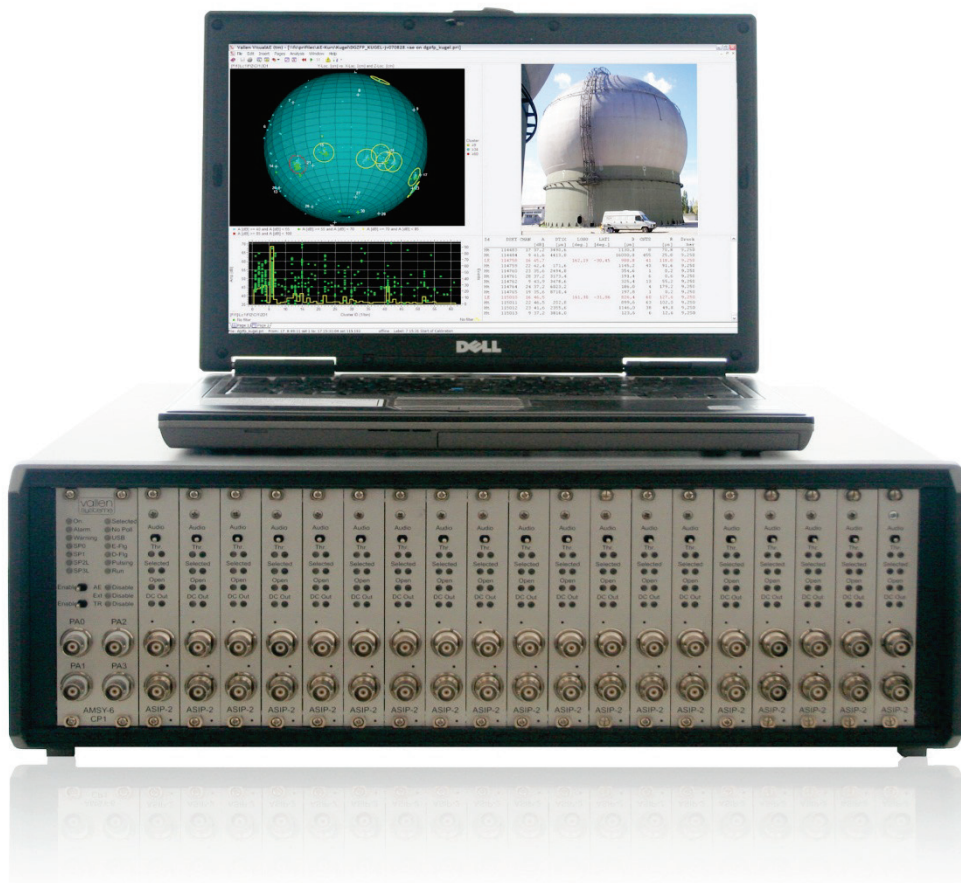


AMSY-6

System Specification

Document released in 2022-07



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Specifications are subject to change as product developments are made.

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Revision Record

Date	Changes
2021-11	Contact address updated
2020-11	Added Vallen AE Suite Lite
2019-09	Changed specification of arrival time bandwidth, R and D resolution

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1 Intended Use of an AMSY-6 System

An AMSY-6 system is a multi-channel Acoustic Emission (AE)-measurement system consisting of parallel measurement channels. AMSY-6 can be used to detect, measure and locate AE-sources such as material failure on microscopic level, corrosion, leakage, partial discharge, friction and wear as well as particle impact.

A measurement channel consists of an AE-sensor (see section 6), a preamplifier (see section 4) and one channel of an ASIP-2 (dual channel acoustic signal processor, see section 3).

ASIP-2 boards are mounted in a chassis which is connected via a USB interface to a PC. Up to eight chassis can be paralleled on the USB hub. Each chassis has various interfaces, which are described in section 2.6 and 2.7. Additionally an AMSY-6 has at least 4 parametric channels (PaX; see section 2.6.2) for measuring environmental conditions such as temperature, load, humidity, wind speed, etc.

The system front-end (see section 9) is running on a PC (see section 8). It controls and initializes the measurement system and stores the results. The analysis software VisualAE, VisualTR and VisualClass can be operated on-line to achieve an on-line measurement and analysis system.

