ES1321.1 PWM I/O Board

User's Guide

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Contents

1 Introduction

This manual contains the description of the ES1321.1 PWM I/O Board. This section contains details of the basic functions and area of application of the ES1321.1 PWM I/O Board. A block diagram illustrates the schematic set-up of the board.

CAUTION!

Some components of the ES1321.1 PWM I/O Board may be damaged or destroyed by electrostatic discharges. Please keep the board in its storage package until it is installed.
The ES1321.1 PWM I/O Board should only be taken from its package, configured and installed at a working place that is protected against static discharge.

WARNING!

The components, connectors and conductors of the ES1321.1 PWM I/O Board may carry dangerous voltages. These voltages may even exist when the ES1321.1 is not installed in the ES4100, ES4105 or ES4300 or the ES4100, ES4105 or ES4300 is powered off.
Make sure that the ES1321.1 is protected against contact during operation. Disconnect all connections to the ES1321.1 before removing the board.

1.1 Features and Areas of Application

The ES1321.1 PWM I/O Board has 24 input channels and 16 output channels which can all be configured as PWM or digital I/O channels.

The following signals can be generated or measured:

- Measuring of signals with frequencies of up to 100 kHz (on up to 24 channels)
- Generation of signals with frequencies of up to 100 kHz (on up to 16 channels)
- Generation of multipulse signals with up to eight different period lengths and duty cycles (on up to two channels)
- Generation of signals in accordance with the SENT specification (on up to four channels)
- Measuring of signals in accordance with the SENT specification (on up to two channels)

Fig. 1-1 shows the front panel of the ES1321.1 PWM I/O Board with the port for the input and output signals and the LEDs.

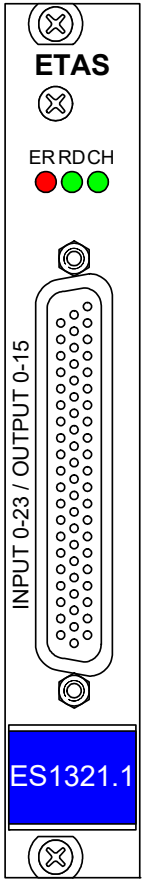


Fig. 1-1 Front Panel of the ES1321.1 PWM I/O Board

1.2 Block Diagram

Fig. 1-2 shows the block diagram of the ES1321.1 PWM I/O Board.

