Janich & Klass Computertechnik GmbH

J&K EMBEDDED

ISA96 H1/103

Technical Description

Revision: **1.0**

Date: **20.08.2018**

Dokument Name: ISA96 H1103R10.doc

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Disclaimer

The contents of this manual are checked for matching the described product. Deviations cannot be excluded, so that we cannot give any guarantee for full accuracy. The details of this manual are however regularly checked. Necessary corrections will be contained in the subsequent revisions. We will be thankful for any improvement proposals.

Janich & Klass Computertechnik GmbH assume no liability for damages incurred directly or indirectly from errors in this manual, omissions, or discrepancies between this manual and the product.

Safety Hints

- This unit may not be used in any other way than described in this manual.
- Installation, putting into operation, and maintenance of this unit may exclusively be made by qualified personnel. This personnel must be familiar with the warnings and hints of this manual.
- Qualified personnel by means of this manual are persons who are familiar with installation, mounting, putting into operation and operation of this unit and who have the qualification fitting their tasks, like for example:
  - Education and instructions, respectively the authorization to switch on/off, to ground, and to tag current circuits and units resp. systems as per the actual standards of safety technique.
  - Education and instruction as per the actual standards of safety technique concerning maintenance and use of appropriate safety equipment.
  - Education in First Aid.
- Before you put this unit into a bus-rack, you have to check whether the required voltages are available at the specific connector pins, and whether the required currents can be fed.
- Before exchanging any units, the sub-rack must be switched off.
- This unit contains electro-statically endangered components. Electro-static discharge through the human body or similar must therefore by all means be avoided, for example, by prior touch to grounded metal parts (water pipe, etc.). This is important specially before exchanging the unit.
- You have to retighten all locking screws after every exchange.
- Protect this unit from moisture. By no means conductive matters or liquids may enter the unit.
- Do not operate the unit at higher temperatures than stated in this description.
- Connected wires may not be subject to tension load.

- Do not expose the unit to strong magnet fields, for the danger of data loss from the hard disk.
- The unit may not be exposed to strong vibrations, as they might destroy the hard disk.
- In case of a defective fuse, please by all means replace it with a new one of the same type, as otherwise fire danger exists.
- This unit contains a lithium battery. **ATTENTION!** Explosion danger at inadequate battery exchange. The battery may be replaced only with the same type, or with a type recommended by Janich & Klass. Used batteries must be disposed according to legal prescriptions.
- At visible damages of the unit, please return it to Janich & Klass for repair. (Each unauthorized repair may lead to loss of the guarantee.)
- Do not try to repair this unit on your own. Please always address yourself to Janich & Klass in case of eventual repair.
- Guaranty repair must always be made directly by Janich & Klass.

History

Revision	Date	Name	Modifications	HW-Revision
0.8	28.03.2017	s.h.	initial Revision	1.0
1.0	01.12.2017	s.h.	used IO space updated, technical data appended	1.1

1 Overview

The x86 processor module "ISA96 H1/103" (hereafter referred to as H1 / 103) orients itself on the existing Janich & Klass modules D2/103, A2/103 and M4/103 in order to do this as compatible as possible, but without lacking the benefits of the new processor platform with its new, more powerful interfaces.

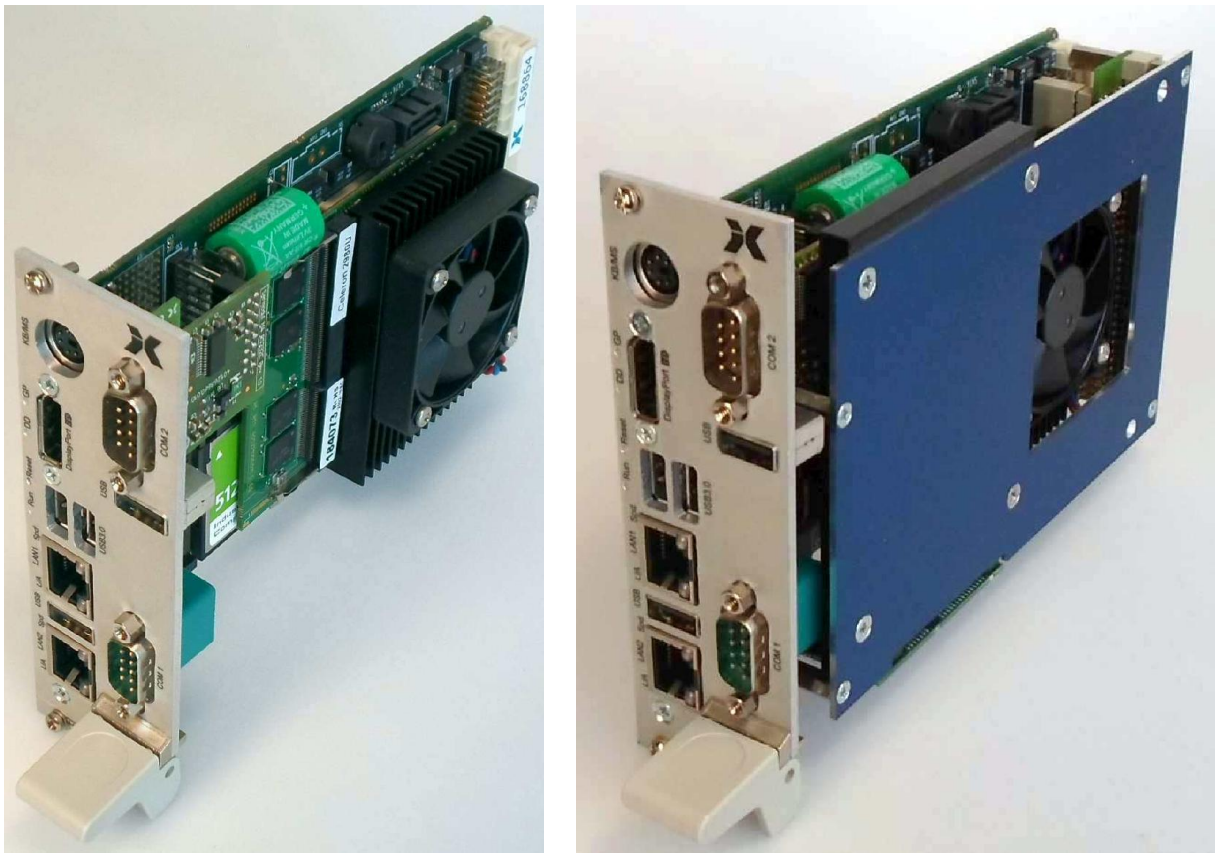
Like the predecessor modules already mentioned, the H1/103 essentially consists of a CPU-module and a baseboard. The CPU-module mainly carries the processor as well as the main memory. The baseboard provides all other necessary system components as well as all interfaces to the outside world.

The processors used (Intel's 4th generation of Core i processors, code name "Haswell") offer in comparison to the predecessors a multiplication of performance at about the same level of power dissipation. Also with these processors completely passively cooled systems are feasible.

Even in the basic version of the H1/103 there are 2 gigabit ethernet controllers available, as well as 2x USB3.0 interfaces. The outdated VGA port makes place for a DisplayPort connector, which over appropriate adapters connection possibilities to HDMI, DVI or again VGA is offered.

As usual, this processor board is provided by factory configuration for both ISA96 and the AT96 bus available.

Compared to the predecessor modules, at H1/103 the connectors for LPT port and IDE drives and also the onboard FLASH disk been omitted.



