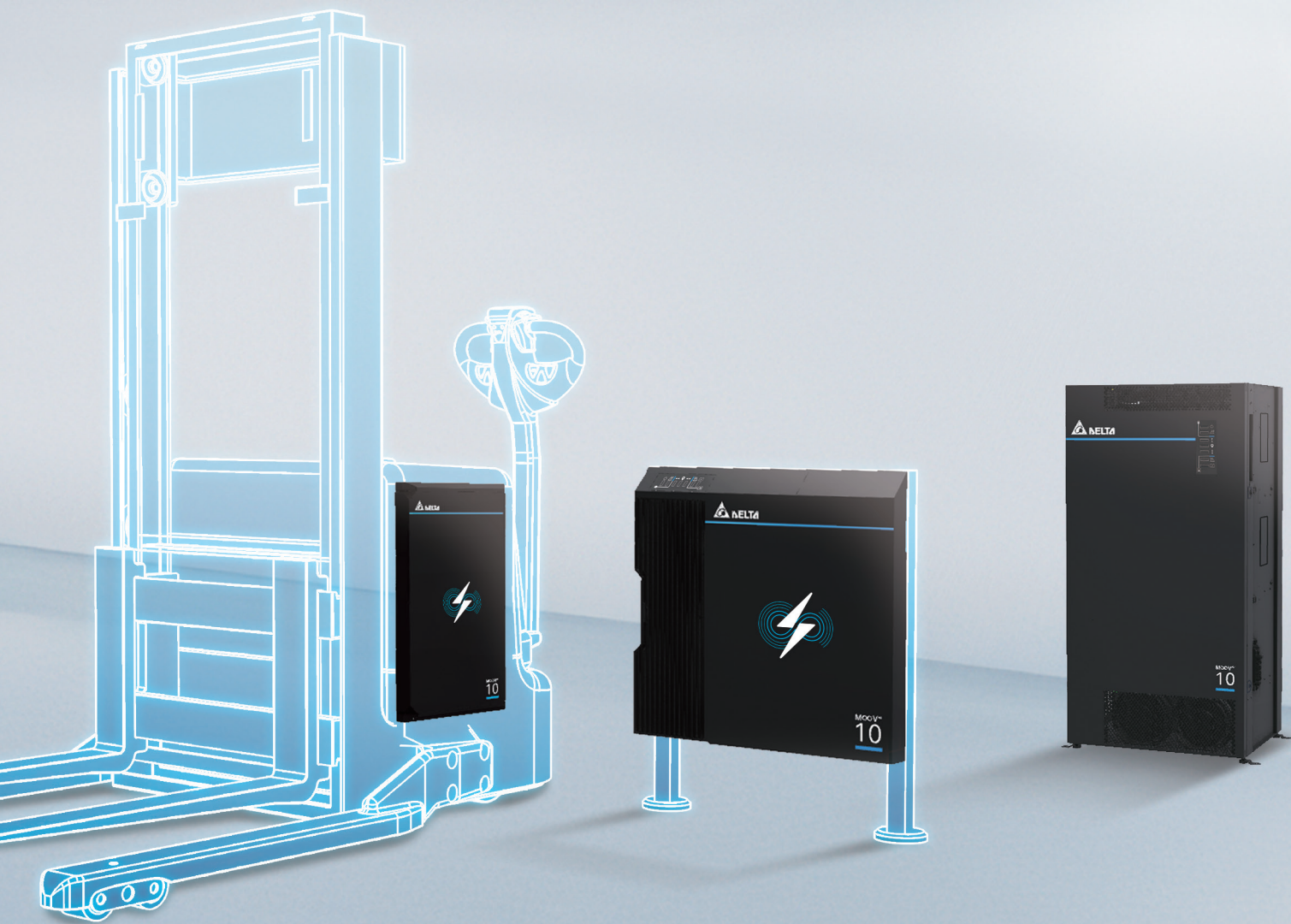




MOOV^{air}

10 kW Wireless Charging System

Installation and operation manual



LEGAL INFORMATION

This manual applies to the Wireless Charging System (WCS 10kW).

Delta manuals undergo continuous revision to provide user with complete information regarding the installation and operation of WCS. Therefore, before starting installation work, always consult Delta to check whether a newer version of the User Manual is available.

This manual is intended for use by electrical installers who are competent for installation and commissioning of grid-connected electrical systems/products.

The information in this manual should be treated as confidential and no part of this manual may be reproduced without prior written permission from Delta. The information in this manual may not be used for any other purpose, directly connected to the use of the WCS.

All translations of this manual that are not authorized by Delta Energy System (Germany) must be marked with the words "Translation of the original operating instructions."

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1 Revision Record

Changes to the previous version are highlighted in **green** in this document. Changed images are **framed in green**, and the changes within these images are also highlighted in **green**.

Revision	Date	Description
1.0	23.10.2025	First release
2.0	22.01.2026	Information according to the regulatory compliances for the United States have been updated, see 4.2 FCC (USA), p. 11 . Information to safety keep-out areas and the use of a technical barrier according to FCC has been updated, see 9.3.2 USA/FCC: Safety keep-out areas and safety markings for charging zone, p. 74 .
3.0	28.01.2026	Incorrect values for the WPP dimensions corrected, see 5.4.5 Technical specification, p. 28 . An incorrect value for the keep-out area in several images has been corrected, see 9.3.2 USA/FCC: Safety keep-out areas and safety markings for charging zone, p. 74 .

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3 About this document

3.1 Purpose of this Document

This documentation describes the operation, installation, and maintenance of the Wireless Charging System and its subsystems.

It also explains the connections and interfaces for integration with a vehicle's Battery Management System (BMS). The Wireless Secondary Unit (WSU) is installed as part of the vehicle by the vehicle integrator, whereas the Wireless Primary Box (WPB) and Wireless Primary Pad (WPP) are installed in the facility.

The document also includes the important information for the end customer, which is as follows:

- health and safety
- alignment / positioning
- the charging process
- status indicators
- system maintenance

This information is to be provided to all types of users to make sure the safe and effective use of the WCS before, during and after installation.

This document contains important safety instructions and information that must be read, understood and followed to make sure that the WCS is installed, connected and operated safely. Delta Energy Systems is not liable for any damage or harm resulting from failure to follow the safety instructions or other information contained in this document.

3.2 Target Audience

This documentation is intended for:

- Skilled persons for vehicle integration of the WSU.
- Skilled persons for integration of WPB/WPP at the facility.

Although this documentation is not intended for operators of the WCS, it does contain important information that must be provided to operators to ensure safe and effective use of the system after installation.

3.3 Access to the System

Following table contains the information about the types of users and their accessibility to the system in accordance to IEC 62368-1. In summary:

Kind of Person	Types of User	Description
Ordinary person	NA	Must not use the system.
Instructed person	Operator, Driver	May use the system after being trained by skilled person.
Skilled person	Vehicle integrator, Facility integrator, Maintainer	May install and use the system or its parts.

3.4 References

3.4.1 Delta Documentation

Description	Link
CANopen® Protocol Spec	Contact Delta Sales

3.4.2 Open Source License & Credits

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Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

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3.5 Exclusion of Liability

The firmware and/or hardware may be changed at any time without prior notice. For this reason it is possible that parts of these instructions, technical data and images in this documentation to differ slightly from the product in your possession. All points described in these instructions only serve the purpose of clarification and may not correspond to every situation. Legal claims cannot be made on the basis of this document.

4 Regulatory Compliances

4.1 EU

4.1.1 Declaration of Conformity (DoC)

Hereby, Delta Energy Systems (Germany) declares that the radio equipment type 10 kW Wireless Charging System is in compliance with Directive 2014/53/EU.

The full text of the EU declaration of conformity is available at the following internet address: www.deltaww.com.

4.1.2 Radio Equipment

Radio Frequency Information:

13.56 MHz: Wireless Communication (PPL), max. 200 mW

47-63 kHz: Wireless Power Transfer, max. 10 kW

4.2 FCC (USA)

WARNING:



- During charging/operation there will be electric and magnetic fields between the pads, human bodies must not be in close proximity of the pads. Make sure to follow the installation guidance given in section [6.5 EMF Safety Instructions](#). It is the responsibility of the installer to provide sufficient warnings, keep out restrictions and training to all personnel.

Active charging will generate electric and magnetic fields between the pads. The WCS has been designed to minimize stray fields and has been tested as complying with the following standards:

- 47 CFR Part 15.225 in conjunction with ANSI C63.10:2013
- 47 CFR Part 18, Subpart C
- 47 CFR FCC Part 1.1307(clause (b)(1)(i)(B) and (b)(3)(ii)(B)), KDB 447498 D01 General RF Exposure Guidance v06 KDB 680106 D01 RF Exposure Wireless Charging App v03r01

However, it is still necessary to take precautions to work safely with the WCS.

Operators (if any) must be informed that they could be exposed to EMF, and that they must keep enough distance from the WPP at all times, including when not charging.

ATTENTION:



This WCS complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

This device may not cause harmful interference.

This device must accept any interference received, including interference that may cause undesired operation.

ATTENTION:


This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

ATTENTION:


As defined in FCC document “47CFR Part 15”, any changes or modifications not expressly approved by the party responsible for the compliance could void the user’s authority to operate the equipment.

4.3 ISED (Canada)

4.3.1 Interference statement

Information in English

This device complies with Innovation, Science and Economic Development Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:

- (1) this device may not cause interference, and
- (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Informations en français

Le présent appareil est conforme aux CNR d’Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L’exploitation est autorisée aux deux conditions suivantes :

- (1) l’appareil ne doit pas produire de brouillage, et
- (2) l’utilisateur de l’appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d’en compromettre le fonctionnement.

4.3.2 Basic RF notice

Information in English

This radio transmitter has been approved by Innovation, Science and Economic Development Canada as meeting the RF exposure requirements for an uncontrolled environment.

Informations en français

Cet émetteur radio a été approuvé par Innovation, Sciences et Développement économique Canada comme respectant les exigences d’exposition RF pour un environnement non contrôlé.