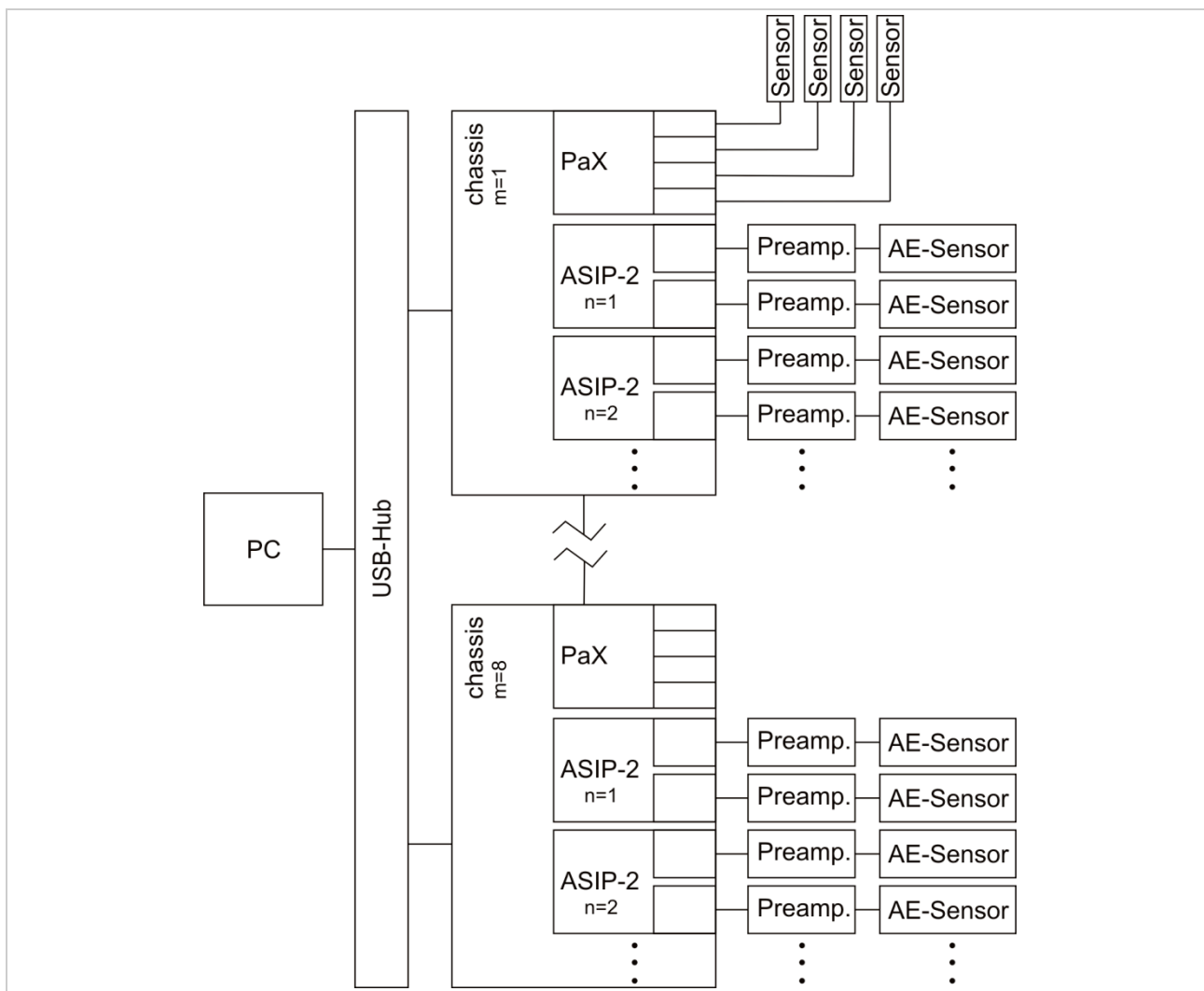


Figure 1: Block diagram of an AMSY-6

AMSY-6 system setup performance parameters

Parameters	Limit
Maximum number of chassis in a multi chassis setup	9
Maximum number of AE-channels with or without transient recording	254
Maximum number of parametric input channels in a multi chassis setup	16
Maximum number of parametric channels in a master chassis (except for the small, 4 AE channel chassis)	8

2 Chassis

The chassis holds the acoustic signal processors (ASIP-2), parametric channels, control panel and various interfaces described in the subsequent sections.

Up to 9 chassis can be interconnected in a multi chassis setup. The chassis with the lowest address setting acts as master chassis. All other chassis are considered slave chassis.

Chassis are available in a standalone version and a rack mountable version.

2.1 Sizes and Weights

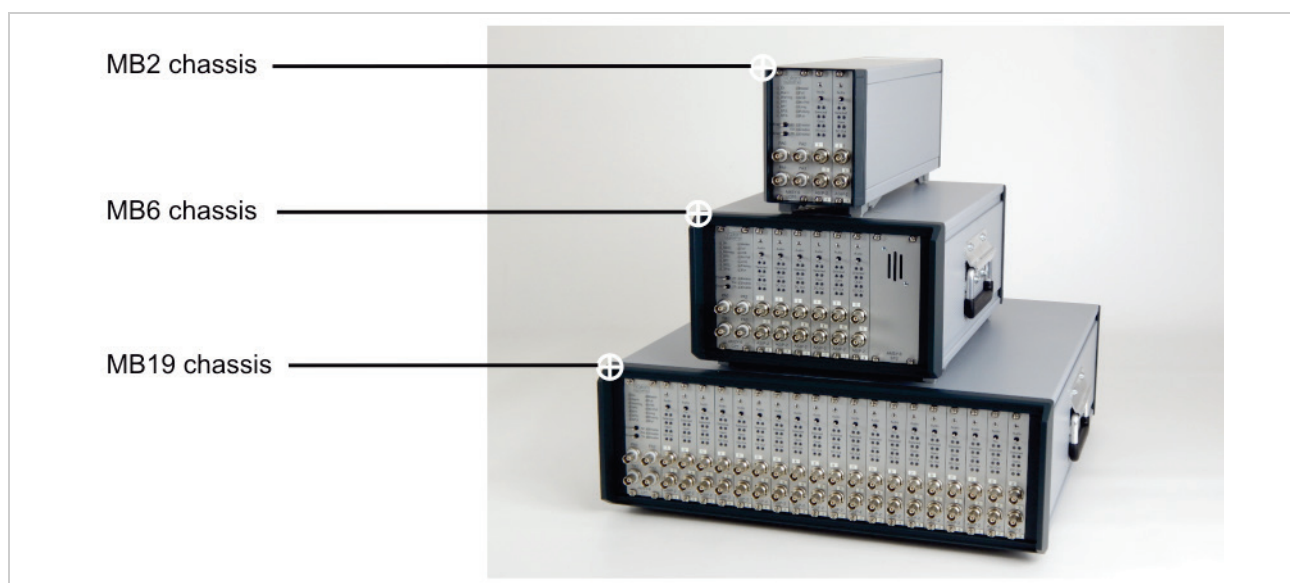


Figure 2: MB2-V2, MB6-V2 and MB19-V2 chassis with 4, 12 and 38 AE-channels, respectively.

A chassis is available in different sizes identified by the chassis codes.

Chassis Code	Size in cm (width x height x depth)	Max. AE-channel number	Weight in kg
MB2-V2	10.5 x 15 x 40.5	4	2.9
MB6-V2	27 x 17 x 39	12	5.0
MB19-V2	48 x 17 x 51	38	7.7
MR19-V2	48.3 x 17.7 x 52 (4HE 84TE)	38	7.1
EB21-V2	48 x 17 x 51	42	7.5

Chassis Code	Size in cm (width x height x depth)	Max. AE-channel number	Weight in kg
ER21-V2	48.3 x 17.7 x 52 (4HE 84TE)	42	6.9

Additional information for rack mountable chassis types MR19-V2 and ER21-V2:

Inside a rack the chassis needs a height of 4 rack units (177.8 mm), a width of 84 pitch units (426.7 mm) and a depth of 506 mm.

We recommend considering 1-2 additional rack units as free space for cables in case you want to run the cables to the preamplifiers from the front connectors to the rear of the control cabinet enclosure.

2.2 Power Inlet

Power Inlet	Description
Input voltage	$(24 \pm 2) V_{DC}$
Connector type	MBx-V2 and EB21-V2: 4 pole XLR MR19-V2, ER21-V2: screw terminal for cable cross-sectional area up to 6 mm ²
Ground socket	4 mm banana jack

2.3 Power Supply Unit

Power supply	Description
Input voltage	$(85 - 264) V_{AC}$
Frequency range	(47 - 63) Hz
Output voltage	24 V _{DC}
Output current	11.67 A

2.4 Power Consumption

Chassis Code	Per ASIP-2 (w. TR2/2GB)	Per preamplifier (in saturation)	Max. (max. number of ASIP-2 mounted in chassis)
	[W]	[W]	[W]
MB2-V2	8	3.5	37
MB6-V2			94
MB19-V2			280
MR19-V2			280
EB21-V2			310
ER21-V2			310

In case of a failure the maximum power consumption is 410 W.

2.5 Environmental Conditions

An AMSY-6 is intended for interior use, only.

