

# Panel-PC S3

## Preliminary Technical Description

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## **Disclaimer**

The contents of this manual are checked for matching the described product. Deviation cannot be excluded, so that we cannot give any guarantee for full accuracy. The details of this manual are however regularly checked. Necessary correction 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 instruction , respectively the authorization to switch on/off, to ground, and to tag current circuits and units or 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 connect this unit to means supply, you must check whether the available voltage lies within the admissible voltage range, as printed on the type label.
- The unit must be connected to ground by the terminals, labeled with .
- The unit may be installed in enclosure doors only by means of the existing mounting parts.
- Before opening the unit, it must always be disconnected from means supply, in order to secure that the unit is not fed with current.
- 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.
- Protect this unit from moisture. By no means, conductive matters or liquids may enter the unit.
- The ventilation holes in the lateral walls must always remain open.

- Do not operate the unit at higher temperatures than stated in this description.
- Connected wires may not be subject to tension load.
- 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 prescription.
- 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	Modification	HW Revision
0.1	31.05.2016	p.b.	Preliminary Description	1.0

## 1 Overview

The Panel-PC S3 is a modular, scalable industrial computer with touch display. Designed for installation in cabinet doors, all its connections are plugged on the back side, upwards, in order to ease their mounting.

The Panel-PC S3 is supplied in a stainless steel housing with foiled aluminum front panel and resistive touch sensor. A high-quality 12" TFT display is included, with backlight in long-life LED technique.

The unit features a Celeron Dual-Core processor with 1.6GHz clock frequency from Intel's "Haswell" family (TDP 15W). Alternatively available are Intel Core-i3/i5/i7 with clock frequencies of up to 1.7GHz. All processors come from Intel's Embedded product line, thus granting a long-term availability of five years, or more.

The Panel-PC S3 allows to realize a redundant Sercos Master controller, without using specific interface modules, or FPGAs. This becomes possible by the combination of two Gigabit Ethernet Controllers i210 from Intel, and the Open Source Project "Sercos SoftMaster". So, cycle times of 125µs can be achieved. The two Sercos interfaces can, at choice, be utilized either as two separate Sercos lines, or as redundant ring structure for raised availability.

The sophisticated cooling concept allows an exclusively passive cooling of all components over the wide range of operating temperatures from -15 to 55°C. Maintenance-demanding fans are not in use.



### 1.1 Technical Data in Short:

- Stainless steel housing designed for installation in enclosure doors, aluminium front panel with protection class IP65, passively cooled, overall Dimensions (W x H x D): about 345 x 270 x 110mm
- TFT display 12" with LED backlight, can be dimmed
- Touch sensor resistive
- External connections are plugged on the rear side, from below
- CPU module H1 with the following features:
  - Fixed soldered Intel® Celeron® Dual-Core processor 2980U (Haswell), clock frequency 1.6GHz
  - Alternatively available are Intel® Core® i3/i5/i7 Dual-Core processors (Haswell), clock frequencies 1.7GHz...1.9GHz
  - 4GB DDR3-SDRAM, DDR3-1600, fixed soldered
  - SODIMM socket for DDR3-SDRAM up to 4GB, DDR3-1600
  - Video controller Intel HD Graphics 4400 with 200MHz clock frequency
- One Gigabit-Ethernet controller Intel i218V with RJ45 receptacle on the connector side
- Two Gigabit-Ethernet-Controllers Intel i210, can be synchronized, RJ45 receptacles on the connector side, designated for Sercos SoftMaster

- One additional Gigabit-Ethernet controller Intel i210 with RJ45 receptacle on the connector side
- On-Board CFAST socket, memory module can be exchanged from outside
- Slot for a PCIe Mini Card module or for a mini-SATA module
- Serial interface COM1 as RS232 (only Rx, Tx, #RTS and #CTS)
- Two USB 3.0 interfaces with up to 5GB/s on the connector side
- Two USB 2.0 interfaces with up to 480MB/s on the connector side
- Additional digital monitor can be connected to Micro-HDMI receptacle
- Nuvoton Super-IO NCT6779D (with internal hardware monitor for survey of temperatures and supply voltages)
- Power failure protection with separate microcontroller, can trigger NMI or interrupts
- LED displays on the connector side: "Power", "HDD", "RUN", 8 LEDs for Ethernet, "GP"-LED
- Buffer battery CR2477, can be exchanged from outside
- Power unit with wide-range input 90-260V AC on Combicon connector
- Operating temperature 5 - 55 °C (shortly up to 70°)  
relative humidity 10-95% non-condensing
- Approvals: CE (UL and ATEX optional)

