)

1.1 Applications and Features

The PB1651ADC1 A/D Module is used to acquire analog signals with average resolution and data rates (e.g. engine temperature, oil temperature). It can be used both with the ES1651 Carrier Board (VMEbus) and with the ES4350 Carrier Board (VXIbus).

The PB1651ADC1 A/D Module has the following features:

- 16 differential input channels
- One A/D converter per channel with 16-bit resolution
- Accuracy ±3 mV typical, ±5 mV warranted
- Conversion rate/sampling rate 25 kSamples/s
- Input overvoltage protection ±60 V
- Input impedance > 10 MΩ
- 4th order low-pass filter 5 kHz (3 dB cutoff frequency)

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The following figure shows the front panel of the PB1651ADC1 A/D Module.

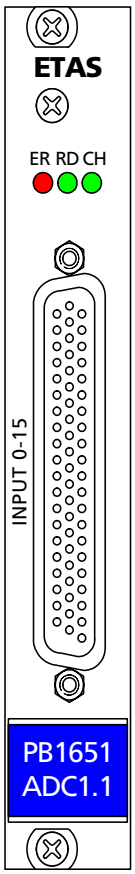


Fig. 1-1 Front Panel of the PB1651ADC1 A/D Module

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1.2 Block Diagram

The following figure shows the block diagram of the PB1651ADC1 A/D Module.

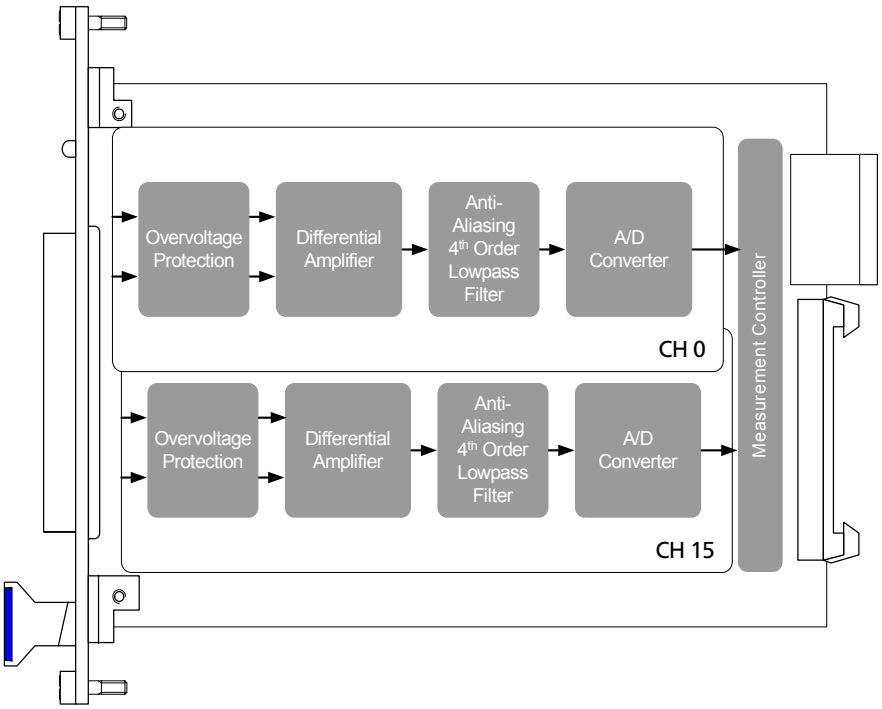


Fig. 1-2 Block Diagram of the PB1651ADC1 A/D Module

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2 Hardware Features

This section contains a description of the inputs of the PB1651ADC1 A/D Module.

2.1 Inputs

2.1.1 Input Voltage Range

The input voltage range of the channels is 0 - 10 V. The analog inputs are protected against overvoltage to +60 V.

2.1.2 Analog Input Channels

The PB1651ADC1 A/D Module has 16 identical input channels – the structure of an input stage is shown in Fig. 2-1. The relevant input signal is measured as a differential signal at a differential amplifier.