Environmental conditions	Description
Temperature range	+5 °C – +40 °C
Relative Humidity	Maximum relative humidity of 80 % at 31 °C Linear decrease of relative humidity to 50 % with increasing temperature up to 40 °C
Maximum altitude	2000 m
Pollution degree	2

2.6 Front Panel Chassis Interfaces

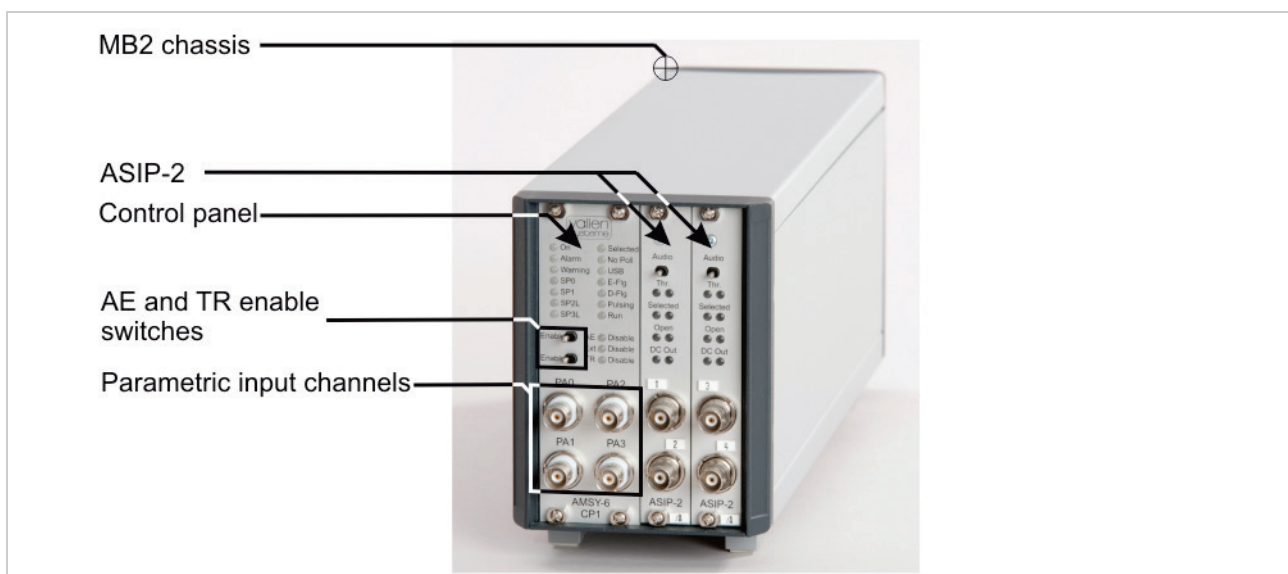


Figure 3: Front side of an MB2 chassis with front panel elements: ASIP-2 (chapter 3), AE-enable and TR-enable switch (2.6.1) and parametric input channels (2.6.2) indicated.

2.6.1 AE-enable / TR-enable Switches

Switch	Description
AE-enable	Switch that enables or disables data acquisition (AE-data as well as TR-data).
TR-enable	Switch that enables or disables acquisition of TR-data, only

2.6.2 Parametric Input Channels

Item	Description
Input range	Software selectable: ± 1 V or ± 10 V
Input impedance (to ground)	100 k Ω
Parametric clock (scan rate)	N x 50 μ s; N = 2, 3, ..., 200

Item	Description
Averaging (low pass)	N samples, N as defined for parametric clock
Resolution	16 bit
Overvoltage protection	±48 V inner wire against ground

2.6.3 LEDs

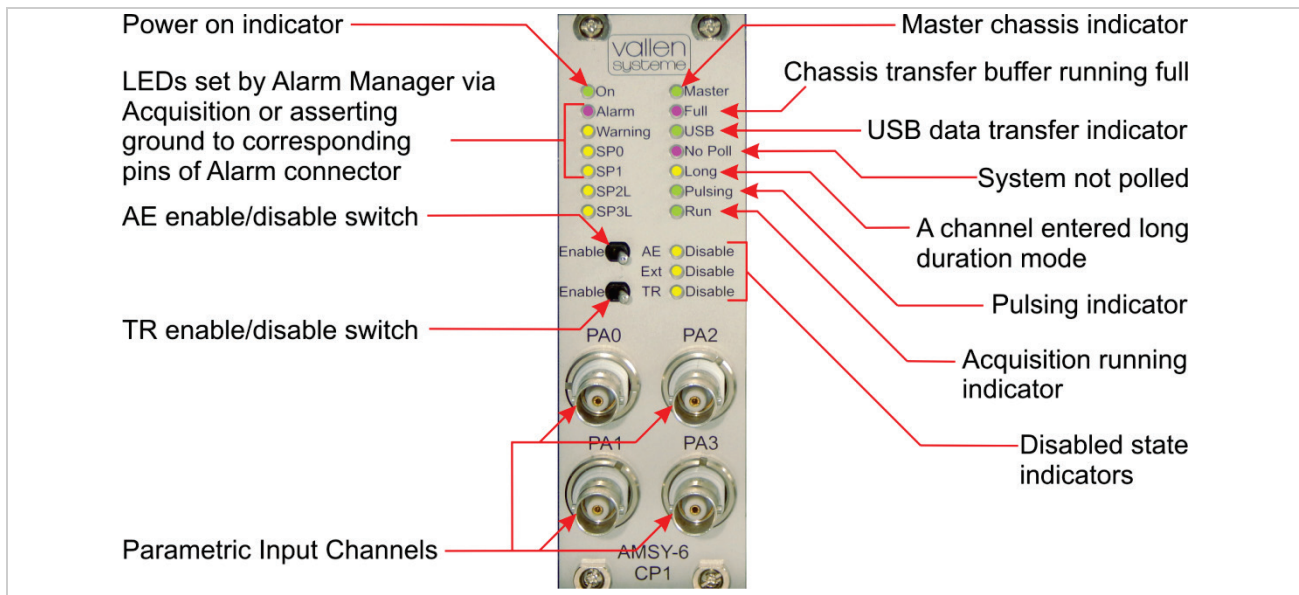


Figure 4: Control Panel LEDs

Control Panel LEDs (CP1 or CP2)

LED	Description
On	Green LED indicating power on/off status.
Alarm	Red LED controlled by the Alarm Manager, the Acquisition program and the ALARM signal at the Alarm Connector. In a slave chassis this LED cannot be controlled by the Alarm Manager. Alarm LED is on if ground is asserted to the ALARM signal of the local Alarm connector. Alarm LED is on in a slave chassis, if an SN/SP error occurs, i.e. the clock is lost.
Warning	Yellow LED controlled by the Alarm Manager, the Acquisition program and the WARN signal at the Alarm Connector. In a slave chassis this LED cannot be controlled by the Alarm Manager Warning LED is on if ground is asserted to the WARN signal of the local Alarm connector. Warning LED is blinking in case of a TOV error.
SP0	Yellow LED set by the Alarm Manager, by acquisition program or by asserting ground to the SP0 signal at the Alarm Connector. In a slave chassis this LED is always off, except the local SP0 signal is asserted.
SP1	Yellow LED set by the Alarm Manager, by acquisition program or by asserting ground to the SP1 signal at the Alarm Connector. In a slave chassis this LED is always off, except the local SP1 signal is asserted.

