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ES1334.2
Measurement Board (16-CH)
User's Guide

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1 Introduction

This manual contains information about the ES1334.2 Measurement Board. This includes:

- "Signal Inputs" on page 11
- "Synchronization Inputs" on page 14
- "Signal Outputs" on page 16
- "VMEbus Interface" on page 16
- "Fuse" on page 16
- "Switches" on page 17
- "Pin Assignment" on page 23
- "Display Elements" on page 25

note

Some components of the ES1334.2 Measurement Board may be damaged or destroyed by electrostatic discharges. Please keep the board in its storage package until it is installed.
The board should only be taken from its package, configured and installed at a working place that is protected against static discharge.

1.1 Features

The ES1334.2 Measurement Board has the following features:

- 16 identical input channels
- 2 measure modes:
  - angle-synchronous (synchronization signal via front-facing connectors)
  - time-synchronous
- two battery voltages
- Motorola PowerPC 555 on-board
- 4 identical output channels (angle-synchronous)

Fig. 1-1 on page 6 shows the front panel of the ES1334.2 Measurement Board with

- the LED displays
- the synchronization input "SYNC" and
- the signal inputs "INPUT 0-15".

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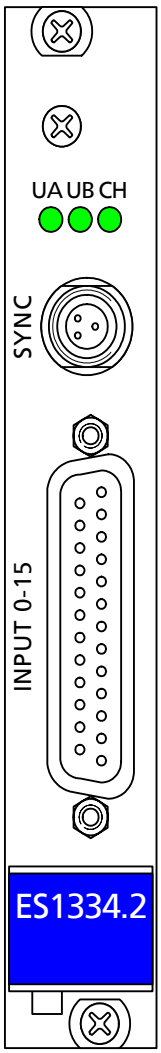


Fig. 1-1 Front Panel of the ES1334.2 Measurement Board

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1.2 Applications

The ES1334.2 Measurement Board is used to acquire and evaluate digital ECU signals in the LabCar environment.

This means:

- acquisition and evaluation of angle-synchronous signals such as injection signals and ignition signals.
- acquisition and evaluation of time-synchronous signals (usually pulse-width modulated (PWM) signals) such as exhaust gas recirculation and canister purge valve.
- acquisition and evaluation of static (switch) signals such as fan control and error lamp.
- generation of digital, angle-synchronous signals to address external hardware, such as knock-signal generators.

The integration of the ES1334.2 Measurement Board in LabCar is shown in Fig. 1-2.

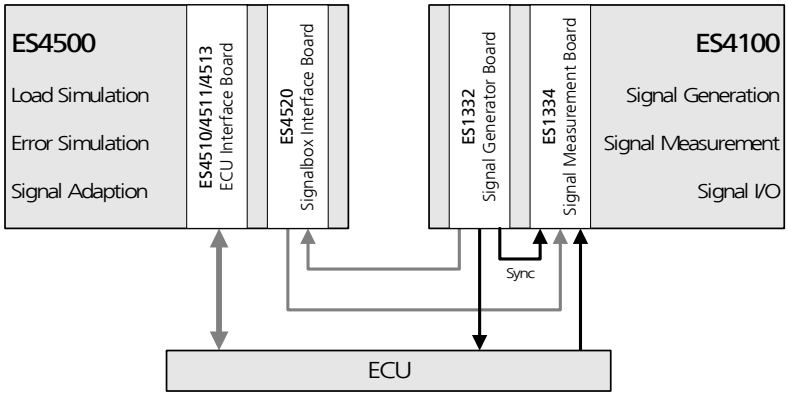


Fig. 1-2 ES4100 Signal Box in LabCar (see Text)

Use without Load and Error Simulation

When there is no ES4500 ("load box"), ECU signals are measured directly at the ECU connections with the ES1334.2 Measurement Board and signals generated with the ES1332 Signal Generator Board are connected directly to the ECU connectors.