## 1.2 Housing

The Panel-PC is built into a stable, multi-part housing, made from stainless steel. From its conception, the housing is foreseen for installation in an enclosure door. It can, however, also be installed in any other housing. On the front side, the Panel-PC is protected to meet IP65. Rear-side protection is granted by the cabinet, or respectively by the surrounding housing.

The housing of the Panel PCs consists of three parts: The front panel, the display hutch and the electronic frame with its heatsink.

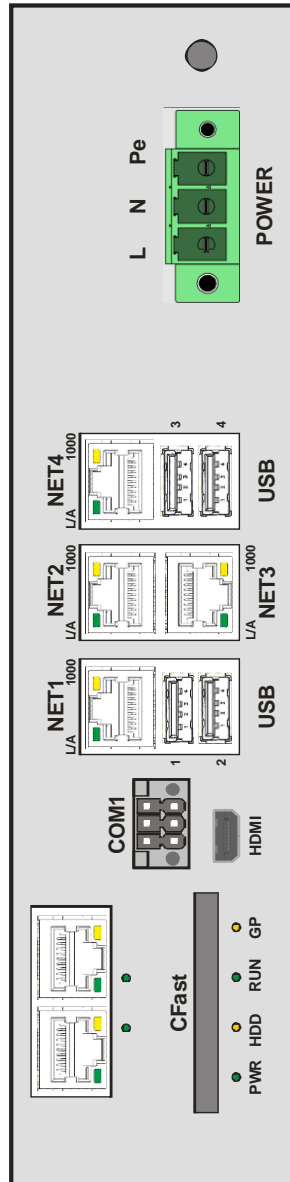
The electronic frame is closed on the rear side with a widely dimensioned heatsink. The frame has multiple ventilation holes on its sides, and on the top.



All external plugs are connected to the bottom of the electronic frame. Therefore, the system can be installed also in very narrow cabinets, or sub-racks.

### 1.3 Connector Side

The below illustration displays the position of all connectors on the connector side of the Panel-PCs:



The following table explains the meaning of the individual interfaces:

Denomination	Interface	Remark
CFast	Memory card	
HDMI	Digital monitor	Micro-HDMI
COM1	RS232	
USB1. USB2	2 x USB 3.0	
NET1. NET4	Gigabit-Ethernet	1x i218V, 1x i210
NET2, NET3	Gigabit-Ethernet	2 x i210 for Sercos (synchro)
USB3, USB4	2 x USB 2.0	
Power	Means supply	90-264VAC (47-440Hz) or 127-370VDC



## 2 Components of the Panel-PCs

### 2.1 CPU Module

The central component of the Panel-PC is its exchangeable CPU module H1. It hosts, among others, the fixed soldered processor, the main memory, and the Intel HD video controller. So, the Panel-PC can be adapted exactly to meet the relative demands of the application, by selecting a suitable CPU module. Actually, you may select from four Dual-Core processors from Intel's "Haswell" family:

Celeron with 1.6GHz clock frequency,  
 Core i3 with 1.7GHz clock frequency,  
 Core i5 with 1.9GHz clock frequency, and  
 Core i7 with 1.7GHz clock frequency.