LED	Description
SP2L	Not used.
SP3L	Not used.
Master	Green LED indicating master chassis in a multiple chassis setup
No Poll	Red LED indicating that the system was not polled by the acquisition program for at least 5 seconds. This LED is controlled for each chassis individually.
USB	Green LED, indicating USB transfer. This LED is controlled for each chassis individually.
Full	Red LED indicating that chassis transfer buffer runs full This LED is controlled for each chassis individually.
Long	Yellow LED indicating that at least one channel in the chassis entered long duration mode. This LED is controlled for each chassis individually.
Pulsing	Green LED indicating that the internal pulser is on.
Run	Green LED indicating that the acquisition program is in recording mode.
AE Disable	Blinking yellow LED indicating that the acquisition of AE data and TR-data is disabled by hardware switch.
Ext Disable	Yellow LED indicating that the acquisition of AE data and TR-data is disabled externally.
TR Disable	Blinking yellow LED indicating that the acquisition of TR-data is disabled by hardware switch.

2.6.4 Speaker

Internal speaker for audio output of frequency filtered AE signal of all audio selected AE channels (see chapter 3 section Mechanical properties).

An internal speaker is only available in the chassis MB6 (front speaker), MB19 and MR19 (rear speaker, front speaker is optional) or EB21 and ER21 (rear speaker, front speaker is optional).

2.7 Rear Panel Chassis Interfaces



Figure 5: Rear side of MB6 chassis with back panel elements: grounding post, power on/off switch (2.7.9), power inlet (2.2), alarm connector (2.7.3), externals connector (2.7.1), USB interface (2.7.7), audio jack (2.7.4), previous/next port (2.7.6), pulse out (2.7.8) and address selector (2.7.5).

2.7.1 Power Inlet

See section 2.2, Power Inlet.

Power Entry LEDs

LED	Description
Power IN	Blue: 24 V detected at the input side
Device ON	Green: device switched on
Device Error	Red: indicates an error which can be e.g. supply voltage too high, current too high or chassis temperature too high.

2.7.2 Externals Connector

The externals connector is a 15-pole male D-sub connector which provides access to the following functions:

- External record control
- Control of the digital parametric counter PCTD
- External trigger input

Pin	Signal	Description
1	I ² C Clock	External I ² C bus clock line
2	GND	Logic ground.
3	GND	Logic ground.
4	GND	Logic ground.

Pin	Signal	Description
5	GND	Logic ground.
6	GND	Logic ground.
7	GND	Logic ground.
8	/DISABLE	Low disables AE- and TR-recording and switches on the LED "Ext. Dis"
9	I ² C Data	External I ² C bus data line.
10	User-DAC	User defined analog output, 0 – 5 V at 10 mA max.
11	PCTD-Clock	Every rising or falling edge increments/decrements the PCTD counter maximum counting frequency: 160 kHz
12	PCTD-up/down	High or open: PCTD increments Low: PCTD decrements
13	PCTD-enable	High or open: enables counter Low: disables counter
14	PCTD-reset	High or open: PCTD is set to 0 (asynchronous to PCTD-Clock) Low: the current PCTD value is stored
15	ETRIG	Spare for future use

Notes:

- Pin 1, 9: Bidirectional open drain signals with 10 kOhm pull-ups to +5 V. Shall be driven to ground only.
- Pin 10: Output of signal. No external voltage shall be applied at this pin.
- Pin 8, 11 to 15: TTL input signals with 10 kOhm pull-ups to +5 V.
- All signals are protected against electrostatic discharge transients up to 15 kV (human body model)
- PCTD: current value of digital counter is stored with parametric data set. Parametric data sets are usually stored asynchronous to PCTD-clock. Last value of PCTD might not be stored when PCTR-reset is detected before next parametric data set is stored.



Voltages between 0 and +5 V against GND (pins 2 to 7) are allowed at TTL input signal pins (8, 11 to 15) when the unit is powered and switched on.



Note:

The Externals connector should be used in a master chassis only. The signals are undefined in a slave chassis

2.7.3 Alarm Connector

The Alarm connector is a 6-pole female Lemo connector (Lemo EPA.1B.306.HLN) with the following pin out:

Pin	Signal	Description
1	+5 V	+5 V, max 60 mA, protected by a PTC resistor
2	ALARM	Driven low when ALARM LED is on under software control. If driven low externally, ALARM LED is on.
3	WARN	Driven low when WARNING LED is on under software control. If driven low externally, WARN LED is on.
4	SP0	Driven low when SP0 LED is on. If driven low externally, SP0 LED is on.

Pin	Signal	Description
5	SP1	Driven low when SP1 LED is on. If driven low externally SP1 LED is on.
6	GND	Logic ground. Bidirectional open drain signals with 10kOhm pull-ups to 5V

All signals are protected against electrostatic discharge transients of up to 15 kV (human body model)



Note:

Alarm connector should be used in a master chassis only. In a slave chassis the outputs are undefined and inputs control only corresponding LEDs without further effect.

2.7.4 Audio Jack

The audio jack can be used to connect an external passive speaker. If an external audio device is attached the internal speakers are disabled. Both audio channels are driven from the same mono signal.

Item	Connector Type	Size	Impedance
Audio out	TRS jack	Miniature: 3.5 mm diameter	8 Ω



Do not use TS type connector (mono), a headphone or active speaker!

2.7.5 Address Selector

The address selector is a rotary switch which defines the address of a chassis. In a multi chassis setup, each chassis has to have a unique address and the one with the lowest address is considered the master chassis. Up to 9 chassis can be interconnected to form one large AMSY-6 measurement system.

2.7.6 Next - / Previous Port

In a multi chassis setup the participating chassis have to be connected in a daisy chain via the Next Port / Previous Port connectors for time synchronization reasons.

The Next Port connector is connected to the Previous Port of the next chassis in the daisy chain.

Connector label	Connector Type	Cabling (pin/pair assignment)
Next Port	Lemo EPC.1B.306.HLN	shielded 100 Ohm balanced twisted-pair cabling, CAT 5 or better, no-crossover
Previous Port	Lemo EPB.1B.306.HLN	shielded 100 Ohm balanced twisted-pair cabling, CAT 5 or better, no-crossover

2.7.7 USB Interface

Item	Description
USB Specification	USB 3.1 Gen 1
Connector	USB 3.0 Type B, 9 pin female
Retention force for mating / unmating	35 N (max) / 10 N (min) Connector supports screw lock mounting



Note:

The 5 V line of the USB is not used, so no USB power is required.



Note:

In a multi chassis setup each chassis has to be connected to USB port(s) of PC for data transfer. If PC does not offer enough USB ports a USB-hub can be used.

2.7.8 Pulse Out

Voltage pulses that are generated by the pulser module are delivered to the BNC socket labeled “Pulse Out”.

