

MEC2

Midrange Embedded Controller

General Operating, Maintenance and Installation Manual



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History

Version	Date	Chapter	Modification	Author
V 1.0	21-July-15		initial version	P. Kauschat
V 1.1	22-October-15	4	Detailed information about Wireless GPRS/UMTS cellular modem module added	M. Ostapovski
V 1.2	19-Jan-16	3.2, 3.3, 4	Manual is supplemented by PROFIBUS master/slave and PROFINET IO controller / IO device	P. Kauschat
		5	Chapter "Nomenclature of MEC2 Item Code" added	
V 1.3	09-Mar-16	4	Further system I/O interfaces (optionally) - additional information of PN and PB interfaces	P. Kauschat

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1 Introduction

All technical information, descriptions and illustrations contained in this 'Operating, Maintenance and Installation Manual' remain our property and shall not be used otherwise than for operating this system, nor shall they be copied, reproduced or passed on to third parties or brought to their notice without our prior written consent.

The information represented in this manual is in keeping with current standards and is subject to later alterations.

This manual contains important instructions referring to safe installation, commissioning, operation and maintenance.

Read this manual carefully before starting up the gateway and observe the instructions.

In order to comply with the guidelines for electro-magnetic compatibility in embedded controllers only CE-certified components are used in compliance with project-specific requirements.

It is to be noted that the hardware platform (MEC2) has not been protected against lightning and the operator should, if desired, take appropriate protective precautions.

Our RS-232 isolator provides efficient protection of your data and equipment against external influences. We will be pleased to draw up a non-binding offer for you.

All trademarks or brand marks mentioned in this document are used for identification purposes only and are property of their respective owners.

Finally we want to draw your attention to the fact that any warranties with respect to the embedded controller will be invalid in the event that:

- Operation, servicing and maintenance are not carried out accurately according to the instructions; repairs are not carried out by our personnel or without our prior written consent.
- Commissioning is not carried out by our personnel or we have not given our approval for the commissioning or the commissioning is carried out by untrained personnel.
- The unit is used inadequately, incorrectly, negligently or inappropriately or for a purpose other than that originally intended.
- The serial number is removed from the product.

For your protection, observe the following safety precautions when setting up your equipment:

- Follow all cautions and instructions marked on the equipment.
- Ensure that the voltage and frequency of your power source match the voltage and frequency inscribed on the equipment's electrical rating label.
- Never push objects of any kind through openings in the equipment. Dangerous voltages may be present. Conductive foreign objects could produce a short circuit that could cause fire, electric shock, or damage to your equipment.

2 Hardware-Description

2.1 General

This embedded PC designed for industrial environment offers a high degree of flexibility, performance and reliability.

Intensive tests of the embedded controller are done in our company. Each device runs through an intensive function test. This function test includes a burn-in test with full communication of all interfaces (min. 48 hours). Drops of communication, transmission errors and every important component with regard to function, temperature, voltages etc. are monitored.

Hundreds of restarts are executed whereby a connection to all interfaces is established at each reboot.

Quality assurance is done according to the four-eye principle. Each device passes a number of quality inspections.

All components are cooled passively.

Important for the selection of our components are particular items like quality, availability and a high durability.

The mains power supply is 12 - 24 V DC ($\pm 20\%$).

The basic system can be equipped with appropriate MiniPCI Express cards that can only be retrofitted at IPCOMM site. Each device has a single PCI socket. That is why only one of the respective variants is possible.