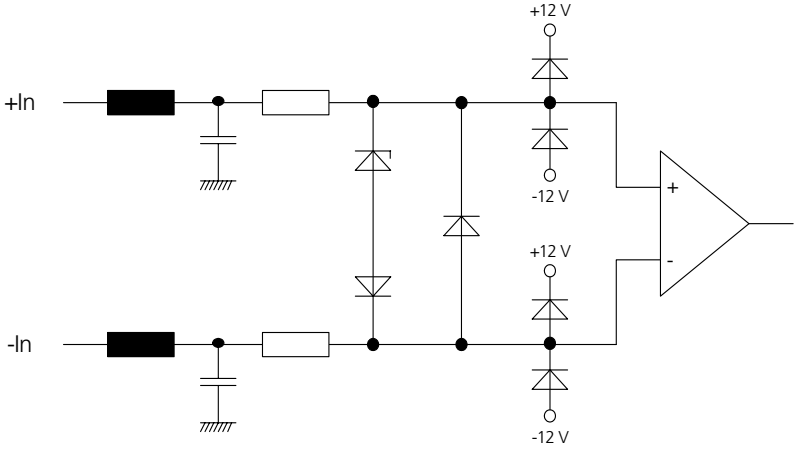


Fig. 2-1 Input Channels

Using a differential amplifier makes it possible to realize systems with a particularly high common-mode rejection ratio (CMRR) – with the PB1651ADC1 A/D Module this is 95 dB.

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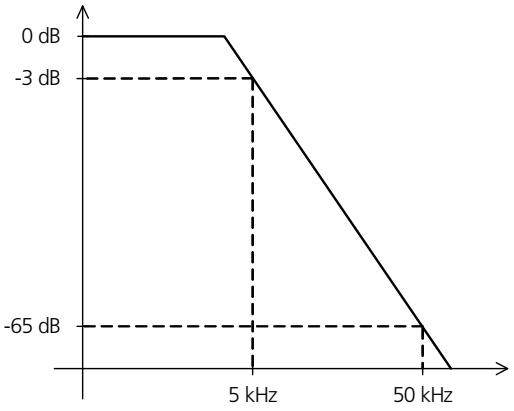
+IN and -IN of all input channels are capacitively coupled to the system housing.

Note

If the signal to be measured is not a differential signal but a single-ended signal, the relevant –IN input at the input connector has to be connected to AGND.

2.1.3 Anti-Aliasing Filter

Every channel is equipped with an anti-aliasing 4th order low-pass filter the 3 dB cutoff frequency of which is 5 kHz.



Note

When sampling at a sampling rate of f_A, only those signals can be acquired without fault which are band-limited and which contain frequency portions to a maximum of half the sampling rate $f_A/2$ (sampling theorem). To ensure that the sampling theorem is adhered to, the sampling rate must be at least 10 kHz.

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2.1.4 External Synchronization Inputs

The PB1651ADC1 A/D Module supports up to six external trigger signals. These trigger signals are supplied by the ES1651 Carrier Board (VME) or by the ES4350 Carrier Board (VXI).

The synchronization inputs make it possible to control the measurement in terms of time. Each channel can be operated either in Auto mode (25 kHz sampling rate) or in "Hardware Triggered" mode (can be set in LABCAR-RTC (Real-Time Execution Connector)). Only one of the six possible external triggers can be selected from all 16 channels.

The measure value is always acquired on a positive edge of the trigger signal. The maximum delay time until a measure value is acquired after a positive edge of the trigger signal is 40 µs.

2.1.5 Creating a Mean Value

The PB1651ADC1 A/D Module supports the creation of a mean value (e.g. for noise suppression) over 2, 4, 8, 16, 32, 64 and 128 measure values. A setting is made in the LABCAR-RTC as to whether a mean value is created and if so, over how many values. The mean value itself, however, is created in the hardware module which ensures a very high performance.

2.2 Configuration

The inputs are configured and controlled via LABCAR-RTC and LABCAR-OPERATOR. A hardware configuration of the module is not necessary.

2.3 LEDs

There are 3 LEDs on the front panel of the PB1651ADC1 A/D Module, the meaning of which is described below.



Fig. 2-2 LEDs on the Front Panel

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The LEDs of the PB1651ADC1 A/D Module have the following significance.

LED	Color	Meaning
ER	Red	Error
RD	Green	Ready
CH	Green	Can be configured using the software (see the section "Driving the "CH" LED" later in this chapter)

Tab. 2-1 Significance of the LEDs

Driving the "CH" LED

The driving source of the "CH" LED can be configured in the software – one of the 16 input channels or "RTIO" can be set as the driving source.

