HEIM DATaRec® 4

Modular
Data Acquisition
and
Signal Conditioning
System

System Description

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Introduction

The requirements in view of accuracy, flexibility and speed which today's test laboratories are confronted with have been constantly increased over the last few years. Development cycles and prototype refinement have to be performed in shorter time intervals. This trend consequently has to lead to the ability to measure more channels at the same time with increased accuracy. Today many tests are carried out in test cells or on test rigs due to time and cost issues. Nevertheless there are still conditions where mobile applications require different data acquisition hardware compared to the one used in laboratories. Systems with high channel count typically installed for test rigs can not be downsized for mobile applications where normally only some few channels are required. In the past the only solution was the procurement of different systems in order to support different applications. This situation has always created large capital investments but has also had other disadvantages like difficulty in operation and in many cases incompatibility and missing integrity of data and results. ZODIAC Data Systems GmbH has responded to these new requirements in the concept of the HEIM DATaRec 4 Series resulting in a totally new design of a modular data acquisition system.

1 Overview

The HEIM DATaRec 4 Series represents a total modular data acquisition and signal conditioning concept which can be tailored to various applications. The modular design provides the basis to configure large multi channel systems as well as small systems for mobile applications. The HEIM DATaRec 4 Series is the result of a continuous and consequent development of data acquisition systems. Many years of expertise and experience in both the automotive as well as the flight test market have been the starting point for the development of the new family incorporating state of the art technology.

HEIM DATaRec 4 Series key facts

- Modular architecture for quasi infinite channel count

- Design provides centralised or decentralised configuration

- System architecture offers total flexibility for user configurations

- IEEE 1394b, USB 2.0, and Ethernet as standard interfaces to analysis systems

- Signal Modules with integrated signal conditioning

- TEDS sensor identification for easy configuration of multi channel systems

- Special Signal Modules for digital data

- Digital data processing for maximum accuracy

- 24 bit A/D converter

- 102 dB dynamic; <0.2° phase error

- Modules galvanic isolated

- Compact and robust design for mobile application

2 HEIM DATaRec 4 System

The HEIM DATaRec 4 System components

Power Module   Signal Module   Link Module
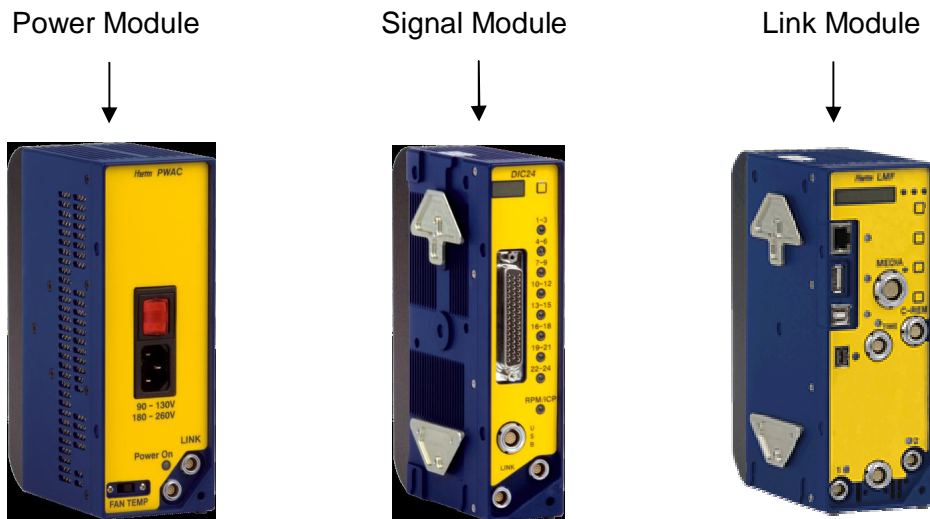
Picture 1– HEIM DATaRec 4 system components

The various sensor signals or data will be connected to the Signal Module. Special Signal Modules support different sensors. All modules can be arranged in any combination.