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Use with Load and Error Simulation

With an ES4500 for load and error simulation, the ES4100 Signal Box is connected to the ES4500 using an interface board (ES4520 Signal Box Interface Board).

As well as measuring the ECU signals with the ES1334.2 Measurement Board, the signals generated on the ES1332 Signal Generator Board can then also be adapted.

1.3 Block Diagram

Fig. 1-3 on page 9 is a block diagram showing all important functional units of the ES1334.2 Measurement Board. These are described briefly below.

Input Signals

The input signals are first of all routed via a DIL surface mount pin header. By opening individual jumpers or all jumpers, the signal flow from the ECU can be opened and a customized piggyback assembled. Pull-up/pull-down resistances or special signal conditionings can be placed on this piggyback.

Overvoltage Protection and Impedance Converter

The overvoltage protection is designed to protect the board against increased input voltages. The impedance converter connects the ECU signals with high impedance to the ES1334.2 Measurement Board.

Threshold Comparison

Then the signal is compared with a threshold value. This results in the conversion of the "analog" input signal to digital 0/1 or active/inactive information (see "Threshold Comparison" on page 11).

Edge Recognition

The 16 bits received in this way are permanently tested for changes (i.e. edges) by the edge recognition hardware. If at least one input signal changes from "active" to "inactive" or vice versa, the 16 bits are assigned a time stamp and the crankshaft angle stamp and stored in a ring buffer (FIFO memory) (see "Edge Recognition" on page 13).

Backplane

The backplane connections correspond to the VMEbus specification - geographical addressing in accordance with the VME64x specification is also supported.

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LED Displays

The ES1334.2 Measurement Board has a total of 3 LEDs on the front panel. One of these LEDs is used to display, e.g. injection or ignition signals. One of the 16 input signals can be selected for display purposes. Two further LEDs visualize the state of the battery voltages (see "Display Elements" on page 25).