4.3.3 Information according to RSS-102.NS.MEAS Annex C.2.3

This Wireless Charging System is powered down within one second after the load (WSU) has been removed from the charging area.

Ce système de recharge sans fil s'éteint dans la seconde qui suit le retrait de la charge (WSU) de la zone de recharge.

5 System Overview

5.1 System Components

The Wireless Charging System (WCS) is designed to charge the batteries of electric systems wirelessly. This WCS can be used by vehicles equipped with a battery, which are automated or manually driven, no user interaction is required to charge a battery.

The WCS consists of 3 subsystems.

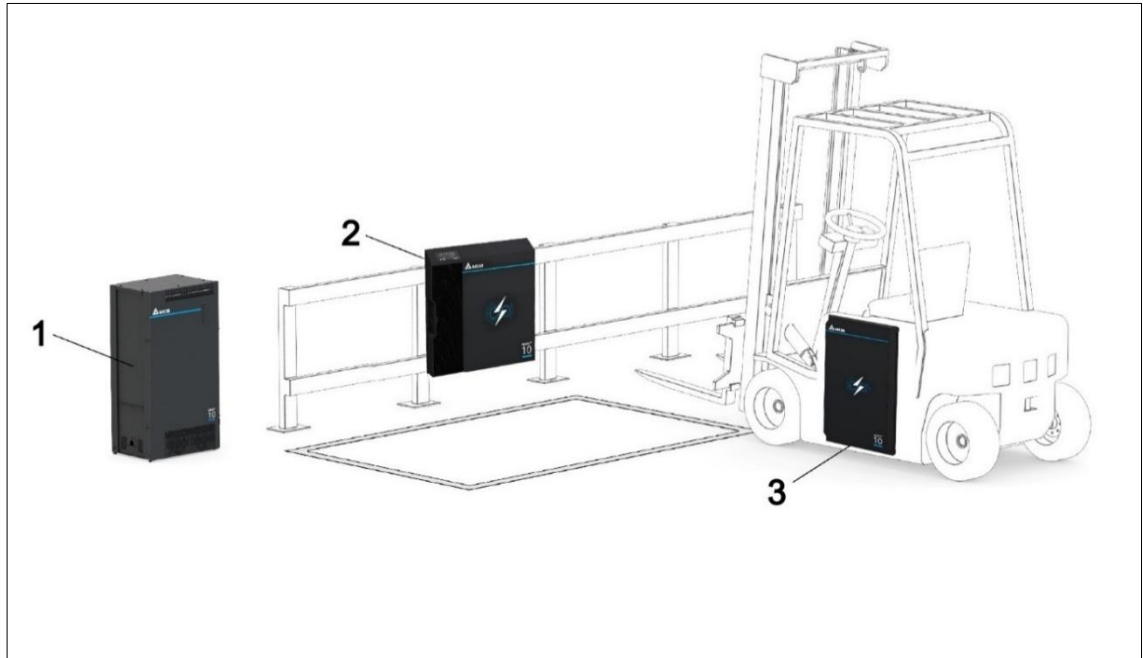
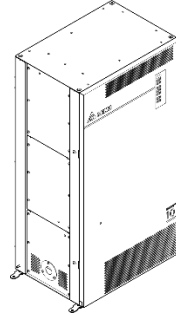
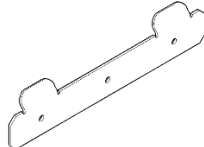
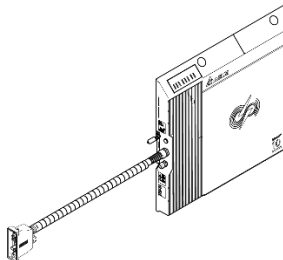
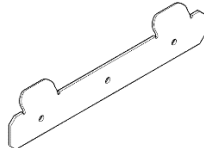
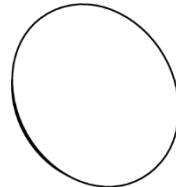
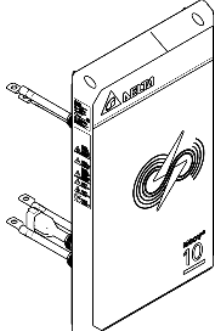


Figure 1 Components of the Wireless Charging System (WCS)

1	Wireless Primary Box (WPB)
2	Wireless Primary Pad (WPP)
3	Wireless Secondary Unit (WSU) available in 2 nominal DC output voltages: 24 VDC and 36/50 VDC)

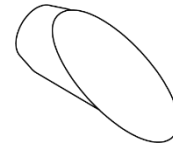
5.2 Scope of Delivery

Part		Quantity
10 kW Wireless Primary Box (WPB), for grid connection Part number: EOE17010813		1
Mounting bracket for WPB Part number: 3487421901		1
10 kW Wireless Primary Pad (WPP) Part number: EOE17010951		1
Mounting bracket for WPP Part number: 3487517401		1
WPP Plug Part number: 3231163600		4
10 kW Wireless Secondary Unit Part number 10 kW WSU 24 VDC : EOE17011077 Part number 10 kW WSU 36/50 VDC : EOE17010950		1

WSU Plug

4

Part number: 34794013xx



5.3 Wireless Primary Box (WPB)

5.3.1 Overview

The Wireless Primary Box (WPB) is a power electronics device which provides the power to be transferred via the Wireless Primary Pad (WPP) to the Wireless Secondary Unit (WSU).

The WPB draws power from the industrial grid and converts it to a medium voltage (MV) AC supply which is fed to the WPP. The WPB communicates with the WPP internally, which forms part of the control loop for safe usage. It also provides user interfaces using Ethernet, Status LEDs and an optional Stack Light.

5.3.2 Components

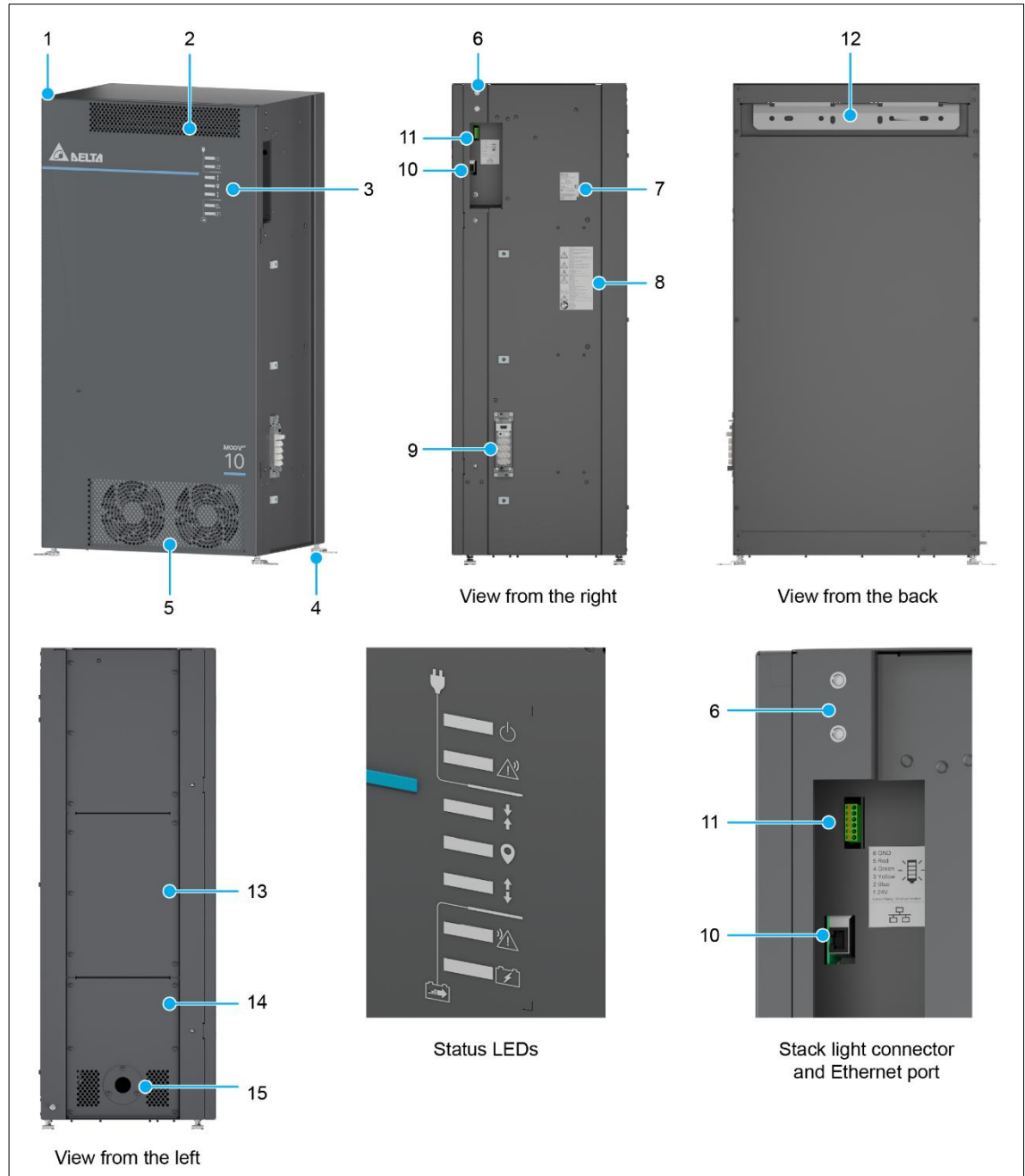


Figure 2 External components of the Wireless Primary Box

- | | |
|----|---|
| 1 | M12 threads for lifting the WPB with a crane or pulley |
| 2 | Air inlet |
| 3 | Status LED panel |
| 4 | Mounting feet for mounting to the floor and leveling |
| 5 | Air outlet |
| 6 | Threads for stack light |
| 7 | Type label and MAC address |
| 8 | Warning label |
| 9 | Heavy duty socket for cable from Wireless Primary Pad (WPP) |
| 10 | Ethernet port |
| 11 | Socket for stack light cable |
| 12 | Mounting plate for wall mounting |
| 13 | Upper cover of AC connection |
| 14 | Lower cover of AC connection |
| 15 | AC cable entry |

5.3.3 Status LED Panel

The Status LED Panel indicates system and operating status.