The MEC2 is available with these supplementary modules:

- Wireless GPRS/UMTS cellular modem incl. antenna and SIM socket
- PROFINET interface
- PROFIBUS interface

2.2 Controls and Display Elements

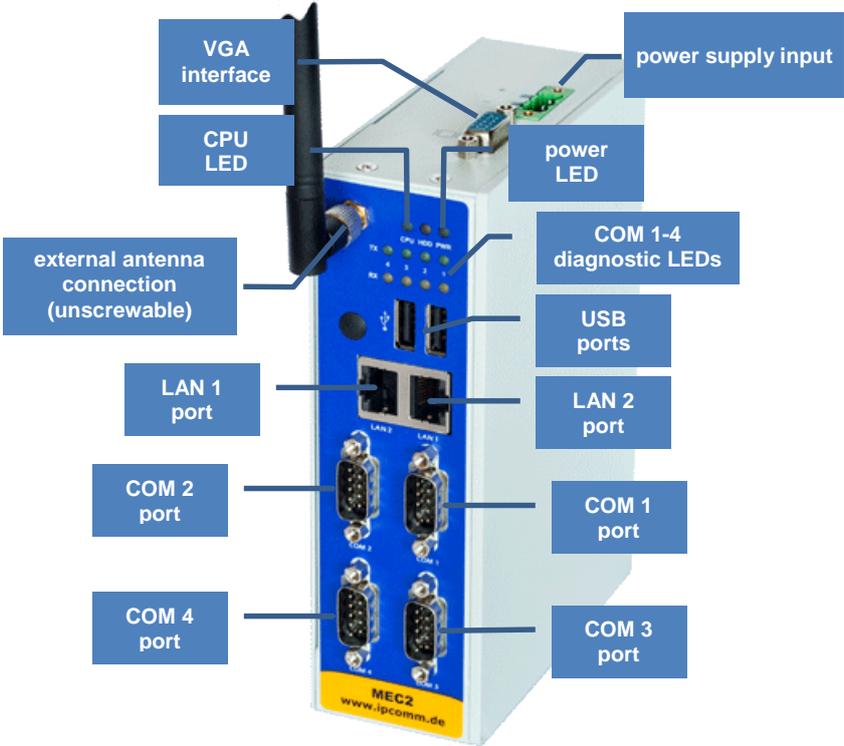


Figure 1: MEC2 front view

Figure 1 shows the MEC2 variant with a GPRS/UMTS cellular modem module incl. antenna and SIM socket.



Figure 2: MEC2 rear view

2.3 Hardware-Components

2.3.1 Mainboard

The used mainboard is an ultra-compact x86 platform with two integrated network interfaces and four serial interfaces. The systems heart consists of a passively cooled Intel processor with 1.46 GHz and supports up to 4 GB system memory.

Available interfaces:

- 4 x RS-232
- 2 x LAN
- 2 x USB
- VGA
- GPRS/UMTS cellular modem module incl. antenna (optional)
- PROFIBUS / PROFINET interface (optionally)

2.3.2 Onboard RS-232/422/485 Interfaces

COM 1 – 4

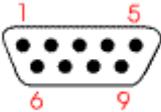
SERIAL PORT DB9 male connector		Pin	RS-232	RS-422	RS-485
		1	DCD	TX-	DATA-
		2	RXD	TX+	DATA+
		3	TXD	RX+	---
		4	DTR	RX-	---
		5	GND	GND	GND
		6	DSR	---	---
		7	RTS	---	---
		8	CTS	---	---
		9	RI	---	---

Figure 3: pin assignment

COM 1-4 are software configurable as RS-232/RS-422/RS-485 interface.

Transmit and receive LEDs of the COM ports are at the front (see [figure 1](#)).

2.3.3 Network Interfaces

The embedded controller has two 10/100/1000 Mbps BaseT (RJ45) interfaces.

2.3.4 CompactFlash

The CompactFlash card serves as a mass storage device, i.e. for storing the operating system, the applications and configuration data.

The advantage over a hard drive is the elimination of rotating parts. Thus the reliability can be much increased. The CompactFlash has an MTBF of at least $\geq 4.000.000$ hours.

In case it is required to change the CompactFlash the following steps must be performed:

CAUTION: The change of a CompactFlash requires ESD safety measures to avoid charge transfer to conductor plate and system components. Please do this only on an earthed and conductive surface when using an antistatic wrist strap!