Pulser Voltage	Description
Maximum voltage	450 V _{PP} , software selectable

2.7.9 Power On/Off Switch

Switch that controls the power supply to the chassis.

Power Entry

LED	Description
Power IN	Blue: 24 V detected at the input side
Device ON	Green: device switched on
Device Error	Red: indicates an error which can be e.g. supply voltage too high, current too high or chassis temperature too high.

3 ASIP-2

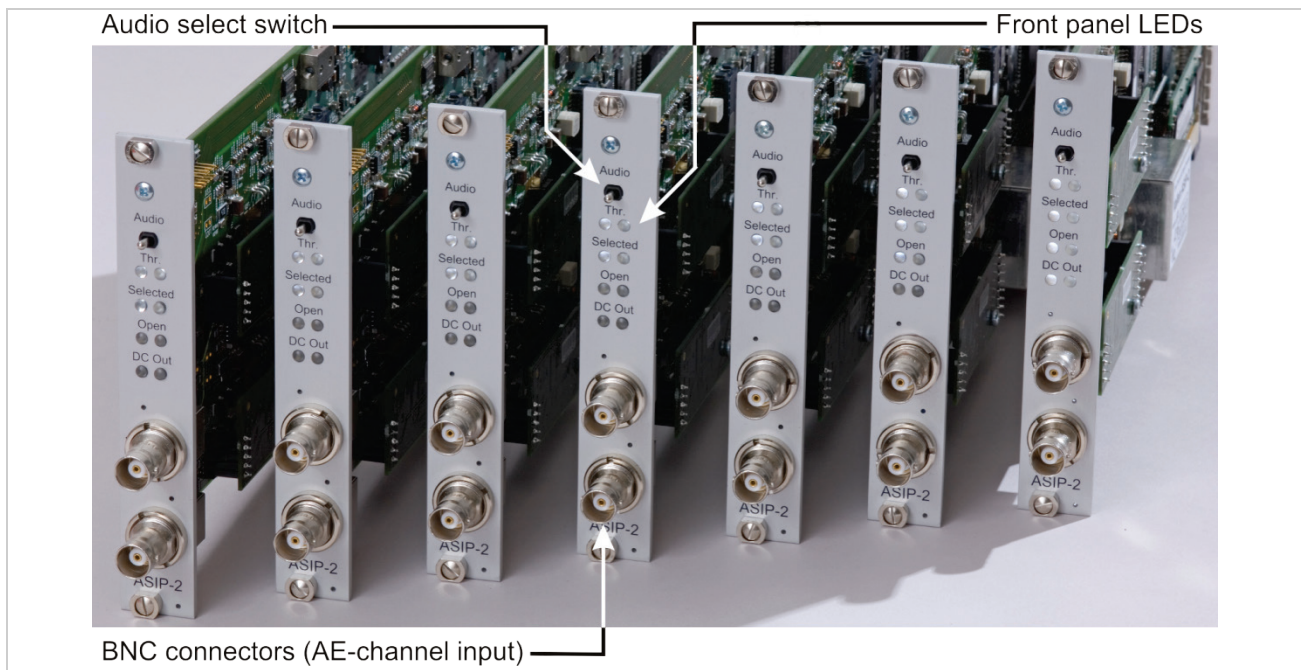


Figure 6: ASIP-2 with front panel elements: audio select switch, LEDs and BNC connectors

ASIP-2 is a dual channel AE-signal processor board which can be mounted in any of the chassis. Each ASIP-2 board and each channel on the board is processing data independent of each other. There are two versions of the ASIP-2:

- ASIP-2/S: standard version or
- ASIP-2/A: advanced version.

Both ASIP-2 versions can be used simultaneously within the same chassis. The following tables describe ASIP-2/S.

Mechanical properties

Mechanical properties	Description
Dimensions	Eurocard plug-in 100 mm x 280 mm
Weight	0.32 kg
Connectors	2x BNC, input impedance: 50 Ω or 100 k Ω
Flip switch	Toggles audio on/off (one position per channel)
Front panel LEDs	LEDs indicating threshold crossing, preamplifier saturation, preamplifier connected, DC-output overload, AC/DC input mode, pulsing mode, audio-selection (makes AE signal audible).
Transient recording (TR) memory	Each ASIP-2 can house one transient recorder storage module of type TR-2/xxMB (see section 3.2) to store waveforms in parallel to the classical AE features per channel.

Electrical properties

Electrical properties	Description
System noise	1.5 μV_{RMS} , 6 μV_P ; (95 – 300 kHz filter, referred to ± 100 mV _{PK} range at preamplifier input; preamplifier not connected)
Preamplifier power supply	28 V _{DC} @ 50 Ω (see also input devices)
Input devices	Software selectable: 28 V _{DC} @ 50 Ω or AC @ 100 k Ω

ASIP-2/S Signal processing

Signal processing	Description
Analogue band pass filters	0.5 or 18 kHz (switch selectable) – 2.4 MHz (at -3 dB attenuation)
ADC	40 MHz at 16 bit per channel
FIR low pass	Cut off: 3.6 MHz (-6 dB) at 40 MSPS, 18 bit. Resulting bandwidth considering both, analogue and FIR Filter: 2.2 MHz (at -3 dB attenuation)
Application specific digital filter	Band-pass filter consisting of low-pass (LP) and high-pass (HP) filter of 8 th order Butterworth each.
Digital filter roll-off attenuation	48 dB/octave for LP and HP
Included digital filters	25 – 45 kHz, 25 – 300 kHz, 25 – 850 kHz, 50 – 300 kHz, 50 – 850 kHz, 95 – 300 kHz, 95 – 850 kHz, 230 – 850 kHz, Bypass (wideband option, e.g. required for System Verification and also recommended for Vallen Sensor Tester (VST)). Additional band pass filters available (see section 3.2)
Digital filter selection	Software selectable for each channel individually.

Transient Recording (needs hardware option TR-2)

Transient data recorded to onboard DRAM. For available sizes of onboard DRAM see section 3.2

Transient Recording	Description
Sample interval	Programmable between 625 kHz to 10 MHz (1 – 16 x 0.1 μ s), globally valid for all AE-channels
Maximum samples per record	2 M samples
Pretrigger	Individually programmable per AE-channel up to 64 k samples
Trigger modes	Four trigger modes defined globally across multiple chassis for individual Trigger groups: Internal-, Pool- (Pool-trigger is when the first-hit channel simultaneously triggers all transient recorders of channels defined as Pool or Slave), Master- (Master triggers its own transient recording plus transient recording of all Slave and Pool channels) and Slave- (transient recording of slave channels can only be triggered by a Master channel) trigger.
Trigger group	A subset of channels, even across multiple chassis can be assigned to a trigger group. Trigger modes are applied per trigger group. The first hit channel of a trigger group triggers the other channels according to the selected modes. Each channel can be assigned to one trigger group, only.
Recording modes	Two recording modes: Fixed page length recording: a predefined number of samples is recorded per trigger Duration adapted recording: number of samples that are recorded per trigger depend on duration of hit, pretrigger samples and post duration samples; maximum length of record is 2 M samples.