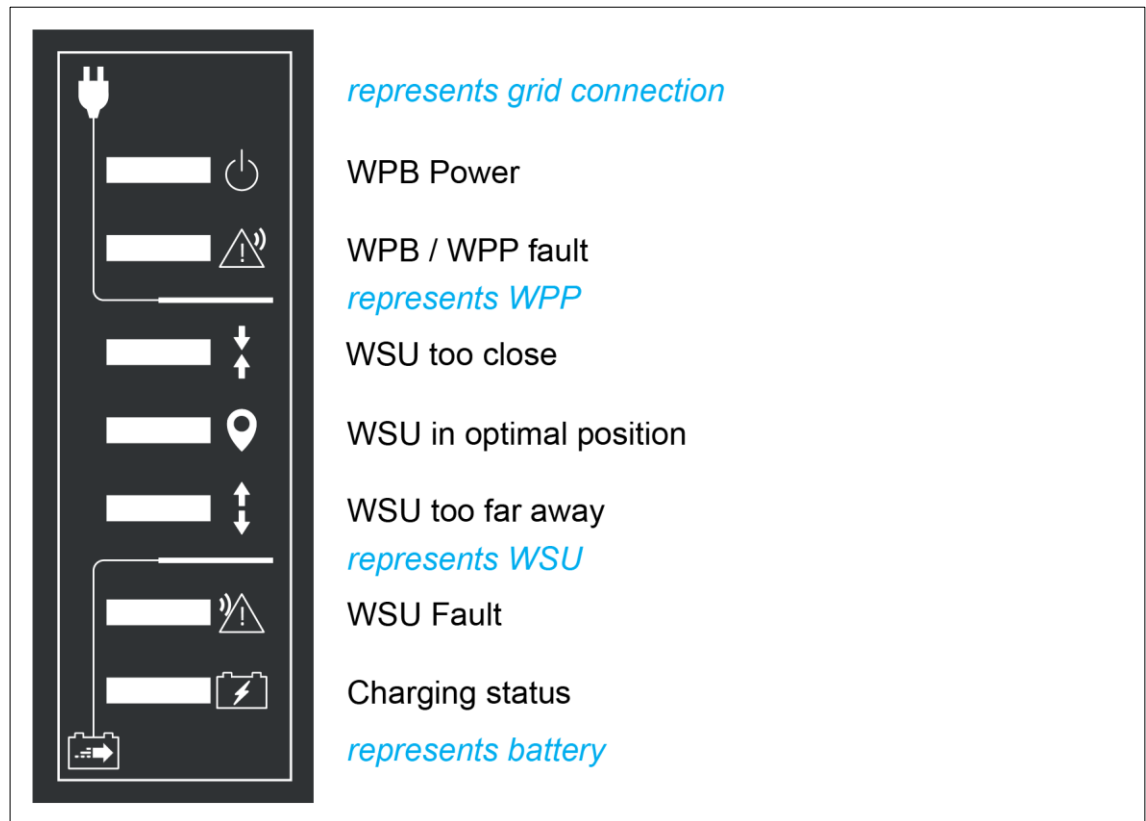


Figure 3 Status LED Panel on WPB

5.3.4 AC Input

5.3.4.1 Field Wiring Terminals

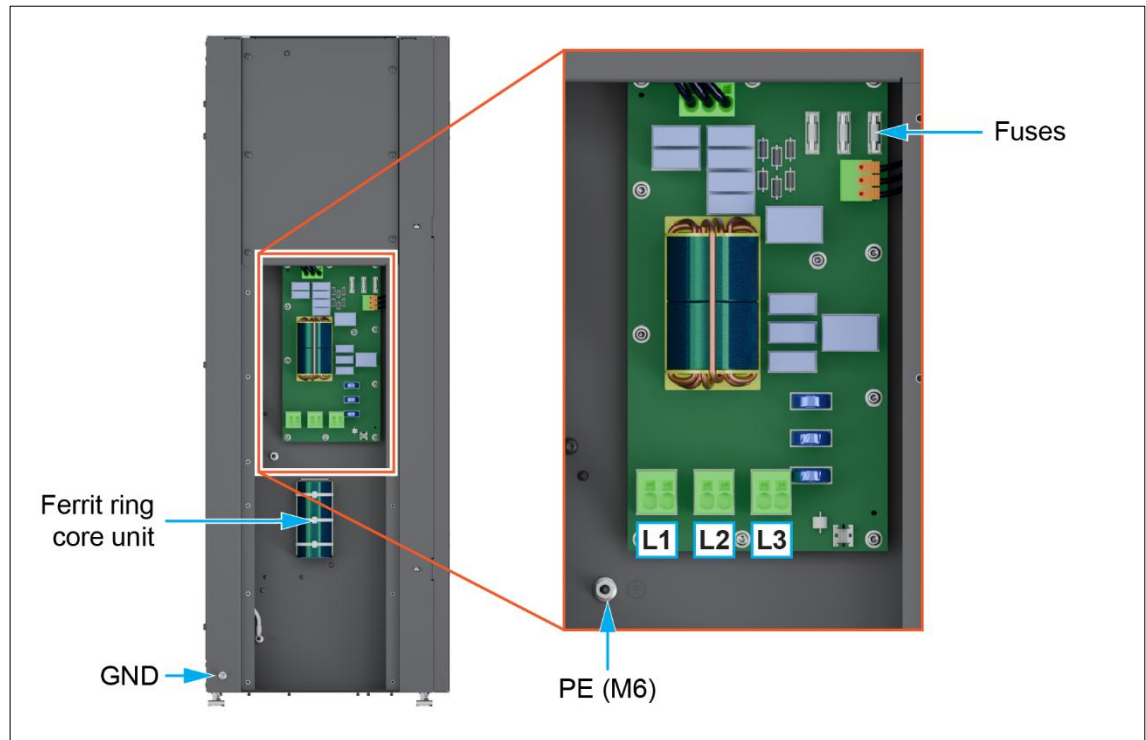


Figure 4 Field wire terminals on WPB

L1, L2, L3	Phases of the AC Supply Grid with grounded star point. Voltage 400 / 480 V, 47 to 63 Hz.		
PE/GND	PE/GND connected to star point of the AC Supply Grid. PE/GND Bolt on Chassis part close to X105X of Input filter.		
Fused supply line with SDD (Supply Disconnecting Device)	For installation and operation of the WPB, a fused supply line with a SDD according to the following specifications is required (not supplied by Delta)		
Region	Supply Voltage	Fuse	SDD
Europe	400 VAC/47 Hz	32 A	CEKON (IEC 60309) plug
US and Canada	480 VAC/63 Hz	20 A	A Switch box in accordance with NFPA 70 and C22.1-15

Table 1 Required supply disconnecting device (SDD)

5.3.4.2 Grounding System

The WPB requires a 3-phase industrial AC input connection in order to provide power to the other system components.

Grounding systems supported are TN-C, TN-S, TN-C-S, TT with grounded star points.

5.3.5 Ethernet Service Interface

The Ethernet service interface has a physical RJ45 socket configured with 100BASE-TX (Fast Ethernet) as per IEEE 802.3u. The Ethernet service interface can be used for system monitoring and control. For more information refer 3.5.2 WPB – Ethernet.

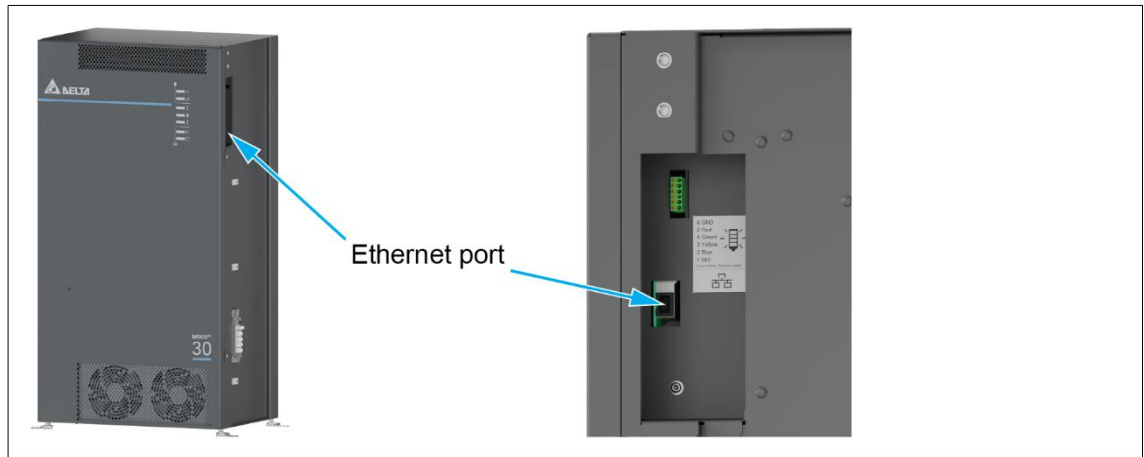


Figure 5 WPB – Ethernet Service Interface

ATTENTION:



Ethernet service interface must be used by qualified skilled person during the service and should be disconnected once the service is done.

The ethernet service cable length is restricted to 3 m.

