

Harmony IIoT Core Box

HMIBSC

User Manual

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www.schneider-electric.com



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All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

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Safety Information



Important Information

NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of this symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result in** minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

DANGER

HAZARD OF ELECTRIC SHOCK

- Do not open product.
- Product to be serviced by qualified people only.

Failure to follow these instructions will result in death or serious injury.

WARNING

UNAUTHENTICATED ACCESS AND SUBSEQUENT UNAUTHORIZED MACHINE OPERATION

- Evaluate whether your environment or your machines are connected to your critical infrastructure and, if so, take appropriate steps in terms of prevention, based on Defense-in-Depth, before connecting the automation system to any network.
- Limit the number of devices connected to a network to the minimum necessary.
- Isolate your industrial network from other networks inside your company.
- Protect any network against unintended access by using firewalls, VPN, or other, proven security measures.
- Monitor activities within your systems.
- Prevent subject devices from direct access or direct link by unauthorized parties or unauthenticated actions.
- Prepare a recovery plan including backup of your system and process information.

Failure to follow these instructions can result in death, serious injury, or equipment damage.



At a Glance

Document Scope

This manual describes the configuration and usage of the Box PC IIoT, part of the range of Harmony Industrial PC, for its cataloged and configured product offers.

The Box PC IIoT are designed to operate in an industrial environment.

1 Cataloged product offer:

- HMIBSCEA53D1L0T - IIoT Edge Box Core eMMC DC Linux TPM
 - 12...24 Vdc
 - ARM-A53 processor
 - 1 GB RAM
 - 8 GB eMMC
 - TPM module
 - Linux Yocto
 - mini PCIe and M.2 slots for optional interface
- HMIBSCEA53D1L01 - IIoT Edge Box Core eMMC DC Linux
 - 12...24 Vdc
 - ARM-A53 processor
 - 1 GB RAM
 - 8 GB eMMC
 - Linux Yocto
 - mini PCIe and M.2 slots for optional interface
- HMIBSCEA53D1L0A - IIoT Edge Box Core eMMC DC Linux
 - 12...24 Vdc
 - ARM-A53 processor
 - 2 GB RAM
 - 64 GB eMMC
 - Linux Yocto
 - mini PCIe and M.2 slots for optional interface
 - Conformal coating

NOTE: The part number for your unit may not be included in the user manual. Commercial part numbers listed in the user manual are for products available when the user manual was published. New part numbers may be added to the product range.

New and existing cataloged part numbers are always composed of a prefix (HMI), followed by a serial arrangement of 12 alphanumeric characters. Each one of the twelve characters matches with one characteristic of the cataloged Box PC IIoT, such as storage device size, storage device type, memory size, and bundled software.

Use the following legend to identify the features that correspond with each character of the part number:

Character number	Prefix	1	2	3	4	5	6	7	8	9	10	11	12
Range name	HMI												
iPC family		B											
Type			S										
Version	IIoT Edge Box			C									
Drive	eMMC				E								
CPU type	ARM-A53					A	5	3					
Power supply	DC								D				
Expansion slots	1 mini PCIe with optional interface									1			
Operating system	Linux										L		
Bundled software	None											0	
Hardware iteration	Initial												1
	Conformal coating												A

2 Configured product offer:

In addition to the catalog offer, other configurations may be available in some countries.

These configured offers use a fixed method of identification. The configured part numbers are always composed of an arrangement of 20 alphanumeric characters. The first 6 characters are always **HMIPCC**. The remaining 14 characters match with one characteristic of the configured Box PC IIoT, such as storage device size, storage device type, memory size, and bundled software.

The configured offers have similar characteristics and functionalities as the cataloged offer described in this manual.

In addition to this part number, a configuration number is printed on the product label.

The configuration number format is as follows:

Character number	Prefix (1-6)	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Part number	HMI PCC														
Form factor	Edge Box Core A53	X													
Product generation	Second generation	2													
Modular displays	None			B											
Box PC IIoT	Box ARM Core DC 1 GB, eMMC 8 GB				7										
	Box ARM Core DC 2 GB, eMMC 64 GB				8										
CPU type	ARM-A53					X									
Power supply	DC						D								

Character number	Prefix (1-6)	7	8	9	10	11	12	13	14	15	16	17	18	19	20
RAM	1 GB							1							
	2 GB							2							
Operating system	Linux Yocto								Y						
Storage device	eMMC (soldered)									4					
Optional interfaces	None										0				
	Interface - M.2 2 x analog input										Y				
	Interface - mini PCIe 8 x analog input										Z				
	Cellular 4G for US										M				
	Cellular 4G for EU /ASIA										N				
	TPM module										L				
Second storage	None											N			
	SD Card industrial grade 16 GB											5			
	SD Card industrial grade 64 GB											6			
Software bundle	None											N			
Reserved	None												0		
Reserved	None														0

NOTE: All instructions applicable to the enclosed product and all safety precautions must be observed.

Validity Note

The technical characteristics of the devices described in the present document also appear online. To access the information online:

Step	Action
1	Go to the Schneider Electric home page www.schneider-electric.com .
2	In the Search box type the reference of a product or the name of a product range. ● Do not include blank spaces in the reference or product range. ● To get information on grouping similar modules, use asterisks (*).
3	If you entered a reference, go to the Product Datasheets search results and click on the reference that interests you. If you entered the name of a product range, go to the Product Ranges search results and click on the product range that interests you.
4	If more than one reference appears in the Products search results, click on the reference that interests you.
5	Depending on the size of your screen, you may need to scroll down to see the datasheet.
6	To save or print a datasheet as a .pdf file, click Download XXX product datasheet .

The characteristics that are presented in the present document should be the same as those characteristics that appear online. In line with our policy of constant improvement, we may revise content over time to improve clarity and accuracy. If you see a difference between the document and online information, use the online information as your reference.

Registered trademarks

Linux®, Yocto Project® are registered trademarks of Linux Foundation in the United States and/or other countries.

Intel®, Cortex®, ARM® are registered trademarks of Intel corporation.

Hazardous Location

The Box PC IIoT (HMIBSC) are not classified for used in hazardous locations.



POTENTIAL FOR EXPLOSION IN HAZARDOUS LOCATION

Do not use these products in hazardous locations.

Failure to follow these instructions will result in death or serious injury.

WARNING

LOSS OF CONTROL

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop.
- Separate or redundant control paths must be provided for critical control functions.
- System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link.⁽¹⁾
- Each implementation of a Harmony Industrial PC must be individually and thoroughly tested for proper operation before being placed into service.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

⁽¹⁾ For additional information, refer to *NEMA ICS 1.1 (latest edition), "Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control"* and to *NEMA ICS 7.1 (latest edition), "Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems"* or other applicable standards in your location.

NOTE: The Box PC IIoT are a highly configurable device and is not based on a real-time operating system. Changes to the software and settings of the following must be considered new implementations as described in the previous warning messages. Examples of such changes include:

- Linux system
- IIoT
- Operating system
- Installed hardware
- Installed software

NOTE: The Operating System includes security protection for SD card. When using some device, system may experience issue. Resolution is available here: http://www.schneider-electric.com/en/faqs/index?page=content&id=FA290340&actp=search&viewlocale=en_US&searchid=1469171130324#highlight

WARNING

UNINTENDED EQUIPMENT OPERATION

Use only Schneider Electric software with the devices described in this manual.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

DANGER

EXPLOSION HAZARD

For battery replacement, contact the field services department.

Failure to follow these instructions will result in death or serious injury.

WARNING

POWER SUPPLY

You must use a Listed Power Adapter or DC power source, rated 12-24Vdc, 1.5A minimum and Tma 55 degree C with this product. If further assistance is needed, contact Schneider Electric.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Connection for AC mains

Prerequisites

- Power installation must be performed with qualified electrician and followed with National Electrical Code, ANSI/NFPA 70 and Canadian Electrical Code, Part I, CSA C22.1
- Use No.14 AWG, 75°C solid copper wire with RHW, THHW, THW, THWN, XHHW, USE or ZW type pressure terminal connector and 4.5lb-in torque force when connecting to terminal block.
- Connected mains shall be built branch circuit breaker which possessed 20 A of current rating.

To connect AC mains

Step	Action
1	Turn OFF AC mains by branch circuit breaker of building and the equipment.
2	Ensure AC mains connected earthed cable to the building.
3	Ensure power cable from AC mains to AC IN connector with an earthed cable which is of AWG14 minimum green-and-yellow wire.
4	Connect signal cables to the equipment.
5	Ensure correct terminals, then connect power cable to the equipment.
6	Connect the power cable to the terminal block of AC mains.
7	Turn ON AC mains by branch circuit breaker of building and the equipment.

To disconnect AC mains

Step	Action
1	Turn OFF AC mains by branch circuit breaker of building and the equipment.
2	Disconnect the power cable from AC mains and the equipment.
3	Remove the signal cables from the connectors.

Chapter 1

Important Information

General

This chapter describes specific aspects related to the operation of the Harmony Box iPC.

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
FCC Radio Frequency Interference Statement for USA.	14
Certifications and Standards	15

FCC Radio Frequency Interference Statement for USA.

Federal Communications Commission (FCC) Radio Interference Information

This equipment has been tested and found to comply with the federal communications commission (FCC) limits for a Class A digital device, according to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a commercial, industrial, or business environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause or be subject to interference with radio communications. To minimize the possibility of electromagnetic interference in your application, observe the following two rules:

- Install and operate the Harmony Industrial PC in such a manner that it does not radiate sufficient electromagnetic energy to cause interference in nearby devices.
- Install and test the Harmony Industrial PC to ensure that the electromagnetic energy generated by nearby devices does not interfere with the Harmony Industrial PC's operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this product.

FCC RF Radiation Exposure Statement

- This Transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
- This equipment complies with RF radiation exposure limits set forth for an uncontrolled environment.
- This equipment should be installed and operated with a minimum distance of 20 cm between the radiator and your body.

WARNING

ELECTROMAGNETIC / INTERFERENCE

Electromagnetic radiation may disrupt the Harmony Industrial PC's operations, leading to unintended equipment operation. If electromagnetic interference is detected:

- Increase the distance between the Harmony Industrial PC and the interfering equipment.
- Reorient the Harmony Industrial PC and the interfering equipment.
- Reroute power and communication lines to the Harmony Industrial PC and the interfering equipment.
- Connect the Harmony Industrial PC and the interfering equipment to different power supplies.
- Always use shielded cables when connecting the Harmony Industrial PC to a peripheral device or another computer.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Certifications and Standards

Introduction

Schneider Electric submitted this product for independent testing and qualification by third-party agencies. These agencies have certified this product as meeting the following standards.

NOTE: Always refer to the markings on the product to confirm the certifications.

Certifications

- Underwriters Laboratories Inc., UL 60950, and CSA 60950 (Information Technology Equipment).
- CCC, RCM, and EAC certification. Refer to product markings.

Compliance Standards

Schneider Electric tested this product for compliance with the following compulsory standards:

- United States:
 - Federal Communications Commission, FCC Part 15, Class A
- Europe: CE
 - 2014/53/EU RED Directive, based on EN 301 489-1/-17
In complement, the products have been tested according IEC 60950 and EN 61000-6-2 / EN 61000-6-4
- Australia: RCM
 - Standard AS/NZS CISPR11

RF Certifications

Introduction

Schneider Electric submitted this product for independent testing and qualification by third-party agencies. These agencies have certified this product as meeting the following countries/geographical zones regulations.

CAUTION

EXPOSURE TO RADIO FREQUENCY RADIATION

- This device and its antenna must not be co-located or operating in conjunction with any other antenna or transmitter.
- A separation distance of at least 20 cm (0.79 in) must be maintained between the antenna of this device and all persons.

Failure to follow these instructions can result in injury or equipment damage.

RF certifications

- **RED** for Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Russia, Slovakia, Slovenia, Spain, Sweden, Switzerland, UK
- **FCC RF** for USA
- **IC** for Canada
- **SRRC** for China
- **TELEC** for Japan
- **RCM** for Australia, New Zealand

The detailed documentation for these certifications can be found @ <https://www.se.com>

If your country is not in this list, in case of issue, please contact our support to troubleshoot:
<https://www.se.com>

Qualification Standards

Schneider Electric voluntarily tested this product to additional standards. The additional tests performed, and the standards under which the tests were conducted, are identified in the environmental characteristics.

Hazardous Substances

This product is compliant with:

- WEEE, Directive 2012/19/EU
- RoHS, Directive 2011/65/EU, and 2015/863/EU
- RoHS China, Standard GB/T 26572
- REACH regulation EC 1907/2006

NOTE: Documentation about sustainable development is available on Schneider Electric website (Product Environmental Profile and End of Life Instruction, RoHS, and REACH certificates).

End of Life (Waste Electrical and Electronic Equipment)

The product contains electronic boards. It must be disposed of in specific treatment channels. The product contains cells and/or storage batteries which must be collected and processed separately, when they have run out and at the end of product life (European Directive 2012/19/EU).

Refer to the section Maintenance to extract cells and batteries from the product. These batteries do not contain a weight percentage of heavy metals over the threshold (European Directive 2006/66/CE).

Batteries comply with UN recommendations and IATA requirements.

European (CE) Compliance

The products described in this manual comply with the European Directives concerning Electromagnetic Compatibility and Low Voltage (CE marking) when used as specified in the relevant documentation, in applications for which they are intended, and in connection with approved third-party products.

Canadian Notice

This device contains license-exempt transmitter/receiver that comply with Innovation, Science and Economic Development Canada's license-exempt RSS. Operation is subject to the following two conditions:

- This device may cause interference.
- This device may accept any interference, including interference that may cause undesired operation of the device.

Chapter 2

Physical Overview

Subject of this Chapter

This chapter provides a physical overview of the Box PC IIoT.

What Is in This Chapter?

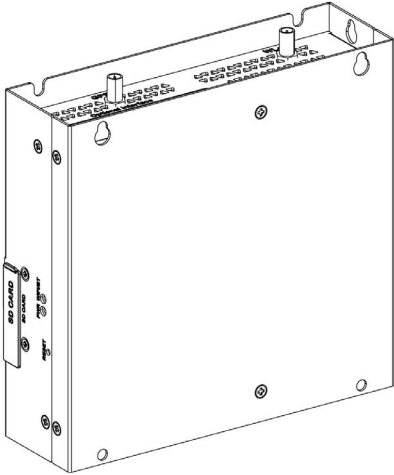
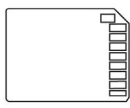
This chapter contains the following topics:

Topic	Page
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Description	22

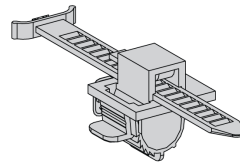
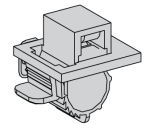
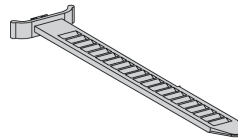
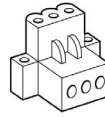
Package Contents

Items of The Box PC IIoT

The following items are included in the package of the Box PC IIoT. Before using the Box PC IIoT, confirm that all items listed here are present:

Box PC IIoT	
● Recovery media containing the software required to reinstall the operating system. Additional drivers are in the recovery media ● Chinese user manual ● "Before using this product" flyer ● Chinese RoHS flyer	Flyer + 

- 1 x DC terminal block: 3-pin power connector
- 1 x wire for chassis ground
- 2 X Flexible HDMI/USB lockers
- 1 x GPIO terminal block
- 4 x screws and 4 x washers



The Box PC IIoT has been carefully packed, with special attention to quality. However, should you find anything damaged or missing, contact your local distributor immediately.

Description

Introduction

During operation, the surface temperature of the heat sink may exceed 70 °C (158 °F).

⚠ WARNING

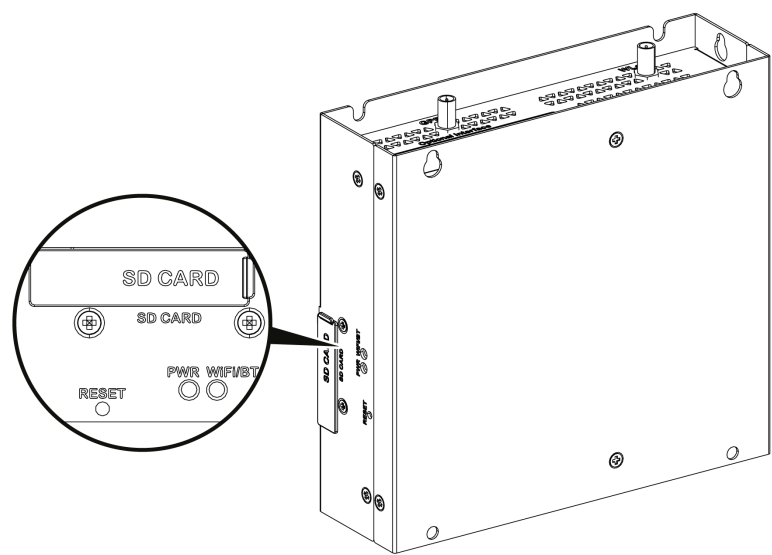
RISK OF BURNS

Do not touch the surface of the heat sink during operation.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Standard Description

Overview

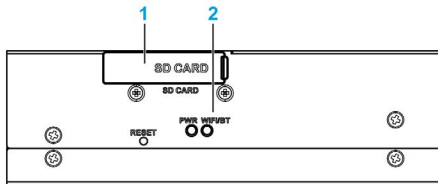


Reset button and LEDs

The table describes the meaning of the status LEDs:

Marking	Color	State	Meaning
PWR	Green	On	Active (user operates OS) (state S0).
WiFi/BT	Green	Off	No WiFi/BT data transmission.
		On	Data transmission.

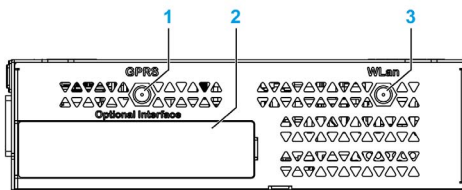
Front View



- 1 SD card socket
- 2 LEDs and reset button

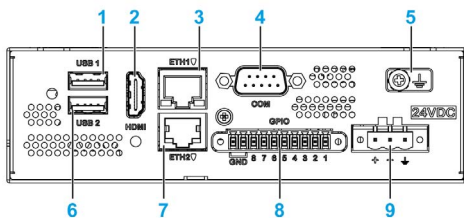
NOTE: The regular installation of the default OS has to be made with the SD card.

Top View



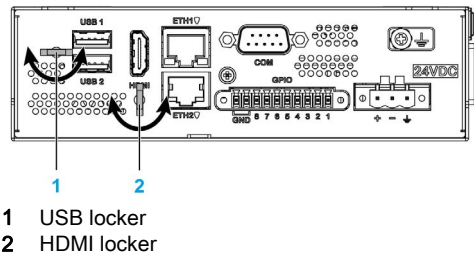
- 1 SMA connector for the GPRS/4G external antenna
- 2 Optional interface
- 3 SMA connector for the WLAN external antenna

Bottom View



- 1 USB1 (USB 2.0)
- 2 HDMI port
- 3 ETH1 (10/100/1000 Mb/s)
- 4 COM port RS-232 (default), RS-232/422/485 (non-isolated)
- 5 Ground connection pin
- 6 USB2 (USB 2.0)
- 7 ETH2 (10/100/1000 Mb/s)
- 8 GPIO
- 9 DC power connector

HDMI and USB Locker



Chapter 3

Characteristics

Subject of this Chapter

This chapter lists the product characteristics.

What Is in This Chapter?

This chapter contains the following topics:

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Power Supply Characteristics	28
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Box iPC Characteristics

Characteristics

Element	Characteristics
Processor	ARM-A53 Qualcomm ARM® Cortex®-A53 Qualcomm Snapdragon 410 (APQ8016) Quad core up to 1.2 GHz
Memory	1 GB or 2 GB, LPDDR3: maximum transfer data rate 533 MHz, 1066 MTs
Storage memory	8 GB or 64 GB, eMMC: maximum raw transfer rate 200 MBps
Buzzer	No
Cooling method	Natural air flow
Weight	1 kg (2.2 lbs)

Serial Interface

Element	Characteristics
Type	RS-232 (default), RS-422/485 (non-isolated)
Transfer rate	Maximum 115.2 kbps
Connection	D-Sub 9-pin, plug

NOTE: The serial interface COM port default setting is with RS-232. Refer to the software configuration ([see page 117](#)) to set RS-422 or RS-485.