Processor	Clock Frequencies	Cores	L2-Cache	Main Memory	Thermal Power
Core i7-4650U	1.7GHz/3,3GHz	2	4MB	4GB DDR3	15W
Core i5-4300U	1.9GHz/2,9GHz	2	3MB	4GB DDR3	15W
Core i3-4010U	1.7GHz	2	3MB	4GB DDR3	15W
Celeron 2980U	1.6GHz	2	2MB	4GB DDR3	15W

### 2.2 Main Memory

The CPU module H1 already comes with fixed soldered 4GByte DDR3-SDRAM. For applications with higher demands to main memory, a socket exists for a 204pole DDR3-SODIMM module (1.5V), so that memory sizes up to 8GByte can be realized. The transfer rate of the main memory is 800MT/s. Therefore, PC3-12800 modules may be used.

**Attention:** Only modules with eight memory chips of the 4Gbit technology can be used! Modules with more than eight memory chips are not applicable.

### 2.3 Gigabit-Ethernet Controller

The Panel-PC is equipped with four Gigabit-Ethernet controllers Intel i218V, or Intel i210 respectively. These controllers put available four independent IEEE 802.3ab compatible network connections of type 10/100/1000Base-T.

The RJ45 receptacle for connecting Standard-Twisted-Pair network cables (Cat.5e or better) are accessible in the connection area of the Panel-PC.

## General Features

- Gigabit-Ethernet controller
- IEEE 802.3ab compatible PHY for 10/100/1000Base-T interface
- Matches the demands of IEEE/ANSI 802.3x
- IEEE 1588/802.1AS Precision Time Synchronization (i210)
- 6KByte (i218V) or 48KByte (i210) internal FIFOs for Rx and Tx
- Two LEDs at RJ45 receptacle for control of network activities

## Status LEDs:

The Gigabit-Ethernet controllers control two each 2 LEDs "SP" (orange/green) and "L/A" (green). Those are placed, on the connector side, directly in the RJ45 receptacles NET1 ... NET4. These LEDs supply information about condition and activity of the relative network, and of the controller:

**SP:** "Speed" - This LED lights green when the controller is working in Gigabit mode, and orange, when it works in 100Base-TX mode. When the LED does not shine, the controller is in 10Base-T mode. Detection and switch-over to the actual network type is done automatically.

**L/A:** "Link/Activity" - This LED shines as long as a trouble-free network connection exists. During network activities, this LED goes out in the rhythm of sent, or received data packets.

### 2.3.1 PXE Boot

The Panel-PC offers the possibility to boot the operating system not from a local drive, but instead via the network, from a PXE server. Therefore, the BIOS of the Panel-PC is equipped with a PXE-BIOS Extension. In order to be able to boot the system from the network, the boot sequence must be set so in the BIOS setup. **Attention:** Booting via network is possible only with the i218V controller. The according RJ45 receptacle is labeled with NET1 (left-hand connector). For the i210 controllers, the PXE-Boot function is not available.

### 2.3.2 Sercos

The Panel-PC allows to realize a redundant Sercos master controller, without the usage of specific interface modules or FPGAs. The two network connections NET2 and NET3 are foreseen for this purpose. The related Gigabit-Ethernet controllers i210 support the Precision Time Protocol (PTP) as per IEEE 1588. They can be synchronized via their relative SDP pins. Furthermore, the two controllers are fed from a common clock source, for preventing drift effects.

In combination with the Open Source Project "Sercos SoftMaster" it is possible to reach cycle times of 125µs on the Sercos bus. Here, the two interfaces NET2 and NET3 can be used, at choice, as two separate Sercos lines, or as redundant ring structure for raised availability.

In case that the Sercos Master functionality is not requested, the NET2 and NET3 connections can surely be utilized for general network connections.

## 2.4 Super-I/O Controller

The Super-I/O controller NCT6779D of the Panel-PC puts available two serial interfaces, one parallel interface, a PS/2 keyboard and mouse controller, a hardware monitor and multiple GPIO pins. On the Panel-PC, however, the parallel interface is not in use.

## 2.5 Hardware Monitor

A hardware monitor is integrated in the Super-I/O chip for survey of supply voltages, temperatures, and fan speed on the Panel-PC. The measured values from this component are displayed in the BIOS setup, in the "PC Health Status" menu.