The Link Module collects the time stamped digital data from the different Signal Modules.

The Link Module supports the front-end operation via IEEE 1394b, USB 2.0 and Ethernet interface and a standalone recorder operation mode.

The detailed functionality of the components is described in the following.

3 Application Scenarios

1st application: low channel count

Picture 2 – one module system

One module based system with a maximum of 6 or 24 measuring channels. Direct PC interfacing via built-in USB link (external power needed)

2nd application: compact system

Picture 3 – compact system using LMF2

Up to 16 Signal Modules can be linked together. The maximum channel count is in a range from 96 (using only 6 channel modules) to 384 (using only 24 channel modules).

3rd application: distributed system

Picture 4 – distributed system using LMF2

Up to 16 Signal Modules can be interconnected via up to 50 meter long data links (10 meters between two modules). The maximum channel count may range from 96 (using only 6 channel modules) to 384 (using only 24 channel modules).

4th application: high channel count distributed system
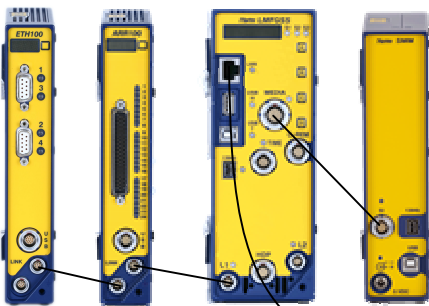

Picture 5 – high channel count distributed system using LMF4

Distributed system with up to 768 measurement channels for enhanced flexibility and performance.

5th application: standalone recorder
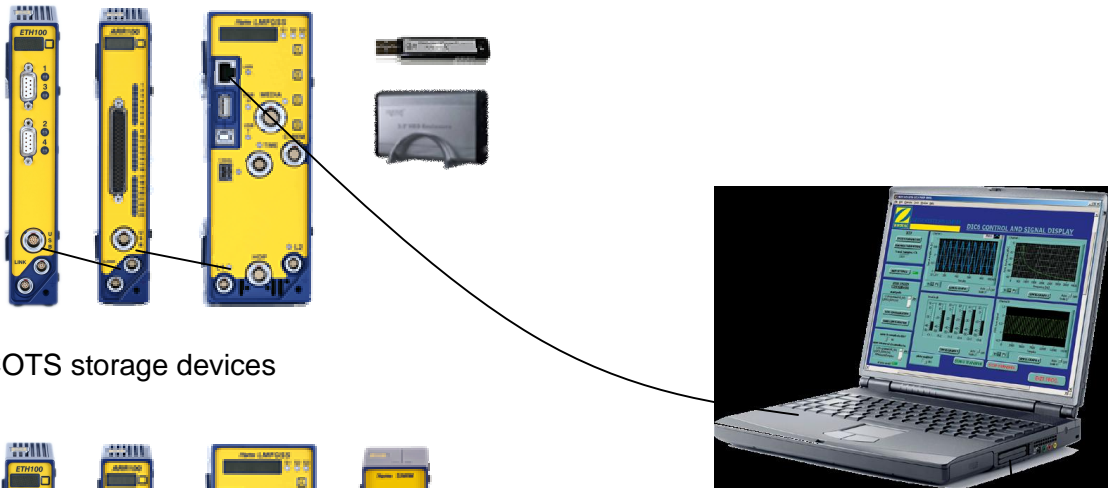
COTS storage devices

HEIM DATaRec 4 Storage Module

Picture 6 – standalone recorder mode

In this application the Link Module writes the collected data from the Signal Module directly to a storage device via USB 2.0 or IEEE 1394b interface. For harsh applications Heim provides a HEIM DATaRec 4 Storage Module with a rugged version of the storage device and the data interface connection.

In addition to this mode the Link Module can operate in a parallel recording and front-end mode with a reduced system data rate.