USB Interface

Element	Characteristics
Type	USB 2.0
Transfer rate	Low speed (1.5 Mb/s), full speed (12 Mb/s), high speed (480 Mb/s)
Current load	Maximum 0.5 A per connection
Connection	Type A

Ethernet Interface

Element	Characteristics
Type	RJ45
Speed	10/100/1000 Mb/s base-T

HDMI Port

Element	Characteristics
HDMI	1920 x 1080 at 60 Hz, HDCP 1.3
Encode	30 fps 720 p (H.264 Baseline/MPEG-4) 30 fps 1080 p (MPEG-4/H.264/VP8/H.263)
Decode	30 fps 1080 p (MPEG-4/H.264/H.263/DivX/MPEG2/VC1/Soreson/VP8)

GPIO

The general-purpose input/output (GPIO) has eight channels with digital input and output (DIO). The characteristic is 3.3 Vdc TTL.

Wi-Fi

WCN3620 802.11 b/g/n 2.4 GHz.

Bluetooth

WCN3620 Bluetooth 4.1.

SD Socket

SD 3.0, max raw transfer rate 104 MBps, support SD,SDHC,SDXC (Standard SD: 32 x 24 mm).

mini_PCl_e Card

USB 2.0: max raw transfer rate 480 MBps.

M.2 Card

M.2 2230 key.E (cannot support storage), USB 2.0: max raw transfer rate 480 MBps.

Conformal Coating (HMIBSCEA53D100A - IIoT Edge Box iPC - Base Unit)

Conformal coating is used for assembly process on:

- Single motherboard

Board coating scope excludes:

- connectors
- screw holes (standoffs)
- chipsets
- RTC battery
- dip switches
- labels

NOTE: The conformal coating is available according to the product configuration

Power Supply Characteristics

Box PC IIoT DC Power Supply

Element	Characteristics
Rated voltage	24 Vdc (12...24 Vdc)
Inrush current	0.43 A
Power consumption	16 W

Environmental Characteristics

Characteristics

Characteristics	Value
Pollution degree	For use in pollution degree 2 environment
Operating temperature	0...50 °C (32...122 °F) Optional interface installed: limited to 45 °C (113 °F)
Operating temperature for horizontal mounting	0...50 °C (32...122 °F) mini PCIe installed: limited to 45 °C (113 °F)
Storage temperature	-20...60 °C (-4...140 °F)
Operating altitude	2,000 m (6,560 ft) max
Random vibration	5...500 Hz: 2 G _{rms}
Storage humidity	10...95 % RH at 40 °C (104 °F), no condensation
Operating humidity	10...95 % RH at 40 °C (104 °F), no condensation

Chapter 4

Installation

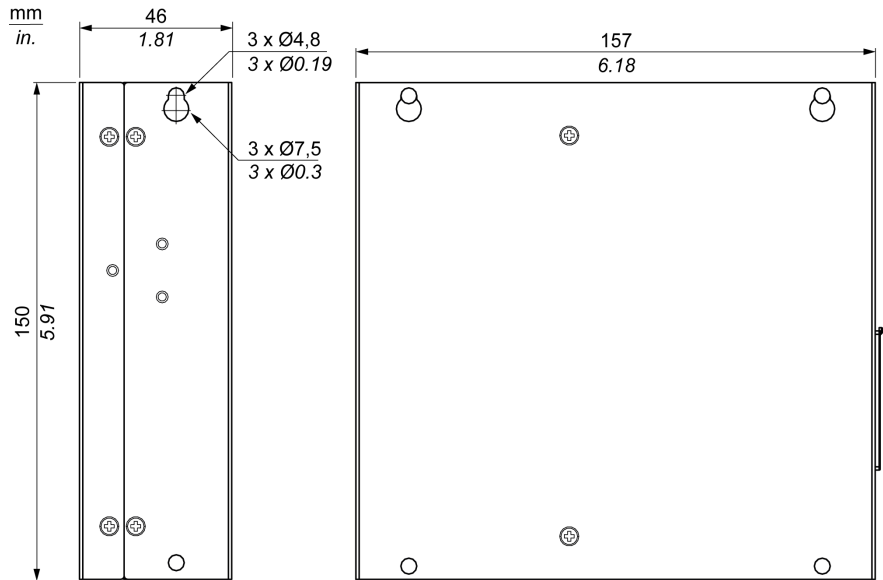
What Is in This Chapter?

This chapter contains the following topics:

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Dimensions

Dimensions



Dimensional Tolerances

The table indicates the general tolerance for the dimensions:

Nominal measurement range	General tolerance acc. DIN ISO 2768 medium
up to 6 mm (up to 0.236 in)	±0.1 mm (±0.004 in)
6...30 mm (0.236...1.181 in)	±0.2 mm (±0.0078 in)
30...80 mm (1.181...3.149 in)	±0.25 mm (±0.0098 in)
80...180 mm (3.149...7.08 in)	±0.3 mm (±0.012 in)

Installation

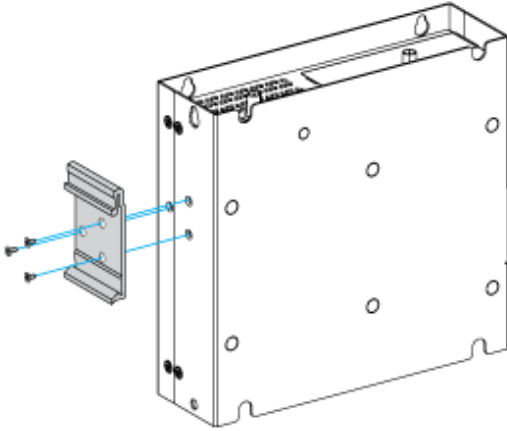
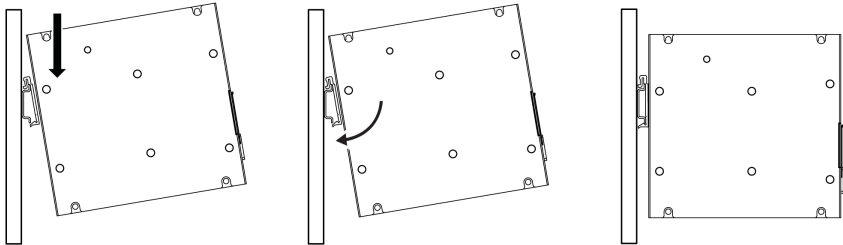
Installation of the Box PC IIoT

Follow these steps for installation:

Step	Action
1	Remove the power and confirm that the power supply is disconnected from its power source.
2	Wall mounting: Fasten the Box PC IIoT on the cabinet with four M4 hex screws (8 mm (0.31 in)). Book mounting: Fasten the Box PC IIoT on the cabinet with two M4 hex screws (8 mm (0.31 in)). NOTE: The recommended torque to tighten these screws is 0.5 Nm (4.5 lb-in). Horizontal mounting: Fasten the Box PC IIoT with four M4 hex screws (8 mm (0.31 in)): NOTE: • The horizontal mounting is allowed with a temperature derating. See Environmental Characteristics (see page 29). • For correct heat dissipation when horizontal mounting, the marking is at the bottom. • Use screw driver less than 4.5 mm for Hex socket cap screws provided. • The recommended torque to tighten these screws is 0.5 Nm (4.5 lb-in).

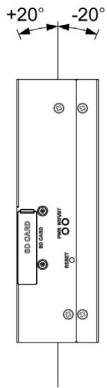
Installation Din-Rail Mounting of the Box PC IIoT

Follow these steps for installation:

Step	Action
1	Remove the power and confirm that the power supply is disconnected from its power source.
2	Fasten the Din-rail bracket (HMIYADBMODIN11) to the Box PC IIoT with three M3 screws (6 mm (0.23 in)): 
3	Hook the Box PC IIoT with bracket on the mounting rail: 

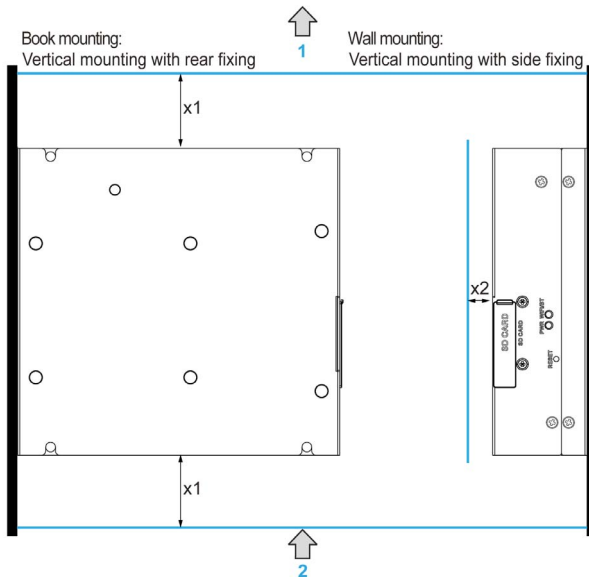
Mounting Orientation

The figure shows the allowed mounting orientation for the Box PC IIoT:

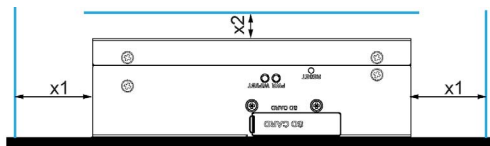


Spacing Requirements

In order to provide sufficient air circulation, mount the Box PC IIoT so that the spacing on the top, bottom, and side is as follows:



- 1 Air out
- 2 Air in
- x1 > 100 mm (3.93 in)
- x2 > 50 mm (1.96 in)



x1 > 100 mm (3.93 in)

x2 > 50 mm (1.96 in)

Chapter 5

Connections

Subject of This Chapter

This chapter describes the connection of the Box iPC to the main power supply. It also describes the USB ports and identifies the serial interface pin assignments.

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
Grounding	38
Connecting the DC Power Cord	41
AC Power Supply Module Description	43
AC Power Supply Module Installation	46
UPS Module - Description and Installation	52
Interface Connections	62

Grounding

Overview

The grounding resistance between the Box PC IIoT ground wire and the ground must be 100 Ω or less. When using a long grounding wire, check the resistance and, if required, replace the wire with a thicker wire and place it in a duct.

The table shows the maximum length for the wires:

Wire cross-section	Maximum line length
1.3 mm ² (AWG 16)	30 m (98 ft)
	60 m (196 ft) round trip

Grounding Procedure



WARNING

UNINTENDED EQUIPMENT OPERATION

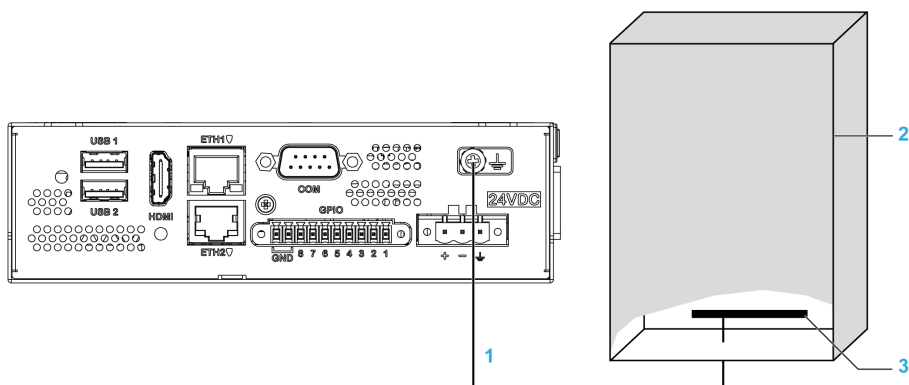
- Use only the authorized grounding configurations shown below.
- Confirm that the grounding resistance is 100 Ω or less.
- Test the quality of your ground connection before applying power to the device. Excessive noise on the ground line can disrupt operations of the Harmony Industrial PC.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

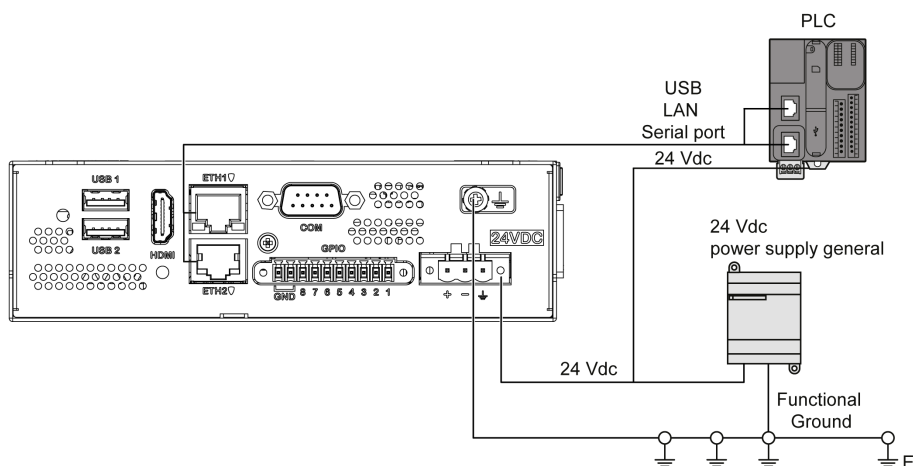
The Box PC IIoT ground have 2 connections:

- DC Supply voltage
- Ground connection pin

The Box PC IIoT connections:



- 1 Ground connection pin (functional ground connection pin)
- 2 Switching cabinet
- 3 Grounding strip



When grounding, follow this procedure:

Step	Action
1	Ensure all of the following is done for the system wiring: ● Connect the cabinet to ground. ● Ensure that all cabinets are grounded together. ● Connect the ground of the power supply to the cabinet. ● Connect the ground pin of the Box PC IIoT to the cabinet. ● Connect the I/O to the controller if needed. ● Connect the power supply to the Box PC IIoT.
2	Check that the grounding resistance is 100 Ω or less.
3	When connecting the SG line to another device, ensure that the design of the system/connection does not produce a ground loop. NOTE: The SG and ground connection screw are connected internally in the Box PC IIoT.
4	Use 1.3 mm ² (AWG 16) wire to make the ground connection. Create the connection point as close to the Box PC IIoT as possible and make the wire as short as possible.

Grounding I/O Signal Lines

The Box PC IIoT (HMIBSC) are not classified for use in hazardous locations.

 **DANGER**

POTENTIAL FOR EXPLOSION IN HAZARDOUS LOCATION

Do not use these products in hazardous locations.

Failure to follow these instructions will result in death or serious injury.

Electromagnetic radiation may interfere with the control communications of the Box PC IIoT.

 **WARNING**

UNINTENDED EQUIPMENT OPERATION

- If wiring of I/O lines near power lines or radio equipment is unavoidable, use shielded cables and ground one end of the shield to the Harmony Industrial PC ground connection screw.
- Do not wire I/O lines in proximity to power cables, radio devices, or other equipment that may cause electromagnetic interference.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Connecting the DC Power Cord

Precaution

When connecting the power cord to the power connector on the Box iPC, first ensure that the power cord is disconnected from the DC power supply.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Remove all power from the device before removing any covers or elements of the system, and prior to installing or removing any accessories, hardware, or cables.
- Unplug the power cable from both the Harmony Industrial PC and the power supply.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace and secure all covers or elements of the system before applying power to the unit.
- Use only the specified voltage when operating the Harmony Industrial PC. The DC unit is designed to use 24 Vdc input.

Failure to follow these instructions will result in death or serious injury.

WARNING

EQUIPMENT DISCONNECTION OR UNINTENDED EQUIPMENT OPERATION

- Ensure that power, communication, and accessory connections do not place excessive stress on the ports. Consider the vibration in the environment.
- Securely attach power, communication, and external accessory cables to the panel or cabinet.
- Use only D-Sub 9-pin connector cables with a locking system in good condition.
- Use only commercially available USB cables.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Wiring and Connecting the Terminal Block of the Box iPC

The table below describes how to connect the power cord to the DC terminal block:

Step	Action
1	Remove all power from the Box iPC and confirm that the DC power supply is disconnected from its power source.
2	Remove the terminal block from the power connector on the Box iPC and connect the power cord to the terminal block: Use copper wire rated for 75 °C (167 °F) with a section of 0.75 to 2.5 mm² (AWG 18 to AWG 14) and use 2.5 mm² wire to make the ground connection.
3	Place the terminal block in the power connector and tighten the screws: NOTE: The recommended torque to tighten these screws is 0.5 Nm (4.5 lb-in).

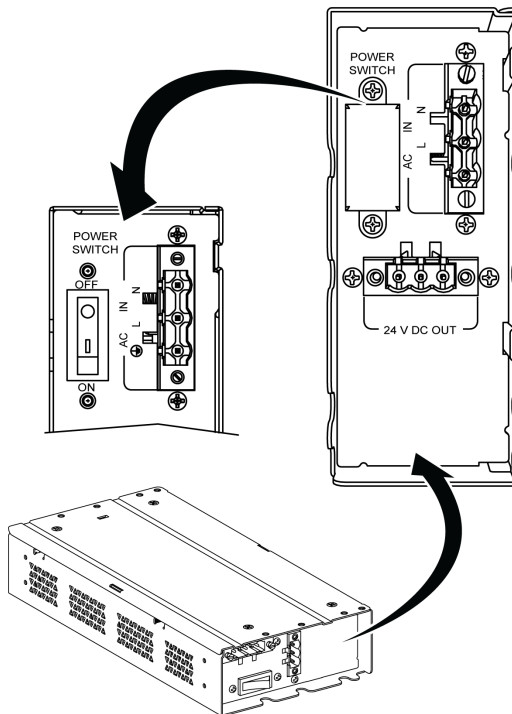
AC Power Supply Module Description

Overview

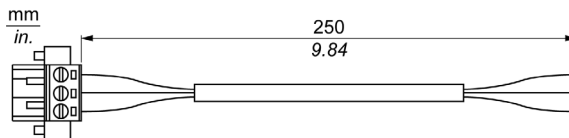
The AC power supply modules HMIYMMAC1 (100 W) or HMIYPSOMAC1 (60 W) can optionally be used with the Box iPC to be operated with 100...240 Vac.

AC Power Supply Module (HMIYMMAC1) Description

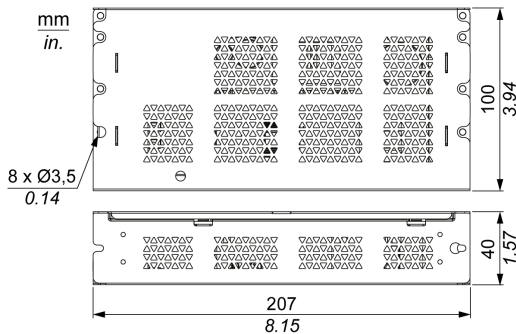
The figure shows the AC power supply module:



The figure shows the DC power cable of the AC power supply module:



The figure shows the dimensions of the AC power supply module:

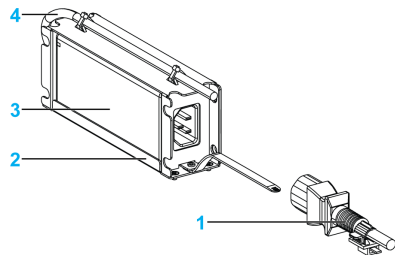


The table gives the technical data of the AC power supply module (PV02):

Features	Values
Nominal input voltage	100...240 Vac
Frequency	47 ...63 Hz
Power switch	Yes
Internal fuse	3.15 A
Nominal output voltage	24 Vdc
Output current	5.5 A maximum
Operation temperature	-20...55 °C (-4...131 °F)
Weight	0.795 kg (1.75 lb)

AC Power Supply Module (HMIYPSOMAC1) Description

This figure shows the AC power supply module:

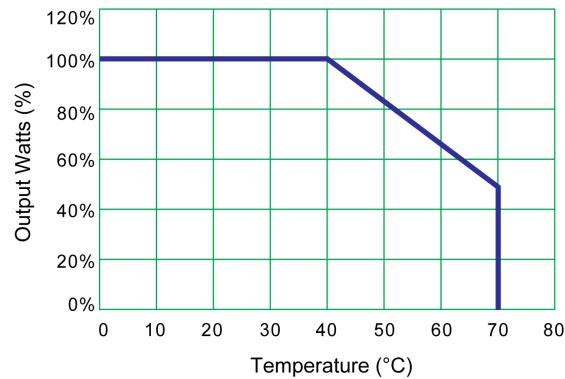


- 1 AC power cord
- 2 Mounting bracket
- 3 AC power supply
- 4 DC power cord

The table provides technical data for the AC power supply module:

Element	Characteristics
Input	90...260 Vac / 47...63 Hz / 1.6 A at 100 Vac
Output	24 Vdc / 2.62 A maximum
Inrush current	70 A at 230 Vac
Environment	
Operation temperature	0...70 °C (32...158 °F), see derating curve
Storage temperature	-40...85 °C (-40...185 °F)
Relative humidity:	0...95 %, non-condensing

Operation temperature of the AC power supply derating curve:



AC Power Supply Module Installation

Installing the AC Power Supply Module (HMIYMMAC1)

Before installing an AC power supply module (HMIYMMAC1), shut down the operating system in an orderly fashion and remove all power from the device.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Remove all power from the device before removing any covers or elements of the system, and prior to installing or removing any accessories, hardware, or cables.
- Unplug the power cable from both the Harmony Industrial PC and the power supply.
- Always use a properly rated voltage sensing device to confirm that power is off.
- Replace and secure all covers or elements of the system before applying power to the unit.
- Use only the specified voltage when operating the Harmony Industrial PC. The AC unit is designed to use 100...240 Vac input.