If an input channel is set as the driving source, the LED lights up when the channel level is high and does not light up when the channel level is low. If "RTIO" is set as the driving source, the LED can be powered on/off by the simulation model.

The "LED Driving Source" parameter is described in the Real-Time Execution Connector (LABCAR-RTC) User's Guide.

Display of the Version Number of the I/O Modules

When the signal box is powered on, the I/O modules show the version number via the "RD" and "CH" LEDs. The version number consists of three parts (e.g. 2.1.3). First of all, the "RD" LED flashes twice ("CH" LED off). Then the "RD" LED flashes once ("CH" LED lights up). Then the "RD" LED flashes three times ("CH" LED off).

After the version number of the relevant I/O module has been displayed, the two LEDs, "RD" and "CH", go out and take on the relevant function of the I/O module used.

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3 Pin Assignment

This section describes the pin assignment of the PB1651ADC1 A/D Module.

The connector for the signal inputs is a DSub62HD connector (male). The shielding is at front panel and housing potential and thus at protective earth.

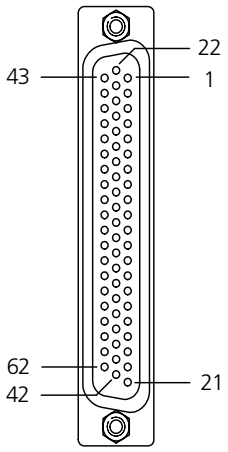


Fig. 3-1 Front-Facing Connector of the PB1651ADC1 A/D Module (View from the Plug-In Side)

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The following table contains the connector pin assignment.

Pin	Signal	Pin	Signal	Pin	Signal
1	+IN_CH0	22	AGND	43	-IN_CH0
2	+IN_CH1	23	AGND	44	-IN_CH1
3	+IN_CH2	24	AGND	45	-IN_CH2
4	+IN_CH3	25	AGND	46	-IN_CH3
5	+IN_CH4	26	AGND	47	-IN_CH4
6	+IN_CH5	27	AGND	48	-IN_CH5
7	+IN_CH6	28	AGND	49	-IN_CH6
8	+IN_CH7	29	AGND	50	-IN_CH7
9	+IN_CH8	30	AGND	51	-IN_CH8
10	+IN_CH9	31	AGND	52	-IN_CH9
11	+IN_CH10	32	AGND	53	-IN_CH10
12	+IN_CH11	33	AGND	54	-IN_CH11
13	+IN_CH12	34	AGND	55	-IN_CH12
14	+IN_CH13	35	AGND	56	-IN_CH13
15	+IN_CH14	36	AGND	57	-IN_CH14
16	+IN_CH15	37	AGND	58	-IN_CH15
17	NC	38	AGND	59	NC
18	NC	39	AGND	60	NC
19	NC	40	AGND	61	NC
20	NC	41	AGND	62	NC
21	AGND	42	AGND		

Tab. 3-1 Pin Assignment

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4 Technical Data

This section contains the technical data of the PB1651ADC1 A/D Module in tabular form.

Inputs

Number of inputs	16
Input voltage V_{+IN}	-10 V...+10 V
Input voltage V_{-IN}	-10 V...+10 V
Voltage between V_{-IN} and V_{+IN}	0 V...+10 V
Overvoltage protection	±60 V
Input impedance	>10 MΩ
Resolution	152 µV (16 Bit)
Accuracy	±3 mV typical ±5 mV warranted
Sampling rate (internal synch. mode)	25 kSamples/s
Sampling rate (external synch. mode)	Max. 12.5 kSamples/s
Ext. Trigger - minimum high time	40 µs
Ext. Trigger – maximum delay time	40 µs

Power Supply

Current consumption	300 mA @ +5 V DC 200 mA @ +12 V DC 200 mA @ -12 V DC 100 mA @ +3.3 V DC

Environmental Conditions

Operating temperature	5 °C to 35 °C (5.00 °C to 35.00 °C)
Relative humidity	0 to 95% (non-condensing)

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Physical Dimensions

Printed circuit board (L x W)	145 mm x 100 mm
Front panel	Height: 3 U Width: 4 HP

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16 Technical Data

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5 ETAS Contact Addresses

ETAS HQ

ETAS GmbH

Borsigstraße 14	Phone:	+49 711 89661-0
70469 Stuttgart	Fax:	+49 711 89661-106
Germany	WWW:	www.etas.com

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