1. Disconnect the embedded controller from mains; disconnect data lines.
2. Remove the device from DIN-RAIL.
3. Unscrew and lift the housing cover by loosening the corresponding six screws. It is recommended to use a PH2 screwdriver.

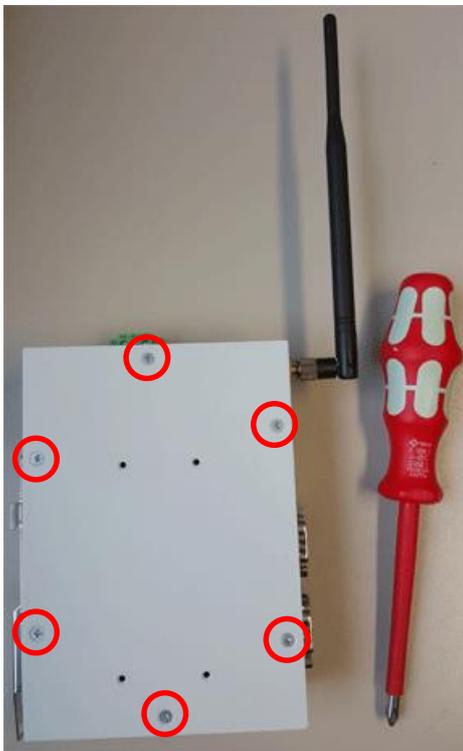


Figure 4: loosening screws

4. Pull out the CompactFlash of the slot with the plastic flag.

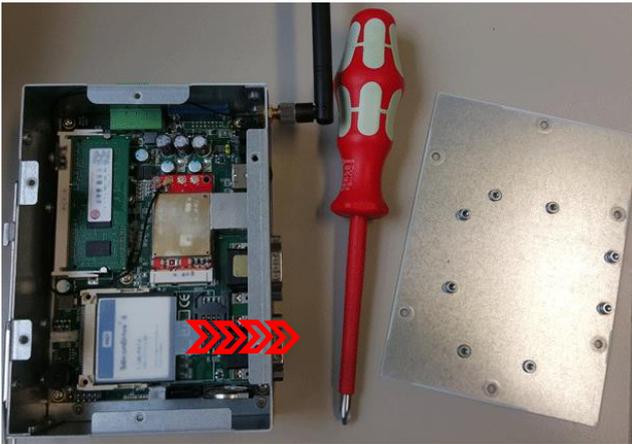


Figure 5: change of CompactFlash

5. Insert the new CompactFlash in reverse direction into the slot until stop and screw housing cover.
6. Put the DIN-rail embedded controller back into operation.

2.3.5 Mini SIM Card

Open the housing as described in chapter 2.3.4 (steps 1 to 4) and pull out the CompactFlash in order to insert or to change the Mini SIM card. It is necessary to remove the CompactFlash to reach the SIM socket.

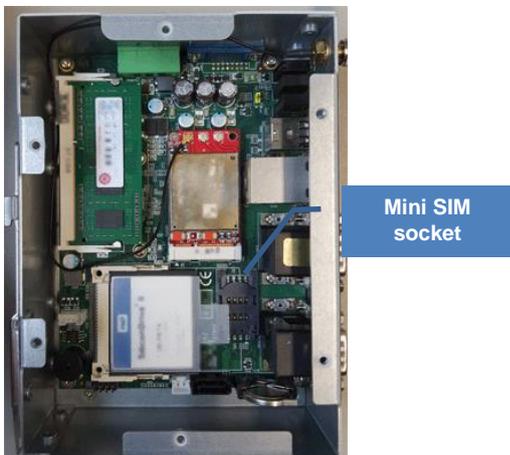


Figure 6: Mini SIM socket

Unlock the socket, insert the Mini-SIM card with the pins downwards and lock the socket again.