5.3.6 Heavy-duty Connector

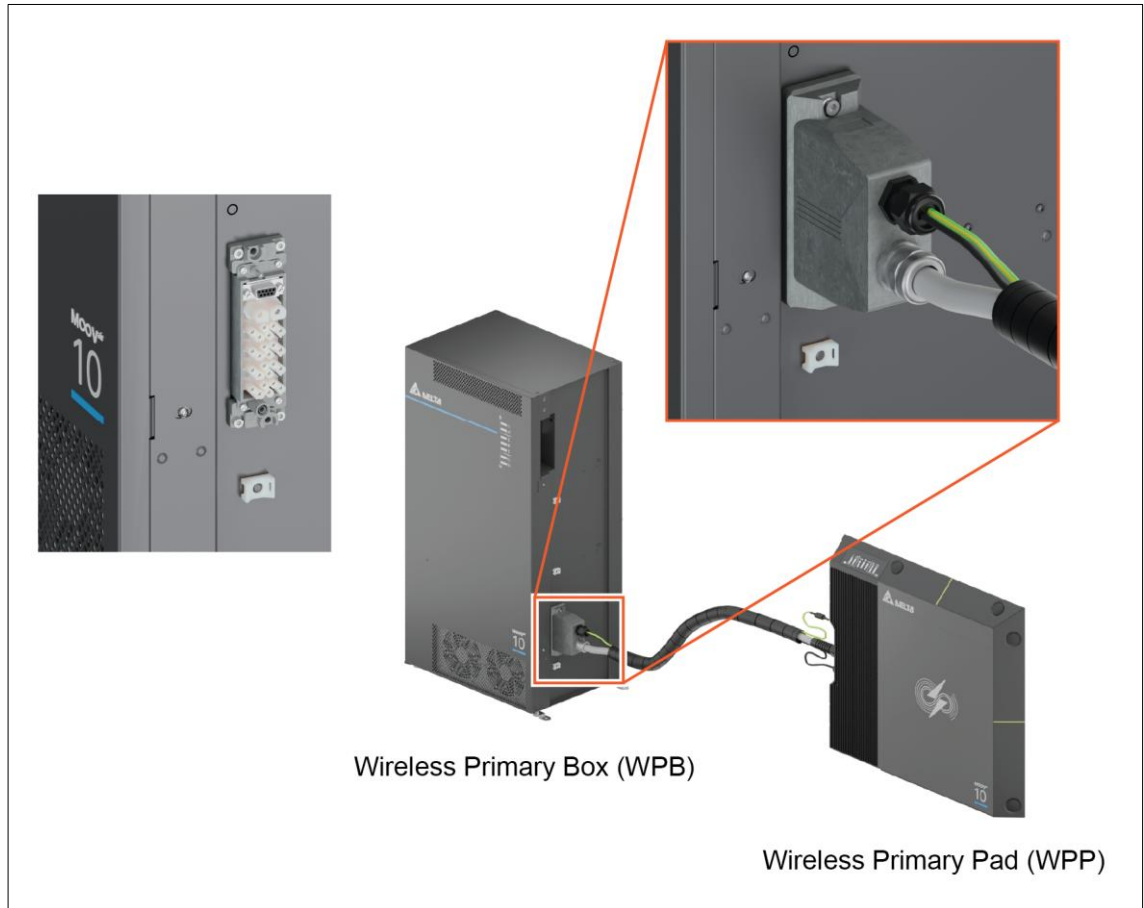


Figure 6 WPB – Heavy-duty connector

The heavy-duty plug of the WPP is connected to the heavy-duty socket of the WPB.

The heavy-duty plug has 3 cables:

- PE/GND cable
- Signal cable
- Power cable

5.3.7 Technical specification

Dimensions (H x W x D)	1050 x 550 x 400 mm (41.3 x 21.7 x 15.7 in)
Weight	107 kg (235.9 lbs)
Ingress protection classes	IP21
Cooling	Forced air
Ambient temperature	+5 to +40 °C (+41 to +104 °F)
Ambient relative humidity	5% to 85%, non-condensing
Maximum operating altitude	3000 m (9842 ft) above sea level for all subsystems
Noise levels emitted	Up to 75 dB(A), depending on fan speed. Fans will operate if internal temperature is >+40 °C.
Shock and Vibration (operating)	EN IEC 60721-3-3:2018, Class 3M11
Shock and Vibration (transport and handling)	EN IEC 60721-3-2:2018, Class 2M4
Storage temperature	-45 to +70 °C (-49 to +158 °F)

Table 2 Specifications WPB – Mechanical

	EU / UK	US / Canada
AC Input rated Voltage	400 VAC 3PH 400 to 480 VAC 3PH 	480 VAC 3PH
AC Input voltage range	360 to 528 VAC 3-phase	
AC Input frequency	47 to 63 Hz	
Maximum AC input current	18 A	
Required supplementary fuse	32 A, tripping characteristic: B	20 A, tripping characteristic: B
	Note: Installed externally to the WPB by site installer.	
Branch fuse	Use 125 Amp. Branch protection is provided by the branch fuse. Note: Installed externally to the WPB by site installer.	
Required SDD (Supply Disconnecting Device)	CEKON (IEC 60309) plug	A Switch box in accordance with NFPA 70 and C22.1-15
Required short circuit ratio	> 30	
Max. line inductance	≤ 400 μH	
Minimum conductor size (for mechanically protected/unprotected power cords)	4 mm ² /10 AWG	
Input power	11.5 kVA	
Power factor (100% Load)	0.95	
Peak efficiency	> 92%	

Table 3 Specifications WPB – AC Input

5.4 Wireless Primary Pad (WPP)

5.4.1 Overview

The WPP is fed by the WPB with a medium voltage (MV) AC supply and transfers it to the WSU via magnetic field. The WPP supplies the WSU with wireless power. The WPP communicates its operating limits to the WPB. WPP with the WSU via Pad-to-Pad link (PPL), refer [8.7.1 WPP & WSU Interface – Pad to Pad Link \(PPL\)](#). The status of the WPP is displayed on the status LED panel. The chamfered edges prevent metallic foreign objects from remaining in the magnetic field.

5.4.2 Components

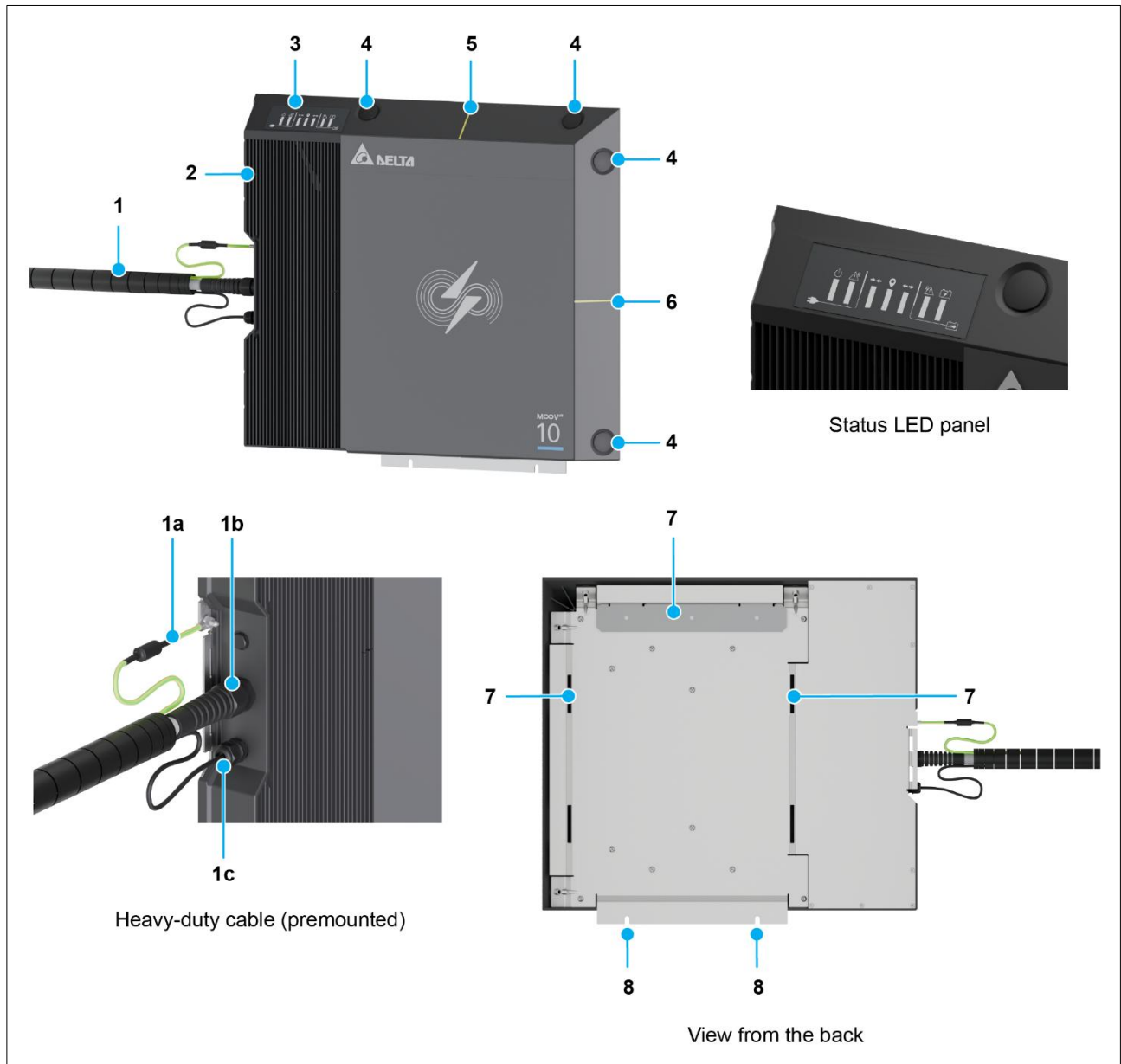


Figure 7 Components of the Wireless Primary Pad (WPP)

1	Heavy-duty cable (connected to WPB) with grounding cable (1a), AC power cable (1b) and communication cable (1c)
2	Heatsink
3	Status LED panel
4	M12 threads for lifting the WPP with a crane or pulley
5	Center mark for horizontal alignment with the Wireless Secondary Unit (WSU)
6	Center mark for vertical alignment with the WSU
7	Mounting plate for wall mounting with different positioning options
8	Mounting holes for screwing the WPP to a wall or mounting system

5.4.3 Status LED panel

The Status LED Panel indicates system and operating status.