Failure to follow these instructions will result in death or serious injury.

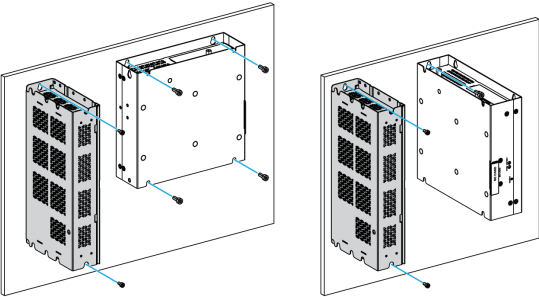
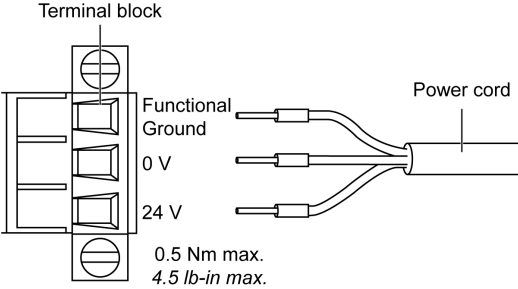
CAUTION

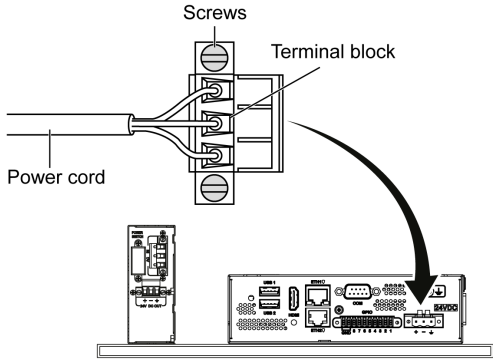
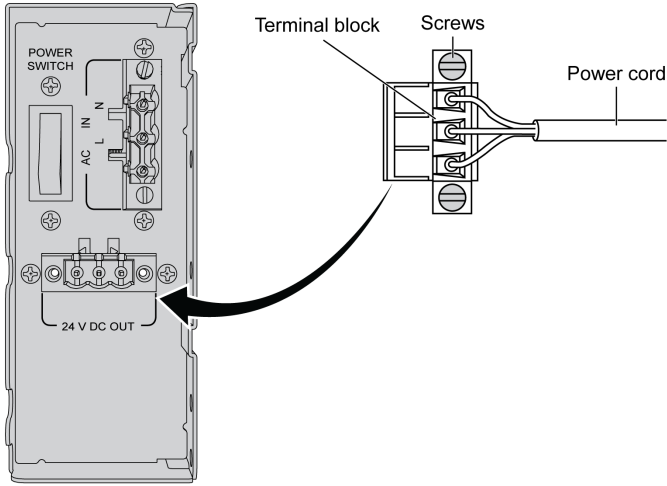
OVERTORQUE AND LOOSE HARDWARE

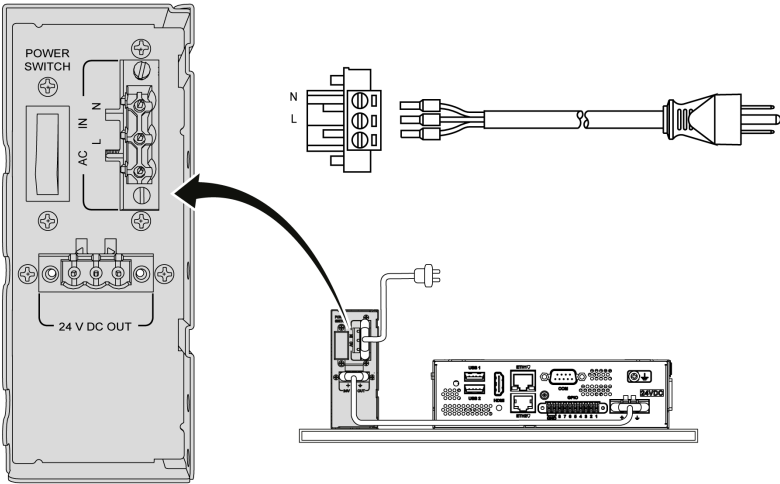
- Do not exert more than 0.5 Nm (4.5 lb-in) of torque when tightening the installation fastener, enclosure, accessory, or terminal block screws. Tightening the screws with excessive force can damage the installation fastener.
- When fastening or removing screws, ensure that they do not fall inside the Harmony Industrial PC chassis.

Failure to follow these instructions can result in injury or equipment damage.

Follow these steps when installing the AC power supply module (HMIYMMAC1):

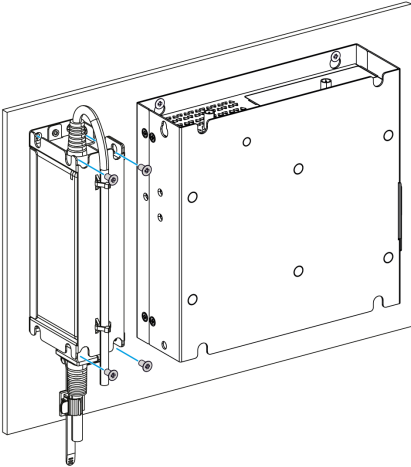
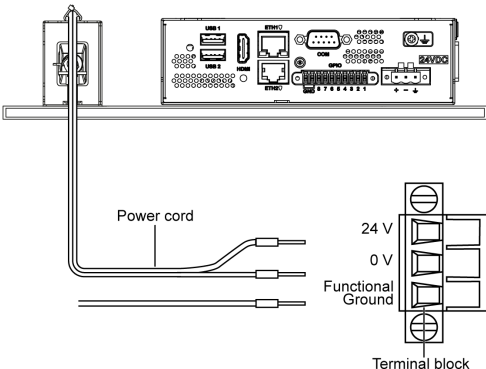
Step	Action
1	Remove the power from the Box PC IIoT and confirm that the power adapter has been disconnected from its power source.
2	Mount the AC power supply module on the cabinet with two screws (the power switch cover and the AC IN connector have to be removed):  1 Wall mounting 2 Book mounting NOTE: The recommended torque to tighten these screws is 0.5 Nm (4.5 lb-in).
3	Remove the terminal block from the power connector on the Box PC IIoT and connect one side of the DC power cable to the terminal block: 

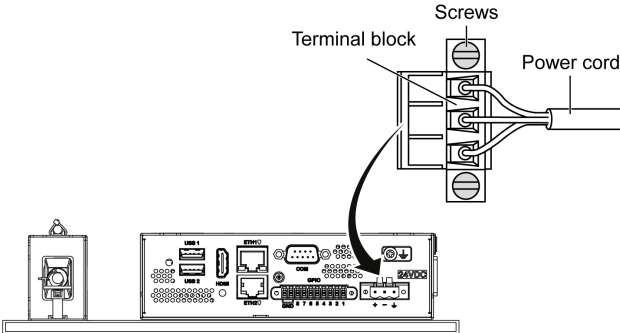
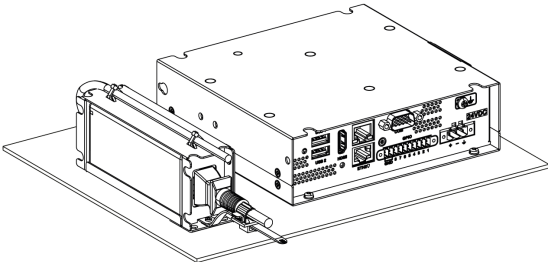
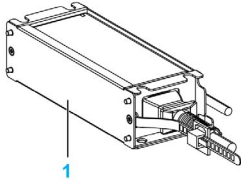
Step	Action
4	Place the terminal block in the power connector of the Box PC IoT and tighten the screws:  NOTE: The recommended torque to tighten these screws is 0.5 Nm (4.5 lb-in).
5	Connect the other side of DC power cable with the terminal block attached to 24 V DC OUT of the AC power supply module and tighten the screws:  Use copper wire rated for 75 °C (167 °F) with a section of 0.75 to 2.5 mm² (AWG 18 to AWG 14).

Step	Action
6	Connect the AC power cable with the terminal block attached to AC IN of the AC power supply module from its power source: 

Installing the AC Power Supply Module (HMIYPSOMAC1)

Follow these steps when installing the AC power supply module (HMIYPSOMAC1):

Step	Action
1	Remove all power from the Box PC IIoT and confirm that the power adapter is disconnected from its power source.
2	The AC power supply module is mounted to the cabinet with four screws M3 x 6:  NOTE: The recommended torque to tighten these screws is 0.5 Nm (4.5 lb-in).
3	Remove the terminal block from the power connector on the Box PC IIoT and connect the power cord to the terminal block:  Connect the black wire with the 0 V and the red wire with the 24 V of the terminal block. Use 2.5 mm² copper wire to make the ground connection of the terminal block.

Step	Action
4	Place the terminal block in the power connector and tighten the screws:  NOTE: The recommended torque to tighten these screws is 0.5 Nm (4.5 lb-in).
5	Put on the clip through the mounting bracket and the power cord together:  Press the clip to fasten the power cord:  1 Mounting bracket
6	Connect the AC power cable of the AC power supply module from its power source.

UPS Module - Description and Installation

Overview

⚠ DANGER

EXPLOSION, FIRE, OR CHEMICAL HAZARD

Handling and storage:

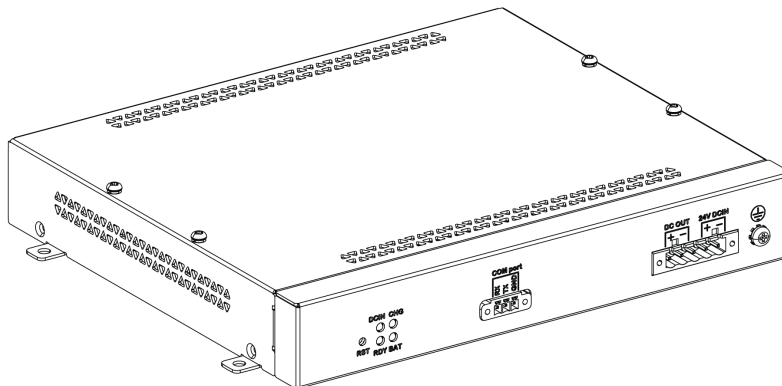
- Store in cool, dry and ventilated rooms with impermeable surfaces and appropriate containment in case of leakage.
- Protect from adverse weather conditions and keep separate from incompatible materials during storage and transport.
- A sufficient supply of water must be located nearby.
- Damage to containers where batteries are stored and transported must be prevented.
- Keep away from fire, sparks, and excessive heat.

Failure to follow these instructions will result in death or serious injury.

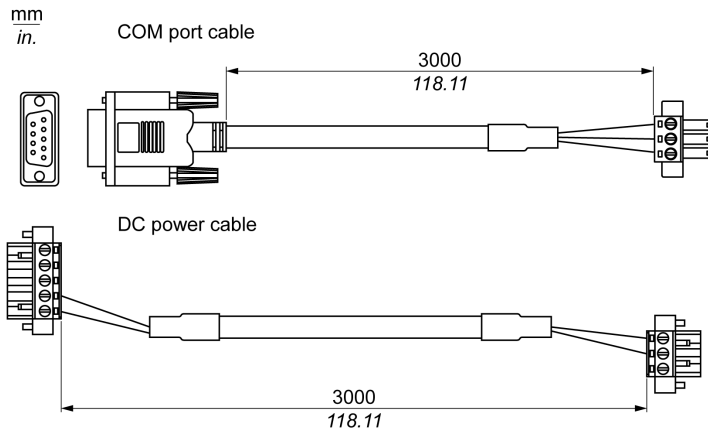
The uninterrupted power supply (UPS) option (HMIYMUPSKT1) includes a battery cell, a charger circuit, and a power path switch circuit. When battery capacity is not full, the charger circuit charges the battery cell automatically.

NOTE: If the UPS is configured and is activated in IIoT, the UPS is available.

The figure shows the UPS module:



The figure shows the UPS module cables:



The main features of the UPS option are:

- Long-lasting, maintenance-free rechargeable batteries
- Communication via integrated interfaces

UPS Principle

With the optional UPS module, the Box PC IIoT completes write operations even when it is turned off while write operations are being executed. When the UPS module detects a power off, it switches to battery operation immediately without interruption.

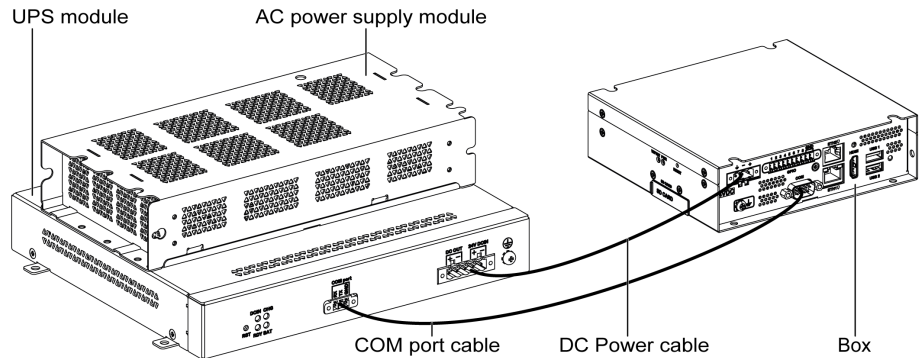
NOTE:

- The connected monitor is not handled by the UPS and shut-off when the power is exhausted.

There are two configurations for UPS module:

- UPS module: The power source of the UPS module is from DC input power.
- UPS and AC power supply modules: The power source of the module is from AC input power.

This figure shows the UPS module (HMIYMUPSKT1) with the AC power supply module (HMIYMMAC1) and the Box PC IIoT with the **COM port** cable and the **DC power** cable of the UPS cable kit (HMIYCABUPS31):



The Box PC IIoT can get battery information from the COM port.

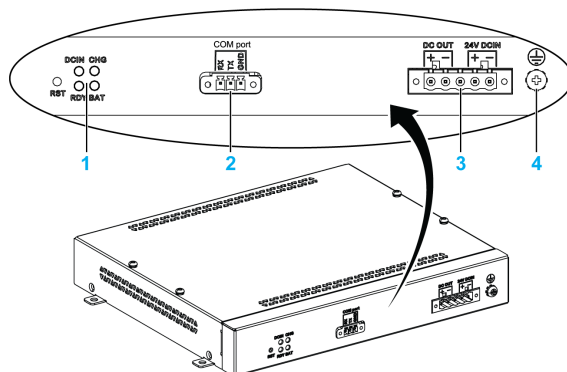
The table describes the additional modules for the UPS:

Input power	UPS	Additional modules	Reference
DC	No	–	–
	Yes	UPS module / UPS cables	HMIYMUPSKT1 / HMIYCABUPS31
AC	No	AC power supply module	HMIYMMAC1
	Yes	UPS module / UPS cable and AC power supply module	HMIYMUPSKT1 / HMIYCABUPS31 and HMIYMMAC1

UPS Module Description

The UPS module is subject to wear and should be replaced regularly, depending on the battery status. This information is displayed by **IloT**. The **Health** status shows when the battery needs to be changed.

The figure shows the UPS module (HMIYMUPSKT1):

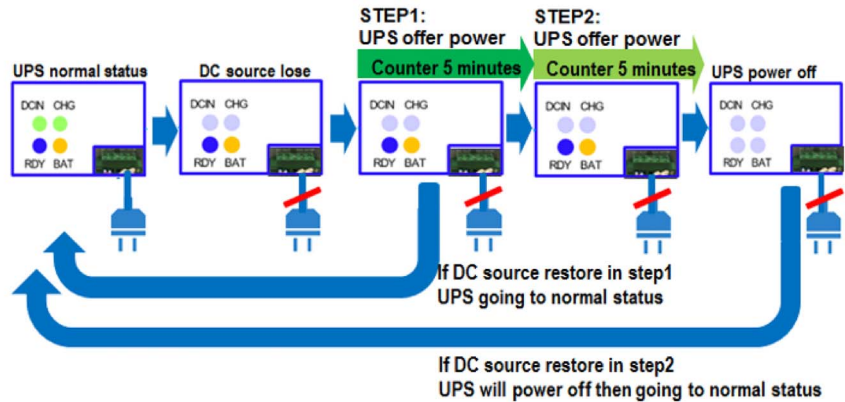


- 1 LEDs ([DCIN / CHG / RDY / BAT]) and reset button ([RST])
- 2 Communication port connector ([COM port / PWR])
- 3 DC power connector ([DC OUT / 24V DCIN])
- 4 Ground connection pin

The table describes the meaning of the status indicator:

Marking	Color	State	Meaning
DCIN	Green	ON	The input source is OK.
		1 Hz Flashing	DCIN loss up to 5 minutes.
		OFF	DCIN loss.
CHG	Green	0.5 Hz Flashing	The temperature of the battery is > 60 °C (remains flashing until the temperature is < 55 °C).
		1 Hz Flashing	The battery is charging.
		OFF	The battery capacity is over 90 % (charging not required).
RDY	Blue	ON	The UPS module is ready.
		OFF	The UPS module is not functioning.
BAT	Yellow	ON	The battery is ready.
		0.5 Hz Flashing	The temperature of the battery is > 60 °C (remains flashing until the temperature is < 55 °C) or less than 15 % charge.
		OFF	The battery is not detected.

UPS working flow:

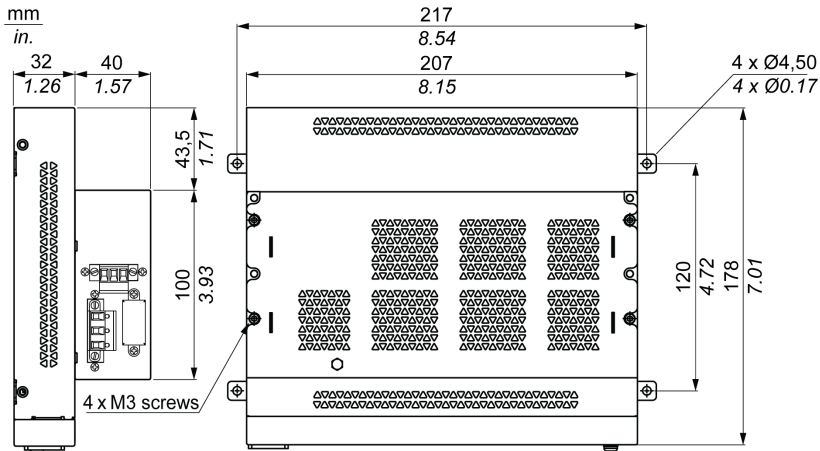


NOTE: The button **RST** is used to reset the UPS module.

The table shows the technical data of the UPS module:

Features	Values
UPS	
Input voltage	18...36 Vdc
Output voltage	24 Vdc
Output current	3 A
Communication port	COM port / RS-232 (non-Isolated)
Back-up time	10 minutes (battery 70 % full)
Operating temperature	0...45 °C (32...113 °F)
Mounting	Horizontal mounting
Battery cells	
Capacity:	27.5 Wh (2.73 Ah, 4S1P)
Maximum discharger current	9 A (if discharged at high rate and high temperature frequently, the battery life will be shortened)
Charging current (max)	1 A
Operating voltage	12...16 Vdc
Cycle life of recharging	300 times
Operating temperature	Charge: 0...45 °C (32...113 °F) Discharge: 0...60 °C (32...140 °F)
Typical recharge time at low battery	4 hours
Weight	1.15 Kg (2.53 lbs)

The figure shows the dimensions of the UPS module (HMIYMUPSKT1) equipped with the optional AC power supply module (HMIYMMAC1):



Installing Instructions

Before installing the UPS system, shut down the operating system in an orderly fashion and remove the power from the device.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Remove all power from the device before removing any covers or elements of the system, and prior to installing or removing any accessories, hardware, or cables.
- Unplug the power cable from both the Harmony Industrial PC and the power supply.
- Always use a properly rated voltage sensing device to confirm that power is off.
- Replace and secure all covers or elements of the system before applying power to the unit.
- Use only the specified voltage when operating the Harmony Industrial PC. The AC unit is designed to use 100...240 Vac input. The DC unit is designed to use 24 Vdc input. Always check whether your device is AC or DC powered before applying power.