Insert the CompactFlash as described in chapter 2.3.4 (step 5) and put on and screw the housing cover.

2.3.6 CMOS Lithium Battery

The battery-backed CMOS stores the BIOS system settings.
The long-life Lithium battery has normally a lifetime of at least 5 years.

If the CMOS battery is empty and the CMOS information deleted, the CMOS-RAM is programmed by the BIOS with default settings.

The converter works faultlessly even if the battery does not provide the CMOS RAM. Synchronizing (NTP) date and time is necessary after battery change. In case the protocol converter is time synchronized, the system has date and time available without battery as well.

Only a qualified electronics technician should perform the battery replacement. However, there is the possibility to engage IPCOMM GmbH with that. Incorrect replacement might cause the danger of explosion. Replace the battery exclusively by the same type (3 V DC, CR2032). Used batteries are to be disposed absolutely in accordance with the manufacturer's instructions.

Contact IPCOMM GmbH to order a low priced spare battery.

First, carry out the steps described in chapter 2.3.4 (steps 1 to 3) to change the battery.

CAUTION: The device must be zero potential. The change of a CompactFlash requires ESD safety measures to avoid charge transfer to conductor plate and system components. Please do this only on an earthed and conductive surface when using an antistatic wrist strap!

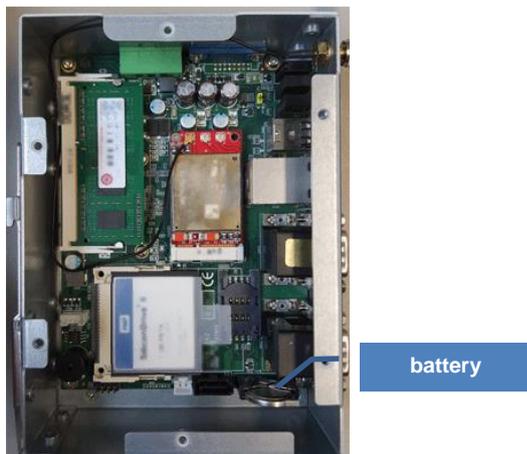


Figure 7: battery

Please pay attention to the correct polarity!

2.3.7 Power Supply

MEC2 operates with different power supplies. Please pay attention to the correct polarity and input voltage.

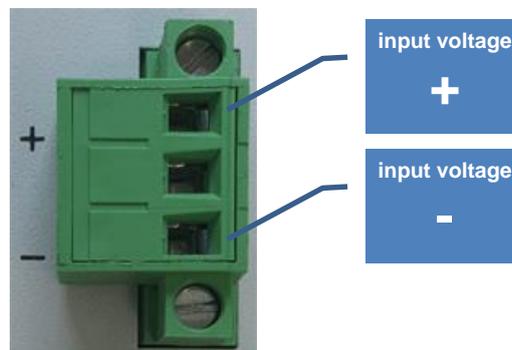


Figure 8: power supply connection

The device is always equipped with a connector. Please, use this connector exclusively. The connection to the voltages source must be poled correctly. The wire cross section must be at least 0.5 mm².

The connector is fixed to the housing with 2 screws.



Figure 9: connector for power supply

3 Diagnostic

3.1 CPU

The CPU-LED visualizes the status of the operating system and the converter software. The following figure shows the possible operating states:

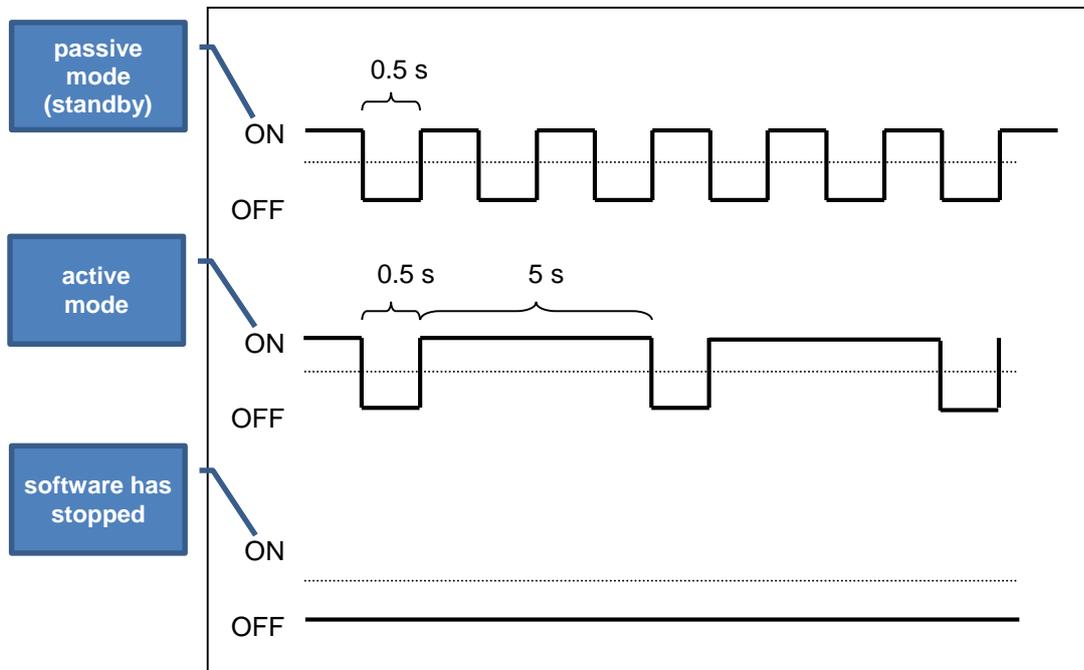


Figure 10: CPU LED display

3.2 PROFIBUS-DP

3.2.1 PROFIBUS-DP Interface

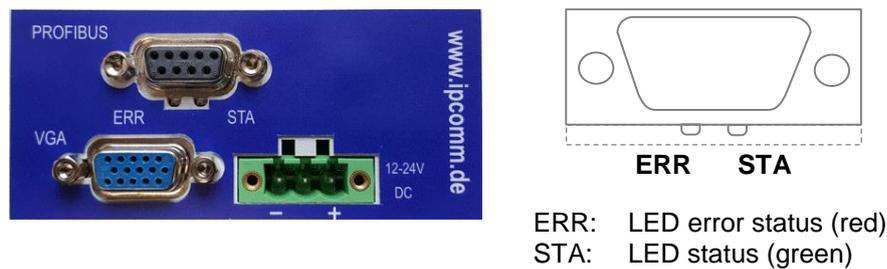


Figure 11: front view or LED displays of the PROFIBUS interface (AIFX-DP)

3.2.2 PROFIBUS-DP Master

With regard to the PROFIBUS DP master protocol the communication LEDs **STA** and **ERR** can assume the following different states:

LED	Color	State	Meaning
cifX with 2 Communication Status LEDs (AIFX-DP is connected or for prior hardware revisions)			
STA	LED green		
	 (green)	on	Communication to all slaves is established
	 (green)	flashing (5 Hz)	PROFIBUS is configured, but bus communication is not yet released from the application.
	 (green)	flashing acyclic	No or faulty configuration
	 (off)	off	<i>Red LED is off:</i> The device is switched off or there is no voltage. <i>red LED flashes or state „on“:</i> see description of „LED red“
ERR	LED red		
	 (off)	off	See description of „LED green“
	 (red)	flashing (5 Hz)	Communication to at least one slave is disconnected.
	 (red)	on	Communication to all Slaves is disconnected or another serious error has occurred. Redundant Mode: The active Master was not found.