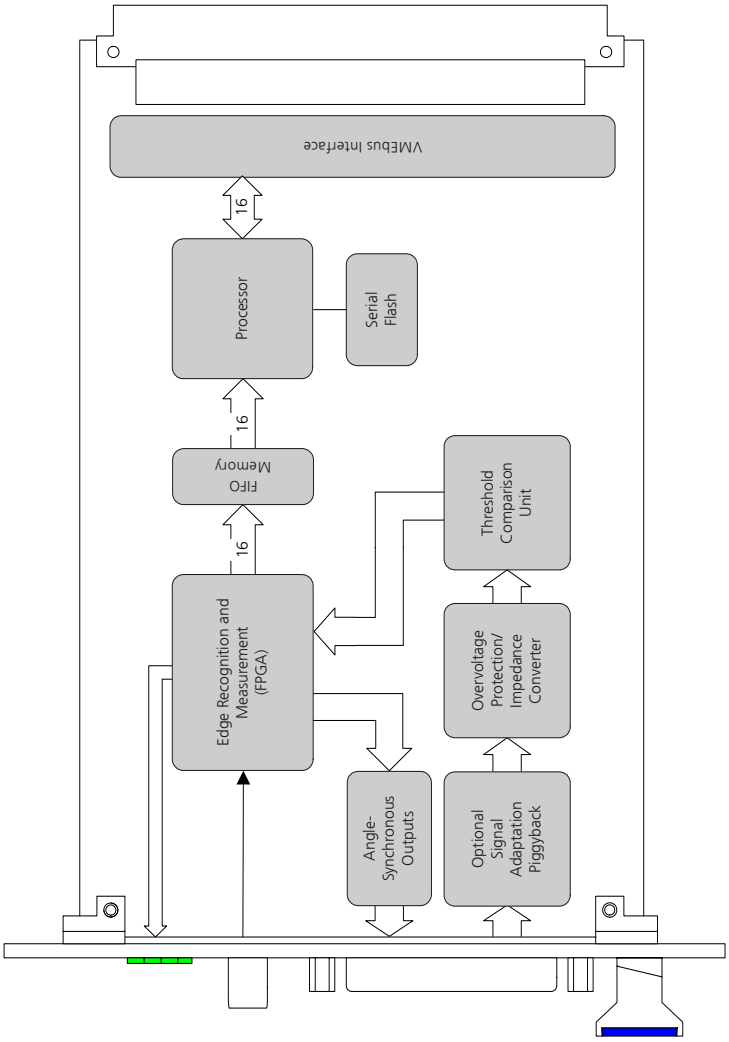


Fig. 1-3 Block Diagram of the ES1334.2 Measurement Board

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2 Hardware Features

This chapter contains information on the features of the ES1334.2 Measurement Board. These are:

- "Signal Inputs" on page 11
- "Synchronization Inputs" on page 14
- "Signal Outputs" on page 16
- "VMEbus Interface" on page 16
- "Fuse" on page 16
- "Switches" on page 17

2.1 Signal Inputs

This section contains information on the input circuit and overvoltage protection of the signal inputs.

For more details on pin assignment, please refer to the section "Signal Inputs "INPUT 0-15"" on page 23.

2.1.1 Input Circuit

The input circuit of every channel of the ES1334.2 Measurement Board is shown in detail in Fig. 2-1.

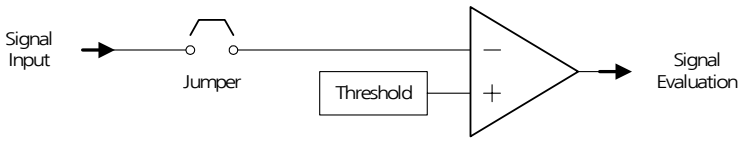


Fig. 2-1 Block Diagram of Input Channels on the ES1334.2

2.1.2 Overvoltage Protection and Impedance Converters

The 16 input channels are equipped for input voltages of 0 - 60 V and are protected against overvoltages up to 75 V.

Impedance converters are used to attain an input impedance > 1 MΩ.

2.1.3 Threshold Comparison

Each of the 16 input signals of the ES1334.2 Measurement Board can be compared with a threshold value. This comparison leads to the analog input signal being converted to digital (0/1) information.

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The threshold value to be used in the comparison is defined using the software. There are the following four possibilities:

- comparison to 5 V/2 for TTL input signals
- comparison to UBatt_A/2 (via the front panel)
- comparison to UBatt_B/2 (via the front panel)
- comparison to an external threshold value (via the front panel)

As the channels are divided into two groups (Input [0..7] and Input [8..15]), the threshold value cannot be set for each channel individually. The threshold value source is always set for the entire group.

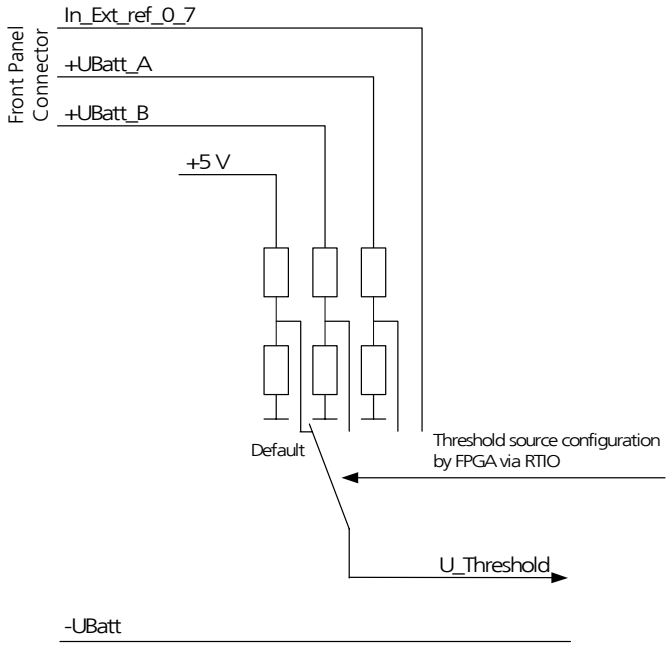


Fig. 2-2 Selection of Threshold Value Source

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Voltage	$V_{ThreshOn}$	$VT_{hreshOff}$
(5 V)/2	3.0 V	2.0 V
(UBatt_A)/2 und (UBatt_B)/2	0.43 x UBatt_X + 1.49 V	0.43 x UBatt_X + 0.51 V
Ext_Ref	0.97 x U_{Ext_Ref} + 1.01 V	0.97 x U_{Ext_Ref} + 0.07 V