Failure to follow these instructions will result in death or serious injury.

⚠ CAUTION

OVERTORQUE AND LOOSE HARDWARE

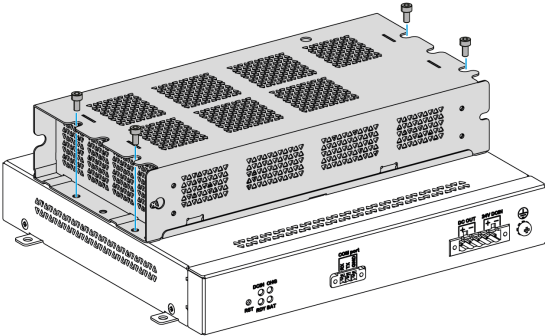
- Do not exert more than 0.5 Nm (4.5 lb-in) of torque when tightening the installation fastener, enclosure, accessory, or terminal block screws. Tightening the screws with excessive force can damage the installation fastener.
- When fastening or removing screws, ensure that they do not fall inside the Harmony Industrial PC chassis.

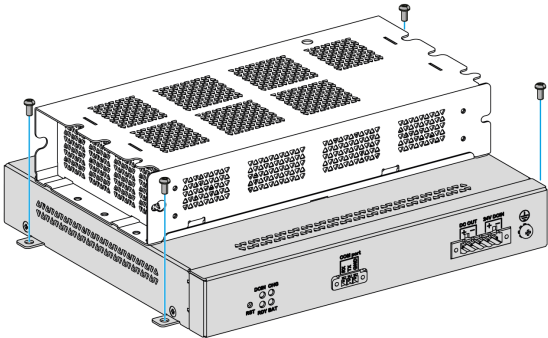
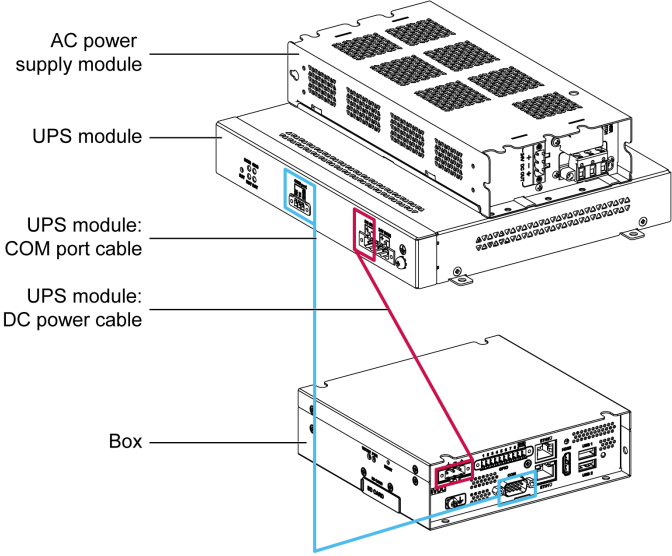
Failure to follow these instructions can result in injury or equipment damage.

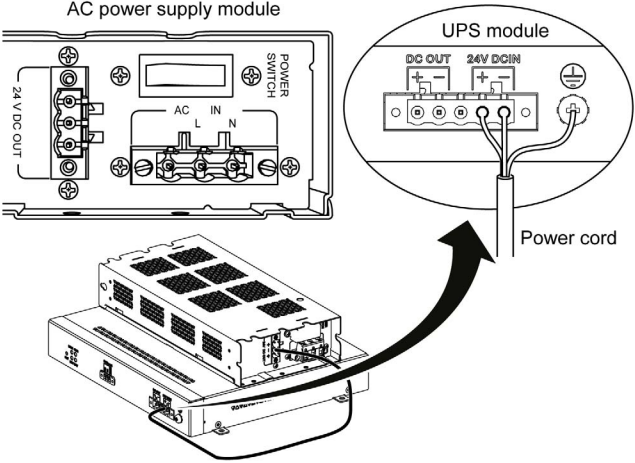
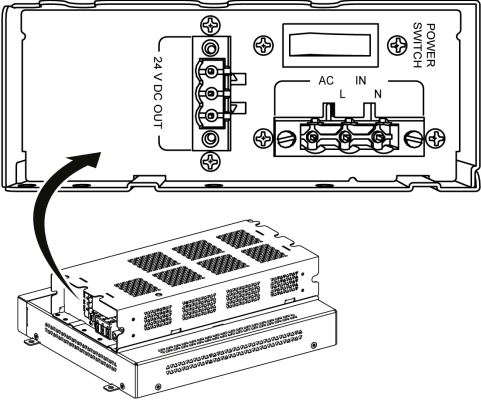
By adding the charging circuit in the Box PC IIoT housing, installation is reduced to merely attaching the connection cable to the UPS module mounted next to the Box PC IIoT.

NOTE: Due to the construction of these batteries, you can store and operate the UPS module in any position.

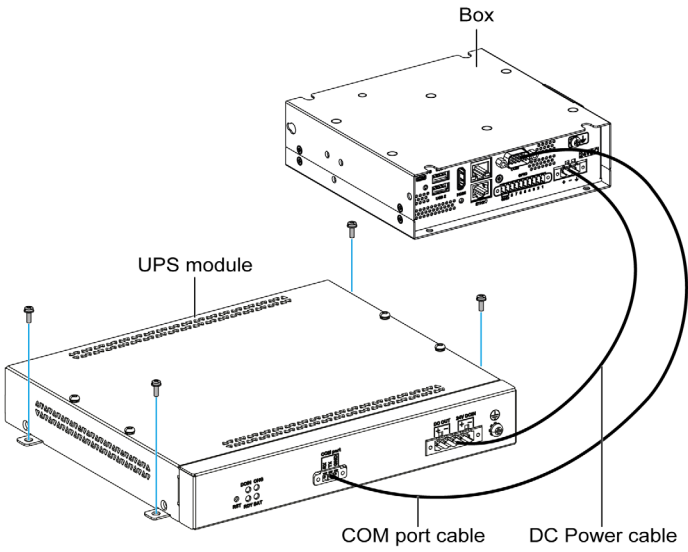
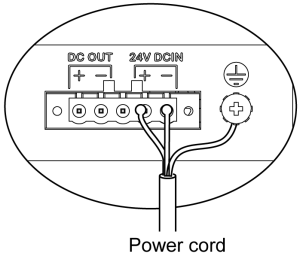
Follow the steps when installing the UPS module equipped with the optional AC power supply module:

Step	Action
1	Disconnect the power supply of the Box PC IIoT.
2	Touch the housing or ground connection (not the power supply) to discharge any electrostatic charge from your body.
3	Mount the AC power supply module on the UPS module with the four screws supplied: 

Step	Action
4	Install the UPS module (HMIYMUPSKT1). The installation requires four x M5 screws and four washers: 
5	Connect the two UPS cables (HMIYCABUPS31) to the UPS module. Be sure to use the correct connection terminals.
6	Connect the DC power cable of the UPS module to the DC power connector of the Box PC IloT. Connect the COM port cable of the UPS module to the [COM] port of the Box PC IloT:  Tighten the connected cables in the screw clamps.

Step	Action
7	Connect the AC power supply module ([24V DCOUT]) to the DC power cable ([24V DCIN]) of the UPS module: 
8	Connect the AC power cable ([AC IN]) of the AC power supply module: 

Follow the steps when installing the UPS module without the optional AC power supply module:

Step	Action
1	Disconnect the power supply of the Box PC IIoT.
2	Touch the housing or ground connection (not the power supply) to discharge any electrostatic charge from your body.
3	Install the UPS module (HMIYMUPSKT1). The installation requires four x M5 screws and four washers. Connect the two UPS cables (HMIYCABUPS31) to the UPS module. Connect the DC power cable to the DC power connector of the Box PC IIoT and connect the communication cable (COM port) to the COM port RS-232 of the Box PC IIoT:  Tighten the connected cables in the screw clamps.
4	Connect the DC power supply ([24V DCIN]) of the UPS module from its power source: 

Interface Connections

Introduction

The Box PC IIoT are not classified hazardous locations.

DANGER

POTENTIAL FOR EXPLOSION IN HAZARDOUS LOCATION

Do not use these products in hazardous locations.

Failure to follow these instructions will result in death or serious injury.

WARNING

EQUIPMENT DISCONNECTION OR UNINTENDED EQUIPMENT OPERATION

- Ensure that power, communication, and accessory connections do not place excessive stress on the ports. Consider the vibration in the environment.
- Securely attach power, communication, and external accessory cables to the panel or cabinet.
- Use only D-Sub 9-pin connector cables with a locking system in good condition.
- Use only commercially available USB cables.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Serial Interface Connections

This interface is used to connect the Box PC IIoT to remote equipment, via a serial interface cable. The connector is a D-Sub 9-pin plug connector.

By using a long PLC cable to connect to the Box PC IIoT, it is possible that the cable can be at a different electrical potential than the panel, even if both are connected to ground.

NOTE: The Box PC IIoT can get UPS information from COM port.



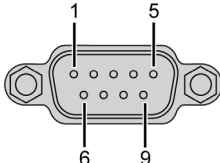
DANGER

ELECTRIC SHOCK

- Make a direct connection between the ground connection screw and ground.
- Do not connect other devices to ground through the ground connection screw of this device.
- Install all cables according to local codes and requirements. If local codes do not require grounding, follow a reliable guide such as the US National Electrical Code, Article 800.

Failure to follow these instructions will result in death or serious injury.

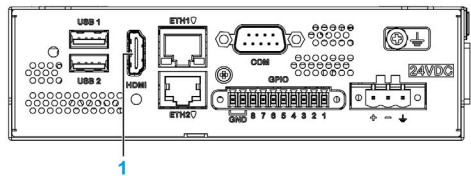
The table shows the D-Sub 9-pin assignments (COM):

Pin	Assignment			D-Sub 9-pin plug connector
	RS-232	RS-422	RS-485	
1	DCD	TxD-	Data-	
2	RxD	TxD+	Data+	
3	TxD	RxD+	N/A	
4	DTR	RxD-	N/A	
5	GND	GND	GND	
6	DSR	N/A	N/A	
7	RTS	N/A	N/A	
8	CTS	N/A	N/A	
9	RI	N/A	N/A	

Any excessive weight or stress on communication cables may disconnect the equipment.

HDMI Port

The figure shows the HDMI port:



1 HDMI port

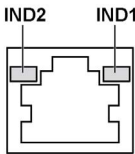
Pin number	Description	Pin number	Description	HDMI port
Pin1	HDMI_TD2+	Pin11	GND	HDMI 19H
Pin2	GND	Pin12	HDMI_CLK-	
Pin3	HDMI_TD2-	Pin13	HDMI_CEC	
Pin4	HDMI_TD1+	Pin14	NC	
Pin5	GND	Pin15	HDMI_DDC_SCL	
Pin6	HDMI_TD1-	Pin16	HDMI_DDC_SDA	
Pin7	HDMI_TD0-	Pin17	GND	
Pin8	GND	Pin18	POWER	
Pin9	HDMI_TD0-	Pin19	HDMI_HPD	
Pin10	HDMI_CLK+			

GPIO

Pin number	Description	Pin number	Description	GPIO terminal block
Pin1	GPIO1	Pin6	GPIO6	GPIO terminal block
Pin2	GPIO2	Pin7	GPIO7	
Pin3	GPIO3	Pin8	GPIO8	
Pin4	GPIO4	GND	GND	
Pin5	GPIO5	GND	GND	

Ethernet Interface Connector Status LEDs

The figure shows the RJ45 connector status LEDs:



The table describes the RJ45 connector status LED:

Label	Description	LED		
		Color	Status	Description
IND1	Ethernet link	Green/Yellow	Off	Link at 10 Mb/s
			Solid yellow	Link at 100 Mb/s
			Solid green	Link at 1000 Mb/s
IND2	Ethernet activity	Green	Off	No activity
			On	Transmitting or receiving data

USB Interface

Pin number	Description	Pin number	Description	USB port
Pin1	USB power	Pin5	USB power	1 2 3 4 5 6 7 8 VCC_USB0 USB-0_B USB+0_B GND_1 VCC_USB1 USB-1_B USB+1_B GND_2 PTH_1 PTH_2 PTH_3 PTH_4 USB A TYPE
Pin2	USB_0+	Pin6	USB_1+	
Pin3	USB_0-	Pin7	USB_1-	
Pin4	GND	Pin8	GND	

Chapter 6

Hardware Modifications

Subject of This Chapter

This chapter describes the hardware modifications for the Harmony Box iPC.

What Is in This Chapter?

This chapter contains the following sections:

Section	Topic	Page
6.1	Before Modifications	68
6.2	Box iPC and Storage Modifications	70
6.3	Optional Cards and Optional Interfaces	73

Section 6.1

Before Modifications

Before Making Modifications

Introduction

For detailed installation procedures for optional units, refer to the OEM (original equipment manufacturer) Installation guide included with the optional unit.

 **DANGER**

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Remove all power from the device before removing any covers or elements of the system, and prior to installing or removing any accessories, hardware, or cables.
- Unplug the power cable from both the Harmony Industrial PC and the power supply.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace and secure all covers or elements of the system before applying power to the unit.
- Use only the specified voltage when operating the Harmony Industrial PC. The DC unit is designed to use 24 Vdc input.

Failure to follow these instructions will result in death or serious injury.

The Box PC IIoT (HMIBSC) are not classified for use in hazardous locations.

 **DANGER**

POTENTIAL FOR EXPLOSION IN HAZARDOUS LOCATION

Do not use these products in hazardous locations.

Failure to follow these instructions will result in death or serious injury.

During operation, the surface temperature of the heat sink may exceed 70 °C (158 °F).

 **WARNING**

RISK OF BURNS

Do not touch the surface of the heat sink during operation.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

 CAUTION**OVERTORQUE AND LOOSE HARDWARE**

- Do not exert more than 0.5 Nm (4.5 lb-in) of torque when tightening the installation fastener, enclosure, accessory, or terminal block screws. Tightening the screws with excessive force can damage the installation fastener.
- When fastening or removing screws, ensure that they do not fall inside the Harmony Industrial PC chassis.

Failure to follow these instructions can result in injury or equipment damage.

 CAUTION**STATIC SENSITIVE COMPONENTS**

Harmony Industrial PC Internal components, including accessories such as RAM modules and expansion boards, can be damaged by static electricity.

- Keep static-producing materials (plastic, upholstery, carpeting) out of the immediate work area.
- Do not remove ESD-sensitive components from their anti-static bags until you are ready to install them.
- When handling static-sensitive components, wear a properly grounded wrist strap (or equivalent).
- Avoid unnecessary contact with exposed conductors and component leads with skin or clothing.

Failure to follow these instructions can result in injury or equipment damage.

Section 6.2

Box iPC and Storage Modifications

SD Card Installation

Introduction

The Box PC IIoT operating system views the SD card as a hard disk. Proper handling and care of the SD card helps extend the life of the card. Familiarize yourself with the card before attempting to insert or remove the card.

Before installing or removing an SD card, shut down the operating system in an orderly fashion and remove the power from the device.



DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Remove all power from the device before removing any covers or elements of the system, and prior to installing or removing any accessories, hardware, or cables.
- Unplug the power cable from both the Harmony Industrial PC and the power supply.
- Always use a properly rated voltage sensing device to confirm that power is off.
- Replace and secure all covers or elements of the system before applying power to the unit.
- Use only the specified voltage when operating the Harmony Industrial PC. The AC unit is designed to use 100...240 Vac input. The DC unit is designed to use 24 Vdc input. Always check whether your device is AC or DC powered before applying power.

Failure to follow these instructions will result in death or serious injury.



CAUTION

MEMORY CARD DAMAGE AND DATA LOSS

- Remove all power before making any contact with an installed memory card.
- Use only memory cards sold by Schneider Electric as accessory for this product. The performance of the Harmony Industrial PC has not been tested using memory cards from other manufacturers.
- Confirm that the memory card is correctly oriented before insertion.
- Do not bend, drop, or strike the memory card.
- Do not touch the memory card connectors.
- Do not disassemble or modify the memory card.
- Keep the memory card dry.

Failure to follow these instructions can result in injury or equipment damage.

NOTICE

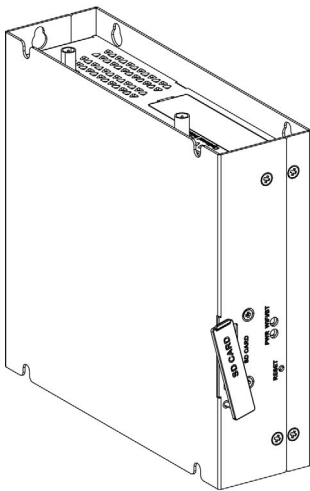
ELECTROSTATIC DISCHARGE

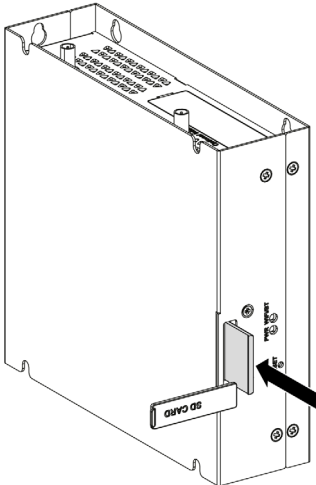
Take the necessary protective measures against electrostatic discharge before attempting to remove the Box PC IIoT cover.

Failure to follow these instructions can result in equipment damage.

Inserting the SD Card

The procedure describes how to insert the SD card.

Step	Action
1	Remove the cover of the SD card slot: 

Step	Action
2	Insert the SD card into the card slot. Press the SD card slot firmly into the Box PC IIoT. Replace the cover: 

Section 6.3

Optional Cards and Optional Interfaces

Overview

This section describes the optional cards, optional interfaces, and their installation.

What Is in This Section?

This section contains the following topics:

Topic	Page
Optional Interface Installation	74
2 x Analog Input Interface Description	81
8 x Analog Input Interface Description	84
4G Cellular Description	87
Cyber Security TPM Module Description	90

Optional Interface Installation

Introduction

Before installing or removing an interface, shut down the operating system in an orderly fashion and remove the power from the device.

⚡ ⚠ DANGER

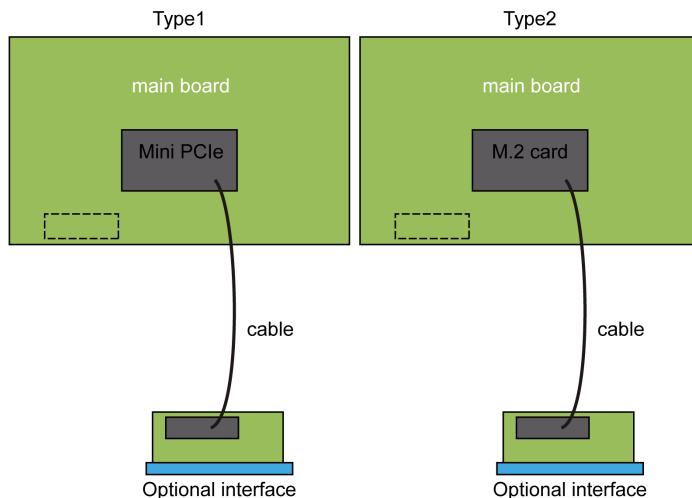
HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Remove all power from the device before removing any covers or elements of the system, and prior to installing or removing any accessories, hardware, or cables.
- Unplug the power cable from both the Harmony Industrial PC and the power supply.
- Always use a properly rated voltage sensing device to confirm that power is off.
- Replace and secure all covers or elements of the system before applying power to the unit.
- Use only the specified voltage when operating the Harmony Industrial PC. The AC unit is designed to use 100...240 Vac input. The DC unit is designed to use 24 Vdc input. Always check whether your device is AC or DC powered before applying power.

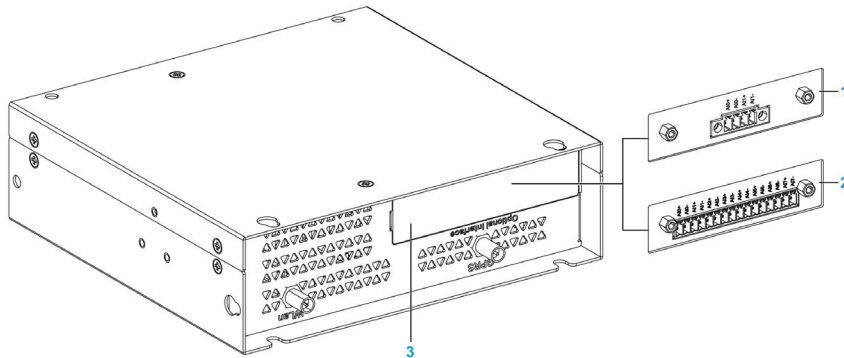
Failure to follow these instructions will result in death or serious injury.