Table 1: LED states of the PROFIBUS DP master protocol – two communication state LEDs (AIFX-DP connected or older hardware revision)

LED states	Definition
On	The LED is constantly on.
Off	The LED is constantly off.
Flashing (5 Hz)	The LED turns on and off with a frequency of 5 Hz: on for 100 ms, followed by off for 100 ms.
Flashing acyclic	The LED turns on and off at irregular intervals.

Table 2: definitions of the PROFIBUS DP master protocol LED states

3.2.3 PROFIBUS-DP Slave

With regard to the PROFIBUS DP slave protocol the communication LEDs **STA** and **ERR** can assume the following different states:

LED	Color	State	Meaning
cifX with 2 Communication Status LEDs (AIFX-DP is connected or for prior hardware revisions)			
STA	LED green		
	 (green)	on	RUN, cyclic communication
	 (green)	flashing (2 Hz)	Master has the state CLEAR.
	 (off)	off	<i>Red LED is off:</i> The device is switched off or there is no voltage. <i>red LED flashes or state „on“:</i> see description of „LED red“
ERR	LED red		
	 (off)	off	See description of „LED green“
	 (red)	flashing acyclic (1 Hz)	Device is not configured.
	 (red)	flashing cyclic (2 Hz)	STOP, no communication, connection error
	 (red)	on	Wrong configuration at PROFIBUS-DP side

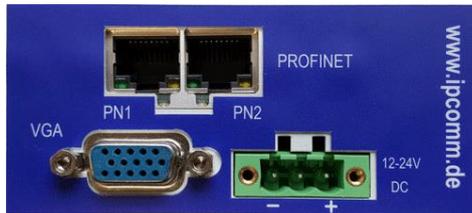
Table 3: LED states of the PROFIBUS DP slave protocol – two communication state LEDs (AIFX-DP connected or older hardware revision)

LED states	Definition
On	The LED is constantly on.
Off	The LED is constantly off.
Flashing acyclic (1 Hz)	The LED turns on and off at irregular intervals with a frequency of 1 Hz: on for 750 ms, followed by off for 250 ms.
Flashing (2 Hz)	The LED turns on and off with a frequency of 2 Hz: on for 250 ms, followed by off for 250 ms.

Table 4: definitions of the PROFIBUS DP slave protocol LED states

3.3 PROFINET

3.3.1 PROFINET Schnittstelle



PN1: communication status LED 0 (red/green)
PN2: communication status LED 1 (red/green)

Figure 12: front view or LED displays of the Ethernet interface (AIFX-RE)

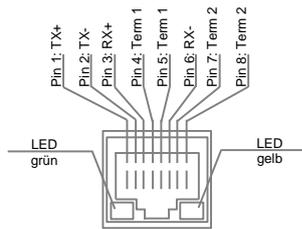


Figure 13: Ethernet RJ45 female connector

3.3.2 PROFINET IO-Controller / Master

With regard to the PROFINET IO-controller protocol the communication LEDs **SF** and **BF** as well as the Ethernet LEDs **LINK** and **RX/TX** can assume the following different states:

LED	Color	State	Meaning
SF (system error) General naming: PN1	Duo-LED red/green		
	 (off)	off	No error
	 (red)	flashing (1 Hz, 3 s)	DCP signal service is triggered via the bus.
	 (red)	flashing (2 Hz)	System error: invalid configuration, Watchdog error or internal error
	 (red)	on (<i>together with BF „red ON“</i>)	No valid master license
BF (bus error) General naming: PN2	Duo-LED red/green		
	 (off)	off	No error
	 (red)	flashing (2 Hz)	Configuration fault: not all configured IO devices are connected.
	 (red)	on (<i>together with SF „red ON“</i>)	No valid master license
	 (red)	on (<i>together with SF „red OFF“</i>)	No connection: no link
LINK Ch0 & Ch1	LED green		
	 (green)	on	A connection to the Ethernet exists.
	 (off)	off	The device has no connection to the Ethernet.
RX/TX Ch0 & Ch1	LED yellow		
	 (yellow)	flickering (load-dependent)	The device sends/receives Ethernet frames.
	 (off)	off	The device does not send/receive Ethernet frames.