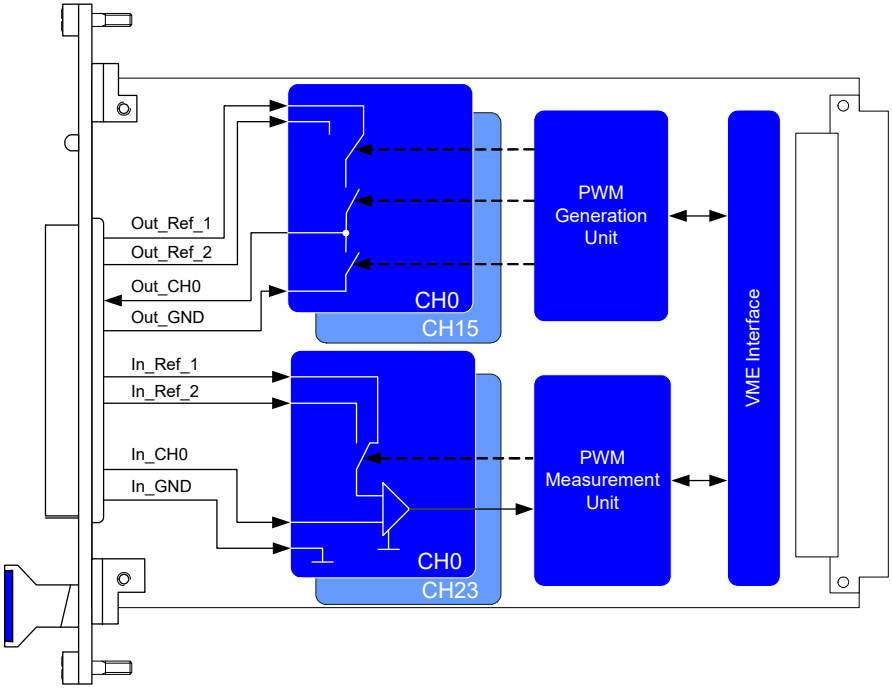


Fig. 1-2 Block Diagram of the ES1321.1 PWM I/O Board

1.3 Taking the Product Back and Recycling

The European Union has passed a directive called Waste Electrical and Electronic Equipment, or WEEE for short, to ensure that systems are setup throughout the EU for the collection, treating and recycling of electronic waste.

This ensures that the devices are recycled in a resource-saving way representing no danger to health or the environment.

Fig. 1-3 WEEE Symbol

The WEEE symbol on the product or its packaging shows that the product must not be disposed of as residual garbage.

The user is obliged to collect the old devices separately and return them to the WEEE take-back system for recycling.

The WEEE directive concerns all ETAS devices but not external cables or batteries.

For more information on the ETAS GmbH Recycling Program, contact the ETAS sales and service locations (see page 25).

2 Hardware

This section contains information on the features of the ES1321.1 PWM I/O Board.

2.1 Outputs

Each of the 16 outputs is a push-pull switch (one high side and one low side driver per channel). The output voltage level is defined by two external supply voltages.

The following figure shows a block diagram of a channel.

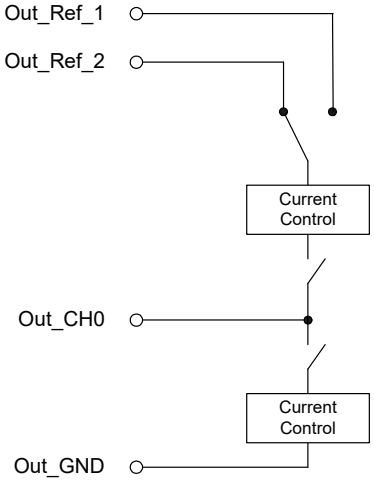


Fig. 2-1 Block Diagram of an Output Channel

Output Modes

The following output modes are available:

- PWM
- Level high/low
- Multipulse
- SENT

Accuracy

The outputs have an accuracy of 0.04% in the range 1 Hz to 10 kHz or 0.4% in the range 10 kHz to 100 kHz.

Current Limitation

The maximum output current per channel is 100 mA. If an overcurrent condition occurs, the output is powered off after a while and an error message is issued in LABCAR-OPERATOR. After 10 ms has elapsed several times, the output is powered on again.

Electrical Strength

The outputs withstand voltages up to ±60 V.

2.2 Inputs

There are the following measurement modes for the 24 measure inputs:

- Pulse width measurement
- Additive pulse width measurement
- Pulse and edge count
- Frequency measurement
- Duty cycle measurement
- Level measurement
- Measuring SENT signals
- Measuring speed-synchronous signals

For a detailed list, refer to the section "Supported Measurement Modes" on page 13 – these measurement modes are described in the current User's Guide on the Real-Time Execution Connector.

The input voltages refer to two external reference voltages "In_Ref_1" and "In_Ref_2" which are applied via the front-facing connector. The threshold voltage for edge detection is 2/3 * In_Ref_*n* (rising edge) and 1/3 * In_Ref_*n* (falling edge).

The following figure shows a block diagram of an input channel..