4 System Components

4.1 Signal Modules

The Signal Modules provide the interface to the different signal sources to be measured. A range of individual Signal Modules can be used for signal conditioning of different sensors or data sources (see ch. 9.2). A maximum of 24 channels can be connected to one Signal Module. Visualisation of the input signals is carried out by means of a display and overload LED's. The display ensures the identificatin of the module within a decentralised configuration by displaying the selected unique module number.

The Signal Module performs the signal conditioning and the A/D conversion (24bit). Each channel is completely independent and consists of sensor support (power), amplifier, A/D converter, anti aliasing filter and optional high or low pass filter. In view of accuracy, measurement speed, and noise characteristic the Signal Modules represent "State-of-the-art" technology. The digital and the analogue module parts and the power voltage input part are galvanic isolated to remove the noise introduced by potential differences. All modules have their own power supplies as well as their own calibration units.

The sample rate can be set for each module individually. A special 6 channel module feature is the overload detection. An overload situation will be detected by means of a comparator already before the A/D conversion. Also two channels can be used as signal channel or as RPM channel.

One Signal Module can be connected directly to the USB interface of a PC (picture 2).

4.2 Link Modules

If the systems consists of more than one Signal Module a Link Module will be needed.

The Link Module is the central processing module and supports a different number of subsystems (Signal Module chains). A subsystem consists of max. 8 Signal Modules.

The Link Module LMF2 supports two subsystems. This means, that the LMF2 supports up to 16 Signal Modules. Multi channel Link Modules can be used to connect many Signal Module chains in order to create large multi channel acquisition systems. (LMF4 up to 768 channels)

Data acquired from the Signal Modules can either be transferred in the front-end mode via IEEE 1394b, USB 2.0 and Gigabit Ethernet to an analysis computer and / or transferred directly to a storage device in the standalone recorder mode.

Since the Link Module provides the time basis for the connected Signal Modules a high precision synchronisation of the signal is always guaranteed. Furthermore the Link Module controls the calibration, the phase alignment, and the system test if a new system configuration is required.

4.3 Power Modules

The power input voltage of all modules of the HEIM DATaRec 4 system is 17 V – 28 V. Each module generates the different internal required voltages. The Power Module converts the input voltages to the 24 V system voltage.

Within each chain of Signal Modules at least one Power Module must be integrated, since the Link Module does not pass the supply voltage throughout to its other link connectors.

Power Modules are available for AC as well as for DC supplies.

If a combination of Signal Modules and Link Modules request higher power consumption, than more than one Power Modul can be integrated in a chain.

5 Design

5.1   Mechanics
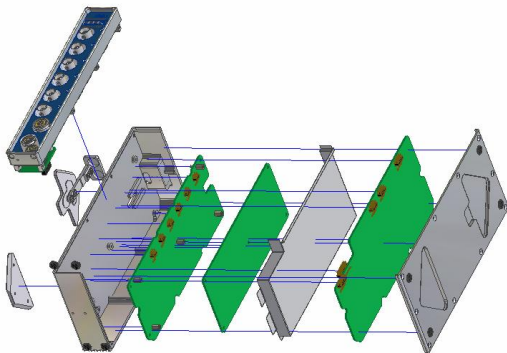
The modules are made of milled aluminium, which copes best with the demanding environment the system is daily subjected to. All modules have a unique height and depth. They get assembled together based on an innovative mechanics that makes it possible to add, swap or remove any module within the chain without any tool required.

A series of accessories like handles, seat belt holders, hooks, 19" extenders, etc. can be added to the system, easing its installation.

5.2 Signal connectors and link interfaces

All connectors, displays and control elements are located on the front panel. Their arrangement ensures an easy connection to the sensors. Since they are counter sunk, no damage can occur during transport or operation of the system. The analogue modules are fitted with sensor compatible connectors, e.g. BNC for voltage transients, Micro-Dot for charge sensors.