2.1.4 Edge Recognition

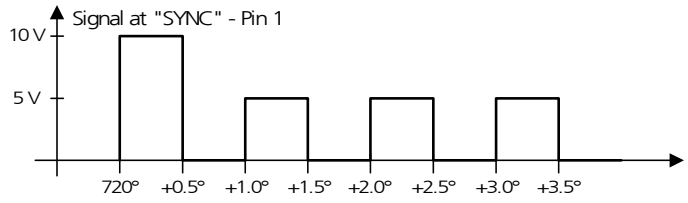
The 16 bits from the threshold comparison described in the previous section are checked for changes to one or more bits (i.e. edges) by the edge recognition hardware. If at least one input signal changes from "active" to "inactive" or vice versa, the current status of the 16 inputs is saved and the values of the integrated counters are queried for the determination of the current time and crankshaft angle stamp.

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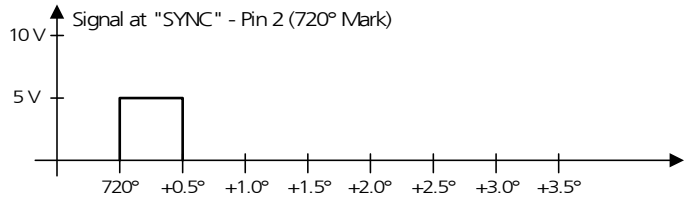
2.2 Synchronization Inputs

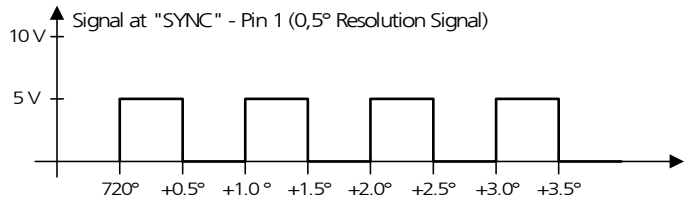
The ES1334.2 Measurement Board is provided with the latest angle information via the "SYNC" connector on the front panel. The angle information consists of the 720° mark and a 0.5° resolution signal. There are two ways of supplying this information with the ES1334.2:

1. A signal with a 10 V pulse for the 720° mark and with 5 V pulses every 1.0°. Both rising and falling edges are evaluated resulting in a crankshaft resolution of 720° / 1440 edges = 0.5°.



2. Two signals with a pulse height of 5 V





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2.2.1 Overvoltage Protection and Impedance Converters

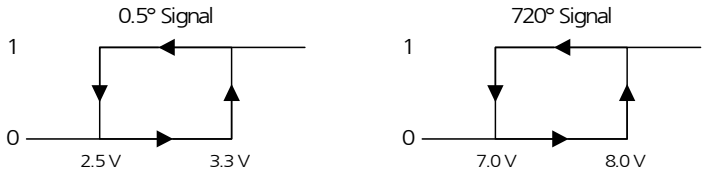
The inputs are equipped for input voltages of 0 - 10 V and are protected against overvoltages of up to 75 V.

Impedance converters are used to attain an input impedance > 1 MΩ .