Versions with Serial-Module, on the right with carrier plate for 2.5“-SATA-SSD

1.1 Technical data at a glance

- ISA96/AT96 processor boad in 3U, 8HP
- CPU-Modul H1 (fixed mounted) with following features:
  - Possible processor types from Intel's 4th generation of Core i processors („Haswell“)
    Celeron 2980U (2M Cache, 1.6 GHz)
    Core i5-4300U (3M Cache, 1.9 GHz, Turbo 2.9 GHz)
    Core i7-4650U (4M Cache, 1.7 GHz, Turbo 3.3 GHz)
  - By default actively cooled by fan, but passive cooling also possible (depending on ambient temperature and system case, processor type and performance settings).
  - 4GByte onboard DDR3L memory, SODIMM socket for up to 8GB SODIMM modules, memory speed 1600MHz
- optional „Rear-Extender“, fitting to existing „Extender-Busses“ of M4/103 and D2/103, e.g. for connection of flatpanels.
- optional 2,5“ SATA drive, mountable on fitting aluminium carrier plates
- SATA socket (7pol. with power supply logic for „SATADOM“-Module, as replacement of earlier onboard flash disk).
- CF socket for CF memory cards, directly connected to IDE port (PATA)
- 2x Gigabit-Ethernet-Controller (Intel i218 and i210) on frontpanel
- 2x USB 3.0 und 1x USB2.0 on frontpanel
- PS/2 connector for Keyboard/Mouse (with Y-cabel) on frontpanel
- DisplayPort connector on frontpanel
- Serial interface COM1 as RS232C on frontpanel
- At standard version there are optional serial modules as COM2 like RS232, RS232 Opto or RS485/422 Opto (all with additional USB interface)
- The Extended-Version offers a high density onboard connector for additional adapter boards, which are easely to develop on customer demands. All extensions using PCIe, SATA, USB, I2C are realizable, like 3. Ethernet-Controller, CFast socket, WLAN module, digital I/O etc.
- 1MByte battery buffered SRAM
- Nuvoton Super-IO NCT6779D (with internal hardware monitor for observing temperaturen, fan rotation and supply voltages)
- Ambient temperature 0-65°C
- Required power supply voltage: +5V

H1/103 version with „Rear-Extender“ and carrier plate for 2,5“-SATA-SSD.

2 Conception of the ISA96 H1/103

In the development of the H1/103, the focus was on being able to cover a wide variety of customer requirements for equipment, interfaces, performance, etc. This is made possible by several properties of the assembly:

- CPU modules with different processor versions offer flexibility in terms of performance, power dissipation (and the potential for passive cooling) and price.
- Both the ISA96 and AT96 buses are supported (factory configuration via solder jumpers)
- Possibilities for connecting internal devices such as flat screens, USB devices, speakers, case fans with speed monitoring. For this is a 64pol. connector available (next to the VG96 bus connector), which can be used either for direct connection of cables, or for the concept of cableless "Rear-IO", in which an additional adapter brings the signals on a permanently mounted "extender bus" (see below for details).
- Optionally, a second serial interface in the form of a serial module can be provided on the front panel. The serial modules are available in various designs (RS232C, RS232 opto-decoupled, RS485/422 opto-decoupled, 20mA opto-decoupled, each with an additional USB2.0 interface).
- The following drives can be connected:
  - A CompactFlash memory card with a CF socket on the board.
  - 2.5 "SSD or harddisk. This drive can be optionally mounted with a support plate and an adapter board firmly on the H1/103, the width of the assembly of 8HP remains.
  - Any drives with SATA connection. For this, the existing SATA socket can be used.
  - Instead, a "SATADOM" module from InnoDisk as a SATA SSD, which can be plugged into the SATA socket, powered cablele over it.
- Instead of the optional serial module, so-called "front extenders" can be used to provide additional interfaces on the front panel and additional functionalities. This concept is intended primarily for customer-specific extensions, which are not covered by the standard equipment of the H1/103.
- The VGA socket has been replaced on the H1/103 with a DisplayPort++ connector. DisplayPort (version 1.2) offers up-to-date performance, a reliable, lockable connector and a wide range of low-cost adapters and adapter cables for HDMI, DVI and VGA conversion. Thus, DipslayPort can be used to backwards compatibility with VGA and connect all current digital monitors.

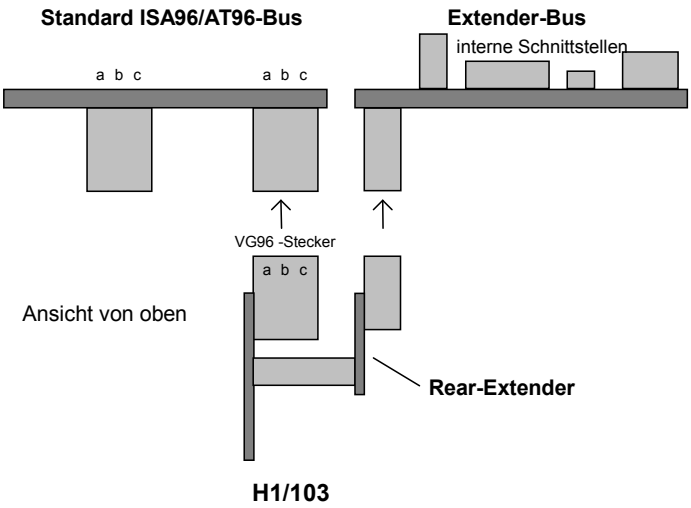
2.1 Concept of Rear-Extender and Extender-Bus

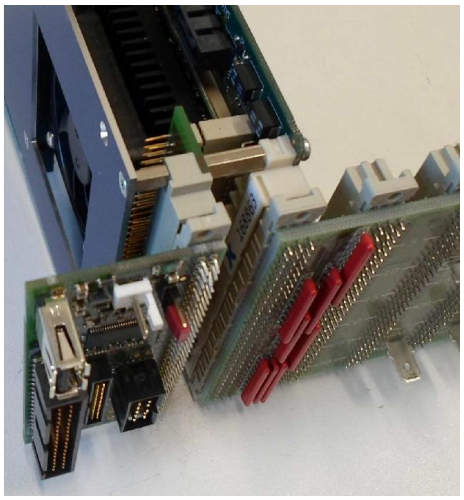
The concept of the “Rear-Extender” in combination with “Extender Buses” offers the possibility of connecting flat-screens without having to route cables directly to the H1/103. As a result, on the one hand, the ease of assembly and service is increased, on the other hand, cables can be kept shorter.

Another important advantage is that additional adaptations can be realized on Extender Buses, e.g. for flat panel displays, converting from LVDS to Digital RGB, additional logic for power supply or background brightness, or just adapting the signals to a suitable connector, optimally to use existing cables.

The same applies to a USB interface routet to Rear-Extender, which e.g. can also be multiplied by a USB hub.

The following drawing illustrates the principle of the concept:





The picture on the right shows an example of an Extender-Bus with the H1/103 and AT96 bus (H1/103 with carrier plate for 2.5 "SATA drive).

The following signals / interfaces are available on the Rear-Extender:

- 2 LVDS channels with 24-bit color depth each
- USB 2.0 port
- SM-bus interface
- I2C interface
- Speaker output of the system speaker
- Reset output
- PWM output and speed input for external (enclosure) fan

The concept is made for customized designs of Extender Buses, for optimal fit. The development of such an extender bus is quite easy and fast to realize, with no major development costs incurred.

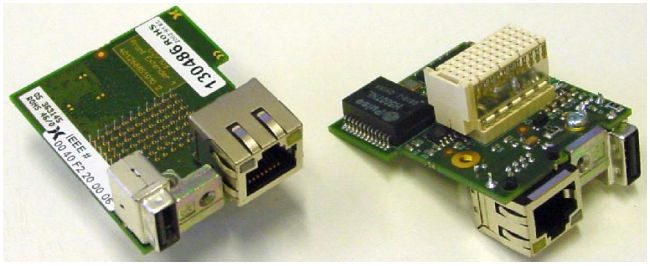
Please contact us if such a design seems interesting to you!

2.2 Konzept der Front-Extender

The concept of the front extender already exists on the modules M4/103, D2/103 and A2/103, where it is primarily used to realize a 2nd Ethernet controller. However, the actual possibilities of this concept go far beyond that.