Hit assembly

Hit assembly parameters	Description
Threshold	Software selectable for each AE-channel individually. Fixed or floating threshold.
Duration discrimination time (DDT)	A time setting used for discriminating hits
Rearm time (RAT)	A timer setting used for discrimination hit cascades

Feature extraction

Dual core feature extractor with loadable firmware for optimum flexibility.

Hit processing	Description
Sampling rate	10 MHz
Arrival time resolution	100 ns
Arrival time bit width	63 bit corresponding to 29,247 years at 10 MHz sampling rate
Peak amplitude resolution	~ 1.53 μ V at 200 mV _{pp} input range
Threshold resolution	~ 1.53 μ V at 200 mV _{pp} input range

Hit processing	Description
Rise time resolution	100 ns at 10 MHz sampling rate
Duration resolution	100 ns at 10 MHz sampling rate
Ring down count resolution	16 bit
Hit cascade ¹ features	Number of cascaded hits, cascaded counts, cascaded energy and cascaded signal strength of the complete hit cascade ¹ . Maximum number of hits in a hit cascade: 127
Hit flags	Hit flags indicating a time-out-hit, artificially started hit, hits because of pulses (active and passive), saturation of ADC and many more.
Energy calculation	True Energy
Energy resolution	$1.8 \cdot 10^{-18} \text{ V}^2\text{s}$ referred to sensor signal at 34 dB preamplifier gain.
Energy units	$1 \text{ eu} = 10^{-14} \text{ V}^2\text{s}$
True RMS resolution (true RMS before a hit)	<1 μV resolution referred to sensor signal at 34 dB preamplifier gain.
True RMS resolution of a hit	<1 μV resolution referred to sensor signal at 34 dB preamplifier gain, needs SW-option VAEUPE: User Processor Extension
Signal Strength resolution	0.3 pVs referred to sensor signal at 34 dB preamplifier gain.
Signal Strenght units	$\text{nVs} = 10^{-9} \text{ Vs}$
Average noise level before a hit	<1 μV resolution referred to sensor signal at 34dB preamplifier gain.
Average noise level of a hit	<1 μV resolution referred to sensor signal at 34dB preamplifier gain; needs SW-option VAEUPE: User Processor Extension

¹ Hit cascade: A hit cascade consists of hits that follow each other within an interval less than the rearm time (RAT). Features of a hit cascade are number of hits, sum of ring down counts and sum of energy of hits in a cascade. These features are part of the data set generated with the first hit of a cascade.

Hit time-outs

A hit is artificially terminated after about 100 ms. An artificial hit is started automatically after a hit is timed-out. A hit that is timed-out and thus terminated is assigned a “time-out” hit flag. A hit that is artificially started is assigned an “artificially started” hit flag.

Hit processing performance

About 20 000 hits/second (peak) can be filled into the buffer of each AE-channel, 100 000 hits/second can be transferred to the PC and stored on the hard disk drive continuously, in parallel with data analysis program.

Above 100 000 hits per second a buffer overflow of hit-data is avoided by setting the respective ASIP-2 into long duration mode, when the ASIP-2 buffer runs half full. The whole chassis is set into long duration mode if the USYC buffer runs 80% full.

Status data

Status data is generated per time interval. The time interval is software selectable. Following status data is generated:

- RMSS: RMS at the time of the generation of a status data set. RMS is calculated exclusive AE-signals that are part of hits.

- ENYS: True Energy cumulated between two status data sets
- SSS: Signal strength cumulated between two status data sets
- THRS: threshold at the time of the generation of a status data set

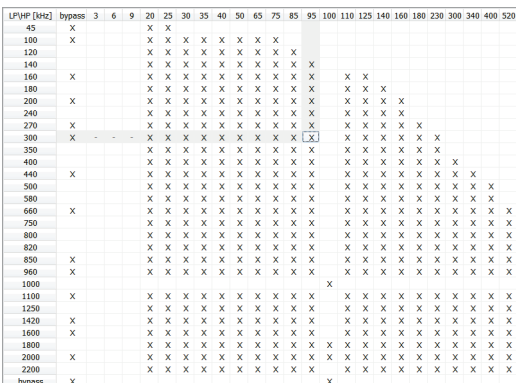
3.1 ASIP-2/A features

The ASIP-2/A fulfills the ASIP-2/S specification (see section 3). Additional features are listed below:

Electrical properties (additional to ASIP-2/S)

Electrical properties	Description
Preamplifier power supply	Software selectable: 28 V _{DC} @ 50 Ω (see also input devices), 4 – 28 V _{DC} (programmable voltage) @ 50 Ω, 4 – 28 V _{DC} (programmable voltage) @ 200 Ω
Input devices	Software selectable: 28 V _{DC} @ 50 Ω, AC @ 100 kΩ, 4 – 28 V _{DC} @ 50 Ω, 4 – 28 V _{DC} @ 200 Ω

Signal processing (additional to ASIP-2/S)

Signal processing	Description
Application specific digital filters	<p>over 500 band pass filters available</p>  <p><i>Figure 7: matrix of available filters for up to 20 MHz sampling rate. Rows for low pass-, columns for high pass selection</i></p>
Digital filter order	8 th order Butterworth at up to 20 MSPS (each high- and low pass) 4 th order Butterworth at 40 MSPS (each high- and low pass)
Transient recording (TR)	Up to 40 MSPS (requires TR-2)
Input ranges	Three software selectable input ranges (10 V _{PP} , 5 V _{PP} , 2.5 V _{PP}) for better resolution for applications with low amplitude.
Notch filter stage	<p>Notch filter rejects user-selectable frequencies. Max. notch filter frequency: 250 kHz (8th order) or 500 kHz (4th order) Notch filter rejects:</p> <ul style="list-style-type: none"> • at 10 MHz sampling rate: 4 frequencies each 2nd order. • at 20 MHz sampling rate: 2 frequencies each 2nd order. • at 40 MHz sampling rate: 1 frequency of 2nd order.

Feature extraction (additional to ASIP-2/S)

Hit processing	Description
Arrival time resolution	100 ns, 50 ns or 25 ns (software selectable)
Arrival time bit width	63 bit

3.2 Options for ASIP-2

Application specific filters (ASIP-2/S only)

Any number of application specific filters can be enabled for an ASIP-2/S.