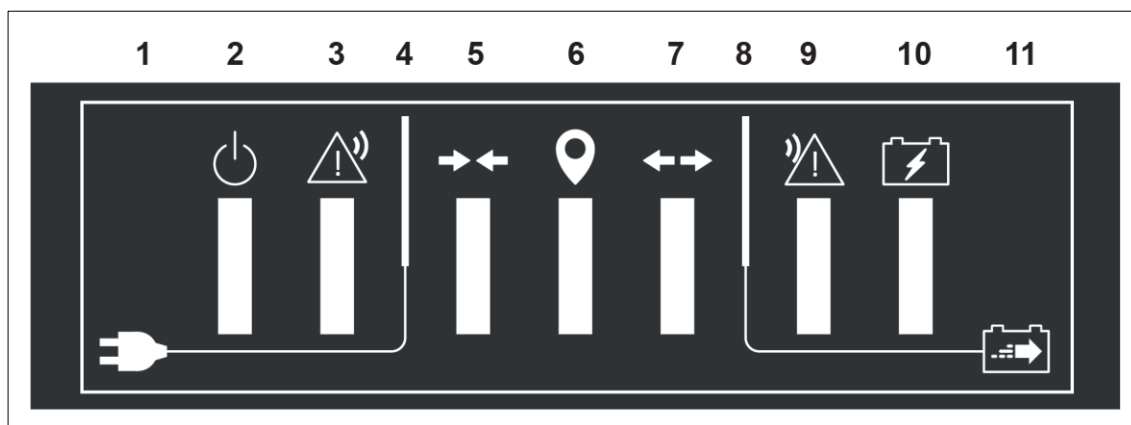


Figure 8 Status LED Panel on WPP

Refer to section [12.2 “LED status indication”, page 126](#), for detailed explanation of Status LED functions.

1	Represents grid connection
2	WPB power
3	WPB / WPP fault
4	Represents WPP
5	WSU too close
6	WSU in optimal position
7	WSU too far away
8	Represents WSU
9	WSU fault
10	Charging status
11	Represents battery

5.4.4 Heavy-duty plug

The WPP has a heavy-duty plug with 3 cables for charging power, signals and PE protection (grounding). The heavy-duty connector is plugged into the heavy-duty socket on the WPB. The length of the cables is 5 m (16.4 ft).

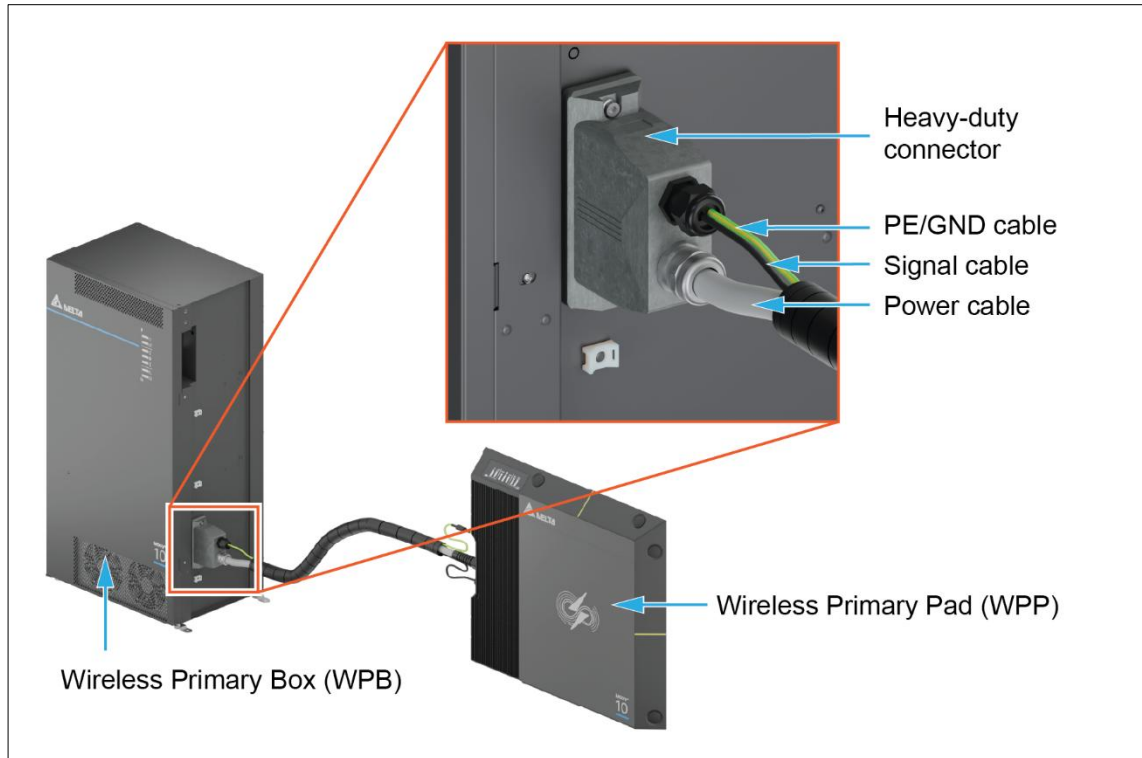


Figure 9 Heavy-duty plug on WPP with cables

5.4.5 Technical specification

Dimensions (H x W x D)	691 x 750 x 70 mm (27.2 x 29.5 x 2.76 in)
Weight	42 kg (92.6 lbs)
Cable length (WPB to WPP)	5 m (196.85 in)
Ingress protection classes	IP69
Cooling	Convection
Ambient temperature	-40 to +70 °C (-40 ° to +158 °F), output de-rating above +40 °C (+104 °C)
Ambient relative humidity	4 to 100 %
Maximum operating altitude	3000 m (9842 ft) above sea level for all subsystems
Shock and vibration (operating)	EN IEC 60721-3-4:2018, Class 4M11
Shock and vibration (transport and handling)	EN IEC 60721-3-2:2018, Class 2M4
Impact resistance	IEC 62262 Code IK07: 2 J WPP tested with higher impact force in accordance with IEC 62368-1, UL 1564, CSA 22.2 and 107.2, refer to standards or contact Delta for more information.
Storage temperature	-45 to +70 °C (-49 to +158 °F)

Table 4 Specifications – Wireless Primary Pad (WPP) – Mechanical

5.5 Wireless Secondary Unit (WSU)

5.5.1 Overview

The WSU couples to the magnetic field of the WPP. It converts the energy to an electrical current to charge the battery. The WSU communicates with WPP using PPL, refer [8.7.1 WPP & WSU Interface – Pad to Pad Link \(PPL\)](#), and with the BMS via CANopen®. The WSU is provided with over voltage protection, over current protection, reverse polarity protection and short circuit protection. Refer [10.2.4.2 WSU Cable Connections](#) for cable connections.

Following are the main parts of the WSU.

5.5.2 Components

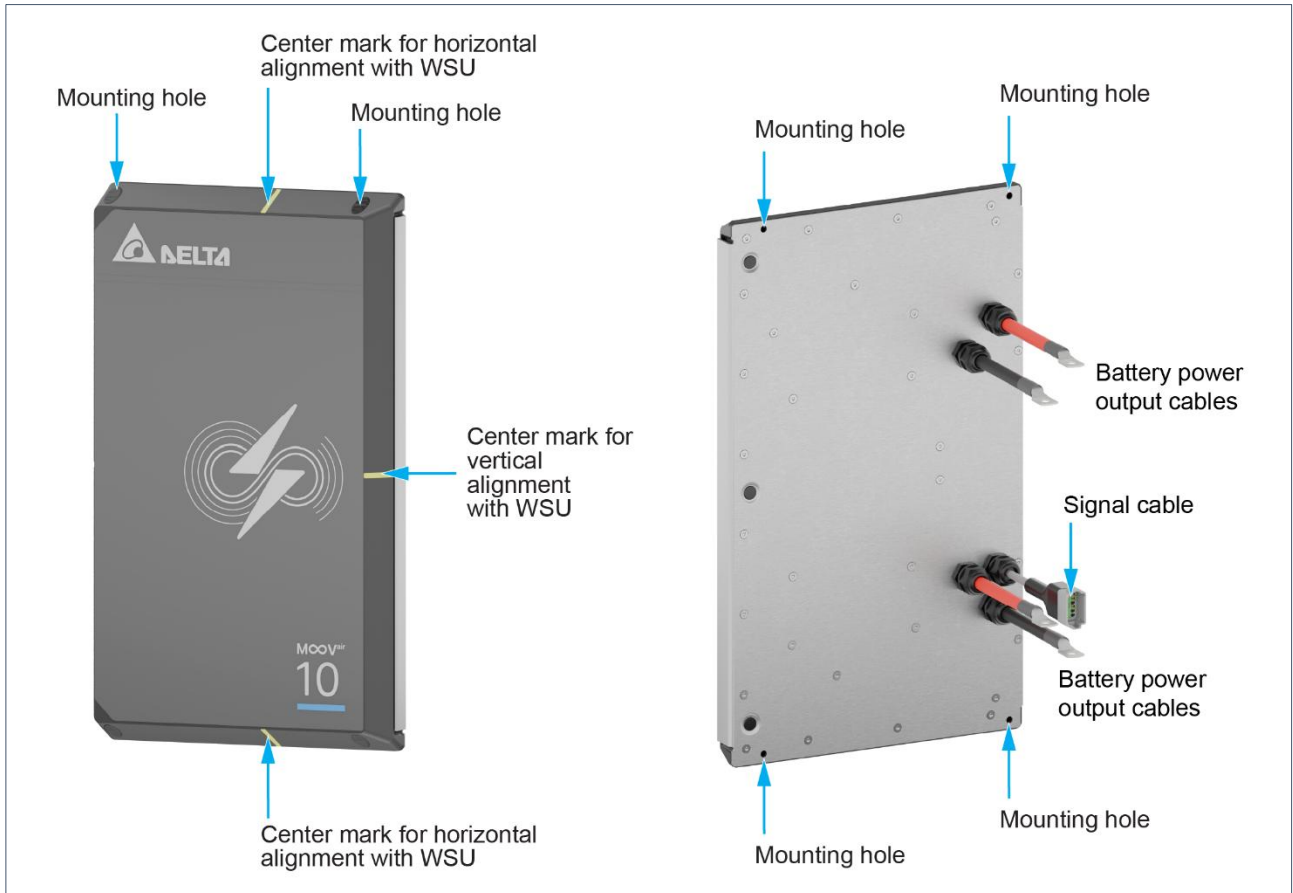


Figure 10 Components of the Wireless Secondary Unit (WSU)

5.5.3 Multi-purpose control cable

The WSU has a multi-purpose control cable for connection to the vehicle, with auxiliary input power, Auxiliary output power and CANopen® communications interfaces.