Optional Interface Types

The figure shows the interface types (top view):



The figure shows the available interfaces:



- 1 2 x AI interface
- 2 8 x AI interface
- 3 Optional interface

The table shows the type and the interface part numbers:

Designation	Part number	Interface	mini PCIe slot	M.2 slot	Interface plate	Pin header from system
2 AI interface (M.2)	HMIYBIN2AIM21	2 x analog input	–	1	1	–
8 AI interface (mini PCIe)	HMIYMIN8AI1	8 x analog input	1	–	1	–
4G cellular for EU/ASIA	HMIYMIN4GEU1	4G cellular for EU/Asia and antenna	1	–	–	–
4G cellular for US	HMIYMIN4GUS1	4G cellular for US and antenna	1	–	–	–
TPM module	HMIYBINLTPM201	–	–	–	–	1

Compatibility Table

Configurations	2 AI interface (M.2)	8 AI interface (mini PCIe)	4G cellular
	HMIYBIN2AIM21	HMIYMIN8AI1	HMIYMIN4GEU1/HMIYMIN4GUS1
1	Yes	No	No
2	No	Yes	No
3	No	No	Yes
4	Yes	No	Yes

NOTE:

- The Box PC IIoT only have one M.2 2230 slot and one mini PCIe slot. The mini PCIe slot only can support either 4G cellular or 8 x AI optional interface module. Therefore, 8 x AI optional interface module cannot be installed together with 4G cellular.
- The 2 x AI optional interface module can be supported together with 4G cellular (with inner GPRS SMA connector, not through 4G optional interface).
- The Box PC IIoT only have one optional interface slot, therefore, 2 x AI optional interface module cannot be used together with 8 x AI optional interface module.
- The 16DI/8DO optional interface module (HMIYMINIO1) is not supported on Box PC IIoT, because no Linux Yocto driver support.

Interface Installation

Before installing or removing a mini PCIe card, shut down the operating system in an orderly fashion and remove the power from the device.

The Box PC IIoT are not classified for use in hazardous locations.

DANGER

POTENTIAL FOR EXPLOSION IN HAZARDOUS LOCATION

Do not use these products in hazardous locations.

Failure to follow these instructions will result in death or serious injury.

NOTICE

ELECTROSTATIC DISCHARGE

Take the necessary protective measures against electrostatic discharge before attempting to remove the Harmony Industrial PC cover.

Failure to follow these instructions can result in equipment damage.

CAUTION

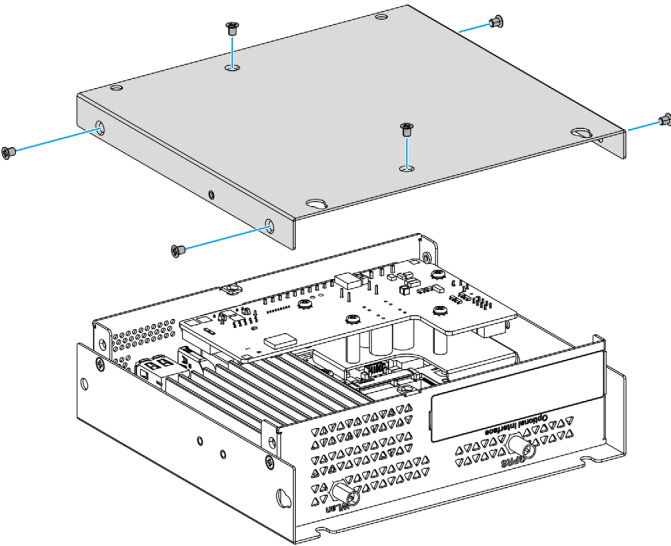
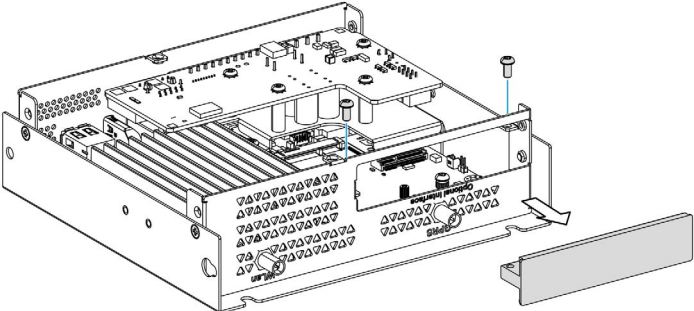
OVERTORQUE AND LOOSE HARDWARE

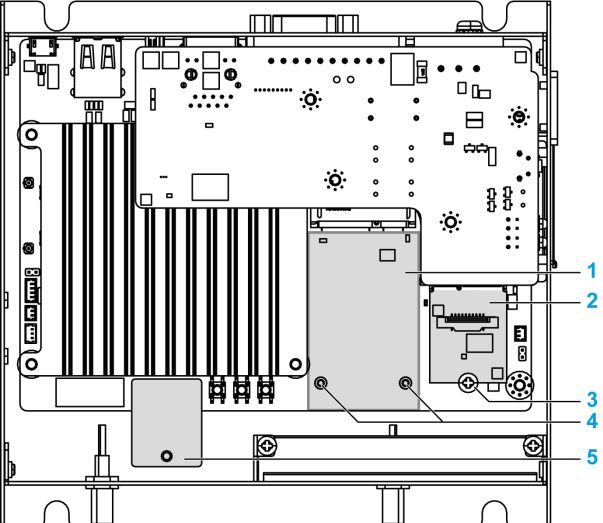
- Do not exert more than 0.5 Nm (4.5 lb-in) of torque when tightening the installation fastener, enclosure, accessory, or terminal block screws. Tightening the screws with excessive force can damage the installation fastener.
- When fastening or removing screws, ensure that they do not fall inside the Harmony Industrial PC chassis.

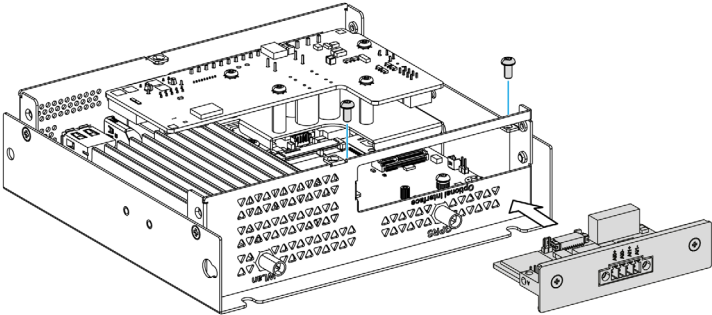
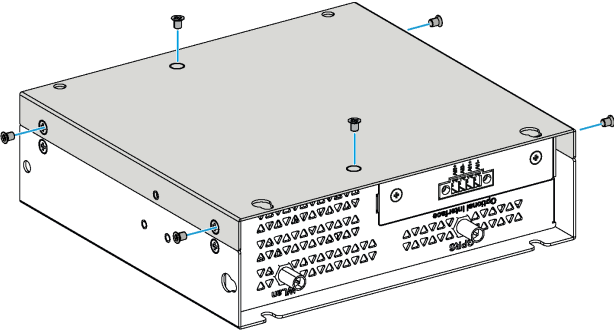
Failure to follow these instructions can result in injury or equipment damage.

NOTE: Remove the power before attempting this procedure.

The table describes how to install an interface:

Step	Action
1	Disconnect the power cord from the Box PC IIoT.
2	Touch the housing or ground connection (not the power supply) to discharge any electrostatic charge from your body.
3	Unscrew the six screws from the cover and remove it: 
4	Remove the plate: 

Step	Action
5	4G cellular or 8 x analog input interface: Insert the mini PCIe card into the expansion card connector of the Box PC IIoT and fasten it with two screws. 2 x analog input interface: Insert the M.2 card into the expansion card connector of the Box PC IIoT and fasten it with one screw. TPM module: Insert the module to the pin header.  1 mini PCIe card with the 4G cellular or 8 x analog input interface 2 M.2 card with the 2 x analog input interface 3 1 x screw size M3 (included in accessory Box PC IIoT) 4 2 x screw size M2 (included in accessory Box PC IIoT) 5 TPM module NOTE: • When using a mini PCIe card with an external cable attached, install a clamp or other device to secure the cable. • The requirement of Phillips screw driver is type size 2. The recommended torque to tighten these screws is 0.5 Nm (4.5 lb-in).

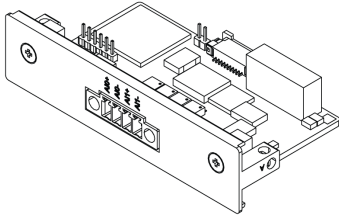
Step	Action
6	Insert the interface in the slot of the Box iPC and fasten it with two screws:  NOTE: The recommended torque to tighten these screws is 0.5 Nm (4.5 lb-in).
7	Replace the cover and fasten it with six screws:  NOTE: The recommended torque to tighten these screws is 0.5 Nm (4.5 lb-in).

2 x Analog Input Interface Description

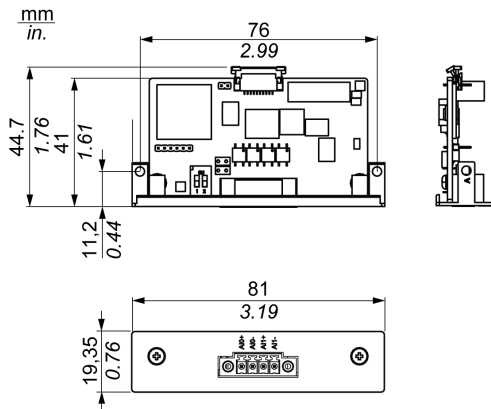
Introduction

The HMIYBIN2AIM21 is categorized as an analog input module. It is compatible with the M.2 card.

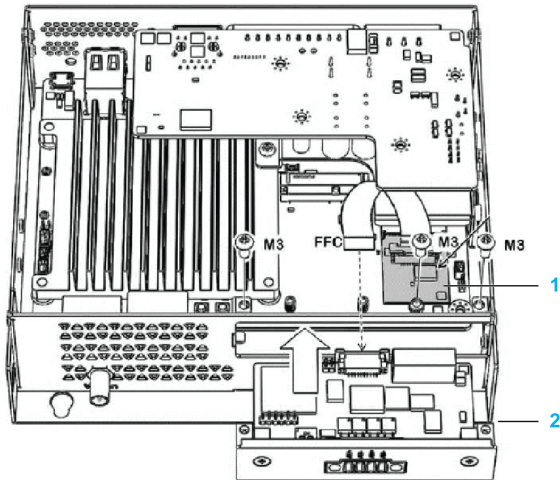
The figure shows the 2 AI interface:



The figure shows the dimensions:



The figure shows the 2 AI interface with the M.2 card installation:



- 1 M.2 card
- 2 2 x AI interface

NOTE: Connect the cable to M.2 card first.

Characteristics

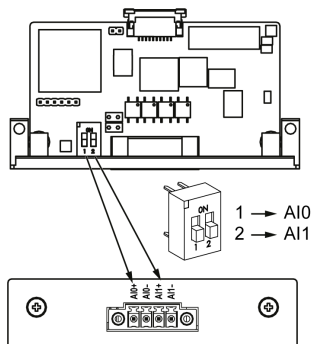
The table shows technical data:

Element	Characteristics
Input channel	2 (differential)
Input impedance	100 K Ω (voltage) 120 Ω (current)
Input type	0...10 Vdc 4...20 mA
Accuracy	$\pm 0.1\%$ or better (voltage) at 25 °C $\pm 0.2\%$ or better (current) at 25 °C
Resolution	16 bits
Calibration	Auto calibration
Sampling rate	10 sample/second
Isolation	2000 Vdc
Common mode rejection (CMR) at 50/60 Hz	90 dB
Normal mode rejection (NMR) at 50/60 Hz	67 dB

Element	Characteristics
Span drift	± 25 ppm
Zero drift	$\pm 6 \mu\text{V}$
Common-mode voltage	350 Vdc

Switch Setting

The switch on 2ch-AI module to modify to voltage or current:



For AI0 and AI1, the switch is pushed to:

- Off - voltage
- On - current

NOTE: By default, the switches are in off state.

Cable Routing

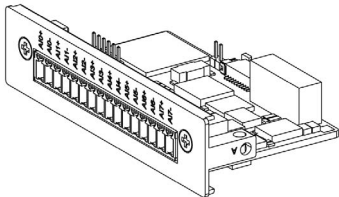


8 x Analog Input Interface Description

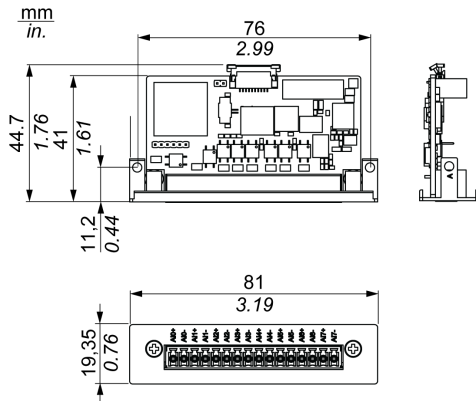
Introduction

The HMIYMIN8AI1 is categorized as an analog input module. It is compatible with the mini PCIe card.

The figure shows the 8 analog input interface:



The figure shows the dimensions:

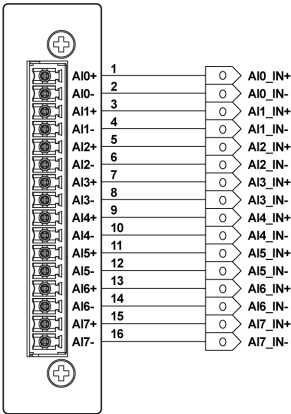


Characteristics

The table shows technical data:

Element	Characteristics
Input channel	8 (differential)
Input range	0...10 V
Input type	0...10 Vdc
Accuracy	± 0.1% or better (voltage) at 25 °C
Resolution	16 bits
Calibration	Auto calibration
Sampling rate	10 sample/second for total channels (when eight channels are activated, average 1 sample/second per channel)
Span drift	±25 ppm

8 Analog Input Connections



Cable Routing



4G Cellular Description

Introduction

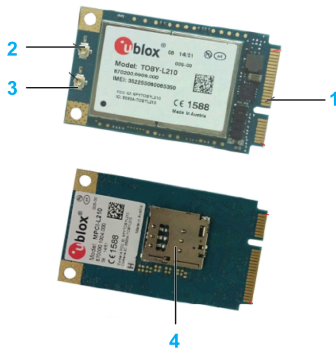
The HMIYMIN4GEU1 and HMIYMIN4GUS1 are categorized as industrial communication modules.

The HMIYMIN4GEU1 is mini PCIe GPRS 4G for Europe and Asia frequencies. The kit including external antenna.

The HMIYMIN4GUS1 is mini PCIe GPRS 4G for North America frequencies. The kit including external antenna.

The HMIYMIN4GBR1 is mini PCIe GPRS 4G for Brazil frequencies. The kit including external antenna.

This figure shows the mini PCIe 4G cellular:



- 1 mini PCIe connector
- 2 RF main antenna connector (use this for connection to the Box PC IIoT)
- 3 RF diversity antenna connector
- 4 SIM holder

NOTE:

1. You can use the SIM holder (micro SIM 3FF, 12 x 15 mm) slot on 4G module to get 4G access.
2. These 4G cards are partner products, sold by Schneider Electric. Please, refer to the leaflet inside the shipping carton for more details.

Description

The table shows technical data:

Features	Values
4G/LTE	Cat. 4 (150 Mbit/s downlink, 50 Mbit/s uplink)
	3GPP rel. 9
	Bands: 2, 4, 5, 7, 17 for North America
	Bands: 1, 3, 5, 7, 8 for Europe and Asia
	Bands: 1, 3, 5, 7, 8, 28 for Brazil and South Asia
	All channel bandwidths: 1.4...20 MHz
	MIMO 2 x 2
	Rx diversity
3G/UMTS/HSPA	Bands: 850/AWS/1900/2100 MHz
	42 Mps downlink, 5.76 Mbps uplink
EDGE/GPRS/GSM	Bands: 850/900/1800/1900
	GPRS and EDGE Class 12
SMS	MT/MO PDU/test mode
	SMS over IMS and via SMS-C
Support USB 2.0 interface	
RF interface: 2 Hirose UFL-R_XMT (50 ohm)	

Cellular View



4G Module Configuration

The 4G module is pre-loaded in OS image, you need to go to 4G setting flag to enable it. Refer to [Editing the Configuration File \(see page 117\)](#).

Cyber Security TPM Module Description

Introduction

The HMIYBINLTPM201 is categorized as industrial module. It is compatible with the low pin count module. The Trusted Platform Module (TPM) is an international standard for a secure cryptoprocessor, which is a dedicated microcontroller designed to secure hardware by integrating cryptographic keys into devices.

The mother board and the OS of Box PC IIoT allows you to install the TPM module and activate encryption. Then, storage drives and operating system are encrypted according to password and keys managed within the hardware module.

According to part number, the HMIYBINLTPM201 TPM module can default mounted following the CTO (configured to order) or can be user mounted afterward as an optional accessory module. The encryption can be activated.



Plug the module onto the Box PC IIoT pin header.

TPM Module Installation

Before installing or removing a card, shut down the operating system in an orderly fashion and remove the power from the device.

NOTICE

ELECTROSTATIC DISCHARGE

Take the necessary protective measures against electrostatic discharge before attempting to remove the Harmony Industrial PC cover.

Failure to follow these instructions can result in equipment damage.

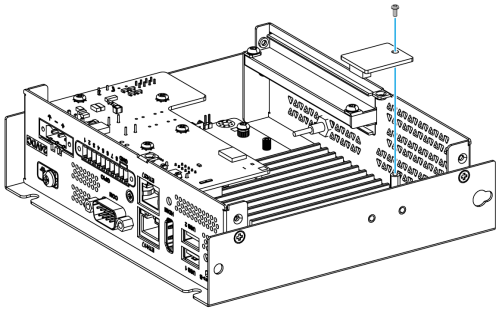
 CAUTION

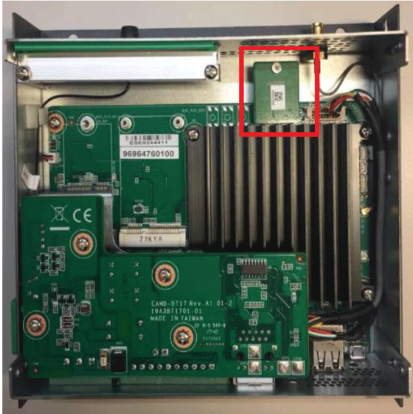
OVERTORQUE AND LOOSE HARDWARE

- Do not exert more than 0.5 Nm (4.5 lb-in) of torque when tightening the installation fastener, enclosure, accessory, or terminal block screws. Tightening the screws with excessive force can damage the installation fastener.
- When fastening or removing screws, ensure that they do not fall inside the Harmony Industrial PC chassis.

Failure to follow these instructions can result in injury or equipment damage.

The table describes how to install a TPM module:

Step	Action
1	Install TPM card: 

Step	Action
2	Lock screw:  NOTE: The recommended torque to tighten these screws is 0.5 Nm (4.5 lb-in).

TPM Module Configuration

The TPM module is pre-loaded in OS image. Refer to Editing the Configuration File *(see page 117)*.

Chapter 7

Configuration Software

This section contains the information required to get started with the Linux Yocto Board Support Packages (BSP).

What Is in This Chapter?

This chapter contains the following topics:

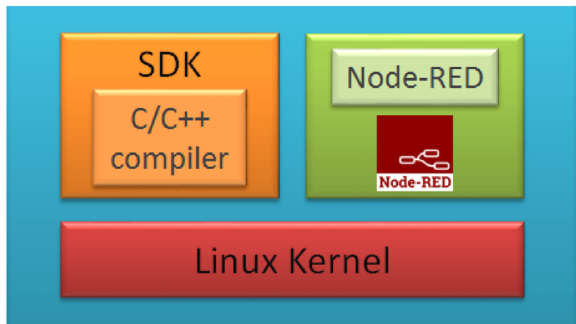
Topic	Page
Configuration	94
Node-RED Quick Start Configuration	98
Software Configuration	117
Using the Utility on the Target Device	124

Configuration

Overview

The Box PC IIoT (HMIBSC) has a default software package architecture based on Linux Yocto project (open source embedded Linux Build).