Item-code	Description
DigBP-2/ <i>hi-pass – low-pass</i>	One digital band-pass filter configuration for one ASIP-2 (i.e. for two channels). Over 500 digital band-pass filters are available for selection (see the table below)

Select corner frequencies from the following lists:

Filter type	Corner frequencies
Hi-Pass [kHz]:	3.1 ⁺ , 6.2 ⁺ , 9.3 ⁺ , 12.4 ⁺ , 17 ⁺ , 20 ⁺ , 20, 25, 30, 35, 40, 50, 65, 75, 85, 95, 100*, 110, 125, 140, 160, 180, 230, 300, 340, 400, 520
Low-Pass [kHz]:	45, 100, 120, 140, 160, 180, 200, 240, 270, 300, 350, 400, 440, 500, 580, 660, 750, 800, 820, 850, 960, 1100, 1250, 1420, 1600, 1800*, 2000*, 2200*

Examples

DigBP-2/95-300 means digital bandpass 95 – 300 kHz,

DigBP-2/25-1420 means digital bandpass 25 – 1420 kHz

⁺ For these high-pass filters the switch on the analog filter shall be “ON” (for 0.5 kHz high-pass), otherwise “OFF” (for 18 kHz high-pass). Signal processing of frequencies below 12 kHz needs input mode “AC@100K” (no DC supply for preamplifier possible).

* These filters are of 4th order running at 40 MHz.

Transient recording memory

Item-code	Description
TR-2/2GB	2 GB TR module for ASIP-2 (1 GByte per channel)
TR-2/512MB	512 MB TR module for ASIP-2 (256 MByte per channel)
TR-2/16MB	16 MB TR module for ASIP-2 (8 MByte per channel)

4 Speed Performance

Total data transfer speed, AE feature data and TR data combined, is 60 MB/s sustained until hard disk is full (Intel i7 Quadcore 4th Generation, 3.6 MHz, 16 GB RAM, USB 3.1, SSD, Win 10). This data rate corresponds to streaming up to 3- or 4 AE channel(s) at a sample rate of 10 MHz or 5 MHz, respectively.

5 Preamplifiers

For information about preamplifiers please see separate specification “Acoustic Emission Preamplifier” (available on www.vallen.de, on the Vallen AE Suite USB drive, or from sales@vallen.de).



6 Sensors

For information about sensors please see separate specification “Acoustic Emission Sensors” (available on www.vallen.de, on the Vallen AE Suite USB drive, or from sales@vallen.de)



7 Accessories: cables, magnet holders, etc

For information regarding cables, magnet holders, and other accessories please see separate specification “Accessories” (available on www.vallen.de, on the Vallen AE Suite USB drive, or from sales@vallen.de)



8 External PC and supported Operating Systems (OS)

The external PC controls the measurement hardware, runs the system front-end and stores the measurement data. Any kind of PC, e.g. desktop, lunchbox, 19” rack industry standard PC with an USB 3.1 Gen 1 interface can be used.

PC Requirements	
OS	Windows 10 ⁽¹⁾
CPU	minimum: dual core processor CPU, 32-bit (x86) or 64-bit (x64), > 2GHz, recommended is a quad core CPU.
RAM	minimum of 2 Gigabyte (GB) in case of Windows XP, recommended is 4 GB for 32 bit OS or more in case of 64 bit OS
HDD	NTFS format, 1 GB free disk space for program installation, depending on your test data much more disk space will be needed.
USB	Free USB 3.1 port, external passive USB hub can be used.

- ⁽¹⁾ The APIs (AcqCmdAPI, Alarm Manager, XTR) of the Vallen AE Suite software are compiled in 32 bit only and thus would require a 32 bit OS. However due to thinking these routines currently work also on 64 bit OS. As long as thinking is supported these APIs can be used on PCs running a 64 bit OS.

9 Vallen AE Suite Software

The Vallen AE Suite Software is made up of individual modules. A module can contain a whole software package (i.e. a number of applications, e.g. the VisualTR module or the VisualClass module or the System Verification module) or add-on features to the VisualAE analysis program (e.g. location- and data processor modules). A module or package provides certain functionality, such as data acquisition, data analysis, pattern recognition, system verification, etc.

A software license grants the user the right to use a software module. These rights are governed by so called options, i.e. an enabled option grants the right to use certain modules or packages.

A detailed description of software modules and software functionality is given in the AMSY-6 System Description document, available from Vallen Systeme GmbH.

9.1 End User License Agreement (EULA)

The EULA can be downloaded from the website: <https://www.vallen.de/quote-ref/>.

9.2 Vallen AE Suite Software Lite

Vallen Systeme grants users the right to use the Vallen AE Suite Software Lite version for free. The following software modules are part of the Vallen AE Suite Software Lite version (i) SWACQ and (ii) SWBN.

9.3 Modules and Packages

Basic Software Packages

Option Code	Description
SWACQ	Data acquisition software package. Contains Acquisition program which manages data recording, data storage and acquisition settings. Contains Hardware Reporter, ADC-Test, TR-Test, Log-File Viewer and Firmware Updater.
SWBN	Basic software package for the analysis of AE-data and AE-waveforms, inclusive extensive and context-sensitive online-help, includes VisualAE™, Alarm Manager, the AGU Vallen Wavelet package, Key Reporter, Key Setup, TraDBComp. The functionality of the VisualAE analysis program: Project Settings, Data Processing Structure, Parametric Conversion, Variable editor, User Text editor, Pulsing Table, Attenuation Profiler, Location Analyzer (not useable), export to pri-file, general 2D diagrams, listing, numerical display, right vertical axis in 2D diagrams, multi-plane support in diagrams, page legends, page layout, page tab editor, page background color, transient recorder diagrams for displaying waveforms (VAETR)
VAE1+2	VisualAE analysis extensions: Event Set Building processor, Grading processor, Alarm processor, still image support, ASCII export of diagrams, bitmap export of diagrams and listings, text export of listings to clipboard and file, 3D-diagram support, picture overlay, page export to bitmap, Library support for visuals and processors, support of a transient feature file, supporting extended features of the transient recorder diagram (such as Gauss correlation and digital filters; VAETRE) Pri-Glue, PRI2DB

VTR	Software for the efficient analysis and management of transient recorder data (waveforms), includes VisualTR™, new Spectral Ratio Extractor, FFT-Feature Extractor, FFT Averager, TR-Copy, TR-Combi, TR-Filter and TR-Unifier. Includes the modules VTRE, VAETR and VAETRE
VCL	VisualClass™ pattern recognition and classification software. Includes the modules VCL-Utilities, VCL-Classifer and VCL-Decode Classifier.

Location Algorithm Modules (add-on modules to the Event Set Building processor)

Option Code	Description
VAELL	Linear location algorithm locates AE-sources between two sensors
VAELP	Planar location algorithm locates AE-sources on plates or cylindrical hulls in between the area which is bounded by the sensors.
VAELS	Spherical location algorithm locates AE-sources on the spherical hull
VAELTB	Tank-bottom location algorithm locates AE-sources on the bottom of a tank-floor. The sensors have to be mounted along the outer hull of the storage tank.
VAEL3D	Location processor algorithm that locates AE-sources in a volume.
VAELMG	Multi group extension for the location processor
VAELAC	Amplitude correction: based on linear attenuation it calculates the amplitude at the source locations

Data Processor Modules (extend VisualAE)

Option Code	Description
VAEFP	Filter processor: filters data based on logical criteria
VAEPP	Polygon processor: assigns polygon ID to hits within a polygon. Can be used as a graphical filter
VAECP	Cluster processor: clusters data according to user-defined attributes
VAEUP	User processor: performs simple mathematical operations on acquired data.
VAEUP E	User processor extension: performs more complex mathematical operations on acquired data.