Length of control cable: 0.5 m (19.7 ft)

Connector type: Deutsch connector

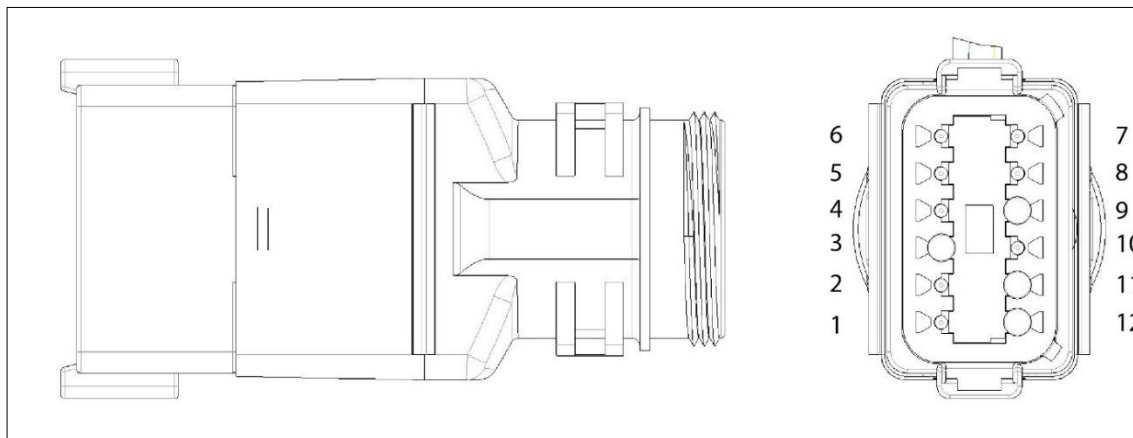


Figure 11 WSU Control cable

Pin	Signal	Function
1	AUXIN+	AUX supply from battery, fused 2A at Vehicle side
2	AUXIN-	AUX supply reference from battery
3	NC	-
4	AUXOUT+	AUX supply for external devices, max. output: 5 V, 100 mA
5	CANOUT_H	BMS Vehicle CAN/2nd WSU/120 Ohm in cable
6	CANOUT_L	BMS Vehicle CAN/2nd WSU/120 Ohm in cable
7	CANIN_H	BMS Vehicle CAN
8	CANIN_L	BMS Vehicle CAN
9	NC	-
10	AUXOUT-	AUX supply reference for external devices
11	NC	Reserved
12	NC	Reserved

Table 5 Pin assignment WSU Deutsch Connector

5.5.3.1 Auxiliary Input Power

The WSU has an auxiliary input power interface which must be supplied by the vehicle to power the WSU internal controller. This is required to be able to establish communications with the WPP for a charge cycle to commence and for the vehicle to acquire data from the WSU for system monitoring.

For integration purposes the WSU can be powered from a 24VDC PSU when the battery is not available.

Note: Connect AUX IN- to Power output cable BLACK (-).

Input voltage range	24 to 60 V
Maximum input current	200 mA
Nominal current without auxiliary output connected	20 mA

Table 6 Specifications – WSU – Auxiliary Input Power

5.5.3.2 Auxiliary Output Power

The WSU has an optional auxiliary output power interface that can be used to power small components/modules on the vehicle. It supplies 5 V with a maximum current of 100 mA.

Nominal output voltage	5 V
Maximum output current	100 mA

Table 7 Specifications – WSU – Auxiliary Input Power

5.5.3.3 CANopen® Interface

The WSU has a CAN bus interface that is used for monitoring the system and also for the BMS to control the WCS.

The CAN bus communications interface is compliant to ISO 11898-1 and 11898-2. It provides both a CAN IN and a CAN OUT interface for flexibility of the wiring configuration within the vehicle. The WSU does not include CAN bus termination, instead this can be achieved using the CAN OUT if desired.

See section [8.4.1 External Commanded CANopen®](#) for details on CANopen® Control Mode and section [8.7.3 WSU - CANopen®](#) for details on CANopen® Communications.

CAN bus termination:

If a CAN termination is needed, it can be placed in between Pin 5 and Pin 6 of WSU Deutsch connector.

5.5.4 Technical specification

Dimensions (H x W x D)	565 x 327 x 50 mm (22.2 x 12.9 x 2 in)
Weight	20 kg (44.1 lbs)
Ingress protection classes	IP69
Cooling	Convection
Ambient temperature	-40 to +80 °C (-40 to +176 °F), output de-rating above +40 °C
Ambient relative humidity	15 to 100%
Maximum operating altitude	3000 m (9842 ft) above sea level for all subsystems
Shock and vibration (operating)	Random vibrations (EN 60068-2-64:2008) Shock test 10 g (EN 60068-2-27:2009) Shock test 25 g (EN 60068-2-27:2009) Shock test 50 g (EN 60068-2-27:2009)
Shock and vibration (transport and handling)	EN IEC 60721-3-2:2018, Class 2M4
Impact resistance	IEC 62262 Code IK07: 2 J WSU tested with higher impact force in accordance with IEC 62368-1, UL 1564, CSA 22.2 and 107.2, refer to standards or contact Delta for more information.
Storage temperature	-45 to +70 °C (-49 to 158 °F)

Table 8 Specifications – Wireless Secondary Unit (WSU) – Mechanical

Nominal output voltage	24 & 36 V _{DC}	50 V _{DC}
Output voltage range	18 to 44 V _{DC} — — — — — —	36 to 60 V _{DC} — — — — — —
Absolute maximum DC voltage on power output and auxiliary input	44 V _{DC}	60 V _{DC}
Maximum charge current (For more details refer 8.5.1.1 Output Operating Area).	275 A	200 A
Maximum output power (See also 8.5.1 Output Power and De-rating).	10 kW	
Output protection	• over voltage • over current • over temperature • short circuit • open circuit • reverse connection	
Length of power cables	2 m (78.74 in)	
Ring terminal	10 mm M10 stud	

Table 9 Specifications – Wireless Secondary Unit (WSU) – DC Output

6 Safety

6.1 Safety Symbols Used in This Document

The Danger, Warnings, Cautions, Attention and Note in this publication highlight the areas of concern to installation/maintenance personnel or operator. The definitions of Danger, Warning, Caution, Attention and Notice as utilized throughout this publication are as follows:

DANGER:

Indicates a hazard which is an immediate threat. If not avoided, will result in serious injury or death. Strictly adhere to all Dangers.

WARNING:

Indicates a hazard which is a possible threat. If not avoided, may result in serious injury or death. Strictly adhere to all Warnings.

CAUTION:

Indicates a hazard which is a possible threat. If not avoided, may result in minor injury. Strictly adhere to all Cautions.

ATTENTION:

Indicates an operation, sequence, or function which, if not observed, may cause damage/malfunction of equipment or to surrounding objects.

Note:

Provides explanatory information/clarification not readily apparent in the text or illustrations of a procedure.

6.2 Safety-related symbols Used in This Document

Wherever required the following labels are also marked with warning signs to indicate the type of hazard.

Symbol	Description
	Risk of Electric shock
	Hot surface
	General warning
	Electromagnetic field (EMF)
	Sharp edges

Other signs used within the document:

Symbol	Description
	Ground (GND)
	Attention/Informative

6.3 Safety-related Labels On the System Components



Figure 12 Type labels

6.4 General Safety Instructions

During handling the system/equipment, following danger, warnings, cautions and notes must be observed.

Electric shock



- ▶ Isolate upstream breaker connected to WPB.
- ▶ Do not open the WCS subsystems during charging as it may lead to death of Personnel.
- ▶ Do not open the WCS subsystems when WPB connected to mains, and WSU connected to battery.
- ▶ In order to replace the fuses and fans of WPB, make sure that only skilled person opens the system only when the system is completely discharged and not in operation.



- ▶ Make sure to install WPP and WSU vertically with the chamfered edge at the top, this would avoid any danger caused by foreign objects lying on the edge of the pad.
- ▶ Make sure that both the pads are free from foreign object to avoid overheat while charging is in progress. Clean the pads as and when needed to avoid danger.



This equipment is not suitable for use in locations where children are likely to be present.



Electromagnetic Field (EMF)

- ▶ The Wireless Primary Pad (WPP) produces a potentially harmful magnetic field during the charging process.
- ▶ Make sure to maintain a safe distance from WPP when charging is in progress. For more details about the safe distance see [6.5 EMF Safety Instructions](#).
- ▶ Use of the WCS may affect or impair the operation of any medical devices, such as an implantable cardiac pacemaker. Check with your medical device manufacturer concerning the effects that wireless charging may have on such devices before using the WCS.
- ▶ Electromagnetic field exposure to pregnant women is strictly forbidden.
- ▶ Advise all user types about safety distances and affix appropriate warning labels and/or signs.
- ▶ Warning signs should be clearly displayed at the charging area.
- ▶ Do not install or operate the system in the public area.
- ▶ Electronic objects such as cell phones and hearing aids may get damaged.