Based on a high-pin connector (which can be equipped optionally), via which additional interfaces such as PCIe, SATA, USB, LPC, I2C are available, customer-specific wishes can be realized that would not be feasible with the standard version.

Here is a picture of the "simple" version for the realization of another Ethernet connection.



The following picture shows a demonstration pattern of a front extender to the A2/103, which exploits the entire height of the 3U.

This board is intended to show the possibilities offered by the concept. On display: gigabit controller, 2x USB, SD card on the front panel and a WLAN module and a mSATA SSD.

Other wishes, such as digital I/Os are also possible. The possibilities are mainly limited by the available space on the front panel and the max. board dimensions.

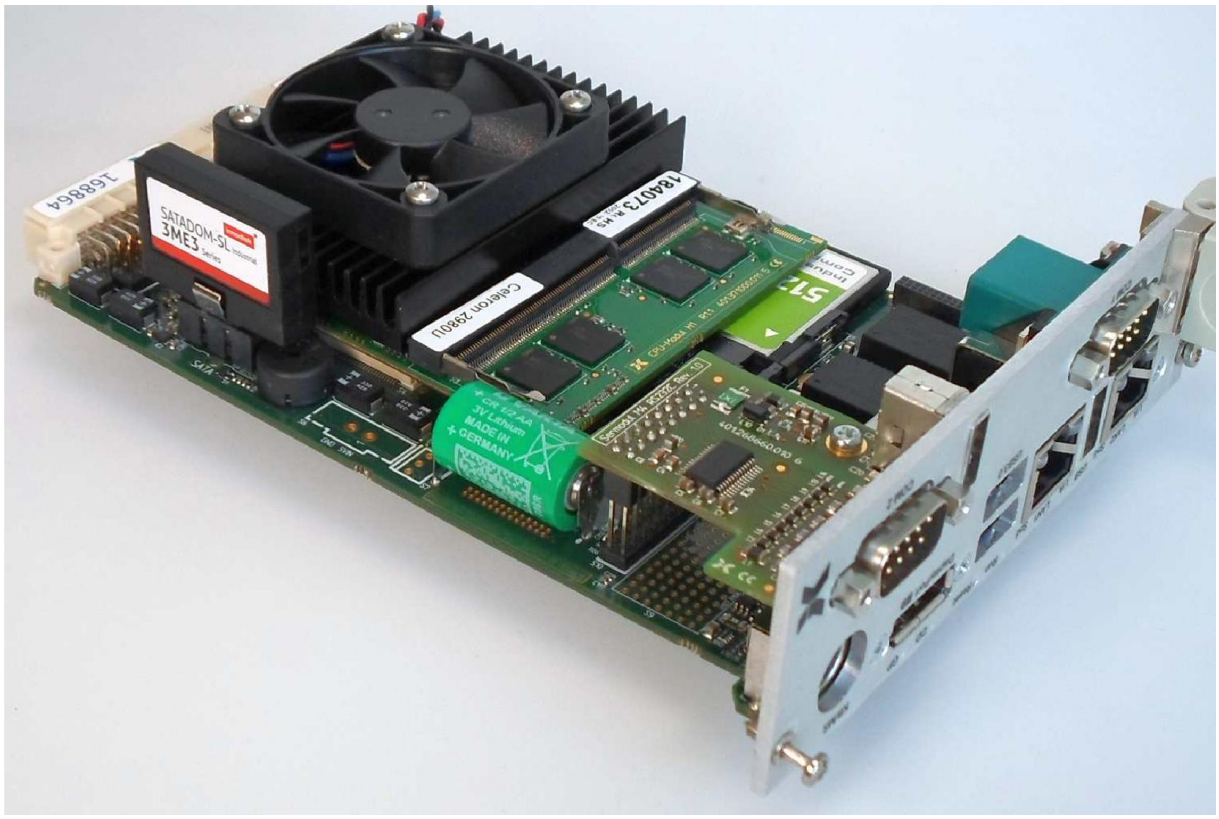
The implementation of such a board normally requires no big effort.

Please contact us if you are interested!

2.3 SATADOM modules

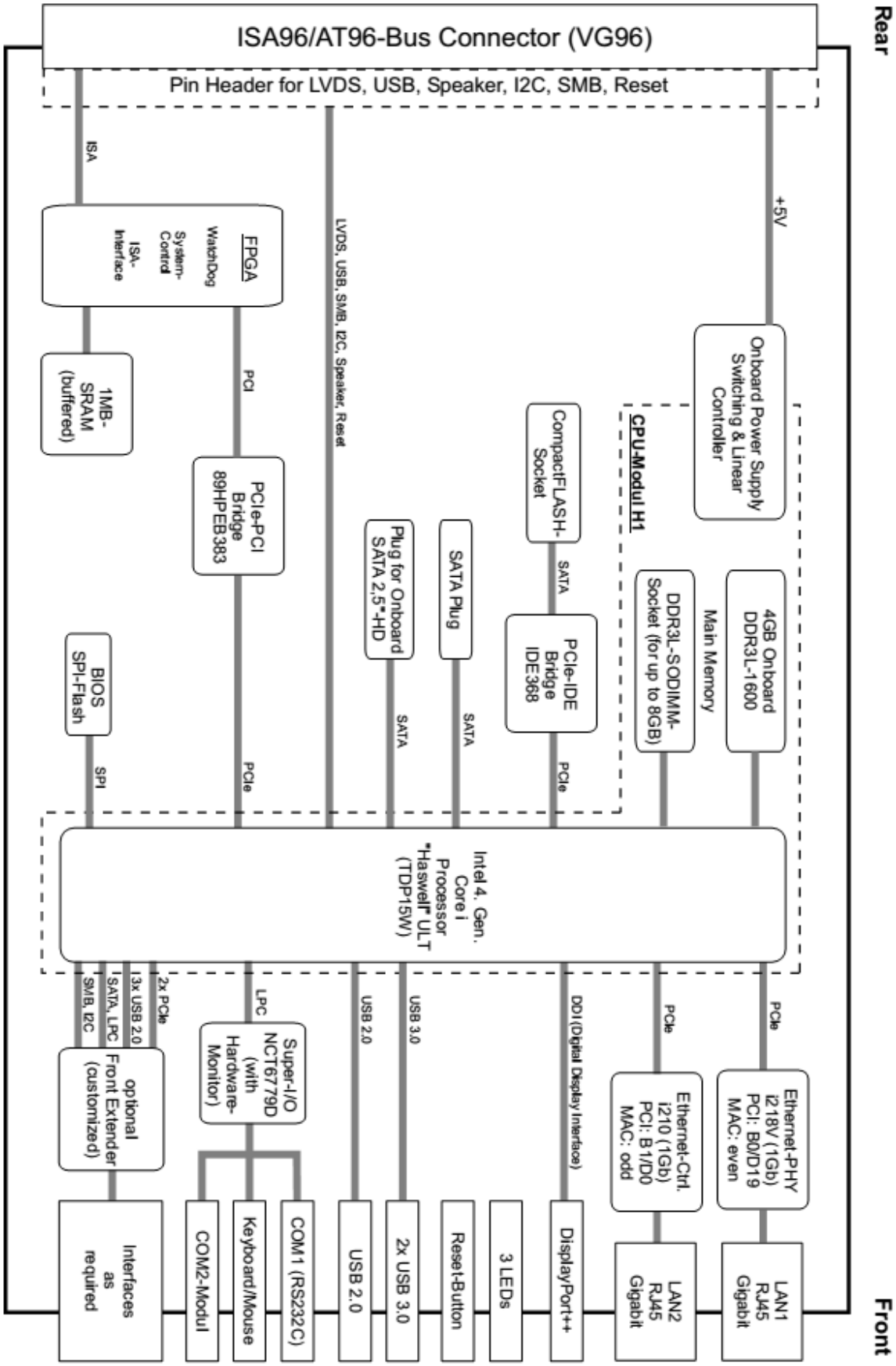
As a new, optional alternative to the onboard flash disk, the H1/103 offers a special SATA socket to which both normal SATA drives can be connected by cable and so-called SATADOM modules can be plugged in cablelessly directly. This is made possible by using a specially-wired pin (normalized GND) to power the modules (so-called Pin7 supply) or the SATA socket provides another power supply pin, which is not available with standard SATA sockets (so-called Pin8 supply)

Such modules (for example, from InnoDisk, picture on the right), which are offered in different technologies and sizes, ultimately offer significantly greater flexibility and scalability with regard to the respective application as well as normally higher performance, making it a powerful replacement for the earlier existing onboard flash disk.