Embedded Code Processor Modules (extends VisualAE)

Option Code	Description
VAECPU	ECP-user license. Allows to execute ECP code in VisualAE
VAECP P	ECP-programmer license, allows to write, debug, and execute ECP-code in VisualAE
VAECP V	ECP-validator license, allows to protect and sub-license, to write, debug, and execute ECP-code in VisualAE

VisualAE diagram extensions (legacy)

Option Code	Description
VAETR	Add the capability of displaying transient recorder data in a waveform diagram. Time domain data (i.e. the waveform) and frequency domain data (i.e. the spectrogram) can be displayed. VAETR is included in SWBN

VAETRE	Extension to VAETR adding the functions Gauss correlation and digital filters. VAETRE is included in VAE2
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Verification software

Option Code	Description
VSTSW	Vallen sensor tester software
SysVeri	Semi-automated verification of AMSY-6 chassis and ASIP-2 signal processor boards

Other software

Option Code	Description
AUTOMAN	Automation Manager software for executing user defined tasks upon occurrence of certain events.
DASHUPL	Dashboard upload program for uploading data written to the export database to the Vallen Dashboard (a webserver running the Vallen Dashboard software)

9.4 Software bundles

A software bundle consists of a number of modules but is identified by a single option in the software license.

Option Code	Description
BDSWB	Software package for the analysis of AE-data and AE-waveforms, inclusive extensive and context-sensitive online-help, includes VisualAE™. Designed for 32-Bit-Windows. Comprises a license for using the analysis software on up to 5 separate Windows PCs. Comprises the following software modules: SWBN software for analysis of AE + TR-data VAE1+2 Extension module, expands VisualAE™ VAEFP Filter Processor VAEUP User Processor VAEUPE User Processor Extension VAEPP Polygon Processor DTACV Converter: dta to pri+tra files
BDSWBupg	Upgrades SWBN to BDSWB, contains VAE1+2 Extension module, expands VisualAE™ VAEFP Filter Processor VAEUP User Processor VAEUPE User Processor Extension VAEPP Polygon Processor DTACV Converter: dta to pri+tra files
BDSWLoc1	Location software package, adds location functionality to SWBN or BDSWB, comprises the following software modules: VAELL Linear location module VAELP Planar/Cylindrical location module VAELMG Multi-Group extension for location modules VAECP Cluster Processor

	VAELAC Amplitude Correction module
ADT	Software bundle for Aerial Device Testing, includes a simplified Acquisition interface for this specific application and a ADT database for configuring the Acquisition and report output.

9.5 Legacy Modules

Option Code	Description
XTR	ActiveX interface for reading and writing tra-files. The XTR module is no longer supported and available.
DTA-Lister	Program that displays the DTA content in a tabular form
DTA-to-PRI	Conversion tool for converting DTA files to PRI files
PRI-to-DTA	Conversion tool for converting PRI files to DTA files

9.6 Software update contract

Code	Description
SWupd	Prolongation of the software update contract by 1 year.

9.7 Other Freeware

The Vallen AE Suite software contains the AGU-Vallen Wavelet-, and Dispersion software which are all free to use.

10 Standard compliance

AMSY-6 complies with the following directives and standards.

	Directive	Applicable Standards
EMV	2014/30/EU	DIN EN 61326-1:2013; Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements Immunity rating: basic electromagnetic environment DIN EN 55011 / CISPR11:2018; Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement Emission rating: Group 1, Class B
Safety	2014/35/EU	DIN EN 61010-1:2011: Sicherheitsbestimmungen für elektrische Mess-, Steuer-, Regel- und Laborgeräte - Teil 1: Allgemeine Anforderungen

AMSY-6 complies with following European standards.

Standard	Title
EN13477-1	Non-destructive testing – Acoustic Emission – Equipment characterisation – Part 1: Equipment description
EN13477-2	Non-destructive testing – Acoustic Emission – Equipment characterisation – Part 2: Verification of operation characteristics
EN13554	Non-destructive testing – Acoustic Emission – General Principles

11 Warranty Conditions

The warranty period is two years from the date of its delivery for AMSY-6 hardware and for software. This warranty does not cover the repair of any damage to the products generated by accident or improper handling. For warranty conditions for consumables such as sensors and cables see our documents “AE Sensor Overview” and “Accessories for AE Systems”.

We warrant that the goods as delivered will conform to the given specifications. We do not warrant that software is totally free from errors (See the End User License Agreement hereafter). If notified during the warranty period that the delivered AMSY-6 system contains defects such it does not conform to the specifications, we will make it operate as specified by providing replacement parts or software updates as determined by us, free of costs, and within a reasonable time. If transportation should become necessary, the customer has to provide the permits for export and re-import of replacement parts and bear the costs of transportation.

Except as expressed before, we disclaim all other warranties. We shall not be liable for any direct, indirect, consequential or incidental damage arising out of the use or inability to use of the delivered system. We reserve the right to charge for any efforts taken to remedy any incorrect or user-altered PC configurations or other problems for which we are not responsible

12 Regulations concerning redemption and disposal of AMSY-6 systems

We, Vallen Systeme GmbH, are registered manufacturer of the measurement instrument AMSY-6 (WEEE-Reg.-Nr. DE 68150283).

According to German law (§10 subparagraph 2 of Elektro- und Elektronikgerätegesetz – ElektroG) and in the interests of our customers, we accept the obligation for redemption and appropriate disposal of those AMSY-6 systems which have been placed by us on the market within the scope of the before mentioned law, after August 13, 2005.

For this we provide the following procedure:

- Owners of old instruments request our agreement with the return of old instruments. The goods to be returned must be described unambiguously and identified by serial number and/or the identification numbers.
- Upon our approval owners may ship the goods free of costs for us.
- We will dispose the goods according to the relevant laws and regulations on our costs.
- Goods returned without our approval will not be accepted and returned to the owner on his account.

With this measure we wish to serve our customers in the best way to properly dispose old instruments and to contribute to re-use, recycling and proper disposal of electronic waste.



Equipment labeled with the symbol shown left must be disposed separately from unsorted municipal waste within the European Union.

13 Restriction of Hazardous Substances (RoHS)

Vallen Systeme GmbH is collaborating with its suppliers to comply with the European Union Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment ("RoHS") Directive (2011/65/EU). The RoHS directive prohibits the sale of electronic equipment containing certain hazardous substances such as lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyls ("PBB") and polybrominated diphenylethers ("PBDE") in the European Union.