Table 5: LED states of the PROFINET IO controller protocol

LED states	Definition
ON	The LED is constantly on.
OFF	The LED is constantly off.
Flashing (1 Hz, 3 s)	The LED turns on and off for three seconds and with a frequency of 1 Hz: on for 500 ms, followed by off for 500 ms.
Flashing (2 Hz)	The LED turns on and off with a frequency of 2 Hz: on for 250 ms, followed by off for 250 ms.
Flickering (load-dependent)	The LED turns on and off with a frequency of 10 Hz indicating high Ethernet activity: on for 50 ms, followed by off for 50 ms. The LED turns on and off at irregular intervals to indicate low Ethernet activity.

Table 6: definitions of the PROFINET IO controller protocol LED states

3.3.3 PROFINET IO Device / Slave

With regard to the PROFINET IO-device protocol the communication LEDs **SF** and **BF** as well as the Ethernet LEDs **LINK** and **RX/TX** can assume the following different states:

LED	Color	State	Meaning
SF (system error) General naming: PN1	Duo-LED red/green		
	 (off)	off	No error
	 (red)	flashing (1 Hz, 3 s)	DCP signal service is triggered via the bus.
	 (red)	on	Watchdog timeout; channel, generic or extended diagnosis present; system error
BF (bus error) General naming: PN2	Duo-LED red/green		
	 (off)	off	No error
	 (red)	flashing (2 Hz)	No data exchange
	 (red)	on	No configuration ; or low speed physical link; or no physical link
LINK Ch0 & Ch1	LED green		
	 (green)	on	A connection to the Ethernet exists.
	 (off)	off	The device has no connection to the Ethernet.
RX/TX Ch0 & Ch1	LED yellow		
	 (yellow)	flickering (load-dependent)	The device sends/receives Ethernet frames.
	 (off)	off	The device does not send/receive Ethernet frames.

Table 7: LED states of the PROFINET IO device protocol

LED states	Definition
On	The LED is constantly on.
Off	The LED is constantly off.
Flashing (1 Hz, 3 s)	The LED turns on and off for three seconds and with a frequency of 1 Hz: on for 500 ms, followed by off for 500 ms.
Flashing (2 Hz)	The LED turns on and off with a frequency of 2 Hz: on for 250 ms, followed by off for 250 ms.
Flickering (load-dependent)	The LED turns on and off with a frequency of 10 Hz indicating high Ethernet activity: on for 50 ms, followed by off for 50 ms. The LED turns on and off at irregular intervals to indicate low Ethernet activity.

Table 8: definitions of the PROFINET IO device protocol LED states

4 Technical Data

General

- No rotating parts

Processor

- Intel Atom 1.46 GHz processor, fanless

Dynamic memory

- DDRIII RAM, max. 4,096 MByte

Additional modules (optionally)

- PROFIBUS (master / slave)
- PROFINET (master / slave)
- Wireless GPRS/UMTS cellular modem
incl. antenna and SIM socket

Standard system I/O outlet

- 4 x 9-pin D-SUB male for RS-232/422/485
- 1 x CompactFlash
- 2 x LAN RJ-45 10/100/1000 Base-T
- 2 x USB
- 1 x 15-pin D-SUB female for VGA

Further system I/O interfaces (optionally)

- PROFIBUS DP interface
DP master or DP slave
 - Max. 125 slaves
 - 1 x RS-485, DB9 male connector
 - Potential-free
 - 9,6 Kbit/s to 12 Mbit/s
 - Inputs and outputs: max. 244 Bytes per slave
 - DPV0 / DPV1 Class1 & Class 2
- PROFINET IO interface
master (IO controller) or slave (IO device)
 - Max. 128 server (IO device)
 - 2 x industrial Ethernet, RJ45 female connector
 - Potential-free
 - 10BASE-T/100BASE-TX
 - Inputs and outputs: max. 1440 Bytes per server
 - IO device V3.5.35 – V3.5.x