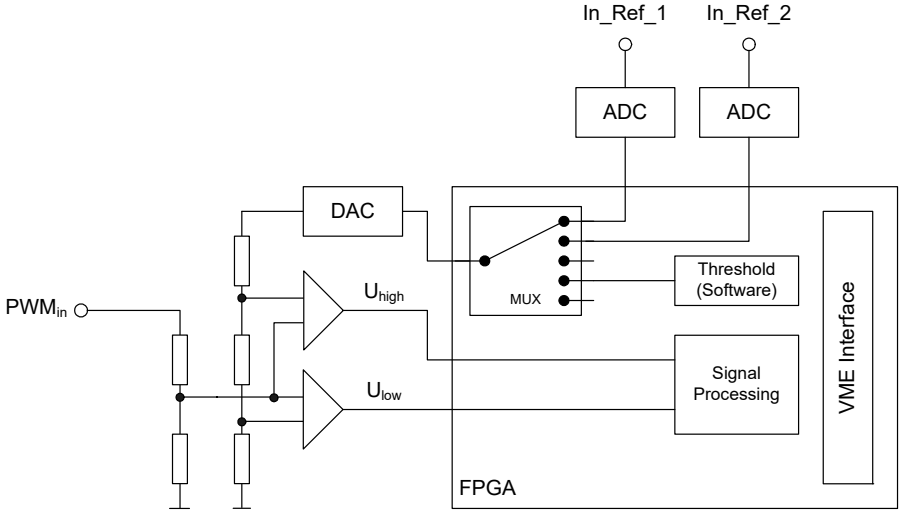


Fig. 2-2 Block Diagram of an Input Channel

The inputs are protected against overvoltage up to ±60 V.

2.3 Configuration

Signal output is configured and controlled via the Real-Time Execution Connector and LABCAR-OPERATOR. A hardware configuration of the module is not necessary.

2.4 LEDs

There are three LEDs on the front panel of the ES1321.1 PWM I/O Board; their significance is described below.

Fig. 2-3 LEDs on the Front Panel

The LEDs of the ES1321.1 PWM I/O Board have the following meaning.

LED	Color	Meaning
ER	Red	Error
RD	Green	Ready
CH	Green	Can be configured via software (see the section "Driving the "CH" LED" below)

Tab. 2-1 Meaning of the LEDs

Driving the "CH" LED

The driving source for the "CH" LED can be configured in the software - one of the 24 input channels or "RTIO" can be set as driving source.

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

For a description of the "LED Driving Source" parameter, refer to the Real-Time Execution Connector User's Guide.

3 Firmware

This chapter contains an overview of the types of signal available at the outputs and measurable at the inputs.

- Generation and measuring of PWM signals (on all channels)
- Generation/measuring of pulses in accordance with the SENT specification (on up to four/two channels)
- Generation of multipulse signals with up to eight different period lengths and duty cycles (on up to two channels).

3.1 Supported Measurement Modes

The following measurement modes are supported with the inputs:

Asynchronous Measurement Modes

- High Time [µs]
- Low Time [µs]
- Additive High Time [µs]
- Additive Low Time [µs]
- Number of Low Pulses
- Number of High Pulses
- Number of Rising Edges
- Number of Falling Edges
- Frequency --/-- [Hz]
- Duty Cycle L/(L+H) --/--
- Duty Cycle H/(L+H) --/--
- Level (Active High)
- Level (Active Low)
- Stepper A
- Stepper B

Speed-Synchronous Measurement Modes

- Angle of first rising edge of a pulse sequence
- Angle of first falling edge of a pulse sequence
- Angle of last rising edge of a pulse sequence
- Angle of last falling edge of a pulse sequence

SENT

- SENT Input

The Real-Time Execution Connector User's Guide contains detailed documentation of these measurement modes.

3.2 SENT

SENT (Single Edge Nibble Transmission) version Jan. 2010 is supported on any four output channels of the ES1321.1 PWM I/O Board.

SENT is a unidirectional communications scheme from a sensor/transmitting device to a controller/receiving device which does not include a coordination signal from the controller/receiving device. The sensor signal is transmitted as a series of pulses with data measured as falling to falling edge times.