2.2.2 Threshold Values

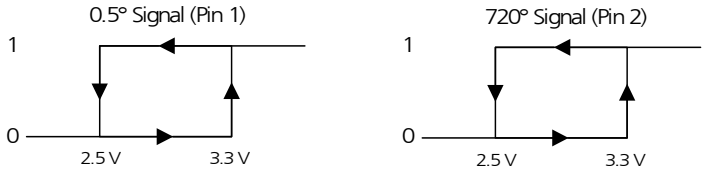
1. One signal (at pin 1):

   The thresholds are 2.5 V for the 0.5° signal and 7.0 V for the 720° signal.



2. Two signals:

   The threshold is 2.5 V for both signals.

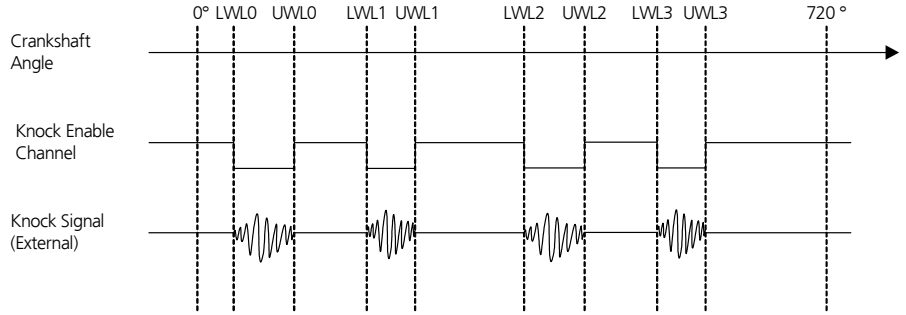


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2.3 Signal Outputs

The ES1334.2 Measurement Board has four angle-synchronous outputs which are used to address external hardware (e.g. knock generators).

With one output, it is possible to generate up to 12 pulses per 720 °CA. The polarity of the pulses (high- or low-active), their number and position can all be configured.



2.3.1 Overvoltage Protection

All output channels are protected against short-circuits against - UBatt and overvoltage to 60 V. Each output can drive currents of up to 15 mA with TTL level.

2.4 VMEbus Interface

Backplane Connector J1

The assignment of the backplane connector J1 adheres to the VMEbus specification. For a detailed description, please refer to the ES4100 VME64x Signal Box User's Guide.

2.5 Fuse

To avoid damage to the hardware, the -UBatt line is protected by a fuse (0.75 A, slow-blowing). The fuse is directly beside the "INPUT 0-15" SubD connector (Fig. 2-3).

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2.6 Switches

There are several switches on the ES1334.2 the function of which is described in this section. Fig. 2-3 shows where the switches are located on the board.

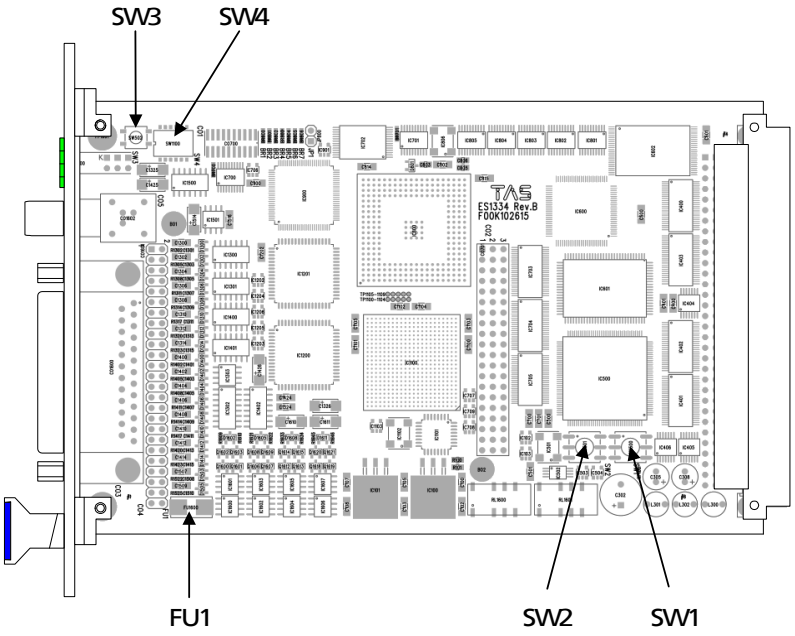


Fig. 2-3 Position of Switches SW1 .. SW4 on the Board

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2.6.1 Address Switches SW1 and SW2