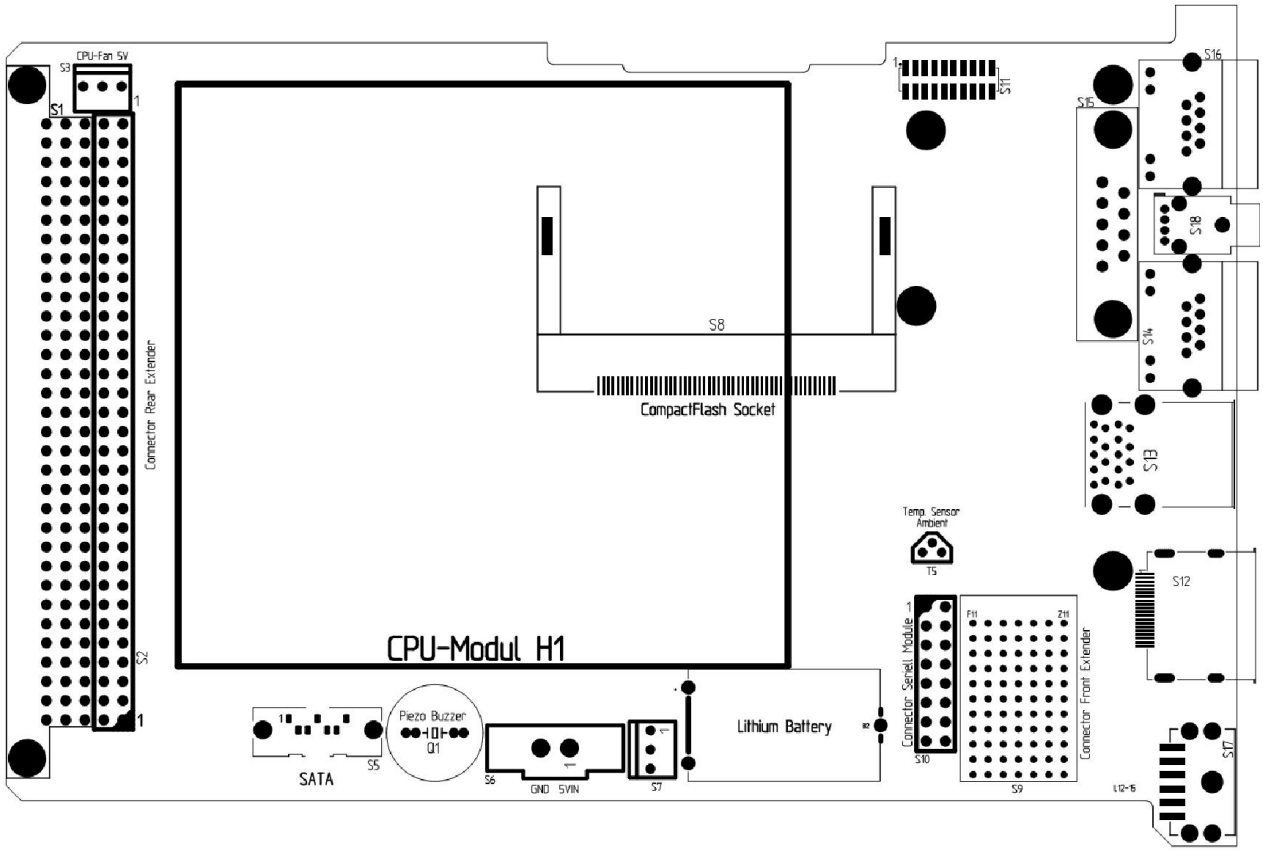


H1/103 with attached SATADOM module and inserted CompactFlash memory card (mostly covered by CPU module).

3 Block diagram of the ISA96 H1/103

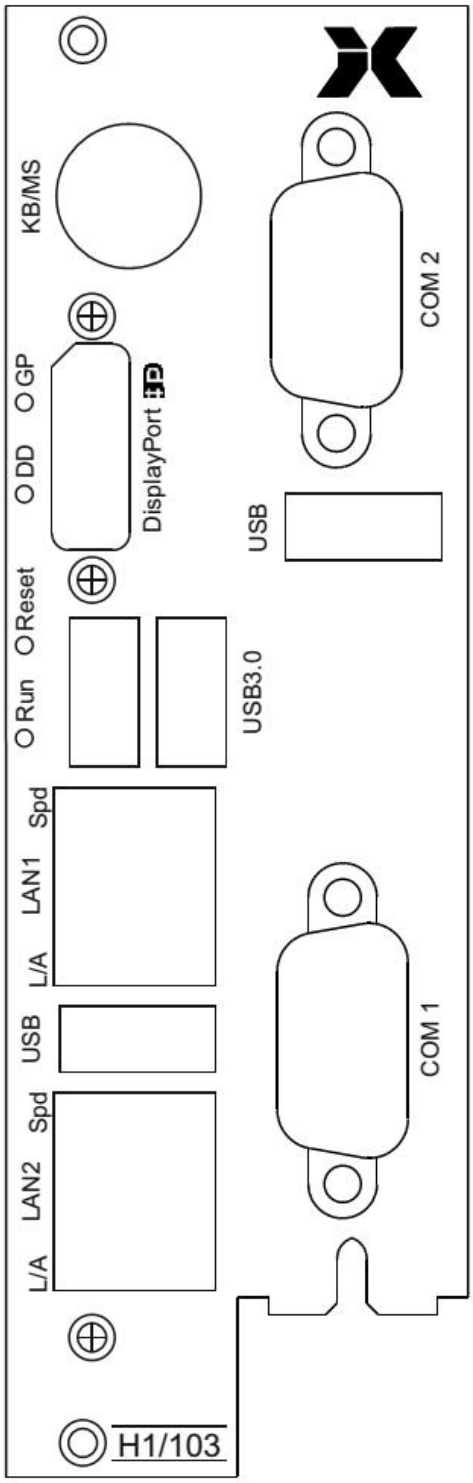


4 PCB map


CPU-Fan 5V
S3
S1
Connector Rear Extender
S2
S8
CompactFlash Socket
S11
S16
S15
S18
S14
S13
Temp. Sensor Ambient
TS
S12
CPU-Modul H1
Connector Senell Module
S10
Connector Front Extender
S9
S17
SATA
S5
Piezo Buzzer
Q1
S6
GND 5VIN
S7
Lithium Battery

5 Front Panel

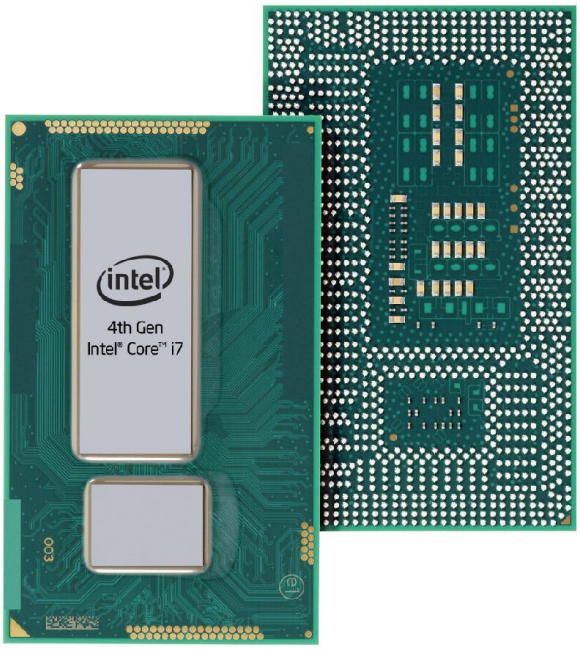
This drawing shows the front panel of the H1/103 in the 8HP version with cut-outs for an optional serial module. For the basic version without serial module, the two sections top right (COM2 and USB) are omitted.