The following measured values can be called:

- Supply voltages: CPU core voltage, 0.675V, 0.93V, 1.05V, 1.5V, 1.8V, 3.3V, 5V, 12V and the voltage of the RTC battery
- Temperatures: CPU temperature and ambient temperature
- Fan: Rotation speed of the system fan

The hardware monitor can be addressed via specific I/O addresses (via LPC-Bus) or via the SMBus. The following table summarizes the possibilities to address the hardware monitor:

Bus	Address	Description	Remarks
LPC	2Eh/2Fh	Super-I/O configuration register	Index/Data
LPC	295h/296h (1)	Hardware monitor configuration register	Index/Data
SMB	01011011b write 01011010b read (2)	Hardware monitor configuration register	

### Remarks:

- (1) The I/O address is settable via Super-I/O configuration register CR60/CR61 of logical devices B.
- (2) The SMB address is settable via hardware monitor configuration register 48h.

Please find a detailed description of all registers of the hardware monitor in the data sheet NCT6779D of its manufacturer Nuvoton: <http://www.nuvoton.com>

## 2.6 Power Failure Detection

The Panel-PC is equipped with a power failure detection, controlled via an Atmel microcontroller (ATmega8L). This microcontroller continuously surveys the supply voltage of the power supply. If the net fails, for a settable number of periods, the controller will create an interrupt or an NMI on the CPU module, at choice. The main processor still has about 100ms time left before the full shut-down, to execute some specific actions. These might be, for example, a controlled stop of a drive, or securing important operating data on the CFast-memory card.

The microcontroller also has 2KByte non-volatile FRAM-memory. Here, data are stored that may help to survey the correct function of the power failure detection when the Panel PC is switched on next time.

Please find a detailed explanation of the microcontroller functions in the document [tbd].

## 2.7 Touch Controller

The Panel-PC has a USB touch controller TSHARC-A2 from Microchip for four- or five-wire resistive touch sensors. Therefore, a front panel with resistive touch sensor can directly be connected without the need of any additional hardware.

## 2.8 CFast

The Panel-PC offers a slot for a CFast memory card. These are memory cards in the former CompactFlash-Format, however with the much faster SATA interface. The slot is accessible on the connector side of the Panel-PC. So, the card can be exchanged without opening the housings.

### How to Insert the CFast Card:

For easier handling of the CFast card, it is inserted with its rear face upside, see below illustration. Therefore, the grip edge shows to the top, and an inserted card can easily be removed at this edge.



**Attention:** The CFast card may be inserted only in the way as described above, without executing bigger effort! Any forcible, tilted or skewed insertion will damage the CFast socket!

## 2.9 Slot for PCIe Mini Card / mini-SATA

Slot **S18** is foreseen for an optional PCIe Mini Card (29.8mm x 50.8mm). You can assemble a WLAN module here, for example, or a network controller.

Alternatively, this slot can be populated with a mini-SATA Solid-State Drive (Full Size). Switch-over between PCIe Mini Card and mini-SATA is done automatically. Should the automatic switch-over fail, it is still possible to determine the card type manually, via Jumper S13:

Setting Jumper S13	Card Type
1 - 2	automatic selection
2 - 3	force PCIe Mini Card
no jumper	force mini-SATA SSD

**Attention:** Available are also Solid-State Drives with the denomination "PCIe Mini Card". These modules, however, are much longer (29.8mm x 70mm) and therefore will not fit in this slot.

## 2.10 Battery

In order to grant that the real-time clock continues running also in switched-off condition, a lithium battery exists in the Panel-PC. It is a lithium coin cell of CR2477 with 3.0V nominal voltage and a typical capacity of 1000mAh.

The durability of the lithium battery strongly depends on the kind of usage of the Panel-PC, on the environment temperature, and on the component tolerances. The following table gives a rough overview of the expected lifetime of the battery:

Environment temperature	Kind of usage	Expected lifetime
25°C	Constantly switched off	12 years
0...55°C		8 years
0...55°C	Switched on for 50%	10 years
0...55°C	Constantly switched on	13 years

The actual battery voltage can be queried via the hardware monitor. The battery should be exchanged when the voltage drops below 2.0V.