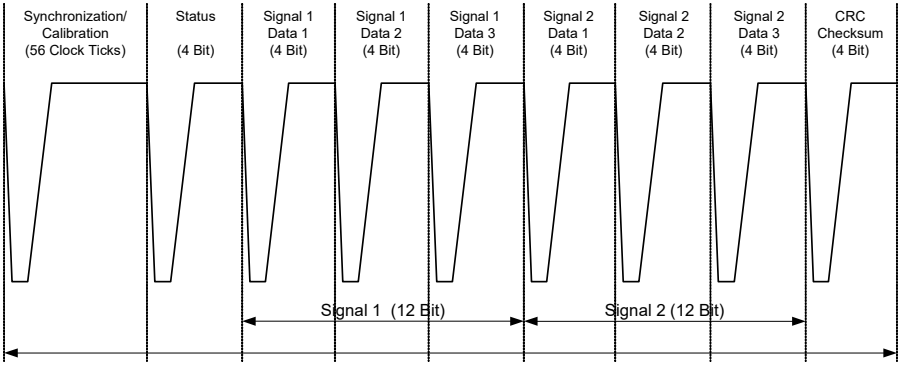
The following section describes how the data is encoded.

Data Format

The encoding scheme consists of a sequence of pulses which is repeatedly sent by the transmitting module.

- Calibration/synchronization pulse period of 56 clock ticks.
- One 4 bit status and serial communication nibble pulse of 12 to 27 clock ticks.
- A sequence of one or more 4 bit data nibble pulses (12 to 27 clock ticks each) representing the values of the signal(s) to be communicated.
- One 4 bit checksum nibble pulse of 12 to 27 clock ticks.
- Transmission of serial messages (slow channel)

The following figure shows an example single message transmission for two 12 bit sensor values:



3.2.1 Measuring SENT Signals

The ES1321.1 PWM I/O Board can measure SENT signals on a maximum of two channels. The data nibbles of signals 1 and 2 as well as the status nibble are sent to the RTIO as a result.

3.3 Multipulse

A multipulse is a sequence of several pulses with different frequencies and duty cycles. The multipulse function is supported by any two output channels of the ES1321.1.

Fig. 3-1 shows a sample sequence.

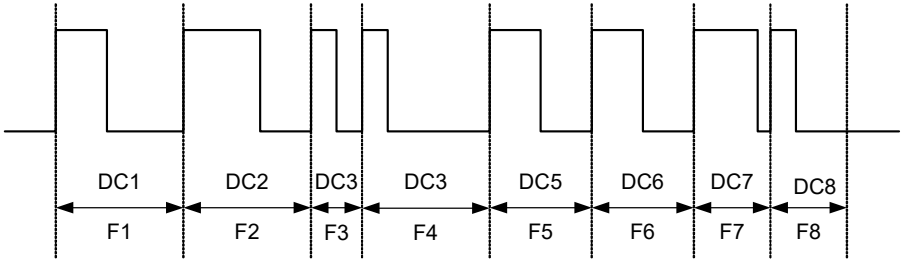


Fig. 3-1 Multipulse Sequence with Eight Pulses (F = Frequency, DC = Duty Cycle)

These sequences are output cyclically.

3.4 Speed-Synchronous Signal Measuring

The ES1321.1 PWM I/O Board offers the following speed-synchronous measurement modes:

- Angle of first rising edge of a pulse sequence
- Angle of first falling edge of a pulse sequence
- Angle of last rising edge of a pulse sequence
- Angle of last falling edge of a pulse sequence

3.4.1 Measuring First Edges

The measurement mode for the first falling (or rising) edge works as follows (see the example of a first falling edge in Fig. 3-2 on page 16):

After the definition of a measurement window (reaching from LWL to UWL) in the RTIO, a search takes place for the first falling edge of a pulse sequence. The angle range between this first falling edge and a specified reference angle is returned as measure value. The first rising edge is measured the same way.