6 Components of the H1/103

6.1 CPU-Modul

The central component of H1/103 is the replaceable CPU-Modul H1. There are the hard-soldered processor, main memory and the Intel HD graphics controller. The H1/103 can thus be adapted exactly to the requirements of the respective application by selecting a suitable CPU-Modul. The choice is currently of three dual-core processors from the Intel "Haswell" family: Celeron with 1.6GHz, Core i5 with 1.9GHz and Core i7 with 1.7GHz.



Processor	Clockspeed	Cores	L2-Cache	Main memory	Powerloss
Core i7-4650U	1,7GHz/3,3GHz	2	4MB	4GB DDR3	15W
Core i5-4300U	1,9GHz/2,9GHz	2	3MB	4GB DDR3	15W
Celeron 2980U	1,6GHz	2	2MB	4GB DDR3	15W

6.2 Main memory

4GB of DDR3L-1600 SDRAM is already soldered to the CPU-Modul H1.

The processor works exclusively with DDR3 low-voltage memory ("DDR3L", lower supply voltage 1.35V) and supports clock rates of effectively 1600MHz (DDR3L-1600 or PC3-12800). Faster memory modules are normally backward compatible and can be used. The maximum memory size of the module can be 8GByte. Overall, 12GByte can be realized.

6.3 Gigabit-Ethernet-Controller

The H1/103 is equipped with two Gigabit Ethernet controllers Intel i218V and Intel i210. These controllers provide two independent, IEEE 802.3ab compatible 10/100/1000Base-T network communications ports. The RJ45 jacks for connecting standard twisted-pair network cables (Cat.5e or better) can be found on the front panel.

General properties:

- Gigabit Ethernet Controller
- IEEE 802.3ab compatible PHY for 10/100/1000Base-T interface
- Meets requirements of IEEE / ANSI 802.3x
- 2 LEDs on the RJ45 socket to control network activity

Status-LEDs:

The Ethernet controllers each control 2 LEDs "Spd" (yellow/green) and "L/A" (yellow), which can be found on the front panel directly in the RJ45 sockets "NET1" and "NET2". These LEDs provide information about the state and activity of each network and controller:

Spd: "Speed" - this LED lights up green when the controller is working in gigabit mode and yellow when working in 100Base-TX mode. If this LED is off, the controller is in 10Base-T mode. The detection and switching to the present network type is automatic.

L/A: "Link / Activity" - this LED lights up as long as there is a faultless network connection. In network activities, this LED goes out in the rhythm of the transmitted or received data packets.

PXE-Boot:

The H1/103 provides the ability to boot the operating system from a PXE server rather than from a local drive, but instead over the network. In addition, the BIOS of the H1/103 is equipped with a PXE BIOS extension. In order to be able to boot the system from the network, the boot order must be set appropriately in the BIOS Setup.**Attention:** Booting via network is only possible with the i218V controller, the corresponding RJ45 socket is marked with "NET1" (left socket). The PXE boot feature is not enabled on the i210 controller.

6.4 Super-I/O Controller

The Super I/O Controller NCT6779D provides two serial ports, a parallel port, a PS/2 keyboard and mouse controller, a hardware monitor and numerous GPIO pins. However, the parallel interface is not used on H1/103.

6.5 Hardware-Monitor

To monitor the supply voltages, the temperatures and the fans, a hardware monitor in the Super I / O chip is integrated on the H1 / 103.

To monitor the operating state of the module, the values of the hardware monitor can be read out.

The following measured values can be retrieved:

- Power supply voltages: CPU core voltage, 0.675V, 0.93V, 1.05V, 1.5V, 1.8V, 3.3V, 5V, 12V and RTC battery voltage
- Temperatures: CPU temperature and ambient temperature
- Fan: Speed of the CPU and chassis fans

If interested, sample source code (C for DOS) can be provided.

The hardware monitor can be addressed via special I/O addresses (via LPC bus). The following table summarizes the accessibility options for the hardware monitor:

Bus	Addres	Explanation	
LPC	2Eh/2Fh	Super-I/O configuration register	Index/Data
LPC	A25h/A26h	Hardware monitor configuration register	Index/Data

Comment:

A detailed description of all registers of the hardware monitor can be found in datasheet NCT6779D of the manufacturer Nuvoton: http://www.nuvoton.com

6.6 CompactFlash socket

The H1/103 has a slot for a CompactFlash memory card. The card is operated in true IDE mode and is a master device on the IDE interface. The inserted CompactFlash cards are mechanically locked by the guide rail of the rack.

As the processor of the H1/103 no longer has an IDE interface, this is realized by a PCIe IDE controller. As soon as a CompactFlash card is plugged in, a BIOS extension to support this block appears in the memory area D0000h - D3FFFh. That means, using a CF card, this memory area can not be used for ISA96 / AT96 peripheral cards.

6.7 USB ports

The H1/103 features two USB 3.0 and one USB 2.0 ports on the front panel as standard to connect peripherals. The USB interfaces comply with the USB specification 3.0 and 2.0 and thus allow transmission rates of 5 Gbit/s or 480 Mbit/s. USB devices are "hot plug" capable, they may be connected or disconnected during operation.

To protect the device, the power output is limited at the USB interfaces. The 3.0 interfaces on the front panel may be loaded in total with a maximum of 1.5A

The optional serial modules (for COM2) also provide an additional USB 2.0 interface, which is individually secured and may be charged with 500mA.

Another USB 2.0 interface is routed to the rear 64pole connector.

When using Front-Extenders there are another 3 USB 2.0 ports available.

6.8 EEPROM

On the H1/103 there is a 512Byte EEPROM, which can be used for customer-specific purposes (configuration data, keywords, etc.).

If you are interested in using this EEPROM, please contact us for details regarding access.

6.9 SCRAM

In addition to the SDRAM main memory, a 1Mbyte static CMOS RAM (SCRAM), buffered by the internal lithium battery, is available. The SCRAM can be used in two different ways:

linear: The SCRAM is partially mapped in the memory address range between D0000h and DFFFFh (the full size of 1MByte can not be used here).

switched: In this operating mode, the SCRAM is divided into blocks of 16 KB, of which only one block is mapped in the memory address area between D0000h and DFFFFh. The number of the block to be mapped can be specified via an I/O port.

The configuration of the SCRAM with regard to operating mode, start address and size must be set after each start of the application program via special configuration registers. Of course, the set address range may not be occupied by other cards.

For further configuration details please contact us.

The corresponding configuration registers and the functioning of the SCRAM are compatible with the predecessor boards A2/103, D2/103, V8/103, M4/103.

6.10 Watchdog

The H1/103 has a watchdog that triggers a hardware reset if it is not periodically triggered by the running program within a specific time. The safety of the overall system can be significantly improved.

The watchdog must be configured via software by the user program with regard to its trigger times, as far as it is to be used:

Configuration of Watchdog:

Configuration register **WDCONF** (Index 0Bh):

D7	D6	D5	D4	D3	D2	D1	D0
RLED1 (r/w)	RLED0 (r/w)	-	WSHT (r/w)	WDT2 (r/w)	WDT1 (r/w)	WDT0 (r/w)	ENWD (r/w)

RLED1...0: With this Bits the blue Run-LED on front panel is controlled:
00b: off 01b: on
10b: flash at 1 Hz 11b: flash at 2Hz

WDT2...0: These bits set the time constant of the watchdog.
0h: 0,25s 1h: 0,5s
2h: 1,0s 3h: 2,0s
4h: 4,0s 5h: 8,1s
6h: 16,1s 7h: 32,2s

ENWD: By setting this bit, the watchdog is armed. With the next write access to the configuration register WATCHDOG (index 55h), the counter starts with the time constant set here.