WARNING:


Make sure to observe the battery manufacturers safety instructions. If battery manufacturer instructions conflict with WCS instructions then, kindly contact both for a right solution.

CAUTION:

Risk of burns

The surfaces of the subsystems can become very hot during charging.

- ▶ Do not touch any subsystems of the charging system while charging is in progress.
- ▶ Do not touch WPP and WSU of the charging system up to 30 minutes (cooling time) after the charging process is finished.
- ▶ Wear safety gloves while handling the subsystems after charging.

CAUTION:

Risk of cuts

The back plates of the WPP and WSU have sharp edges.

- ▶ Wear protective gloves when working on WPP and WSU.

CAUTION:

Heavy loads

The subsystems are heavy.

- ▶ Use suitable lifting or transport equipment while lifting or moving the subsystems of the WCS. They might be too heavy and would cause strain or injury to the personnel. The surfaces of the device may become very hot during charging.

ATTENTION:

Material damage

- ▶ Make sure that the metallic objects do not come in between or in contact with the pads during charging. The magnetic field causes metallic objects to become very hot, and this may lead to damage of the pads surface (WPP and WSU).
- ▶ Select the installation position of the WPP and WSU accordingly.
- ▶ All user types of the system must be instructed accordingly.

ATTENTION:

Material damage

- ▶ Do not use powder or foam fire extinguishers on WPB when there is a fire around, it is recommended to use Co2 fire extinguisher or something similar otherwise WPB may get damaged.

6.5 EMF Safety Instructions

These EMF safety instructions are for the following types of users:

1. **Vehicle Integrator:** Integrates the Wireless Secondary Unit (WSU) in an application to charge a battery e.g. forklift manufacturer, AGV manufacturer etc.
2. **Facility Integrator:** The customer where the application is used and who installs WPB (Wireless Primary Box) and (WPP) Wireless Primary Pad.

6.5.1 Responsibility of the Vehicle Integrator

The installation of the WSU must be carried out by a skilled person. The vehicle integrator must:

- consider the keep out areas to ensure that an operator is not exposed to the magnetic field.
- implement the warnings and keep-out areas into the user instructions of their application.

6.5.2 Responsibility of the Facility Integrator

The installation of the WPP must be carried out by skilled persons. Charging must take place in an area where the general public does not have access. A keep-out area is required to inform instructed persons how far they must stay away from the WCS during charging (see 9.3.2 "USA/FCC: Safety keep-out areas and safety markings for charging zone", page 74).

7 Intended Use

CAUTION:

No changes or modifications to the system/equipment are allowed unless approved by Delta.

The intended purpose of the WCS is defined as follows:

- The system is designed only for the use according to the specifications and instructions described in this document by Delta.
- The system is designed for industrial use only.
- The system is designed for the environmental conditions and electrical values provided by Delta.
- The combination of WPB, WPP and WSU is designed to transfer energy inductively via an air gap to charge an industrial battery. No other uses are permitted.
- The system is designed to charge Lithium Ion (Li-Ion) batteries containing a BMS.
- The system is only intended to operate with non-magnetic and non-electrically conductive materials between the WPP and WSU. For example, plastic, wood, glass, and air etc.,
- The WSU is only intended to be covered with a plastic shield if necessary.
- The System is intended to use only disconnected from the internet.

The non-intended purpose of WCS is as follows:

- Use of WPP and WSU installed horizontally.
- Use of WPP and WSU installed vertical-portrait.
- Use in stand-alone as power supply without battery connected.
- Use with a connection to the public grid.
- Use to charge lead acid batteries.
- Use of WPP and WSU covered with metal sheet.
- The WSU is not designed for operation under water.
- The WSU is not designed to operate in series setup.
- The WSU is not designed to charge more than one battery at the same time, especially not a series connection of batteries.
- The systems is not intended to use with a direct or indirect connection to the internet.

Usage going beyond the intended use as described in the document does not constitute proper use. The manufacturer is not liable for damage resulting from improper use; the operator only bears the risk. Intended use also implies that the instructions and rules prescribed by Delta are obeyed.

8 Operating behavior

8.1 The Charging Process

The WCS wirelessly charges the battery of an industrial electric vehicle by means of near field coupling between WPP and WSU. A magnetic field is generated by the WPP and coupled to the WSU. The WSU converts the magnetic field back to electrical current and charges the battery.

ATTENTION:



Material damage

The magnetic field generated during the charging process can cause metal and other foreign objects to become hot. Therefore, it is important to keep the charging area free of foreign objects.

The magnetic field is only emitted by the WPP when there is a WSU in the charging area. The charging status is indicated on the Status LED panels of the WPP and WPB, on an optional stack light, or on the web page of the WPB (accessible via the Ethernet port).

The speed and efficiency of the charging process is dependent on different factors, including:

- Temperature – both the ambient temperature and the internal temperature of the subsystems.
- Pad positioning – both the distance (air gap) and the alignment of the pads, refer 3.3.1.3 WPP & WSU Positioning.

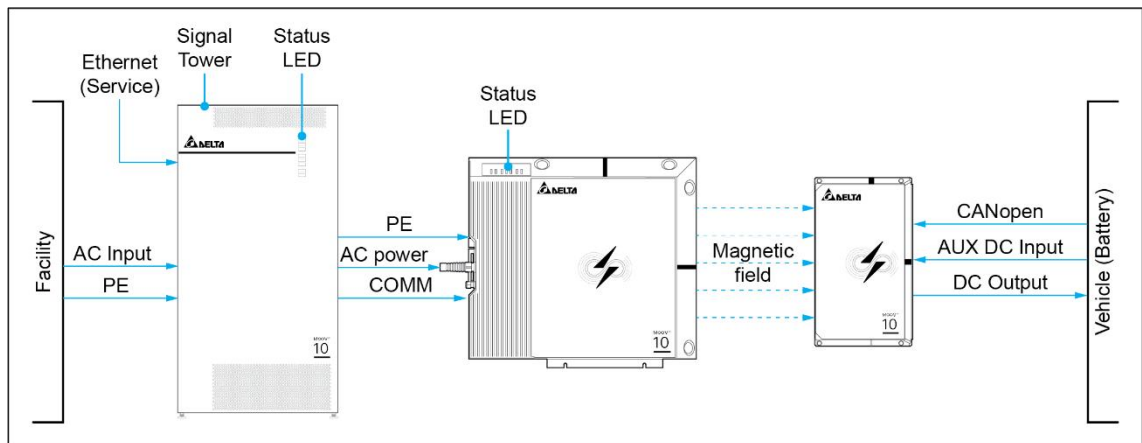


Figure 13 Wireless charging interfaces

- The WCS can be controlled by a BMS via CANopen® on the WSU side.
- There is an interface on the WPB to connect a stack light.
- There are internal interfaces between the subsystems:
 - A wired control connection between WPB and WPP.
 - A wireless control connection between WPP and WSU, referred to Pad-to-Pad Link (PPL).

8.2 Controlling the charging process

Figure 14 Controlling the Wireless Charging Process

- The WCS can be controlled by a BMS via CANopen® on the WSU side.
- There is an interface on the WPB to connect a stack light.
- There are internal interfaces between the subsystems:
 - A wired control connection between WPB – WPP
 - A wireless control connection between WPP – WSU referred to PPL (Pad to Pad Link).

For details on the control interfaces, refer [8.7.3 WSU - CANopen®](#).

8.3 Internal interfaces and interoperability

The subsystems interface to each as follows:

- The WPB interfaces only to the WPP.
- The WPP interfaces to WPB and WSU.
- The WSU interfaces only to the WPP.

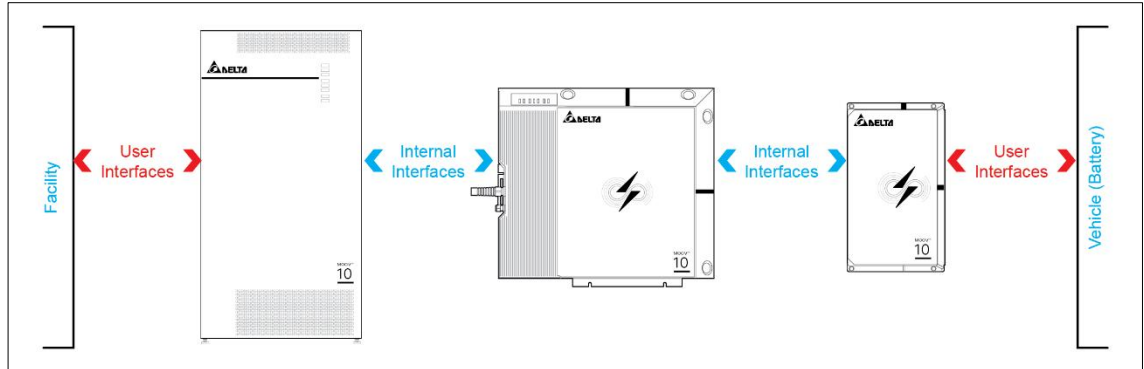


Fig. 1 Interoperability and internal interfaces

Only user interfaces may communicate with external units within the limits described in this document.

8.4 System Control Modes

The WCS has an external entity to control the charge process; External Commanded CANopen®.

The WCS is capable of delivering 100W to 10kW of power to the vehicle battery. To prevent overcharging of the battery, the vehicle or fleet management system (provided by others) is to control the charging process by enabling the charge, disabling the charge and providing routine voltage and current setpoints as required.

8.4.1 External Commanded CANopen®

The charging process is initiated and controlled by the vehicle Battery Management System (BMS). The WSU is connected to the BMS via the control interface based on CANopen®.

This enables the exchange of status information and control messages between the BMS and the WSU, of which the WSU requests power from the WPU over a control loop.

8.4.1.1 Charging with Configured System

1. Battery Power up.
2. WSU power up.
3. NMT-Master set WSU and Battery to “operational” state.
4. Charging is Running.

ATTENTION:



The Delta product will never switch automatic after restart, from “pre-operational” to “operational” state on CANopen®-side. Only NMT-Master controls the CANopen® devices states in its CANopen® network.