The software stack is built from different layers, they are described in the diagram:



A software development kit (SDK) is typically a set of software development tools that allows the creation of applications for a certain software package, software framework, hardware platform.

In embedded systems, a board support package (BSP) is the layer of software containing hardware-specific drivers and other routines that allow a particular operating system to function in a particular hardware environment

NOTE: C/C++ compiler for customization by skilled developers only. Documentation on request to Customer care center, with limited support.

General Information

The Linux Yocto BSP provide software and recipes necessary to support individual boards. The BSP is a collection of information that defines how to support a particular hardware device, set of devices, or hardware platform.

This manual does not show how to solve every possible programming issue. The Linux Yocto Project has the aim and objective of attempting to improve the user experience of developers of customized Linux systems supporting the ARM CPU architecture. To use this manual, you should be familiar with Linux command and Linux Yocto project.

Software Version

Customization table	Software version or later
Linux Yocto project	Krogoth 2.1
BitBake branch	1.30.0
Linux Kernel	4.4.38
GCC	5.2.1
GNU C library (glibc)	2.23
Node.js	10.15.3
Node.RED	0.20.7

NOTE: The Node-RED is pre-installed. For upgrading Node-RED, refer to <https://nodered.org/>. Node-RED coming from the OS image has been validated. If you want to change Node-RED, follow the installation procedure on Node-RED website. (<https://nodered.org/docs/getting-started/installation>)

Standard Node-RED provides the standard Node. To know how to use each node and how to make a link, refer to Node-RED [official website](#).

Account and Authority Management

 **WARNING**

UNAUTHORIZED DATA ACCESS

- Immediately change any default passwords to new and secure passwords.
- Do not distribute passwords to unauthorized or unqualified personnel.
- Limit access rights to users essential to your application needs only.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Start to Use Box PC IIoT

There are default passwords for OS login and Node-RED. These default passwords are set on new products or after system restore. User must change the default password for **root account**, **Node-Red account** and **user account** after first long in.

OS Login Password Change

Step	Action
1	Power up the Box PC IIoT at the first time.
2	User is required to change OS login password for root account after first login.
3	Default user name is root . The default password is IIoTB#8
4	Follow this password change policy: • Passwords must have at least 12 characters. • Passwords cannot contain the username. • Passwords must include the four available character types: lowercase letters, uppercase letters, numbers, and symbols. Symbols must include any one of [!"#\$%&'()*+,-./:;<=>?@^_`{ }~.-]. <pre> ### ===== ### ### Please follow the policy to change the password for security ### ### ===== ### - Passwords must have at least 12 characters. - Passwords can not contain the username. - Passwords must include the four available character types: lowercase letters, uppercase letters, numbers, and symbols. ### ===== ### </pre> <pre> ### ===== ### ### Change root password ### ### ===== ### You are required to change your password immediately (root enforced) Changing password for root New password: Retype new password: passwd: password updated successfully ### (Info) root password has been changed successfully! ### </pre> NOTE: If the password key-in is not met above criteria, system will request again to key in password until meet criteria.
5	After change root password, user is required to change the password of user account: <pre> ### ===== ### ### Change user password ### ### ===== ### You are required to change your password immediately (user enforced) Changing password for user New password: Retype new password: passwd: password updated successfully ### (Info) user password has been changed successfully! ### </pre>

Node-RED Password Change

Step	Action
1	After OS login passwords are changed, user is required to change default Node-RED login password. The default username is NR_account and password is NodeRed#0123 <pre>### ===== ### ### Change Node-RED password ### ### ===== ### You are required to change Node-RED login password immediately (root enforced) Change password for Node-RED Enter current Node-RED password: ### [info] Node-RED password correct! ### Enter New Node-RED password: Retype new Node-RED password: ### [info] Node-RED password matches! ### ### [info] Node-RED password has been changed successfully! ### ### [info] Reboot system now ### Rebooting.</pre> NOTE: Only Root Account has right to change Node-RED password.

OS Login

Step	Action
1	Power on Box PC IIoT every time after default OS login password is changed and default Node-RED login password is changed.
2	● If choose root account, user is required to enter root account password. ● If choose user account, user is required to enter user account password.

Node-RED Password Change

Step	Action
1	You have to complete to change Node-RED password before using Node-RED.
2	Only Root Account has right to Node-RED password. User has to change the default password for Root account , Node-RED account and User account after first long in.
3	Power up the Box PC IIoT every time after OS login password is changed and Node-RED login password is changed: ● If you choose root account, you are required to enter root account password. ● If you choose user account, you are required to enter user account password.
4	Enter <code>https://<IP address>:1880</code> (Port number: 1880) from remote site to use. Password is required to enter every time.

Node-RED Quick Start Configuration

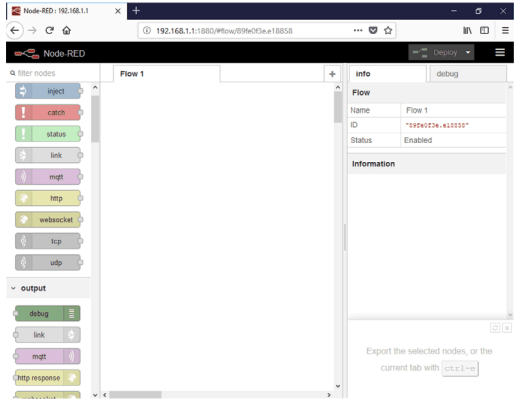
General Information

Node-RED solution is to provide standard Node-RED pre-installed in OS image and Schneider Node which you can install from recovery SD card. Schneider Node also provides sample code and flow sample to help you to use quickly.

Starting Procedure

This procedure gives the information about how to set the Node-RED:

Step	Action	Action
1	Power up the Box.	
2	Open the configuration file.	<code>\$ vi ~/infra_setting.conf</code>
3	Switch to insert mode by press i .	
4	Enable to change Node-RED configuration.	NODERED_SETTINGS_FLAG=1
5	Set up network IP address to the Box PC IIoT (HMIBSC).	LAN_0_SETTINGS_FLAG (enable to modify the LAN 0 configuration). LAN_0_ENABLE_STATIC_IP (switch static IP or DHCP for LAN port 0). LAN_0_NETMASK_BIT_COUNT (set the network mask bit count afterwards for LAN port 0).
6	Press Esc to leave insert mode.	
7	Type :wq to save the setting and exit the editor.	
8	Whenever you modify the configuration file, the settings will be updated after you restart the device.	<code>\$ sync</code> <code>\$ reboot</code>
9	Open a browser from a computer in the same network.	
10	Type https://<ip address>:1880 .	
11	After login in the root account, insert the installer SD card.	
12	Type a command to install the package automatically <code>/run/media/mmcblk1p9/Software/SEnode_Install_packages/install.sh</code> .	
13	After all the install processes are finished, unplug the SD card and the restart the device.	

Step	Action	Action
14	You get Node-RED user interface: 	

Standard Node-RED

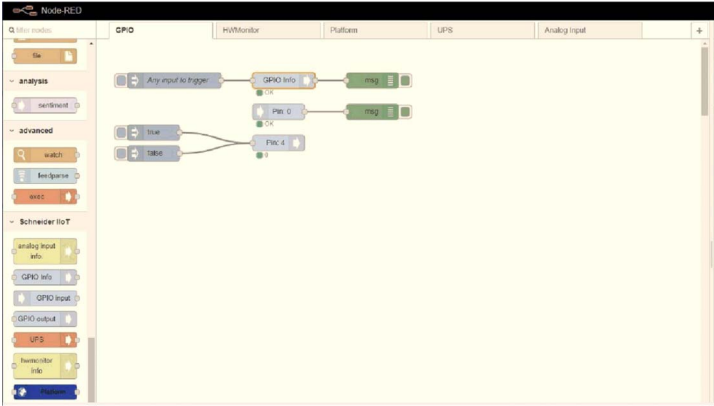
Node-RED is embedded in HMIBSC Operating System image. To up-date the Node-RED version, follow the default installation procedure on Node-RED website. <https://nodered.org/docs/getting-started/installation>

User has to complete the default password change before using Node-RED.

Enter IP address:1880 (port number: 1880) from remote site to use. The password is required to enter every time.

Schneider Electric Node Installation

Node-RED solution is to provide standard Node-RED pre-installed in OS image and Schneider Node which user can install from recovery USB key. Schneider Node also provides sample code and flow sample to help user to use quickly.

Step	Action
1	install Schneider node which are in the recovery SD card/packages folder.
2	After log in the root account, insert the installer SD card.
3	Type a command to install the packages automatically /run/media/mmcblk1p9/Software/SEnode_Install_packages/Install.sh.
4	After all the install processes are finished, unplug the SD card and then restart the device.
5	You see Schneider IIoT Nodes are added in Node List : 
6	Scroll down to see Schneider IIoT Node.

NOTE: Although Node-RED has standard Node build-in, there is no special Node that can support Schneider-Electric hardware, unless you install the Schneider-Electric Nodes.

Start to Use Node-RED

- Node-RED password:
 - Power on the Box iPC for the first time: user is required to change Node-RED password.
 - User has to enter password every time after power-on.
 - Node-RED password has to be changed the first time Node-RED is used.
- User Node-RED:
 - User is required to change password after powering on the Box iPC for the first time (right after the procedure of changing Node-RED password).
 - Enter the Box iPC IP address from remote site. Password is required to enter every time.

Schneider IIoT Node List

- Platform
- UPS
- Hardware Monitor
- GPIO Set
- AI module

NOTE: You can simply change the value in simple code (flow sample code installer), which can be installed through SD card.

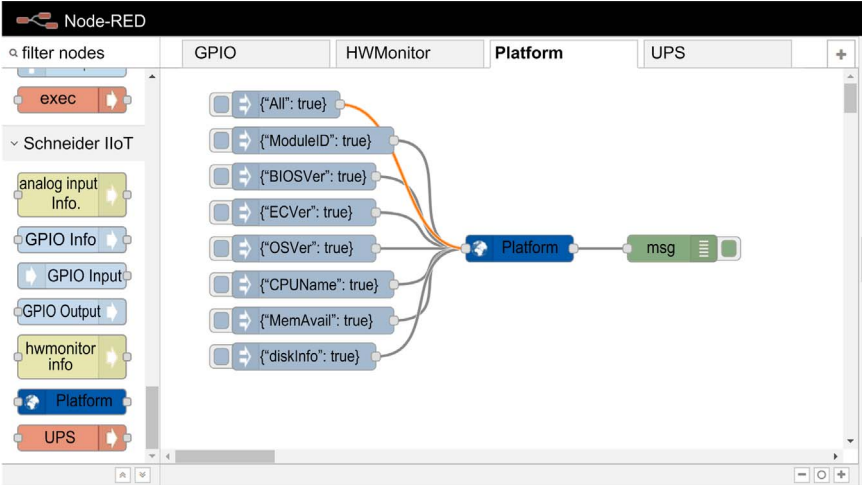
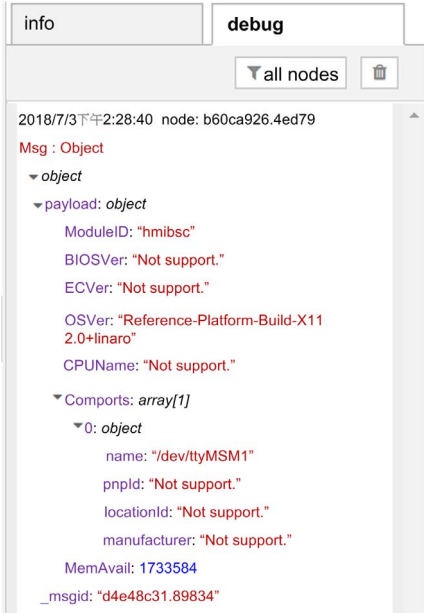
Platform Node

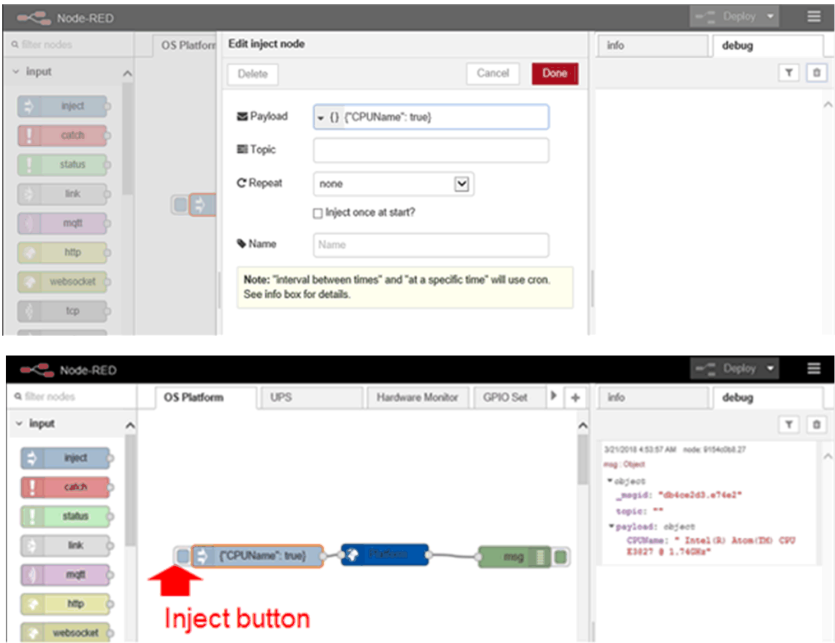
The following information can be obtained from **Platform** node:

Node Name	Information	Description/Value
Platform	Model Name	The information from Windows API or supplier SNMP.
	EC version	
	OS version	
	CPU name	
	Memory available	
	Disk information	

Platform node sends the information once at first, and if you want **OSVer** value, input **OSVer** attribute and set it to true to get only **OSVer** value.

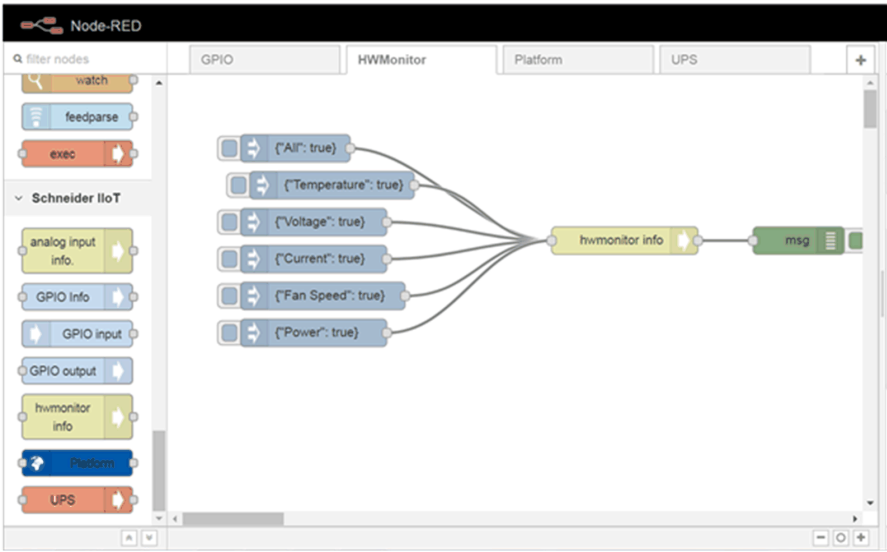
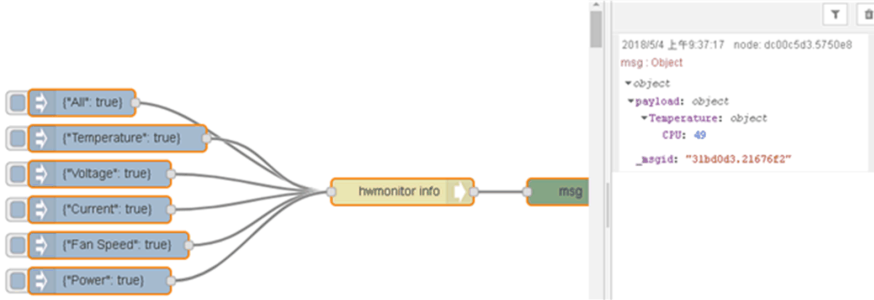
If you want the program to do setting instead of using Node, here is sample code for your reference.

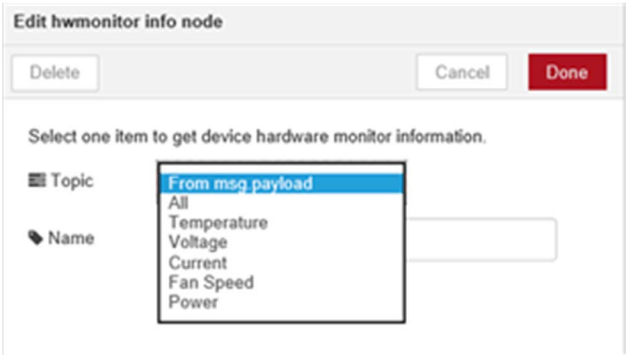
Step	Action
1	Select Platform page.
2	Double-click Platform node: 
3	Click Deploy button to get all information from debug area. 

Step	Action
4	If you want the specific information (for example, CPU name): - Click Platform node to change OSVer in the payload column to CPUName. - Click Done to close the window of Edit inject node. - Click Deploy and then click Inject button to verify the result in debug window.
5	Click Deploy button and then click Inject button to verify the result in debug window: 
6	Sample flow reference. User can get all up-to-date sample flow from bellow link: /usr/lib/node_modules/node-red-contrib-seplatform.

Hardware Monitor Node

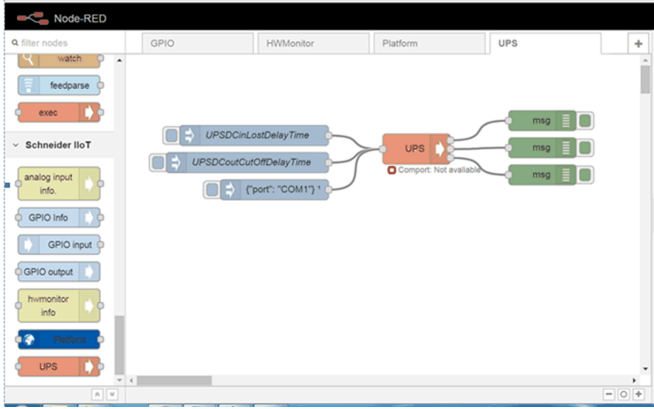
Node Name	Information	Description/Value
Hardware Monitor	Temperature	All current information from embedded control.
	Voltage	
	Current	

Step	Action
1	Select Hardware Monitor page.
2	Double-click Hardware Monitor node: 
3	Click Deploy button to get all information from debug area: 

Step	Action
4	If you want the specific information (for example, Voltage): • Click hwmonitor info node to change all in the topic column to voltage. • Click Done to close the window of Edit hwmonitor info node. • Click Deploy and then click Inject button to verify the result in debug window. 
5	Sample flow reference. User can get all up-to-date sample flow from bellow link: /usr/lib/node_modules/node-red-contrib-selmsensor.

UPS Node

Node Name	Information	Description/Value
UPS	Emergency Output	- DC-IN is lost. - Battery over temperature. - Battery gauge is lost connection. - EEPROM accesses fail. - DC-IN is over voltage. - DC-Out cut-off trigger. - Restores power to IPS-AE DC-IN.
	Status output	- fwversion: device firmware version. - ips: the status of device. 1 is ready and 0 is not ready. - dcin: the status of DC-IN. 1 is ready and 0 is not ready. - battery: the status of battery. 1 is ready and 0 is not ready. - inputlostdelay: the DC Input Lost detection duration(sec). - utoffdelay: the DC-OUT cut-off delay time(minutes). - batterylife: battery life (minutes) at the present rate of discharge. "65535" is battery charged. - temperature: battery. temperature (Celsius). - maxtemperature: It is the max temperature (Celsius) of battery from the system started. - batteryvoltage: It is the battery voltage (mV). - capacity: battery capacity (%).
	Response output	Describe the input result.