5.3   Connection between modules

The connection links ensure the power supply to the modules as well as the synchronisation and configuration of the system and the transfer of

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6 External Noise Reduction

One of the HEIM DATaRec 4 Series key development goals was to produce a system featuring an enhanced signal quality.

The digital conversion of the signal takes place as close to the sensors as possible.

A direct consequence is that the signal loss across the cables and the external noise, introduced by field noise sources like magnetic fields, test units, engines etc., is minimised. Furthermore, the signal conditioning electronics is galvanic isolated from the digital processors, internal signal lines and computer interfaces. This removes the noise introduced by potential differences, ground loops etc.

In order to reduce the digital noise introduced by the electronics the system was designed with high precision components, and active components like DC/DC converters, FPGA etc. are coupled to the analogue sampling frequency.

7 Data Format / Software

The data is converted and multiplexed to the HEIM DATaRec 4 format. It can be transferred on the fly to a computer based system. The "State-of-the-art" time stamping techniques of the HEIM DATaRec 4 format allow a very accurate time correlation between the various analogue and digital signal sources.
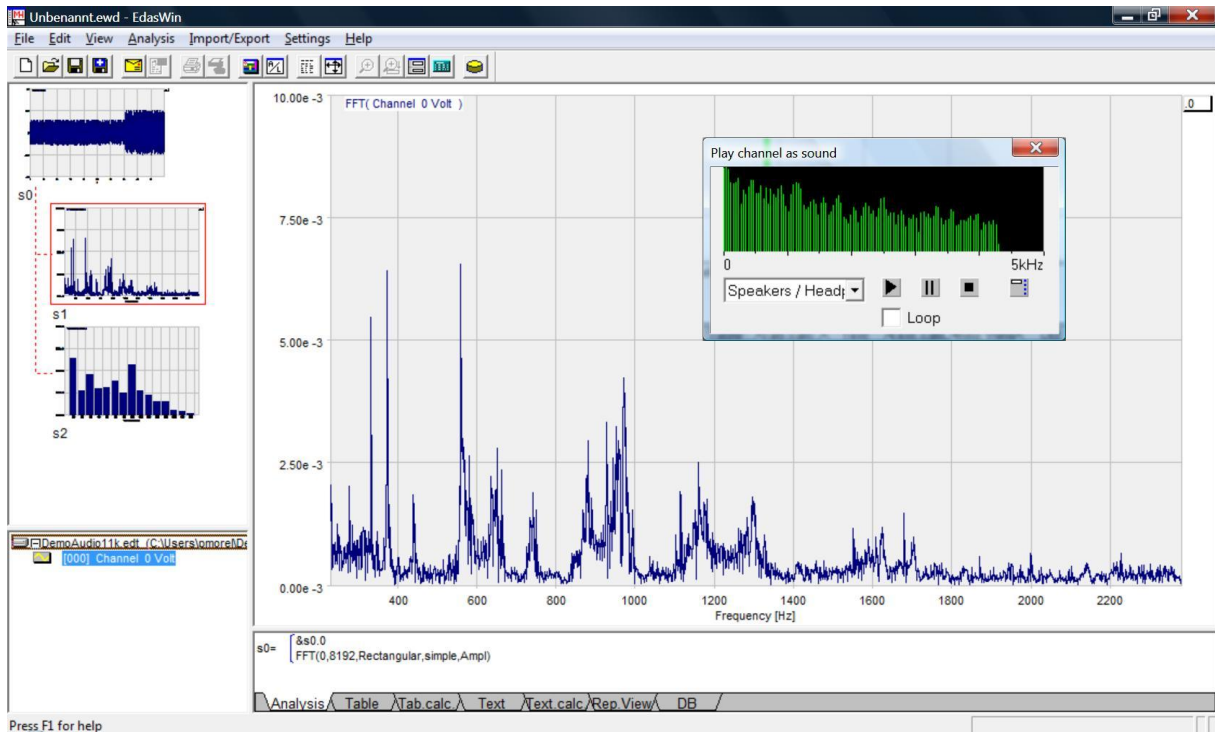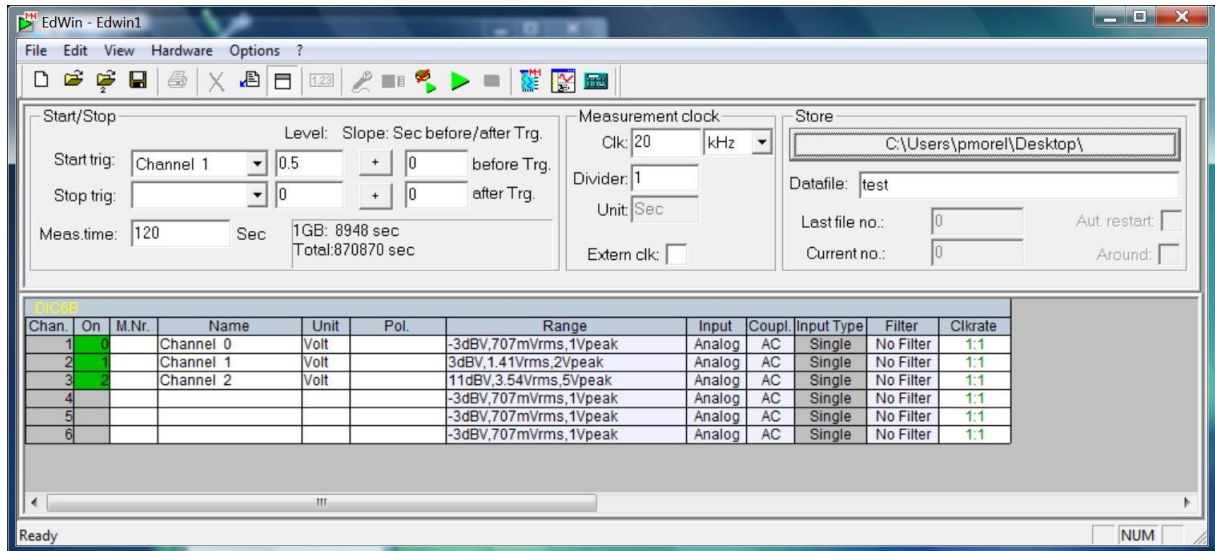
ZODIAC Data Systems offer a new user friendly configuration, and analyse data recording software. In addition a DLL library is available for easy interfacing to existing software platforms.