WSHT: If this bit is set, the watchdog has previously triggered a hardware reset. To reset this bit, first a 1 and then a 0 must be written.

This configuration register WDCONF is described as follows:

- Write 0Bh to I/O register 45h.
- Read out I/O register 46h so as not to change Bit6-7.
- Write the desired value for WDCONF on I/O register 46h (leave Bit6-7 unchanged).

Trigger the Watchdog:

The watchdog only becomes active when it is triggered for the first time.

This happens as follows:

- Write 55h on I/O register 45h
- Write a value ≠55h on I/O register 46h (the value 55h result in an immediate reset of the board)

6.11 LEDs

Apart from the LEDs on the network jack, there are 3 more LEDs on the front panel:

RUN (blue): ON means, that the board is in an active state.

DD (green): Disk drive LED. ON when IDE or SATA drives are accessed.

GP (yellow): GP means "General Purpose". The function of this LED can be changed via configuration register.

In addition to the functions mentioned above, the LEDs in combination signal certain states shortly after power-on the system. This is used in particular for error limitation if the system does not start up properly.

Operating condition	RUN	DD	GP
Resume supply +V3.3_S5 or +V5_S5 **not** OK. Normal duration: ca. 0.3s *Error cause: Switch-Reg. 3,3V or overload/short, 5V-supply too low or unstable*	OFF	OFF	OFF
Resume supply OK, /SLP_S3 low Normal duration: ca. 0.1s *Error cause, if permanent: Defect at CPU-Modul*	OFF	OFF	ON
/SLP_S3 high (resuming supplies are switched on), but PCH_PWROK low Normal duration: ca. 0.3s *Error cause, if permanent: CPU-Modul, or regulators for internal supplies*	OFF	ON	ON
All supplies OK, but System-Reset activ. Normal duration: ca. 0,2s *Error cause, if permanent: CPU-Modul*	OFF	ON	OFF
System-Reset passiv, CPU hast o start now. Normal duration: ca. 1-2s *Error cause, if permanent: SPI-BIOS-Flash, CPU-Modul*	ON	OFF	OFF
BIOS finished Super-I/O initialisation. Normal duration: ca. 1-2s *Error cause, if permanent: SPI-BIOS-Flash, CPU-Modul*	ON	OFF	ON
FPGA is loaded, POST is going on. Normal duration: ca. 3-4s *Error cause, if permanent: FPGA, CPU-Modul*	flash (1Hz)	OFF	ON
Initialize SATA drives. Normal duration: ca. 1-2s *Error cause, if permanent: SATA, CPU-Modul*	flash (1Hz)	flash bei access	ON
BIOS POSTfinished, OS is beeng started.	ON (2Hz) (*1)	flash on access	OFF

(*1): fast flash (2Hz), only if CMOS battery is empty.

6.12 Graphic-Controller

The H1/103 uses the graphic controller integrated in the processor for its graphic outputs. This graphic controller is primarily different in performance depending on the processor type on the CPU module:

Processor Celeron 2980U: Intel HD Graphics
Processor Core i5-4300U: Intel HD Graphics 4400
Processor Core i7-4650U: Intel HD Graphics 5000

The H1/103 uses the processor's Embedded Display Port (eDP) channel as a flat panel LVDS interface and one of the two internal Digital Display Interface (DDI) via a DisplayPort front panel connector.

The processor's digital display interface supports both DisplayPort 1.2a and HDMI 1.4. The detection HDMI or DP is done automatically by the type of the connected cable/adapter.

Properties of the graphic interfaces:

HDMI:	Resolution up to 4096x2304 @ 24Hz
DisplayPort:	Resolution up to 3200x2000 @ 60Hz
LVDS (eDP):	Resolution up to 1920x1200 @ 60Hz

DisplayPort offers the option of using mating connectors with locking, which considerably increases mechanical robustness.

For DisplayPort, there is a wide range of adapters and adapter cables, which can be used in addition to monitors with DisplayPort connection even those with HDMI, DVI and VGA connection.

The LVDS interface consists of 2 LVDS channels with 24-bit color space (each channel consists of 3 differential data lines and 1 clock line).

The setting of the used flat screen type can not be done automatically, but must be configured. For this purpose, a Janich & Klass-owned DOS program is used, which imports the appropriate record.

While there is a menu item in the BIOS setup to set a flat panel type, this setting is ignored.

The DOS program is called as follows:

H1FPCFG /wFILE where FILE is the filename (without the extension .EDD) of the configuration file matching the flat screen.

For further details please contact us.

The graphic controller supports simultaneous display on LVDS and DisplayPort (default, for example in the BIOS Setup) as well as different contents. However, simultaneous representation is only possible with VESA-compatible modes, not e.g. under DOS. Under DOS, only one picture is displayed on the "Primary IGFX Boot Display". Which this is depends on the setting in BIOS Setup, found under "Chipset -> System Agent (SA) Configuration -> Graphics Configuration -> LCD Control". Where:

EFP: Output via DisplayPort (External Flat Panel)

LFP: Output via LVDS (Local Flat Panel)

6.13 Serial ports

There are has two serial interfaces each with 16byte FIFO (16550 compatible). The first interface (COM1) is fixed as RS232C. The second interface COM2 can be realized by a 'serial module M4'.

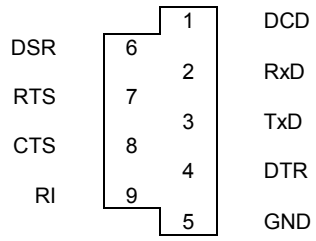
More detailed information on the serial driver modules can be found in the corresponding technical descriptions. The current Janich & Klass price list provides information about which driver modules and adapters are currently available.

For both COM1 and serial modules, there is an assembly option to feed + 5V to pin 9 (RI) of the DSUB connector to power adapters/converters, etc. to be connected there.

Please contact us if this is necessary for you.

6.13.1 RS232 port COM1

9 pole Sub-D connector **COM1**



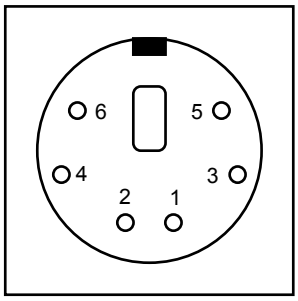
6.14 PS/2 Keyboard/Mice port

At the the front panel a 6 pole mini-DIN socket is installed, where a standard keyboard with PS/2 plug can be connected.

Two pins of the mini-DIN socket, which are not used by the keyboard, are connected to the signals of the PS/2 mouse interface. Using so-called "Y-cables", which provide the signals from the mouse and keyboard interface on two separate mini-DIN jacks, both devices can be operated simultaneously.