Diagnostic LEDs

- Power
- Software state (CPU-LED)
- Link and activity for LAN interfaces
- Transmit and receive LEDs for RS-232 interfaces (COM 1 to COM 4)
- PROFIBUS (STA, ERR)
- PROFINET (SF, BF, LINK, RX/TX)

Mass storage

- CompactFlash, Industrial – Grade
- Removeable flash card
- SLC NAND
- No moving parts
- Max. 64 GB storage capacity supported
- Shock: 1,000 G max.
- MTBF > 4,000,000 h
- Bad block scanning/handling
- Wear leveling system
- ECC
- 2,000,000 write/erase cycles

Vibration endurance

- 2g@5-500Hz, amplitude 0.35mm (operation/storage/transport)

Wireless industrial cellular modem (optionally available)

- Wireless GPRS/UMTS cellular modem module incl. antenna and mini SIM socket
- Five Bands UMTS/HSPA+ (WCDMA/FDD) (850/800, 900, 1900 and 2100 MHz), Quad-Band GSM (850/900/1800/1900 MHz)
- HSDPA Cat. 10 / HSUPA Cat.6 data rates: DL: max. 14.4 Mbps, UL: max. 5.76 Mbps
- EDGE class 12 data rates: DL: max. 237 kbps, UL: max. 237 kbps
- GPRS class 12 data rates: DL: max. 85.6 kbps, UL: max. 85.6 kbps

Additional functions

- Battery buffered real time clock (RTC)
- Watchdog

Power supply

- 12 - 24 V DC ($\pm 20\%$) / 15. W max. (depending on the used type)

Standards

- CE, FCC

Housing

- Aluminum and steel chassis, including clip for mounting on a 35 mm DIN-Rail
- Protection class: IP40

Dimensions

- 48 x 155 x 110 mm (W/H/D)

Weight

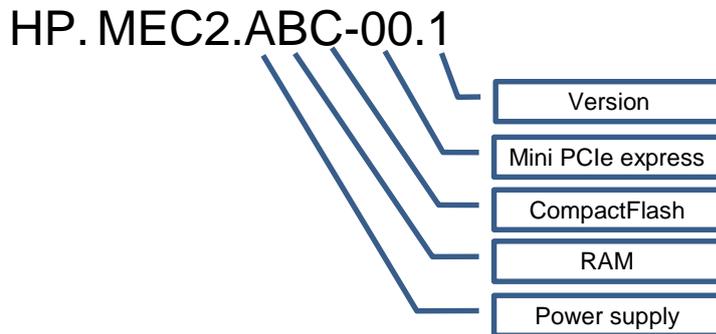
- 1 kg

Operating environment

- Operating temperature: -20°C – 70°C (-20°C - 50°C with PROFIBUS/PROFINET)
- Storage temperature: -40°C – 85°C
- Relative humidity: 5 % to 95 % non-condensing

5 Nomenclature of MEC2 Item Code

The MEC2 item code gives information about the gateway configuration.



Power supply

Value	Description
B	24V DC

RAM

Value	Description
G	2 GB
H	4 GB

CompactFlash

Value	Description
D	1 GB
E	2 GB
F	4 GB

Mini PCI express socket

Value	Description
00	PROFINET card – Hilscher CIFX 90E-RE/ET/F (extended temperature range) - slave
10	PROFIBUS card – Hilscher CIFX 90E-DP/ET/F (extended temperature range) – slave
11	PROFIBUS card – Hilscher CIFX 90E-DP/ET/F (extended temperature range) – master incl. master license HIL
20	GPRS/UMTS module

6 MEC2 CAD-Chart