8 Software Partners

HEAD-Acoustics GmbH	Eberstr. 30a	52134 Herzogenrath	Deutschland
Akustik Technologie Göttingen	Bunsenstr. 9c	37073 Göttingen	Deutschland
MH - Gesellschaft für Hardware / Software mbH	Schloss Lechenich Schlossstr. 18	50374 Erftstadt	Deutschland
Dr. Sibaei + Hastrich Ingenieurgesellschaft b.R.	Münchener Str. 3	83607 Holzkirchen	Deutschland
Triton Audio Solutions Heinz u. Brückmann GbR	Lindenhof 9	99310 Arnstadt	Deutschland
HEIM DATaRec 4 DLL	Friedrich-Ebert-Strasse Technologie Park	51429 Bergisch Gladbach	Deutschland
Eurilogic	Route d'Elne	66200 Montescot	Frankreich

Notes

To get detailed information in regards of a specific software package please contact the issuing company directly.

To get detailed information in regards of the HEIM DATaRec 4 Modules please contact ZODIAC Data Systems GmbH.

9 Signal Modules Overview

The HEIM DATaRec 4 Series represents a total modular data acquisition and signal conditioning concept which can be tailored to various applications. The modular design provides the basis to configure large multi channel systems as well as small systems for mobile applications. The HEIM DATaRec 4 Series is the result of a continuous and consequent development of data acquisition systems. Many years of expertise and experience in both the automotive as well as the flight test market have been the starting point for the development of the new family incorporating state of the art technology.