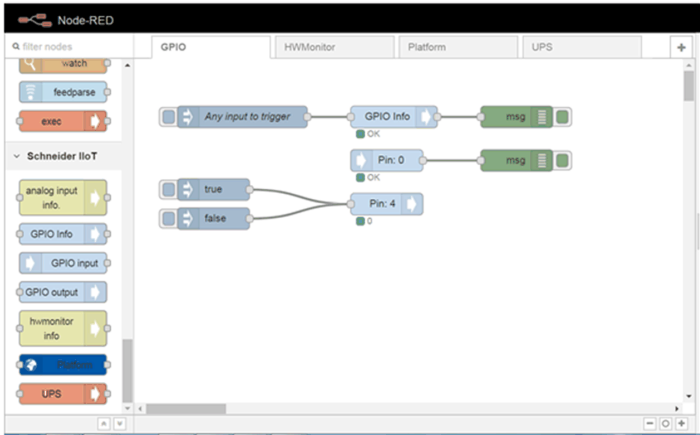
Step	Action
1	Select UPS page.
2	Double-click UPS node: 

Step	Action
3	Sample code: • The inputs must be <code>msg.payload.UPSInputLostDelay</code> and <code>msg.payload.UPSCutOffDelay</code> which are numeric. • <code>msg.payload.UPSInputLostDelay</code> is a number which is the DC Input Lost detection duration(sec). • <code>msg.payload.UPSCutOffDelay</code> is a number which is the DC-OUT cut-off delay time(minutes). • Another input <code>msg.payload.port</code> is COM port name which is used to connect with UPS. Edit UPS node Delete Cancel Done node properties SerialPort /dev/ttyMSM1 Name Name info debug all nodes 2018/04/17 15:43:28 INFO: 0/0/4910.963610 msg: Object object serial: "/dev/ttyMSM1" payload: object fwversion: "VER001.023" ipa: "1" dcin: "1" battery: "1" inputlostdelay: "300" cutoffdelay: "5" batterylife: "65535" batteryvoltage: "15705" maxtemperature: "25.05" temperature: "25.05" capacity: "100" _msgid: "c0ddfb5b.ce59e8"
4	Sample code: <pre>var ups; try { ups = require('./bin/binding/' + process.platform + '-' + process.arch + '/ipsae'); } catch (e) { console.error(e); process.exit(); } function emerency(msg) { console.log("[emerency] : " + msg); } function infomation(msg) { console.log("[infomation] : " + msg); } // The first argument may be COMn or /deb/tty*n ups.start("COM1", emerency, infomation); process.on('SIGINT', function() { ups.bye(); process.exit(); });</pre>

Step	Action
5	Sample code: <pre>// Check if USP is connected console.log('UPS status: ' + ups.getSerialStatus()); // Set DC_IN lost delay time (3 ~ 360s) var dcInLostDelayTime = 0; console.log('Set DC_IN lost delay time to ' + dcInLostDelayTime + 's: ' + ups.setDCinLostDelayTime(dcInLostDelayTime)); dcInLostDelayTime = 300; console.log('Set DC_IN lost delay time to ' + dcInLostDelayTime + 's: ' + ups.setDCinLostDelayTime(dcInLostDelayTime)); // Set DC_OUT cut off delay time (1 ~ 10s) var dcOutCutOffDelayTime = 0; console.log('Set DC_OUT cut off delay time to ' + dcOutCutOffDelayTime + 's: ' + ups.setDCoutCutOffDelayTime(dcOutCutOffDelayTime)); dcOutCutOffDelayTime = 5; console.log('Set DC_OUT cut off delay time to ' + dcOutCutOffDelayTime + 's: ' + ups.setDCoutCutOffDelayTime(dcOutCutOffDelayTime));</pre>

GPIO Set Node

Node Name	Information	Description/Value
GPIO Set	GPIO input	Set the selected GPIO pin to input and then read the value from it.
	GPIO output	Set the selected GPIO pin to output and then write a value to it.
	GPIO info	Pin number, mode (In/Out), value (high/low) of each GPIO pin.

Step	Action
1	Select GPIO page.
2	Double-click GPIO node: 
3	Double-click GPIO in settings: 

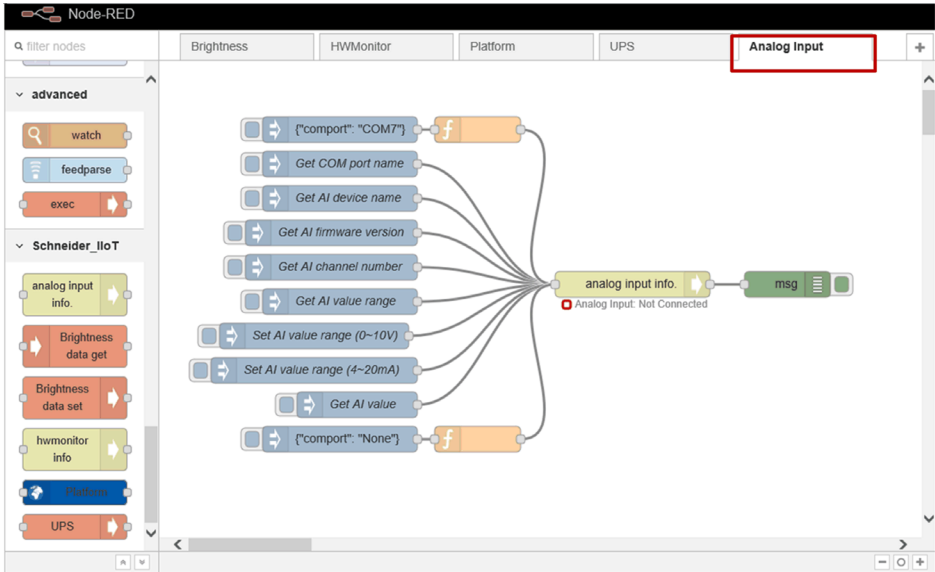
Step	Action
4	Double-click GPIO out settings: 
5	Double-click GPIO info settings: 
6	Sample flow reference. User can get all up-to-date sample flow from bellow link: /usr/lib/node_modules/node-red-contrib-segpio.

Analog Input Module Node

Node Name	Information	Description/Value
AI Module	Get COM port name	COM port name (used by this analog input module).
	Get AI device name	Analog input module name.
	Get AI firmware version	Analog input firmware version.
	Get AI channel number	Analog input channel number.
	Get AI value range	Analog input value range.
	Set AI value range	Analog input value range setting.
	Get AI value	Analog input value.

Sample Flow

You can create your own analog input module flow or you can select the **Analog Input** tab to get default analog input sample flow and the sample flow is as below:



Step	Action
1	At first, COM port path setting is required to make analog input module connect to host. The other functions cannot be used before finishing analog input module connection step. Set a COM port item in an analog input info node. (COMx: X = number, for example, COM7, COM number depends on the host.) Edit analog input info. node Delete Cancel Done COM Port COM7 × Select one item to do the specified action. Topic From msg.payload ▼ Name Name NOTE: It can also be set by Input {"comport": "COMx"} to analog input info. node. (COMx: x=number, for example, COM7, COM number depends on the host.) For example, if you want to set COM7, set msg.payload to {"comport": "COM7"} and send this message to this node. Edit inject node Delete Cancel Done Payload ▼ {} {"comport": "COM7"} Topic Repeat none ▼ ☐ Inject once at start? Name Name Note: "interval between times" and "at a specific time" will use cron. See info box for details.

Step	Action
2	Select an item which you want to do in analog input info. node from Topic list. Edit analog input info. node Delete Cancel Done COM Port COM7 Select one item to do the specified action. Topic Name From msg.payload Get COM port name Get AI device name Get AI firmware version Get AI channel number Get AI value range Set AI value range Get AI value

Step	Action
3	In analog input info node, select Set AI value from Topic list and set Channel Index and Value Range Info field. NOTE: f you want to target all the channels, you can set -1 in Channel Index field. Edit analog input info. node Delete Cancel Done COM Port COM7 Select one item to do the specified action. Topic Set AI value range Channel Index -1 Value Range Info. 0 ~ 10 V Name Name NOTE: It can also be set by Input {"Set AI value range": true, "valRangeInfo": {"minValue":0, "maxValue":10, "unit": "V"}, "chldx": -1} in msg.payload to analog input info. node. For example, if you want to get analog input value, set msg.payload to {"Get AI value": true, "chldx": -1} and send this message to analog input info. node. For example, if you want to target all the channels, you can set "chldx": -1. For example, if you want to target channel 2, you can set "chldx": 2. Edit inject node Delete Cancel Done Payload {} {"Get AI value": true, "chldx": -1} Topic Repeat none ☐ Inject once at start? Name Get AI value Note: "interval between times" and "at a specific time" will use cron. See info box for details.

Step	Action
4	In analog input info node, select Get AI value from Topic list and set Channel Index field. NOTE: f you want to target all the channels, you can set -1 in Channel Index field. Edit analog input info. node Delete Cancel Done COM Port COM7 Select one item to do the specified action. Topic Get AI value Channel Index -1 Name Name NOTE: It can also be set by Input {"attribute name": true} in msg.payload to analog input info. node. For example, if you want to get analog input value, set msg.payload to {"Get AI value": true, "chldx": -1} and send this message to analog input info. node. If you want to target all the channels, you can set "chldx": -1. If you want to target channel 2, you can set "chldx": 2. Edit inject node Delete Cancel Done Payload {} {"Get AI value": true, "chldx": -1} Topic Repeat none ☐ Inject once at start? Name Get AI value Note: "interval between times" and "at a specific time" will use cron. See info box for details.

Step	Action
5	If you do not need analog input module, you can set input {"comport": "None"} to disconnect the communication between host and analog input module. The disconnected step ends after the state of the node change from connected to disconnected. Edit inject node Delete Cancel Done ✉ Payload ▼ {} {"comport": "None"} 📄 Topic 🔄 Repeat none ▼ ☐ Inject once at start? 🏷 Name Name Note: "interval between times" and "at a specific time" will use cron. See info box for details.
6	Sample flow reference. User can get all up-to-date sample flow from the link: /usr/lib/node_modules/node-red-contrib-seai.

Software Configuration

General Information

This manual provides information about using the configuration files to initialize the device and utilities to change the settings on the device.

This manual does not show you how to solve every possible programming issue. To use this manual, you should already be familiar with Linux shell command. If you need to build your own OS image, customizing your OS image or using SDK to compile the application, contact your local Schneider to get further information and resources for better support.

This user guide is divided into the following sections:

- Using the **Configuration File** on the **Target Device**.
- Using the **Utility** on the **Target Device**.

This section gives the information about how many configurations can be set and how to use them on the target device. Whenever you modify the configuration file, the settings are updated after you restart the device.

Editing The Configuration File

The vi editor is a screen-oriented text editor. Use vi editor to modify the configuration file,as follows:

Step	Action	Action
1	Open the configuration file.	\$ vi ~/infra_setting.conf
2	Switch to insert mode by pressing i.	
3	Modify the flags.	<pre>### ----- Flags ----- ### ### ----- Flags ----- ### ### ----- Flags ----- ### ### 1. Enable to change the COM port configuration COM_SETTINGS_FLAG=0 ### 2. Enable to change the GPIO configuration GPIO_SETTINGS_FLAG=0 ### 3. Enable to change LAN 0 configuration LAN_0_SETTINGS_FLAG=0 ### 4. Enable to change LAN 1 configuration LAN_1_SETTINGS_FLAG=0 ### 5. Enable to change WiFi configuration and connect to WiFi WIFI_SETTINGS_FLAG=0 ### 6. Enable to change BT configuration BT_SETTINGS_FLAG=0 ### 7. Enable to change Node-RED configuration NODERED_SETTINGS_FLAG=1 ### Plus 1. Enable to change 4G configuration W4G_SETTINGS_FLAG=0 ### Plus 2. Enable to initialize the TPM 2.0 module TPM_INIT_FLAG=0</pre>

Step	Action	Action
4	Modify the parameters and press Esc to leave insert mode. <pre> ##### ----- ##### ##### ----- Parameters ----- ##### ##### ----- ##### ### 1. The COM Port Configuration ### ## 1-1. Set the mode of RS-232/422/485 transceiver ## COM_MODE=1 -> RS-232 ## COM_MODE=2 -> RS-422 ## COM_MODE=3 -> RS-485 COM_MODE="1" ## 1-2. Set the COM baudrate COM_BAUDRATE="9600" ## 1-3. COM Parity ## COM_PARITY=1 -> odd ## COM_PARITY=0 -> even COM_PARITY="1" ##### ----- ### ### 2. The GPIO configuration ### ## 2-1. Load the GPIO configuration file (File: ~/utility/gpio/gpio_config.conf) ## GPIO_LOAD_CONFIG=1 -> Load the GPIO configuration file ## GPIO_LOAD_CONFIG=0 -> Use the default value ## PS. The GPIO default values are all input for safety GPIO_LOAD_CONFIG="1" ##### ----- ### ### 3. LAN 0 Configuration ### ## 3-1. Switch static IP or DHCP ## LAN_x_ENABLE_STATIC_IP=1 -> static IP ## LAN_x_ENABLE_STATIC_IP=0 -> DHCP LAN_0_ENABLE_STATIC_IP="0" </pre>	
5	Type :wq to save the setting and exit the editor. NOTE: The following common commands are also available: :clear - clear the screen ZZ - Save and exit :q! - Discard the changes, since the last save, and exit :w - Save file :wq - Save and exit	
6	Whenever you modify the configuration file, the settings will be updated after you restart the device.	<pre> \$ sync \$ reboot </pre>

Configuration List

Item	Variable	Description
COM	COM_SETTINGS_FLAG	Enable to modify the COM port configuration.
	COM_MODE	Set the COM mode of RS-232/422/485 transceiver. COM_Mode=0 → RS-232 COM_Mode=1 → RS-422 COM_Mode=2 → RS-485
	COM_BAUDRATE	Set the COM baudrate.
	COM_PARITY	Set the COM parity. COM_PARITY=1 → odd COM_PARITY=0 → even
	<pre> ### 1. The COM Port Configuration ### ## 1-1. Set the mode of RS-232/422/485 transceiver ## COM_MODE=1 -> RS-232 ## COM_MODE=2 -> RS-422 ## COM_MODE=3 -> RS-485 COM_MODE="1" ## 1-2. Set the COM baudrate COM_BAUDRATE="9600" ## 1-3. COM parity ## COM_PARITY=1 -> odd ## COM_PARITY=0 -> even COM_PARITY="1" ### -----### </pre>	
GPIO	GPIO_SETTINGS_FLAG	Enable to modify the GPIO configuration.
	GPIO_LOAD_CONFIG	Load the GPIO configuration file (~/utility/gpio/gpio_config.conf). GPIO_LOAD_CONFIG=1 → Load the GPIO configuration file GPIO_LOAD_CONFIG=0 → Use the default value NOTE: GPIO values are set as default inputs for security reasons.
	<pre> ### 2. The GPIO configuration ### ## 2-1. Load the GPIO configuration file (File: ~/utility/gpio/gpio_config.conf) ## GPIO_LOAD_CONFIG=1 -> Load the GPIO configuration file ## GPIO_LOAD_CONFIG=0 -> Use the default value ## PS. The GPIO default values are all input for safety GPIO_LOAD_CONFIG="1" ### -----### </pre>	

Item	Variable	Description
LAN 0	LAN_0_DNS_IP_1	Set the DNS IP address 1.
	LAN_0_DNS_IP_2	Set the DNS IP address 2.
	LAN_0_SETTINGS_FLAG	Enable to modify the LAN 0 configuration.
	LAN_0_ENABLE_STATIC_IP	Switch static IP or DHCP for LAN port 0. LAN_x_ENABLE_STATIC_IP=1 → static IP LAN_x_ENABLE_STATIC_IP=0 → DHCP
	LAN_0_STATIC_IP	Set the static IP address for LAN port 0.
	LAN_0_NETMASK_BIT_COUNT	Set the network mask bit count afterwards for LAN port 0. LAN_x_NETMASK_BIT_COUNT=8 → Netmask IP Address=255.0.0.0 LAN_x_NETMASK_BIT_COUNT=16 → Netmask IP Address=255.255.0.0 LAN_x_NETMASK_BIT_COUNT=24 → Netmask IP Address=255.255.255.0 LAN_x_NETMASK_BIT_COUNT=25 → Netmask IP Address=255.255.255.128
	LAN_0_DEFAULT_GATEWAY	Set a default Gateway for LAN port 0.
<pre> ### 3. LAN 0 Configuration ### ## 3-1. Switch static IP or DHCP ## LAN_x_ENABLE_STATIC_IP=1 -> static IP ## LAN_x_ENABLE_STATIC_IP=0 -> DHCP LAN_0_ENABLE_STATIC_IP="0" ## 3-2. Set the static IP address LAN_0_STATIC_IP="10.0.0.1" ## 3-3. Set the network mask bit count afterwards ## LAN_x_NETMASK_BIT_COUNT=8 -> Netmask IP Address=255.0.0.0 ## LAN_x_NETMASK_BIT_COUNT=16 -> Netmask IP Address=255.255.0.0 ## LAN_x_NETMASK_BIT_COUNT=24 -> Netmask IP Address=255.255.255.0 ## LAN_x_NETMASK_BIT_COUNT=25 -> Netmask IP Address=255.255.255.128 LAN_0_NETMASK_BIT_COUNT="24" ## 3-4. Set the default gateway ## Warning: If you set this value, it will force LAN 0 as default gateway. LAN_0_DEFAULT_GATEWAY="" ## 3-5. Set the DNS IP address LAN_0_DNS_IP_1="8.8.8.8" LAN_0_DNS_IP_2="8.8.4.4" ### ----- ### </pre>		

Item	Variable	Description
LAN 1	LAN_1_DNS_IP_1	Set the DNS IP address 1.
	LAN_1_DNS_IP_2	Set the DNS IP address 2.
	LAN_1_SETTINGS_FLAG	Enable to modify LAN 1 configuration.
	LAN_1_ENABLE_STATIC_IP	Switch static IP or DHCP for LAN port 1. LAN_x_ENABLE_STATIC_IP=1 → static IP LAN_x_ENABLE_STATIC_IP=0 → DHCP
	LAN_1_STATIC_IP	Set the static IP address for LAN port 1.
	LAN_1_NETMASK_BIT_COUNT	Set the network mask bit count afterwards for LAN port 1. LAN_x_NETMASK_BIT_COUNT=8 → Netmask IP Address=255.0.0.0 LAN_x_NETMASK_BIT_COUNT=16 → Netmask IP Address=255.255.0.0 LAN_x_NETMASK_BIT_COUNT=24 → Netmask IP Address=255.255.255.0 LAN_x_NETMASK_BIT_COUNT=25 → Netmask IP Address=255.255.255.128
	LAN_1_DEFAULT_GATEWAY	Set a default Gateway for LAN port 1.
<pre> ### 4. LAN 1 Configuration ### ## 4-1. Switch static IP or DHCP ## LAN_x_ENABLE_STATIC_IP=1 -> static IP ## LAN_x_ENABLE_STATIC_IP=0 -> DHCP LAN_1_ENABLE_STATIC_IP="0" ## 4-2. Set the static IP address LAN_1_STATIC_IP="10.0.1.1" ## 4-3. Set the network mask bit count afterwards ## LAN_x_NETMASK_BIT_COUNT=8 -> Netmask IP Address=255.0.0.0 ## LAN_x_NETMASK_BIT_COUNT=16 -> Netmask IP Address=255.255.0.0 ## LAN_x_NETMASK_BIT_COUNT=24 -> Netmask IP Address=255.255.255.0 ## LAN_x_NETMASK_BIT_COUNT=25 -> Netmask IP Address=255.255.255.128 LAN_1_NETMASK_BIT_COUNT="24" ## 4-4. Set the default gateway ## Warning: If you set this value, it will force LAN 1 as default gateway. LAN_1_DEFAULT_GATEWAY="" ## 4-5. Set the DNS IP address LAN_1_DNS_IP_1="8.8.8.8" LAN_1_DNS_IP_2="8.8.4.4" ### ----- ### </pre>		

Item	Variable	Description
Wi-Fi	WIFI_SETITINGS_FLAG	Enable to modify Wi-Fi configuration and connect Wi-Fi.
	WIFI_AP_MODE	Enable Wi-Fi AP mode. WIFI_AP_MODE=1 → AP mode WIFI_AP_MODE=0 → Normal mode
	WIFI_AP_MODE_LAN	The network interface for a network bridge (For example, eth0, eth1).
	WIFI_AP_MODE_SSID	Wi-Fi AP SSID.
	WIFI_AP_MODE_PASSWORD	Wi-Fi AP password.
	WIFI_SSID	Set the Wi-Fi SSID.
	WIFI_PASSWORD	Set the Wi-Fi password.
<pre> ### 6. WiFi mode, SSID and Password ### ## 6-1. Set WiFi to AP mode ## WIFI_AP_MODE=1 -> AP mode ## WIFI_AP_MODE=0 -> normal mode WIFI_AP_MODE="0" ## 6-1-1. The network interface for a network bridge (Ex: eth0, eth1) WIFI_AP_MODE_LAN="eth0" ## 6-1-2. WiFi AP SSID (Be defined by yourself) WIFI_AP_MODE_SSID="WiFiAPSSID" ## 6-1-3. WiFi AP password (Be defined by yourself) WIFI_AP_MODE_PASSWORD="12345678" ## 6-2. Set the WiFi SSID WIFI_SSID="WiFiSSID" ## 6-3. Set the WiFi password WIFI_PASSWORD="12345678" ### -----### </pre>		
Bluetooth	BT_SETTINGS_FLAG	Enable to modify BT configuration.
	BT_PAIRABLE	BT is pairable and discoverable.
<pre> ### 7. The BT configuration ### ## 7-1. BT is pairable and discoverable BT_PAIRABLE="0" ### -----### </pre>		

Item	Variable	Description
Node-RED	NODERED_SETTINGS_FLAG	Enable to modify Node-RED configuration.
	NODE_RED_AUTORUN	Run Node-RED automatically.
	<pre> ### 8. Node-RED Configuration ### ## 8-1. Run Node-RED automatically NODE_RED_AUTORUN="1" ### ----- ### </pre>	
TPM	TPM_INIT_FLAG	Enable to initialize the TPM 2.0 module.
4 G	W4G_SETTINGS_FLAG	Enable to modify 4 G configuration.
	W4G_SIM_PIN	The SIM pin code.
	W4G_APN	The access point name.
	W4G_USERNAME	The user name for carrier.
	W4G_PASSWORD	The password for carrier.
	W4G_AUTO_RECONNECTION	Reconnect automatically if the connection is dropped.
	W4G_TRACKING_INTERVAL	Tracking interval for checking whether the connection is dropped (Unit: minute).
	<pre> ### Plus 1. The 4G configuration ### ## Plus 1-1. The SIM PIN code (optional) W4G_SIM_PIN="0000" ## Plus 1-2. The Access Point Name (optional) W4G_APN="" ## Plus 1-3. The username for carrier (optional) W4G_USERNAME="" ## Plus 1-4. The password for carrier (optional) W4G_PASSWORD="" ### ----- ### </pre>	

Using the Utility on the Target Device

General Information

This section gives information about how to use utility on the target device. The peripheral settings can be changed during the runtime.