The ES1334.2 Measurement Board can be operated in both standard VMEbus systems with 96-pin backplane connectors and in VME64x systems with geographical addressing. If the SW1 and SW2 HEX switches are in position "0x00", the board is addressed in "geographical addressing mode" and otherwise in the relevant address spaces.

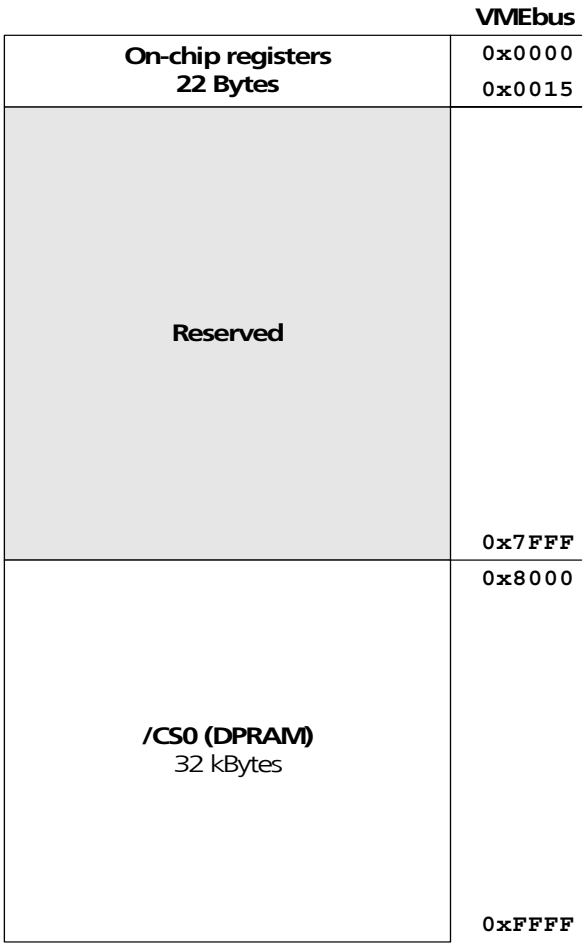


Fig. 2-4 Address Map

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The ES1334.2 maps 256 bytes into the A24 address space in the setting "0x00" depending on the slot position. Depending on the memory space available, the 64 kB address space is then defined dynamically by the system controller.

Slot Position	Address	VME Interface (Control Registers)
1	E0E000 - E0E0FF	256 bytes
2	E0E100 - E0E1FF	256 bytes
3	E0E200 - E0E2FF	256 bytes
4	E0E300 - E0E3FF	256 bytes
5	E0E400 - E0E4FF	256 bytes
6	E0E500 - E0E5FF	256 bytes
7	E0E600 - E0E6FF	256 bytes
8	E0E700 - E0E7FF	256 bytes
9	E0E800 - E0E8FF	256 bytes
10	E0E900 - E0E9FF	256 bytes
11	E0EA00 - E0EAFF	256 bytes
12	E0EB00 - E0EBFF	256 bytes
13	E0EC00 - E0ECFF	256 bytes
14	E0ED00 - E0EDFF	256 bytes
15	E0EF00 - E0EFFF	256 bytes
16	E0F000 - E0F0FF	256 bytes
17	E0F100 - E0F1FF	256 bytes
18	E0F200 - E0F2FF	256 bytes
19	E0F300 - E0F3FF	256 bytes
20	E0F400 - E0F4FF	256 bytes
21	E0F500 - E0F5FF	256 Byte

Tab. 2-1 Slot Position and Address

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In every other setting of the HEX switch (≠ 0x00), the 64 kB address space is assigned statically.