9.1   Analogue Signal Modules Overview

HS310-0120	DIC24	24 analogue input channels up to 50 kS per channel AC, ICP^{TM*}
HS310-0125	DIC24DC	24 analogue input channels up to 50 kS per channel DC
HS310-0010	DIC6B	6 analogue input channels up to 200 kS per channel AC (0.2 Hz), DC, ICP^{TM*}
HS310-0010/1		plus analogue low / high pass filter option
HS310-0011	DIC6B	6 analogue input channels up to 200 kS per channel AC (2 Hz), DC, ICP^{TM*}
HS310-0011/1		plus analogue low / high pass filter option
HS310-0015	DIC6L	6 analogue input channels up to 200 kS per channel AC (0.2 Hz), DC, ICP^{TM*}
HS310-0015/1		plus analogue low / high pass filter option

HS310-0016	DIC6L	6 analogue input channels up to 200 kS per channel AC (2 Hz), DC, ICP^{TM*}
HS310-0016/1		plus analogue low / high pass filter option
HS310-0030	CHG6	6 charge input channels up to 200 kS per channel
HS310-0030/1		plus analogue low / high pass filter option
HS310-0060	DEBU	4 analogue input channels up to 200 kS per channel AC (0.2 Hz), DC, ICP^{TM*} + 2 ASE/EBU input channels
HS310-0060/1		plus analogue low / high pass filter option
HS310-0061	DEBU	4 analogue input channels up to 200 kS per channel AC (2 Hz), DC, ICP^{TM*} + 2 ASE/EBU input channels
HS310-0061/1		plus analogue low / high pass filter option
HS310-0140	SGU[1]	9 analogue input channels for strain gauge up to 25 kS per channel
HS310-0150	OUT6[1]	6 analogue output channels up to 200 kS per channel
HS310-3390	ANH100	2 analogue input channels + 2 analogue output channels up to 25 MS per channel AC, DC
HS310-3395	ANH101	1 analogue input channel + 1 analogue output channel up to 75 MS per channel AC, DC
HS310-3360	VCR100	4 video input channels + 4 audio input channels up to 15 Mbit/s data rate per channel MPEG-2 compression
HS310-3380	VCP100	4 video output channels + 8 audio output channels up to 15 Mbit/s data rate per channel MPEG-2 decompression

[1] under development

9.2 Digitale Signal Modules Overview

HS310-3060	ARR100	24 ARINC429 input channels
HS310-3070	ARP100	24 ARINC429 output channels
HS310-3260	ASM100	8 serial input or output channels 112.5 Baud - 230.4 KBaud
HS310-0130	CAN4	4 CAN input channels
HS310-3300	ETH100	2 Ethernet input or output channels 10 T, 100 T, 1 Gbit/s
HS310-3035	MRG100	PCM input or output channels up to 30 Mbit/s per channel throughput, packed and unpacked mode
HS310-3510	UAR100	8 dual-redundant channels MIL 1553 input channels
HS310-3550	UAP100	8 dual-redundant channels MIL 1553 output channels

Notes

This overview is for general guidance only. There is detailed information available for each individual interface module.

Please contact ZODIAC Data Systems GmbH.

10 Link Modules Overview

The HEIM DATaRec 4 Series represents a total modular data acquisition and signal conditioning concept which can be tailored to various applications. The HEIM DATaRec 4 Link Module is the central processing module and is used to create a single datastream from multiple signal interface subsystems.

Since the Link Module provides the time basis for the connected Signal Modules a high precision synchronisation of all signals is always guaranteed. Furthermore the Link Module controls the calibration, the phase alignment, and gives build in test (BIT) options for the whole system during setup of a new system configuration or normal operation. The modular design provides the basis to configure large multi channel systems as well as small systems for mobile applications. The HEIM DATaRec 4 Series is the result of a continuous and consequent development of data acquisition systems. Many years of expertise and experience in both the automotive as well as the flight test market have been the starting point for the development of the new family incorporating state of the art technology.