Utility List

The following table describes the Utility functions:

Item	File name	Description	Path examples
COM	com_mode_change.sh	Change COM mode.	~/utility/com/com_mode_change.sh
Bluetooth	bt_setup.sh	Initialize the BT module and pair to a specific device.	~/utility/bt/bt_setup.sh
	bt_send.sh	Send a file to a specific remote BT device.	~/utility/bt/bt_send.sh
TPM	rsa_encrypt_files.sh	Encrypt a file with RSA key.	~/utility/tpm/rsa_encrypt_files.sh
	rsa_decrypt_files.sh	Decrypt a file with RSA key.	~/utility/tpm/rsa_decrypt_files.sh
4G	w4g_setup.sh	Initialize the 4G module and connect the 4G module to the base station.	~/utility/w4g/w4g_setup.sh <simPin> <apn> <username> <password>

Bluetooth Utility

The usage and examples for utilities are as follows:

Utilities	Usage	Examples
bt_setup.sh	~/utility/bt/bt_setup.sh start stop list paired pair <macAddress>	Let BT device is pairable and discoverable: ~/utility/bt/bt_setup.sh start List the discovered remote BT device: ~/utility/bt/bt_setup.sh list List the paired remote BT device: ~/utility/bt/bt_setup.sh paired Pair to a specific remote BT device: ~/utility/bt/bt_setup.sh pair 01:02:03:04:05:06 Disable BT device: ~/utility/bt/bt_setup.sh stop
	Parameter: <macAddress>: The remote BT MAC address	
bt_send.sh	~/utility/bt/bt_send.sh <macAddress> <filePath>	Send a file to a specific BT device: ~/utility/bt/bt_send.sh 01:02:03:04:05:06 ~/utility/bt/README.txt
	Parameter: • <macAddress>: The remote BT MAC address • <filePath>: The file path	

TPM Utility

The usage and examples for utilities are as follows:

Utilities	Usage	Examples
rsa_encrypt_files.sh	~/utility/tpm/rsa_encrypt_files.sh <inFile> <outFile>	Encrypt a file: ~/utility/tpm/rsa_encrypt_files.sh test.txt
	Parameter: • <inFile>: Input file path, the original data • <outFile>: Output file path, the encrypted data (optional)	Encrypt a file with specific output name: ~/utility/tpm/rsa_encrypt_files.sh test.txt en_test.txt
rsa_decrypt_files.sh	~/utility/tpm/rsa_decrypt_files.sh <inFile> <outFile>	Decrypt a file: ~/utility/tpm/rsa_decrypt_files.sh en_test.txt
	Parameter: • <inFile>: Input file path, the encrypted data • <outFile>: Output file path, the original data (optional)	Decrypt a file with specific output name: ~/utility/tpm/rsa_decrypt_files.sh en_test.txt de_en_test.txt

4G Utility

The usage and examples for utilities are as follows:

Utilities	Usage	Examples
w4g_setup.sh	~/utility/w4g/w4g_setup.sh <simPin> <apn> <username> <password>	Unlock SIM pin, create PDP context with APN, and connect to the base station: ~/utility/w4g/w4g_setup.sh "0000" "internet"
	Parameter: • <simPin>: The SIM pin code (optional) • <apn>: The access point name (optional) • <username>: The username for carrier (optional) • <password>: The password for carrier (optional)	Unlock SIM pin, create PDP context with APN, username, password and connect to the base station: ~/utility/w4g/w4g_setup.sh "0000" "lte-d.ocn.ne.jp" "mobileid@ocn" "mobile" Overwrite APN, username, password and reconnect to the base station: ~/utility/w4g/w4g_setup.sh "" "lte-d.ocn.ne.jp" "mobileid@ocn" "mobile"

COM Utility

The usage and examples for utilities are as follows:

Utilities	Usage	Examples
com_mode_change.sh	~/utility/com/com_mode_change.sh <mode>	Change COM mode to RS-232: ~/utility/com/com_mode_change.sh 1
	<mode>: The COM mode Parameter: ● 1: RS-232 ● 2: RS-422 ● 3: RS-485	Change COM mode to RS-422: ~/utility/com/com_mode_change.sh 2 Change COM mode to RS-485: ~/utility/com/com_mode_change.sh 3

Chapter 8

IloT and Cyber Security

Subject of This Chapter

This chapter describes the IloT and Cyber Security features of the Box iPC.

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
Cyber Security	128
IloT and Node-RED	132

Cyber Security

Overview

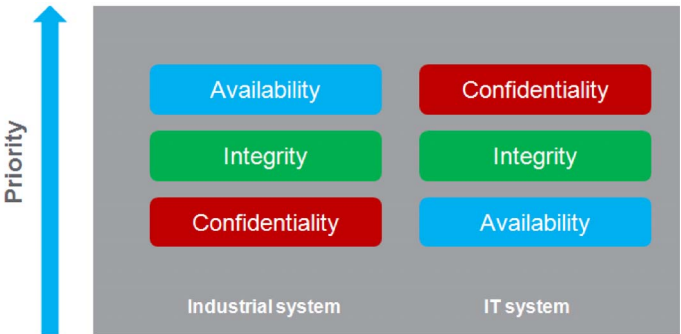
It is a fact that Industrial and control systems are more and more vulnerable to cyber attacks due to their modern design:

- They use commercial technologies.
- They are more and more connected.
- They can be remotely accessible.
- Their strategic location in the industrial processes is a point of interest for hackers.

Industrial systems have also different cyber security objectives compared to typical IT systems. To secure properly the industrial installation, it is important to understand these differences. Three fundamental characteristics have to be considered:

- Availability of the system: how to ensure that the system remains operational?
- Integrity of the data: how to maintain the integrity of information?
- Confidentiality: how to avoid information disclosure?

The priorities between an industrial system and a typical IT system are not the same as described on the following diagrams:



A good recommendation to address these security objectives is to adopt a defense-in-depth approach matching these priorities.

The IIoT Box provides a defense-in-depth approach by default, thanks to the different security mechanisms it contains.

The Harmony Box iPC enhanced cyber security to access, communicate, and store information:

IoT Box Defense-in-depth approach



To keep the system as secured as possible, it is necessary to secure the environment where the Box is installed by following the standard recommendations described below.

Cybersecurity Support Portal: <http://www.schneider-electric.com/b2b/en/support/cybersecurity/overview.jsp>

General Practices

Unauthorized persons may gain access to the Harmony Industrial PC and IloT Box as well as to other devices on the network/fieldbus of the machine and connected networks via insufficiently secure access to software and networks.

To avoid unauthorized access to the Harmony Industrial PC and IloT Box, users are advised to:

- Perform a hazard and risk analysis that considers all hazards resulting from access to (and operation on) the network/fieldbus, and develop a cyber security plan so.
- Verify that the hardware and software infrastructure that the Harmony Industrial PC and IloT Box is integrated into (along with all organizational measures and rules covering access to the infrastructure) consider the results of the hazard and risk analysis, and are implemented according to best practices and standards such as ISA/IEC 62443.
- Verify the effectiveness of the IT security and cyber security systems using appropriate, proven methods.
- Keep your system up to date (security patches).
- Keep your antivirus up to date.
- Define properly the security of the Box: access rights, user's accounts. Ensure that the minimum access rights are given to users to avoid illegal access or too much privilege given to the user.
- Enable data encryption (available by default or as option depending on Part Numbers).
- Limit the access to the only needed information and users.
- Follow the recommendations to secure the Network infrastructure (see **General Practices** chapter in the document **How Can I Reduce Vulnerability to Cyber Attacks in PlantStruxure Architectures?** (<http://www.schneider-electric.com/b2b/en/support/cybersecurity/resources.jsp?>)
- When exiting from commissioning mode, do not accept root login by the operator. The file `/etc/securetty` is empty, the operator cannot login with root permissions without the `su -` command.
- For security reasons, do not open any unused ports. Stop any unused services or use the firewall feature with the `iptables` command.

Cyber Security Features Available

Cyber security features available on Harmony Industrial PC and IIoT Box:

1. IIoT Box architecture is based on the operating system.
2. Hardware can include a TPM module used for security enforcement.
3. Integrity of the operating system is also checked by RISC (Reduced Instruction Set Computer) mechanism that ensures that the OS is the official one.

NOTE: Taking into account the large number of various configurations and applications, convenient and efficient out of the box settings for the Box PC IIoT cannot be provided. It belongs to authorized person in charge of commissioning and configuration to enable or disable functions and interfaces according to cyber security requirements for the applications.

Recommendations For Node-RED

Node-RED can be configured from several channels:

1. Using a connection to IIoT Box Node-RED server from another computer in the network.
2. By importing a JSON file in the IIoT Box using a media or network access.
3. Using Web services from the Node-RED server from an application.

NOTE: What ever the scenario, the user must be sure that the computer used to access the IIoT Box is safe: OS up to date, security patches up to date, antivirus up to date, no malware on the PC.

When importing a JSON file using removable media like USB key must be done very carefully to avoid importation of corrupted JSON files or malware on the IIoT Box. The operation should be reserved to people authorized to modify the configuration of the IIoT Box.

NOTE: A configuration of the IIoT Box has a deep impact on the overall security architecture. All modification done in the box configuration can lead to device access or cloud access by unauthorized users.

The configuration of the IIoT Box is done thanks to Node-RED configuration with the Node-RED server. The system is provided with an existing set of nodes.

However, for specific needs (specific device access, specific cloud access, specific data management) the user may need new functionalities. This is given by the ability to create new Nodes.

NOTE: Creation of new nodes also implies the increase of the attack surface that could lead to an unsecure system.

A Node-RED designer should be aware of the following recommendations to keep the security of the system at the expected level:

- Recommendation 1: Node-RED designers should apply well-known good practices of software engineering to ensure a good quality level and avoid typical mistakes like buffer overflow, bad exception management.
- Recommendation 2: All data coming/going from the devices and more generally all data injected in Node-RED modules should be checked and validated to avoid typical errors like buffer overflow, data injection (see OWASP recommendations for typical errors). Communication errors with devices should also be handled properly to avoid deny of services of the system.
- Recommendation 3: All data coming/going from IT services (like cloud for instance) should be properly checked and validated to avoid information disclosure, deny of services and typical security issues.

IIoT and Node-RED

Overview

The Industrial Internet of Things (IIoT) is the use of Internet of Things (IoT) technologies in manufacturing. The IoT is a network of intelligent computers, devices, and objects that collect and share huge amounts of data. The collected data is sent to Cloud-based service where it is shared with users in a helpful way.

The IIoT works not only at the machine or process level, but from the device itself to be seamlessly wired to the business systems and Internet data levels. It is a parallel application model, connecting edge to cloud computing: Collecting data from agent-enabled edge devices, connected to field devices, and improving operations and asset performance with cloud applications.

The IIoT runs analytics in the agents, preferably the field device itself, or an edge device connected to the field devices, interfacing with the automation application. The analytics are built and deployed over time without the need to modify or even shut down the existing control system.

The IIoT consolidates analytics across a fleet of heterogeneous assets, in disparate geographies. It aggregates data and seamlessly provides analytics at the cloud level, building the digitalized smart factories and improving responsiveness.

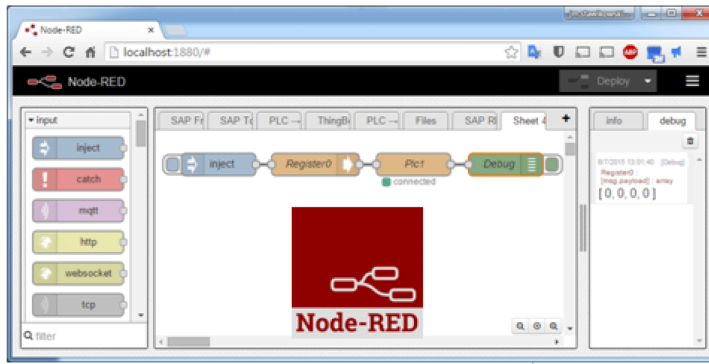
Node-RED

Node-RED leverages IT/OT convergence. It is the new software technology to wire the **things** from the field to the Internet IT and cloud applications without the need to modify existing systems. It is the quick path to the IIoT. Node-RED is light, open source, and simple to use. An existing transparent Ethernet TCP/IP network is used with Node-RED.

Node-RED is composed of an editor tool and an engine to make easily and run the connections between the IIoT applications. Any **things** can be connected with Node-RED over the IIoT, including all automation devices with processing capabilities and Ethernet TCP/IP connections. Even the smallest field devices without such capabilities can be wired with Node-RED thanks to intermediary edge devices that collect data.

Node-RED is the visual tool for wiring the Internet of Things. The Box iPC Nodes are delivered with IIoT package. Any nodes from the Node-RED community can also be used, to “wire” together hardware devices, APIs, and online services in new ways, leveraging Internet of Things and Enterprise 4.0 approaches. It builds the infrastructure for new digitalized services.

Node-RED editor is accessible with Web browser:



The Box iPC can be upgraded with an IIoT featuring Node-RED. Nodes to monitor and control devices are delivered with the package (iPC internal temperatures, storage disk status, power supply status, SMS/email alerts, device recovery, and so on). Open, any of the thousands of nodes available from the Node-RED community can also be added to **[wire]** together hardware devices, APIs, and online services.

Cybersecurity for the IIoT

Cybersecurity has become a challenge to implementing the IIoT. Using standard network means benefitting from the security measures already provided by your IT system, such as firewalls, VPNs, and safe zones.

NOTE: The devices with Node-RED can be set to make only **[output]** communication. The cloud applications have no **[input]** communication request to the Node-RED devices. Node-RED devices push data to the cloud. So communications to the machine and plant levels are not necessary and should be avoided to guard against attacks.

NOTE: Schneider Electric adheres to industry best practices in the development and implementation of control systems. This includes a "Defense-in-Depth" approach to secure an Industrial Control System. This approach places the controllers behind one or more firewalls to restrict access to authorized personnel and protocols only.

WARNING

UNAUTHENTICATED ACCESS AND SUBSEQUENT UNAUTHORIZED MACHINE OPERATION

- Evaluate whether your environment or your machines are connected to your critical infrastructure and, if so, take appropriate steps in terms of prevention, based on Defense-in-Depth, before connecting the automation system to any network.
- Limit the number of devices connected to a network to the minimum necessary.
- Isolate your industrial network from other networks inside your company.
- Protect any network against unintended access by using firewalls, VPN, or other, proven security measures.
- Monitor activities within your systems.
- Prevent subject devices from direct access or direct link by unauthorized parties or unauthenticated actions.
- Prepare a recovery plan including backup of your system and process information.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Chapter 9

Maintenance

Subject of this Chapter

This chapter covers maintenance of the Box iPC.

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
Reinstallation Procedure	136
Regular Cleaning and Maintenance	137

Reinstallation Procedure

Introduction

In certain cases, it may be necessary to reinstall the operating system.

Precautions to take:

- Keep static-producing materials (plastic, upholstery, carpeting) out of the immediate workspace.
- Do not remove ESD-sensitive components from their anti-static bags until you are ready to install them.
- When handling static-sensitive components, wear a properly grounded wrist strap (or equivalent).
- Avoid contact with exposed conductors and component leads.

Before Reinstallation

Hardware required:

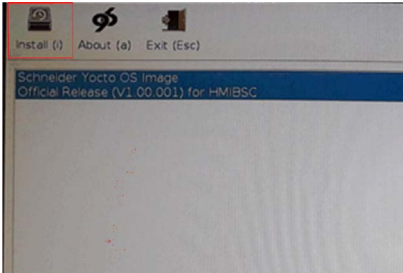
- Recovery media.

Setting up the hardware:

- Shut down the operating system in an orderly fashion and remove all power from the device.
- Disconnect all external peripherals.

NOTE: Save all main data onto a hard drive or a memory card. The reinstallation process returns the computer to its factory settings and erases all data.

Installing OS Image from SD Card

Step	Action
1	Plug in the recovery SD card into the board and restart it.
2	Choose the displayed Operating system (Yocto Linux) and click Install . This flashes the OS on the board eMMC: 
3	Once you see the programming successful dialog, unplug the power cord.
4	Remove the SD card and then plug in the power cord. The system restart into your chosen Operating System.

Regular Cleaning and Maintenance

Introduction

Inspect the Box iPC periodically to determine its general condition. For example:

- Are all power cords and cables connected properly? Have any become loose?
- Are all installation screws holding the unit securely?
- Is the ambient temperature within the specified range?

The following sections describe maintenance procedures for the Box iPC, which can be carried out by a trained, qualified user.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Remove all power from the device before removing any covers or elements of the system, and prior to installing or removing any accessories, hardware, or cables.
- Unplug the power cable from both the Harmony Industrial PC and the power supply.
- Always use a properly rated voltage sensing device to confirm that power is off.
- Replace and secure all covers or elements of the system before applying power to the unit.
- Use only the specified voltage when operating the Harmony Industrial PC. The AC unit is designed to use 100...240 Vac input. The DC unit is designed to use 24 Vdc input. Always check whether your device is AC or DC powered before applying power.

Failure to follow these instructions will result in death or serious injury.

During operation, the surface temperature of the heat sink may exceed 70 °C (158 °F).

WARNING

RISK OF BURNS

Do not touch the surface of the heat sink during operation.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Cleaning Solutions

CAUTION

HARMFUL CLEANING SOLUTIONS

- Do not clean the unit or any component of the unit with paint thinner, organic solvents, or strong acids.
- Use only a mild soap or detergent that will not harm the poly carbonate material of the screen.

Failure to follow these instructions can result in injury or equipment damage.

Appendices



Appendix A

Accessories

Accessories for the Box iPC

Available Accessories

Accessories are available as options. The table shows the list of accessories available for the Box iPC:

Reference	Description
Interfaces	
HMIYBIN2AIM21	Interface M.2 2 x analog input 0-10 V/4-20 mA
HMIYMIN8AI1	Interface mini PCIe 8 x analog input 0-10 V
HMIYMIN4GEU1	Cellular 4G EU/Asia
HMIYMIN4GUS1	Cellular 4G US
HMIYMIN4GBR1	Cellular 4G Brazil
HMIYBINLTPM201	Module TPM
Drives	
HMIYSD016C1	SD Card industrial grade 16 GB
HMIYSD064C1	SD Card industrial grade 64 GB
Accessories	
HMIYMMAC1	AC power supply module 100 W
HMIYPSOMAC1	AC power supply module 60 W
HMIYMUPSKT1	UPS battery
HMIYCABUPS31	UPS 3 m (9.84 ft) cable
HMIYBMKTBSC1	Maintenance kit
HMIYADBMODIN11	DIN rail adaptor
HMIYCAB4GAN51	5 m Cable for 4G card
HMIYCABWIFIAN511	Antenna WiFi/Bluetooth

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