Switch Position	Address Space
0x01	010000 - 01FFFF
0x02	020000 - 02FFFF
0x03	030000 - 03FFFF
..	.
..	.
..	.
0xFF	FF0000 - FFFFFF

Tab. 2-2 Setting of the Address Spaces

SW1	SW2
0x0**n**	0x**n**0
Address A16 - A19	Address A23 - A20

Tab. 2-3 HEX Switches for Setting the Address

2.6.2 Reset Switch SW3

A local board reset can be executed with the SW3 switch.

2.6.3 DIP Switch SW4

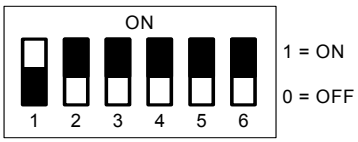


Fig. 2-5 SW4 (Default Settings)

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Switch	Designation	Position*
1	Flash enable	0 = Flash disabled **1** = Flash enabled
2	Internal Memory Space Base Select	**0** = 0x0000 0000 1 = 0x0100 0000
3	Boot Port Size	**0** = 32-bit 1 = 16-bit
4	Reset Config Enable	**0** = External Hard Reset Config Word 1 = Internal Hard Reset Config Word
5 and 6	Memory configuration	5 6 **0** **0**: Internal Flash 1 0: External SRAM 0 1: DPRAM 1 1: External Flash

* Default settings are shown in bold face.

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3 Pin Assignment and Display Elements

This chapter describes the connections and display elements of the ES1334.2 Measurement Board. It consists of the following sections:

- Pin Assignment (section 3.1 on page 23)
  This section describes all connectors on the front panel.
- Display Elements (section 3.2 on page 25)
  This section describes the meaning of the LED displays on the front panel.

3.1 Pin Assignment

This section describes the pin assignment for the signal outputs and for the inputs for external signals:

- "Signal Inputs "INPUT 0-15"" on page 23
- "Synchronization Input "SYNC"" on page 24

3.1.1 Signal Inputs "INPUT 0-15"

The connector for the signal outputs is a Sub-D 25 connector (male). The shielding is at front-panel and housing potential and thus protective earth.

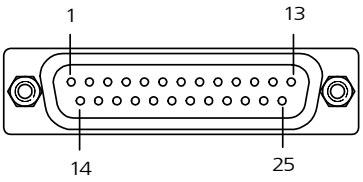


Fig. 3-1 "INPUT 0-15"

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Pin	Signal	Pin	Signal
1	IN_CH0	14	IN_CH13
2	IN_CH1	15	IN_CH14
3	IN_CH2	16	IN_CH15
4	IN_CH3	17	IN_Ext_Ref_0_7
5	IN_CH4	18	IN_Ext_Ref_8_15
6	IN_CH5	19	OUT_CH0
7	IN_CH6	20	OUT_CH1
8	IN_CH7	21	OUT_CH2
9	IN_CH8	22	OUT_CH3
10	IN_CH9	23	+UBatt_A
11	IN_CH10	24	+UBatt_B
12	IN_CH11	25	-UBatt*
13	IN_CH12		
* -UBatt is shielded with 0.75 A			

Tab. 3-1 Pin Assignment of "INPUT 0-15"

3.1.2 Synchronization Input "SYNC"

Jack, Lemo 3-pin. Type: Lemo EXG.0B.303.HLN

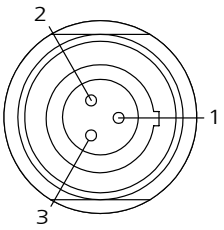


Fig. 3-2 "SYNC" Connector

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Pin	Assignment	Pin	Assignment
1	IN_CrankAngSync	2	IN_CrankAngSync720
3	GND	Shielding	Front-panel/ housing potential

Tab. 3-2 Pin Assignment of "SYNC"

The mating connector is of type LEMO FGG.0B.303.CLAD52Z.