HS300-0100/0 LMF2FE	Module data rate	600 Mbit/s
	Interface data rate	
	Gbit Ethernet	max. 600 Mbit/s
	IEEE 1394b	max. 180 Mbit/s
	USB 2.0	max. 80 Mbit/s[1]
	Operating mode	front end
	HeimLink chains	2 (max. 16 Signal Modules supported)
HS300-0100 LMF2FE+REC	Module data rate	600 Mbit/s
	Interface data rate	
	Gbit Ethernet	max. 600 Mbit/s
	IEEE 1394b	max. 180 Mbit/s
	USB 2.0	max. 80 Mbit/s[1]
	Operating mode	front end standalone recorder
	HeimLink chains	2 (max. 16 Signal Modules supported)

HS300-0200/9 LMF4FE	Module data rate	600 Mbit/s
	Interface data rate	
	Gbit Ethernet	max. 600 Mbit/s
	IEEE 1394b	max. 180 Mbit/s
	USB 2.0	max. 80 Mbit/s[1]
	Operating mode	front end
	HeimLink chains	4 (max. 32 Signal Modules supported)
HS300-0120/0 LMF2FE-REC+LEMO	Module data rate	600 Mbit/s
	Interface data rate	
	Gbit Ethernet	max. 600 Mbit/s
	IEEE 1394b	max. 180 Mbit/s
	USB 2.0	max. 80 Mbit/s[1]
	Operating mode	front end standalone recorder
	HeimLink chains	2 (max. 16 Signal Modules supported)
	External Time	IRIG A, B, G; GPS
	Contact remote interface	
	Storage medium interface	
HS610-3001/1 LMFGSS	Module data rate	650 Mbit/s
	Interface data rate	
	Gbit Ethernet	max. 650 Mbit/s
	IEEE 1394b	max. 180 Mbit/s
	USB 2.0	max. 80 Mbit/s[1]
	Operating mode	front end
	HeimLink chains	2 (max. 16 Signal Modules supported)
	External Time	IRIG A, B, G; GPS
	LMF-Sync.-interface	Syn. of up to 3 LMFGSS Modules

[1] currently under development

Notes

Performance varies depending on the installation environment. The shown values were measured using an appropriately designed test system under nominal conditions of temperature, voltage, etc..

Performance is significantly influenced by storage medium type, host computer performance and load, used acquisition software and signal module configuration.

This overview is for general guidance only.

There is detailed information available for each individual interface module. Please contact ZODIAC Data Systems GmbH.

11 Power Modules Overview

HS300-1050 DC Power Module - PWD9D	Input power	9 – 36 V DC
	Max. power	50 W typical
HS300-1025 DC Power Module - PWH9[1]	Input power	9 – 36 V DC
	Max. power	96 W typical
HS300-1035 DC Power Module - PWAC	Input power	90 - 132 V AC or 180 - 264 V AC, 47 - 63 Hz
	Max. power	150 W typical

[1] under development

12 Accessories

HS300-1205	Lind battery pack
HS300-1200	Lind car adapter pack
HS100-6102	Module extender
HS350-0180	Seat fixing system
	HeimLink chain cables
HS350-0005	cable bridge
HS350-0011	1 meter cable
HS350-0012	2 meter cable
HS350-0013	3 meter cable
HS350-0020	5 meter cable
HS350-0030	10 meter cable
	Accessory cables
HS350-0040	Signal Module USB download cable 9 pin LEMO to USB
HS350-0050	Signal Module power cable 9 pin LEMO to banana plugs
HS350-0060	PWD9 power cable 2 pin LEMO to banana plugs
	Optical HeimLink Repeater Pair [1]

[1] under development

<u>Notes</u>

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