To exchange the lithium battery, please open the cover of the battery bin, in the side wall of the unit. You can now remove the button cell and replace it with a new one of the same kind.

**Attention: Make sure to only use lithium manganic dioxide coin cells of type CR2477 (24mm Ø x 7.7mm) with 3.0V nominal voltage!**

## 2.11 EEPROM

Placed on the Panel-PC is a 512Byte EEPROM, freely available to the user. Data may be stored here which shall remain available also after the unit is switched-off. This EEPROM is controlled by four GPIO pins of the Super-I/O controller.

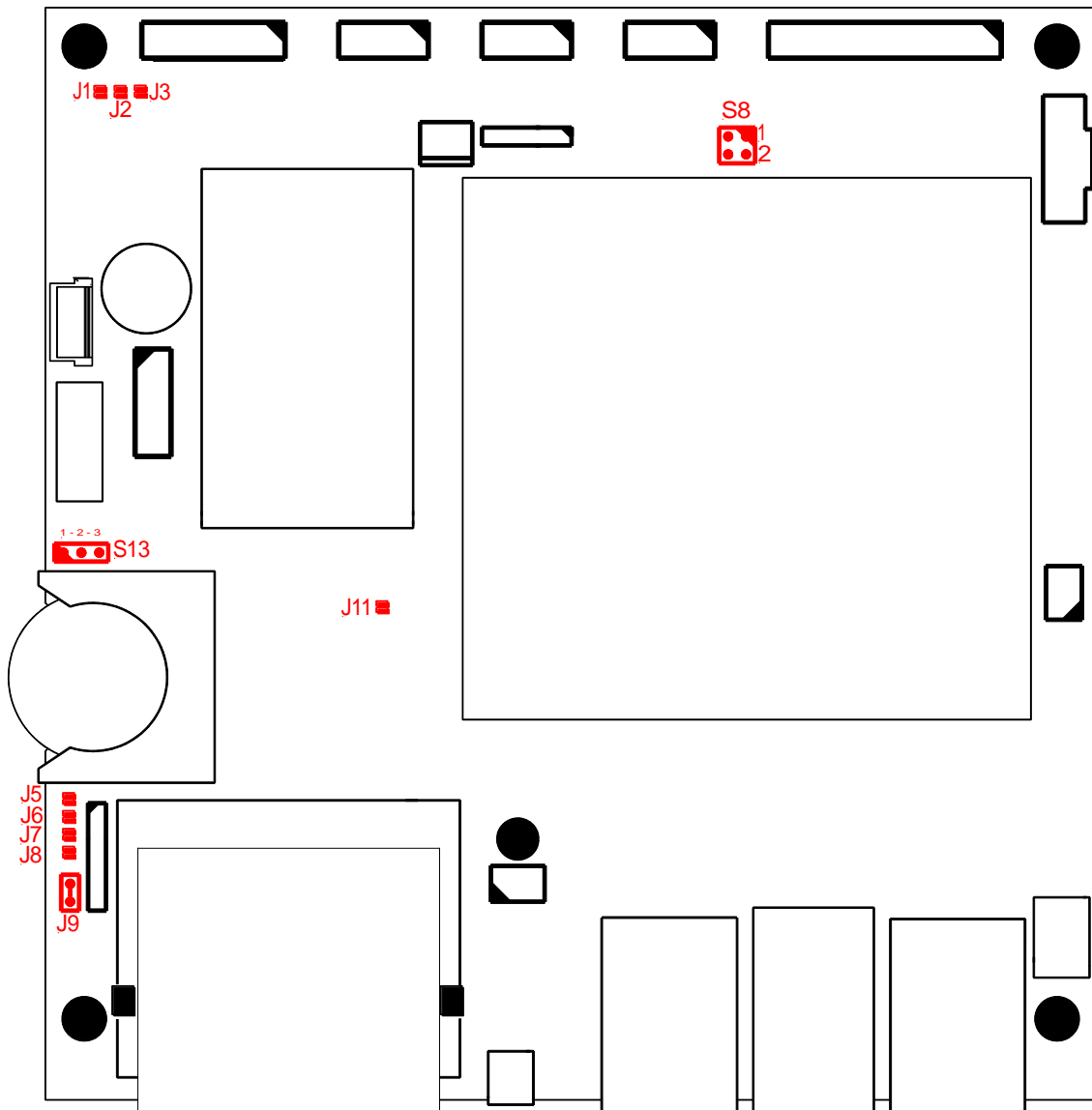
### 3 Jumpers and LEDs

#### 3.1 Jumpers

The Panel-PC has several jumpers. They serve to adapt the system to different configurations. The following table gives an overview of the existing jumpers:

Jumper	Function	Description
J1 / J2	Touch controller	Reserved for future expansion
J3	4/5 wire touch	Jumper must remain set
J5	CFast write protect	CFast memory card write-protected, if set
J7	GP jumper1	Universal jumper at pin GP62 of the Super-I/O: removed: GP62 is high set: GP62 is low
J6	GP jumper2	Universal jumper at pin GP63 of the Super-I/O: removed: GP63 is high set: GP63 is low
J8	Clear CMOS	Bridge this jumper for a short time (1...2s) to delete the CMOS-RAM
J9	CPU module	Flash Descriptor Security Override
J11	Super-I/O	set: Port 80h outputs via COM1
S8	Microcontroller	
S13	PCIe Mini Card	Selection of card type in PCIe Mini Card slot: 1 - 2: automatic selection 2 - 3: force PCIe Mini Card removed: force mini-SATA SSD

**Jumper positions:**



**3.2 LEDs**

In addition to the LEDs at the network connectors and the LEDs of the RS485/422 interfaces, the connection area of the Panel-PC has further four LEDs. Their meaning is explained below:

- PWR (green):** This LED signalizes the actual supply voltage.
- RUN (green):** This LED gives information about the progress of the boot process of the system.
- HDD (yellow):** This LED shows accesses to the CFast memory card.
- GP (yellow):** The denomination GP means "General Purpose". The function of this LED is controlled via pin GP71 of the Super-I/O controller.



The following table shows the functions of these five LEDs, from the moment when the unit is switched on, until the start of the operating systems:

Operating condition	PWR	RUN	HDD	GP
Net voltage ok, 3.3V from DC/DC transformer ok, internal voltages not yet stable, Reset active	ON	OFF	OFF	OFF
Internal voltages stable, Reset still active	ON	OFF	OFF	ON
Internal voltages stable, Reset inactive	ON	ON	OFF	ON
Chipset and Super-I/O are initialized	ON	blinks (2Hz)	OFF	ON
Power-On-Self-Test (POST) completed without error, operating system is started	ON	ON	Blinks on access	OFF ON <sup>*1</sup>

(\*1): The GP-LED lights when GP71 of the Super-I/O controller was set to 0.

On top, diverse LEDs are placed on the base board of the Panel-PC, for diagnosis purposes. The following list provides an overview of the individual LEDs and their meaning:

LED	Color	Functional group	Denomination	Shines if ...
D1	yellow	Touch Controller	Diag	blinks 3x after Reset, then lights constantly
D7	yellow	System	Sleep LAN	GbLAN in sleep mode
D8	yellow		Sleep S3	System in sleep mode S3
D15	green	Microcontroller		
D16	yellow			
D17	green	LVDS display	Backlight 12V enable	LVDS display switched on
D18	green		Display 3.3V enable	



## 4 Interfaces



### 4.1 USB Interfaces

The Panel-PC has, on its connector side, two each USB 3.0- and USB 2.0 interfaces for connecting peripheral units. Depending on the actual design, an additional USB 2.0 interface is available on the front panel via IP65 protected receptacle. The USB interfaces meet USB-specifications 3.0 and 2.0. Therefore, they allow transfer rates of 5Gbit/s or 480Mbit/s to USB units. Also, they are "hot-plug" fit so that they may be connected to, or disconnected from the Panel-PC during its operation.

For safe-guarding the unit, power delivery is limited for all USB interfaces. The two USB 3.0 interfaces on the connector side may in total be loaded with up to 1A, the same holds for the two USB 2.0 interfaces. This allows to have up to four USB units, each with 500mA current consumption, or alternatively two USB units, each with up to 1A current consumption.