Pin assignment of the mini DIN socket (top view):

1 KB-Data
2 MS-Data
3 GND
4 +5V
5 KB-CLK
6 MS-CLK



7 Ressources

7.1 I/O- and Memory-Addresses

At **I/O-address space** from 0000h bis FFFFh following is occupied:

Addresses	Function
0000h-001Fh	DMA-Controller
0020h-0021h	Interrupt-Controller
0024h-0025h	Interrupt-Controller
0028h-0029h	Interrupt-Controller
002Ch-002Dh	Interrupt-Controller
002Eh-002Fh	LPC SIO
0030h-0031h	Interrupt-Controller
0034h-0035h	Interrupt-Controller
0038h-0039h	Interrupt-Controller
003Ch-003Dh	Interrupt-Controller
0040h-0043h	Timer
0044h-0047h	H1/103 Configuration port
0050h-0053h	Timer
0060h-0067h	Keyboard controller
0070h-0077h	RTC & CMOS-RAM
0080h	Debug port
0080h-0091h	DMA-Controller
0092h	Systemstatusbits (Port A)
0093h-009Fh	DMA-Controller
00A0h-00A1h	Interrupt-Controller
00A4h-00A5h	Interrupt-Controller
00A8h-00A9h	Interrupt-Controller
00ACh-00ADh	Interrupt-Controller
00B0h-00B5h	Interrupt-Controller
00B8h-00B9h	Interrupt-Controller
00BCh-00BDh	Interrupt-Controller
00C0h-00DFh	DMA-Controller 0278h-027Fh LPT2 (as set in BIOS-Setup)
02E8h-02EFh	COM4 (as existing)
02F8h-02FFh	COM2
03B4h-03B5h	CRT Registers / Data Port (MDA)
03BAh	Input Status Register 1 (ST01) / Feature Control Register (FCR)
03C2h	Input Status Register 0 (ST00) / Output Register (MSR)
03C0h-03C1h	Attribute Controller Index / Data Port
03C4h-03C5h	Sequencer Index / Data Port
03C6h	Pixel Data Mask Register
03C7h	DAC State Register
03C9h	Palette Data Register
03CAh	Feature Control Register (FCR)
03CCh	Misc. Output Register (MSR)
03CEh-03CFh	Graphics Controller Index / Data Port
03D4h-03D5h	CRT Registers / Data Port (CGA)
03DAh	Input Status Register 1 (ST01) / Feature Control Register (FCR)
03E8h-03EFh	COM3 (as existing)
03F8h-03FFh	COM1

Addresses	Function
04D0h-04D1h	Interrupt-Controller
0680h-069Fh	???
0A00h-0A3Fh	SIO GPIO
0A25h-0A26h	Hardware-Monitor
0CF8h-0CFCh	PCI Configuration Port
1800h-18FFh	???
1C00h-1FFFh	CPU GPIO
2000h-21FFh	???
D000h-D04Fh	IDE-Controller (für CF)
E000h-E01Fh	Ethernet-Controller 2
F000h-F03Fh	Graphic-Controller
F040h-F05Fh	SMBus-Controller
F060h-F07Fh	Ethernet-Controller 1

MEMORY Address space:

0h - 9FFFh	640KByte	DOS Application Area
A0000h - BFFFFh	128KByte	Video Buffer
C0000h - CFFFFh	64KByte	Video-BIOS
D0000h - DFFFFh	64KByte	Adapter Area
E0000h - FFFFFh	128KByte	System BIOS
100000h - 3FFFFFFFh	1GByte	Main Memory
40000000h - FEBFFFFFh	~3GByte	PCI Memory
FEC00000h - FFFFFFFFh	20MByte	APIC & System BIOS

Beside that there are memory and I/O resources occupied bei PCI devices, that are configured bei BIOS.

8 Pin assignments

8.1 ISA96-Bus

The following table shows the pin assignment of the bus connector for the ISA96 variant.

	a	b	c	
1	GND	n.c. (MASTER#)	IOCHCK#	1
2	RESET	SD15	SD7	2
3	+5V	SD14	SD6	3
4	IRQ9	SD13	SD5	4
5	MEMR#	SD12	SD4	5
6	GND (DRQ2)	SD11	SD3	6
7	n.c. (-12V)	SD10	SD2	7
8	0WS#	SD9	SD1	8
9	+12V	SD8	SD0	9
10	GND	SBHE#	IOREADY	10
11	SMEMW#	GND (LA23)	AEN	11
12	SMEMR#	LA22	SA19	12
13	IOW#	GND (LA21)	SA18	13
14	IOR#	LA20	SA17	14
15	+5V (DACK3#)	LA19	SA16	15
16	GND (DRQ3)	LA18	SA15	16
17	+5V (DACK1#)	LA17	SA14	17
18	GND (DRQ1)	+5V (DACK7#)	SA13	18
19	+5V (REF#)	n.c. (DRQ7)	SA12	19
20	CLOCK	+5V (DACK6#)	SA11	20
21	IRQ7	n.c. (DRQ6)	SA10	21
22	IRQ6	+5V (DACK5#)	SA9	22
23	IRQ5	n.c. (DRQ5)	SA8	23
24	IRQ4	+5V (DACK0#)	SA7	24
25	IRQ3	n.c. (DRQ0)	SA6	25
26	+5V (DACK2#)	MEMCS16#	SA5	26
27	TC	IOCS16#	SA4	27
28	BALE	IRQ15	SA3	28
29	+5V	IRQ14	SA2	29
30	OSC	IRQ12	SA1	30
31	MEMW#	IRQ11	SA0	31
32	GND	IRQ10	GND	32
	(Standard-ISA96-Busbelegung in Klammern)			

8.2 AT96-Bus

The following table shows the pin assignment of the bus connector for the AT96 variant.

	a	b	c	
1	GND	SBHE#	IOCHCK#	1
2	RESET	MEMCS16#	SD7	2
3	+5V	SA23	SD6	3
4	IRQ9	IOCS16#	SD5	4
5	n.c.	SA22	SD4	5
6	GND (DRQ2)	IRQ10	SD3	6
7	n.c. (-12V)	SA21	SD2	7
8	0WS#	IRQ11	SD1	8
9	+12V	SA20	SD0	9
10	GND	IRQ12	IOREADY	10
11	SMEMW#	n.c. (UBatt)	AEN	11
12	SMEMR#	IRQ15	SA19	12
13	IOW#	GND (n.c.)	SA18	13
14	IOR#	IRQ14	SA17	14
15	+5V (DACK3#)	n.c.	SA16	15
16	GND (DRQ3)	+5V (DACK0#	SA15	16
17	+5V (DACK1#)	MEMR#	SA14	17
18	GND (DRQ1)	+5V (DRQ0)	SA13	18
19	REF#	MEMW#	SA12	19
20	CLOCK	+5V (DACK5#)	SA11	20
21	IRQ7	SD8	SA10	21
22	IRQ6	+5V (DRQ5)	SA9	22
23	IRQ5	SD9	SA8	23
24	IRQ4	+5V (DACK6#)	SA7	24
25	IRQ3	SD10	SA6	25
26	+5V (DACK2#)	+5V (DRQ6)	SA5	26
27	TC	SD11	SA4	27
28	BALE	SD12	SA3	28
29	+5V	SD13	SA2	29
30	OSC	SD14	SA1	30
31	GND	SD15	SA0	31
32	GND (DRQ7)	n.c. (MASTER#)	GND (DACK7#)	32
	(Standard-AT96-Busbelegung in Klammern)			

8.3 Flat Panel Interface and Rear I / O

The 64 pole Pin header S2 is intended for the rear connection of device-internal periphery (Rear-I/O). On pin 1-40 there are signals for LVDS display. On the other pins there are available serial buses such as USB, SMB and I2C as well as a speaker signal, a control output and speed input for an external fan and a reset input and output.

64 pole pin header **S2**

SMB_CLK	**64**	**63**	+5V_S5
SMD_DATA	**62**	**61**	GND
FAN_CTRL	**60**	**59**	RESET_IN
FAN_RPM	**58**	**57**	Speaker
GND	**56**	**55**	USB+
+5V_S5	**54**	**53**	USB-
+3.3V_S0	**52**	**51**	I2C_DATA
I2C_CLK	**50**	**49**	+5V_S5
nc	**48**	**47**	nc
GND	**46**	**45**	RESET_OUT
nc	44	43	nc
nc	42	41	nc
GND	**40**	**39**	Backlight Enable
GND	**38**	**37**	LVDS_A0-
LVDS_A0+	**36**	**35**	GND
LVDS_A1-	**34**	**33**	LVDS_A1+
GND	**32**	**31**	LVDS_ACLK+
LVDS_ACLK-	**30**	**29**	GND
LVDS_A3-	**28**	**27**	LVDS_A3+
GND	**26**	**25**	LVDS_A2+
LVDS_A2-	**24**	**23**	GND
LVDS +5V	**22**	**21**	LVDS +3.3V
LVDS +3.3V	**20**	**19**	LVDS +5V
GND	**18**	**17**	LVDS_B2-
LVDS_B2+	**16**	**15**	GND
LVDS_B1-	**14**	**13**	LVDS_B1+
GND	**12**	**11**	LVDS_BCLK-
LVDS_BCLK+	**10**	**9**	GND
LVDS_B3-	**8**	**7**	LVDS_B3+
GND	**6**	**5**	LVDS_B0+
LVDS_B0-	**4**	**3**	GND
Backlight Control	**2**	**1**	GND

Erläuterungen zu den Signalen:

Flachbildschirm-Interface:

LVDS_Axx und LVDS_Bxx: Differential signals (+/-) of 2 LVDS channels A and B. At flatpanels with 18bit color depth the signals …3+/- left unconnected.