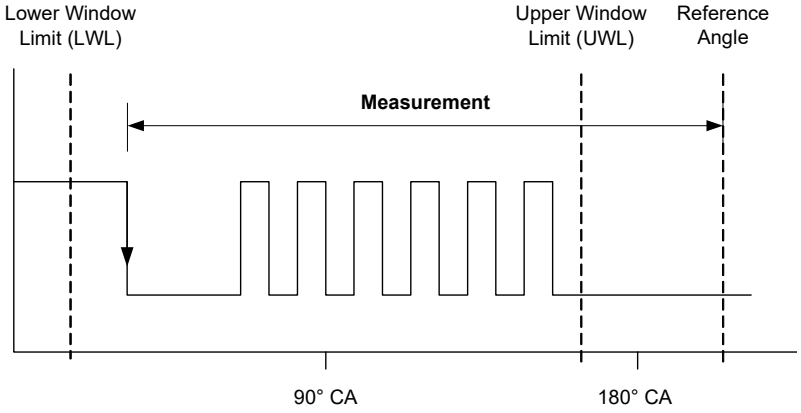


Fig. 3-2 Example: Angle of the First Falling Edge of a Pulse Sequence

Transferring the Measure Values

In this case, the measure value can be determined as soon as the first falling edge is reached and then transferred to the RTIO.

3.4.2 Measuring Last Edges

Fig. 3-3 shows an example of a last falling edge - the angle difference between the last falling edge before the upper window limit is reached and a reference angle is measured. The last rising edge is measured the same way.

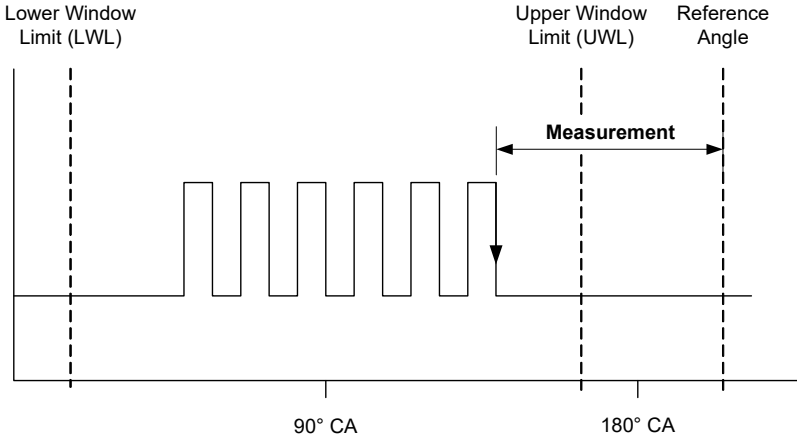


Fig. 3-3 Example: Angle of the Last Falling Edge of a Pulse Sequence

Transferring the Measure Values

The determination and subsequent transfer of the measure values is as follows: the angle of the falling edge currently detected is always stored in a register of the ES1321.1 – as soon as a new falling edge is detected, the register is overwritten with the new angle value.

Once the upper window limit is reached, the angle value last stored is read from the register, the difference to the reference angle (= the measure value) is calculated and then transferred to the RTIO.

4 Connectors

There is a port on the front panel for receiving measure signals and outputting generated signals.

4.1 "INPUT 0-23 / OUTPUT 0-15" Connector

The connector for the signal outputs is a DSUB62HD connector (female). The shielding is at front panel and case potential and thus at protective earth.

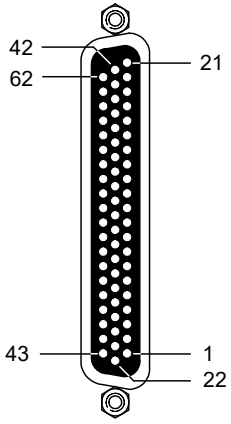


Fig. 4-1 Front Connector of the ES1321.1 PWM I/O Board (View from the Plug-In Side)

The following table contains the pin assignment of the connector:

Pin	Signal	Pin	Signal	Pin	Signal
1	Out_CH0	22	n.c.	43	In_CH0
2	Out_CH1	23	n.c.	44	In_CH1
3	Out_CH2	24	Input UBatt_A	45	In_CH2
4	Out_CH3	25	Input UBatt_A	46	In_CH3
5	Out_CH4	26	Output UBatt_A	47	In_CH4
6	Out_CH5	27	Output UBatt_A	48	In_CH5
7	Out_CH6	28	Output UBatt_B	49	In_CH6
8	Out_CH7	29	Output UBatt_B	50	In_CH7
9	Out_CH8	30	Input UBatt_B	51	In_CH8
10	Out_CH9	31	Input UBatt_B	52	In_CH9
11	Out_CH10	32	Output -UBatt	53	In_CH10
12	Out_CH11	33	Output -UBatt	54	In_CH11
13	Out_CH12	34	Input -UBatt	55	In_CH12
14	Out_CH13	35	Input -UBatt	56	In_CH13
15	Out_CH14	36	n.c.	57	In_CH14
16	Out_CH15	37	n.c.	58	In_CH15
17	n.c.	38	n.c.	59	In_CH16
18	In_CH20	39	n.c.	60	In_CH17
19	In_CH21	40	n.c.	61	In_CH18
20	In_CH22	41	n.c.	62	In_CH19
21	In_CH23	42	n.c.	Casing is at protective earth	

Tab. 4-1 Pin Assignment of the ES1321.1 PWM I/O Board

5 Technical Data

This section contains the technical data of the ES1321.1 PWM I/O Board in tabular form.

Inputs

Number of channels	24
Input voltage range	0 V...+56 V
Input reference voltage range $U_{REF\ A/B}$	+5 V...+60 V
Maximum upper threshold	36 V
Minimum lower threshold	18 V
Hysteresis of input signal	1/3 U_{REF}
Input impedance	1 MΩ
Frequency range	1 Hz...100 kHz
Duty cycle	0%...100%
Electrical strength	±60 V
Clock rate for PWM measurement	20 ns
Counter resolution	31 Bit
Max. high time/low time	40 s
Resolution duty cycle	0.1%
Accuracy between 1 Hz and 10 kHz	±0.04%
Accuracy between 10 kHz and 100 kHz	±0.4%
Resistance between Out GND and VME_GND	0 Ω
Number of SENT inputs	2
SENT specification (version)	SAE J2716 (Jan 2010)

Outputs

Number of channels	16
External reference voltages	0 V...+56 V
Output voltage U_{out} referring to Out_GND when switching output to external reference voltage	U_Out_Ref - 1 V ...U_Out_Ref
Output voltage U_{out} referring to Out_GND when switching output to Out_GND	Out_GND... Out_GND + 1 V
Output impedance	6 Ω
Output overvoltage protection	±60 V
Output current	0...100 mA
Frequency range	1 Hz...100 kHz
Duty cycle	0 %...100 %
Accuracy at 1 Hz...10 kHz	±0.04%
Accuracy at 10 kHz...100 kHz	±0.4%
Accuracy duty cycle (duty cycle 50%) at 1 Hz...10 kHz	±0.2%
Accuracy duty cycle (duty cycle 50%) at 10 kHz...100 kHz	±0.4%
Clock rate for PWM generation (numerically-controlled oscillator)	20 ns
Resistance between Out_GND and VME_GND	0 Ω
Number of SENT outputs	4
SENT specification (version)	SAE J2716 (Jan 2010)

Power Supply

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

Environmental Conditions

Operating temperature	5 °C to 35 °C (41 °F to 95 °F)
Relative humidity	0 to 95% (non-condensing)

Physical Dimensions

Height	3 U
Width	4 HP

6 ETAS Contact Addresses

ETAS HQ

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70469 Stuttgart	Fax:	+49 711 3423-2106
Germany	WWW:	www.etas.com

ETAS Subsidiaries and Technical Support

For details of your local sales office as well as your local technical support team and product hotlines, take a look at the ETAS website:

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Index

W