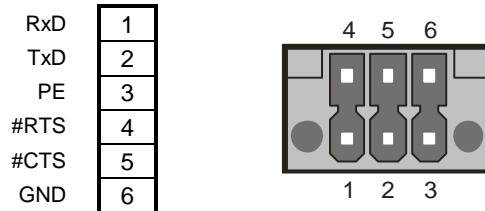
An eventually existing USB interface on the front panel may also be loaded with up to 1A, but maybe reduced by the current consumption of internal USB devices (like touch controller, Bluetooth).

Interface	Current	Remarks
USB1	< 1A in total	Common overcurrent error message
USB2		
USB3	< 1A in total	Common overcurrent error message
USB4		
USB Front	< 1A	Eventually minus power consumption of internal USB devices

### 4.2 RS232 Interface COM1

The Panel-PC has two serial interfaces, each with 16Byte FIFO (16550 compatible). The first interface COM1 is hard-wired as RS232C (only Rx, Tx, #RTS and #CTS), the second interface is reserved for special applications.

6pole Combicon receptacle **COM1**



The utilized Combicon connector is of type DMC 1.5/3-G1F-3,5 (Phoenix Contact), a suitable counter-plug is type DFMC 1.5/3-STF-3,5 , for example.

### 4.3 Monitor

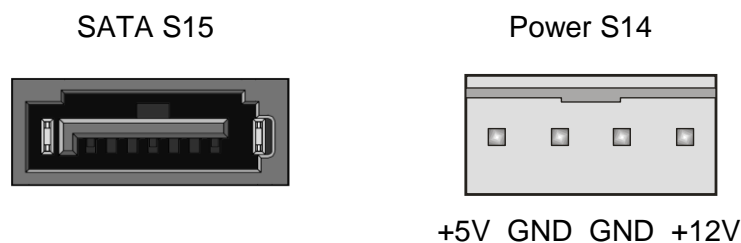
In addition to the built-in display, a digital monitor can be connected to the Panel-PC, via Micro-HDMI receptacle **HDMI**. The following table shows the pin assignment:

19pole Micro-HDMI receptacle **HDMI**

Pin	Signal	Pin	Signal	Pin	Signal
1	Hot Plug Detect	8	TMDS Data 1-	15	
2		9	TMDS Data 0+	16	GND for +5V
3	TMDS Data 2+	10	TMDS Data 0 Shield	17	SCL
4	TMDS Data 2 Shield	11	TMDS Data 0-	18	SDA
5	TMDS Data 2-	12	TMDS Clock +	19	+5V, max. 0,3A
6	TMDS Data 1+	13	TMDS Clock Shield		
7	TMDS Data 1 Shield	14	TMDS Clock -		

### 4.4 SATA Interface

For connection of a CDROM- or DVD drive, the Panel-PC optionally has the SATA-interface **S15**. The supply voltages for the drive are provided by connector **S14**.



#### 4.5 Fan

The plug **J4** is foreseen for connecting an optional 12V system fan. The fan rotation speed can be controlled, and also be monitored, by the hardware monitor of the Super-I/O chip.

##### Connector J4

##### Signal Name

FAN_GND	1
FAN_12V	2
FAN_RPM	3

FAN\_12V: Switched 12V supply, can be loaded with 0,1A at max!  
 FAN\_RPM: Speed signal of the fan

#### 4.6 Power Supply for the Panel-PC

The Panel-PC can be supplied from the following voltage sources:

Variant	Input Voltage	max. Current Consumption
Wide-range input	90-264VAC 47-440Hz 127-370VDC	60W

The supply voltage is electrically separated from PE (protective ground) and from all electric connections of the Panel-PC. Supply voltage is fed via Phoenix Combicon connector **POWER** (PC 4/3-G-7,62). In order to grant correct grounding of the housing, the Panel-PC must also be ground-connected by the existing 6mm grounding bolt. A suitable counter-plug for supply is type PC 4/3-STF-7,62, for example.