The following strain reliefs can be used:

Diameter	Type
2.5 - 2.9 mm	LEMO GMA.0B.025.DN
3.5 - 3.9 mm	LEMO GMA.0B.035.DN
4.5 - 5.2 mm	LEMO GMA.0B.045.DN

3.2 Display Elements

There are several LEDs on the front panel of the ES1334.2 the meaning of which is described in this section.

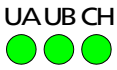


Fig. 3-3 LEDs on the Front Panel

3.2.1 LEDs showing the Status of the Battery Voltages

The "UA" and "UB" LEDs show whether the battery voltages UBatt_A and UBatt_B exist.

If one or neither exists (or in other words: if the value is below a specific voltage), the 12 V supply voltage is applied to the board-internal UBatt_A and UBatt_B via a relay. This means input signals <12 V can be measured.

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The following table shows the threshold values.

UBatt_A / UBatt_B	State of the "UA" or "UB" LEDs
> 2 V	LED lit up
< 2 V	LED is off. 12 V is applied to the board-internal UBatt_A and UBatt_B network.

Tab. 3-3 Meaning of the "UA" and "UB" LEDs

3.2.2 LEDs for Signal Display

LED	Display	Meaning
CH	Lit up green	Signal "active"
CH	Not lit up	Signal "not active"

Tab. 3-4 Meaning of the "CH" LED

The display signal can be selected from the following:

- 1 input channel (from 16)
- OUT_CH0
- OUT_CH1
- OUT_CH2
- OUT_CH3
- Sync_0.5°
- Sync_720°

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4 Technical Data

This chapter contains the technical data on the ES1334.2 Measurement Board.

Digital Inputs

Configuration	16 input channels (single-ended)
Input voltages	0 V....battery voltage +UBatt_A or +UBatt_B
Battery voltage +UBatt_A, +UBatt_B	0 V.....60 V
Input impedance	>1 MΩ
Overvoltage protection	75 V
Ground potential	Absolute (battery ground)

Digital Outputs

Configuration	4 output channels (single-ended)
Output voltage	0 to 5 V
Output current	Max. 20 mA
Overvoltage protection	60 V

Microprocessor

Main processor	Motorola MPC555, 40 MHz, 32-bit
Memory	512 kByte external SRAM 16 kByte FIFO 32 kByte Dual-Ported RAM to the VMEbus

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VME Conformity

VME specification	Revision C.1, October 1985 and IEC 821-1987
Type	Slave
Data bus	A24:D16
Address modifier	39 (hex): A24 non-privileged data access
Base address	$000000-FF0000 jumper-programmable or by VME64x backplane slot detection automatically
Memory map	Standard I/O space, occupying 64 kBytes
Interrupts	Single level, IRQ 1 – 7 By software: – IRQ level – interrupt vector source

Environmental Conditions

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

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5 Glossary

This chapter explains terms which are significant for the ES1334.2 Measurement Board environment.

Battery node

Switchable battery voltage

ES4100

The ES4100 VME64x Chassis is used to hold new generation interface boards (VME64x, 3 U).

ES4500

The ES4500 Component Rack is used to hold boards for error and load simulation (ES4510 to ES4571).

ES4510

The ES4510 ECU Interface Board is used to connect the ECU to the ES4500 Component Rack.

ES4511

The ES4511 ECU Interface Board is used to connect the ECU to the ES4500 Component Rack. The difference between the ES4510 and the ES4511 is that the ES4511 also makes signal interruption possible.

ES4513

The ES4513 ECU Interface Board is used to connect the ECU to the ES4500 Component Rack. In addition to the scope of the ES4511, it also provides a multiplexer for the short-circuit channels.

Real-Time I/O

The Real-Time I/O (RTIO) is the user interface of the hardware drivers which run on the I/O boards. The settings of the board can be configured here, e.g. voltage ranges, signal pre-evaluations, CAN messages etc.

RTIO

→ Real-Time I/O

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