Backlight-Enable: Active high, when flatpanel interface is enabled.

Backlight-Control: PWM-Signal for controlling backlight brightness.

LVDS+5V und LVDS+3.3V: Power supply for flatpanel logik.

USB+/USB-: USB-2.0 interface

SMB_Data/_CLK: System-Management-Bus

I2C_Data/_CLK: I2C host channel

FAN_CRTL: PWM output for controlling speed of external fan.

FAN_RPM: Input for monitoring pin of external fan.

Speaker: Output for direct connect of external speaker or buzzer.

RESET_IN: Input for system reset, active low.

RESET_OUT. Output from system Reset, active low.

+5V_S5: 5V supply (unswitched).

+3.3V_S0: 3.3V supply (after system beeing active).

9 Power supply and power consumption of the H1/103

The H1/103 needs only a supply voltage of +5V.

The power consumption of the module is depending on the processor type and the additional system components (drive, SODIMM module, keyboard and mouse, monitor and screen resolution, USB, Ethernet). In particular, the operating system used (with its possibilities of power management) and the processor utilization significantly determine the power consumption.

In order to give an indication of the expected power consumption, in the following table, real determined values for the average power consumption with different processor population and different operating states are given. The values were determined under the following configuration:

- SATADOM SSD (about 0.4W idle power consumption)
- PS/2 keyboard and mouse (about 0.4W power consumption)
- CPU fan (about 0.5W power consumption)
- Windows 8 Embedded, screen resolution 1920x1080 pixels at 60Hz
- Processor temperature approx. 40°C, ambient temperature approx. 25°C

The values for "full load" are calculated using the freely available program PRIME95.EXE (all cores are maximally utilized) within the first 2min. determined after the start of the program.

Processortype **Operating state**	**Core i7-4650U 3,3GHz Turbo 1,7GHz max. 0,8GHz min.**	**Core i5-4300U 2,9GHz Turbo 1,9GHz max. 0,8GHz min.**	**Celeron 2980U kein Turbo 1,6GHz max. 0,8GHz min.**
BIOS-Setup	15W	13W	10W
Windows 8 Embedded idle	7,5W	7,5W	7,5W
Windows 8 Embedded full load, Non-Turbo-Mode	21,5W	21W	15,5W
Windows 8 Embedded full load, Turbo-Mode	31,5W	25,5W	kein Turbo-Mode unterstützt
Windows 8 Embedded full load, max. 50% CPU-workload (800MHz)	nicht getestet	nicht getestet	11W

The i7 and i5 processors support a turbo mode that enables a higher CPU clock for a short period of time (approximately 30s) during high system load. In this period, the power consumption increases again significantly. In the BIOS Setup there is the possibility to switch off the Turbo mode or to start in the lowest CPU cycle (Advanced -> CPU Confguration -> Boot Performance Mode: Turbo Performance, max Non-Turbo-Performance or Max), but it depends on the operating system whether these settings are accepted or ignored (the latter applies to Windows 8).

The short-term power requirement of the H1/103 can once again be significantly higher than the value derived from the average power consumption. This should be considered when selecting the power supply. In addition, the power consumption increases significantly at higher system/processor temperatures and it must be expected with batch-related fluctuations in the components used.

We therefore recommend at least 30% power reserve in terms of power supply dimensioning.

10 BIOS

The BIOS comes from the company American Megatrends Inc. (AMI) and carries the product name Aptio IV.

The BIOS setup can be started by pressing the DEL key when booting.

The revision of the BIOS can be seen on the main page under "OEM mayor version" and "OEM minor version".

Changes in the BIOS setup are stored in the BIOS SPI flash, so they are not lost when the CMOS battery is discharged.

10.1 BIOS updaten

With DOS program "fpt.exe" it is possible to reprogram the BIOS flash. As a result, BIOS updates are possible at any time without removing the device.

To update the BIOS you need a bootable DOS medium (eg USB stick), the files "fpt.exe", "fparts.txt", "dos4gw.exe" and of course the BIOS image "H103Rxxx.bin" (xxx = version number). The start of the program happens then with the command

fpt -f H103Rxxx.bin -savemac

The SPI flash is now deleted and then reprogrammed. The parameter "savemac" is important and must not be left out! It causes the MAC address of the Gigabit Ethernet controller i218V to be preserved when the SPI flash is deleted.

11 Technical data

Dimensions:	41mm * 128mm * 176mm
Power supply:	+4.85V … +5.25V, max 100mV Vss Ripple
Ambient temperature:	0 – 60°C
Storage temperature:	-40 – +85°C (recommended: < 30°C, because of self-discharge of battery)
Huminity:	0 -95%, no condensation.
CPU fan (if exists):	Manufacturer ADDA, 50x50x10mm, 5V, 4300 RPM, double ball bearings, MTTF: 280000h @ 40°C
Lithium battery (for RTC + SRAM):	Varta: CR 1/2 AA SLF, 3.0V 950mAh. Life expectance: At storage (powered off) @20°C: 18 Jahre Powered on (self-discharge only) @40°C: 28 years Powered on (self-discharge only) @70°C: 10 years
MTBF:	170000h@40°C

12 Order information

The order number of H1/103 put together as follows:

434.2691xy.z00

where the meaning of the numbers to be given for v, w, x, y and z is as follows:

x: Bus-Configuration
1: ISA96
2: AT96

y: Version CPU-Modul H1
1: Celeron 2980U active cooling (CPU fan)
2: Celeron 2980U passive cooling (system ventilation recommended)
3: Core i5-4300U active cooling (CPU fan)
4: Core i5-4300U passive cooling (system ventilation required)
5: Core i7-4650U active cooling (CPU fan)
6: Core i7-4650U passive cooling (system ventilation required)

z: Version of front panel
1: 8HP standard version (front panel without cutting for COM2-Serial-Module)
2: 8HP COM2 version (front panel with cutting for COM2-Serial-Module)
Further customized versions on request.

Order numbers for accessories

- 434.268850.010 2 D2/103 HD-Träger2 for 2,5"-SATA drive, with adapter without drive
- 434.268850.011 3 D2/103 HD-Träger2 with 2,5"-SATA-HD ≥ 320GB (24x7h) and adapter
- 404.268652.000 0 M4/103 Rear-Extender

Usable with M4/103 Rear-Extender:

- 434.268653.001 1 M4/103 Extender-Bus2 (18bit-TFT (Digital-RGB), keyboad, speaker)
- 404.268653.002 0 M4/103 Extender-Bus3 (18bit-TFT (Digital-RGB), keyboard, USB, Z-Schiene)
- 434.268653.003 3 M4/103 Extender-Bus4 (LVDS, keyboard, speaker)

Further customized versions on request.

Serial-Modules for COM2 (for 8HP standard-version:

- 434.268660.000 2 Serial-Module M4 RS232C, 1x USB 2.0
- 404.268661.000 8 Serial-Module M4 RS485/422 Opto, 1x USB 2.0
- 404.268662.000 6 Serial-Module M4 USB-Hub3, 3x USB 2.0
- 404.268663.000 4 Serial-Module M4 RS232C Opto, 1x USB 2.0

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