8.4.1.2 Default CAN Bus Configuration

The WSU CANopen® interface is not pre-configured. This means that the WSU will need to be configured as necessary upon first use before interfacing to a BMS. It has no valid node-id (bus address) and would start with a default bitrate (125kbit/s). Details CiA-301.

For detailed information, refer to 13.1 “Setting the CAN bus Node ID for a new WSU”, page 130, and 13.2, “Setting the CAN bus bitrate”, page 134.

8.4.2 External Commanded Ethernet

The charging process is initiated and controlled by the Fleet Management System (FMS) or other similar system that controls the facility AMR/AGVs. The WPB is logically connected to the FMS via the Ethernet interface, with communications protocol based on HTML/JSON.

This enables the exchange of status information and control messages between the FMS and the WSU via the WPU, of which the WSB requests power from the WPU over a control loop.

This provides the customers the ability to enable their systems for Industry 4.0 and Industrial Internet of Things (IIoT) by controlling the charge process centrally.

Note: It is the responsibility of the FMS to know the status/needs of the battery/BMS.

The WPB Ethernet connectivity will allow for either a physical LAN interface for connecting directly to a customer network via field cabling or connect to a RF Access Point to connect to the customer wireless network (supplied and powered by others).

8.5 System Performance

8.5.1 Output Power and De-rating

8.5.1.1 Output Operating Areas

Output current and output voltage can be set within the limits as shown in the figures below.

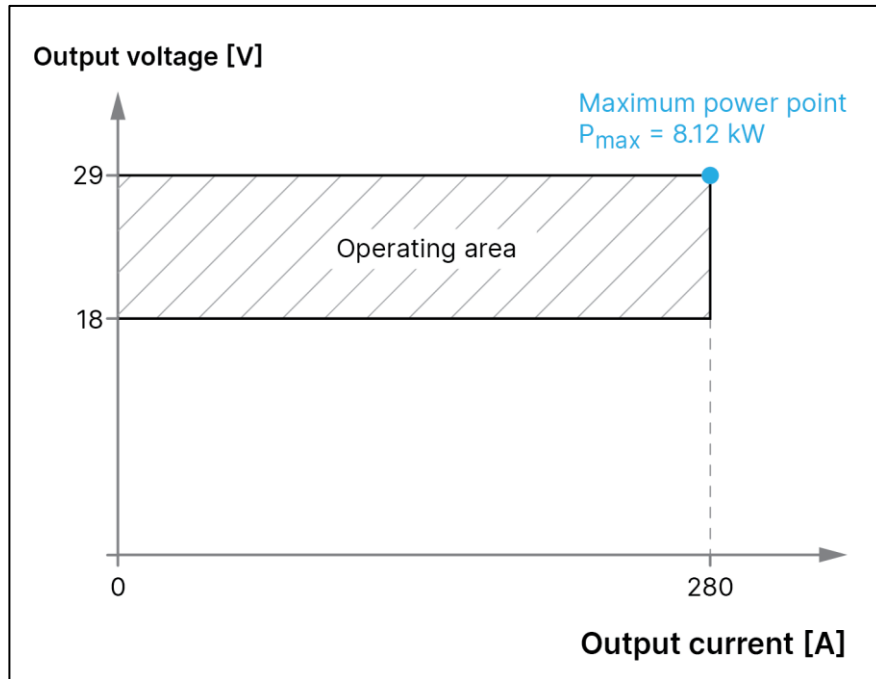


Figure 15 Output Power and Current Limits with Variable Voltage - 24V

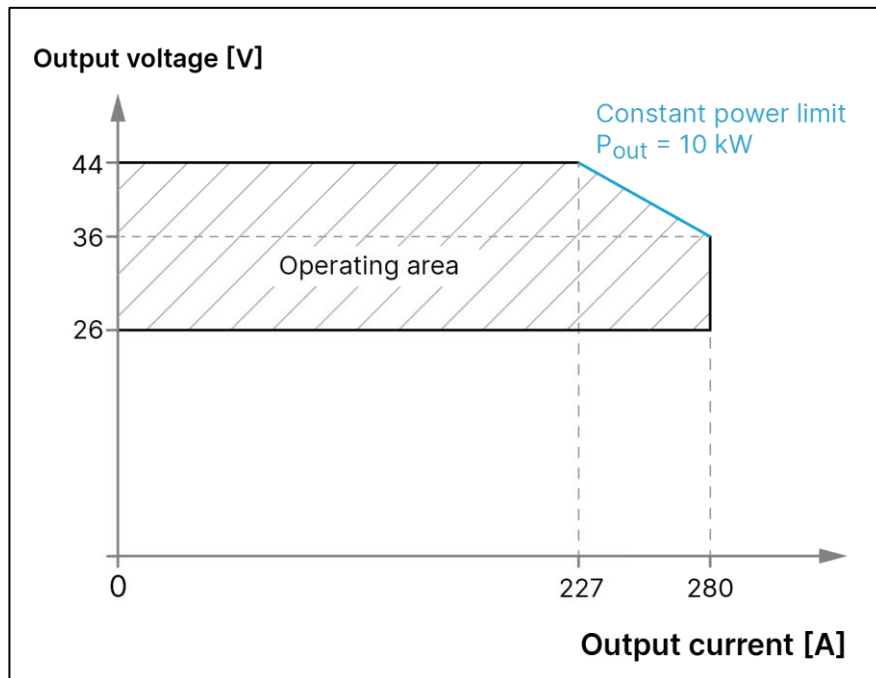


Figure 16 Output Power and Current Limits with Variable Voltage - 36V

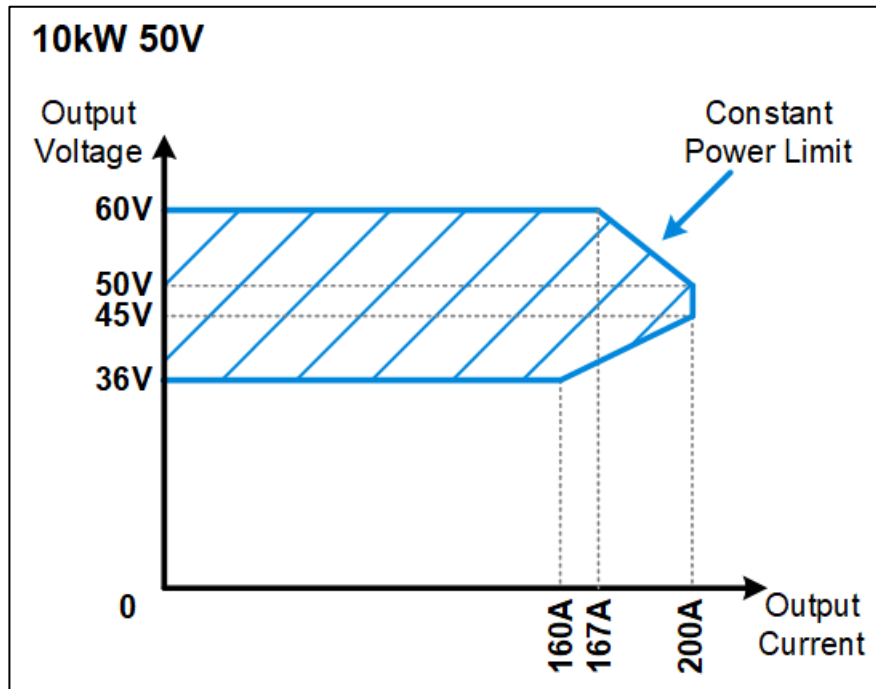


Figure 17 Output Power and Current Limits with Variable Voltage - 50V

8.5.1.2 Output power derating vs. charge time

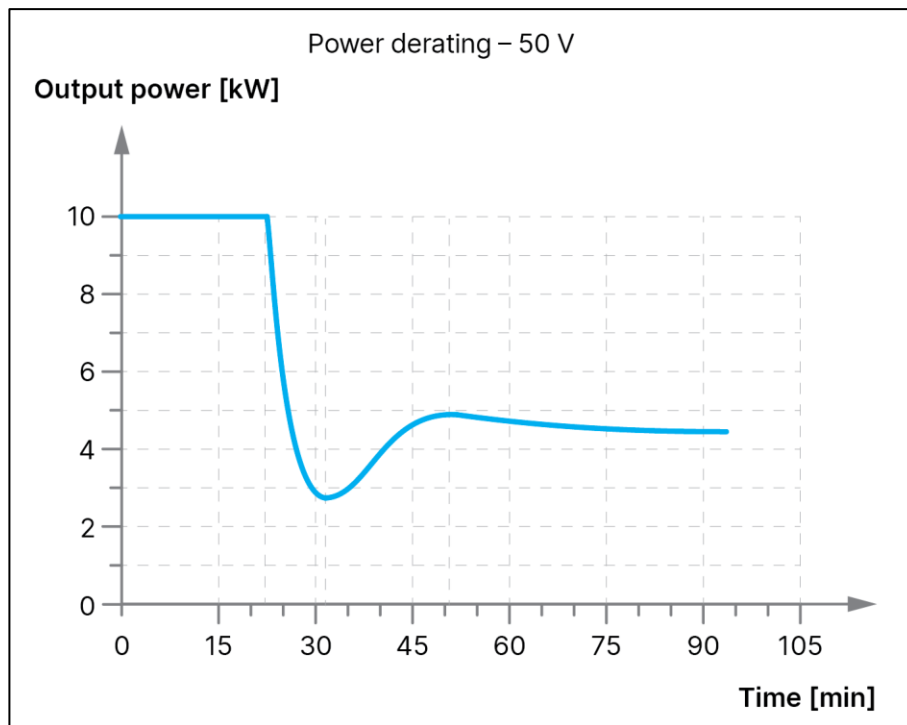


Figure 18 Output Power Derating vs Charge Time - 50V

8.5.1.3 WPP & WSU Positioning

The images in this section show the maximum misalignments at which charging still works.

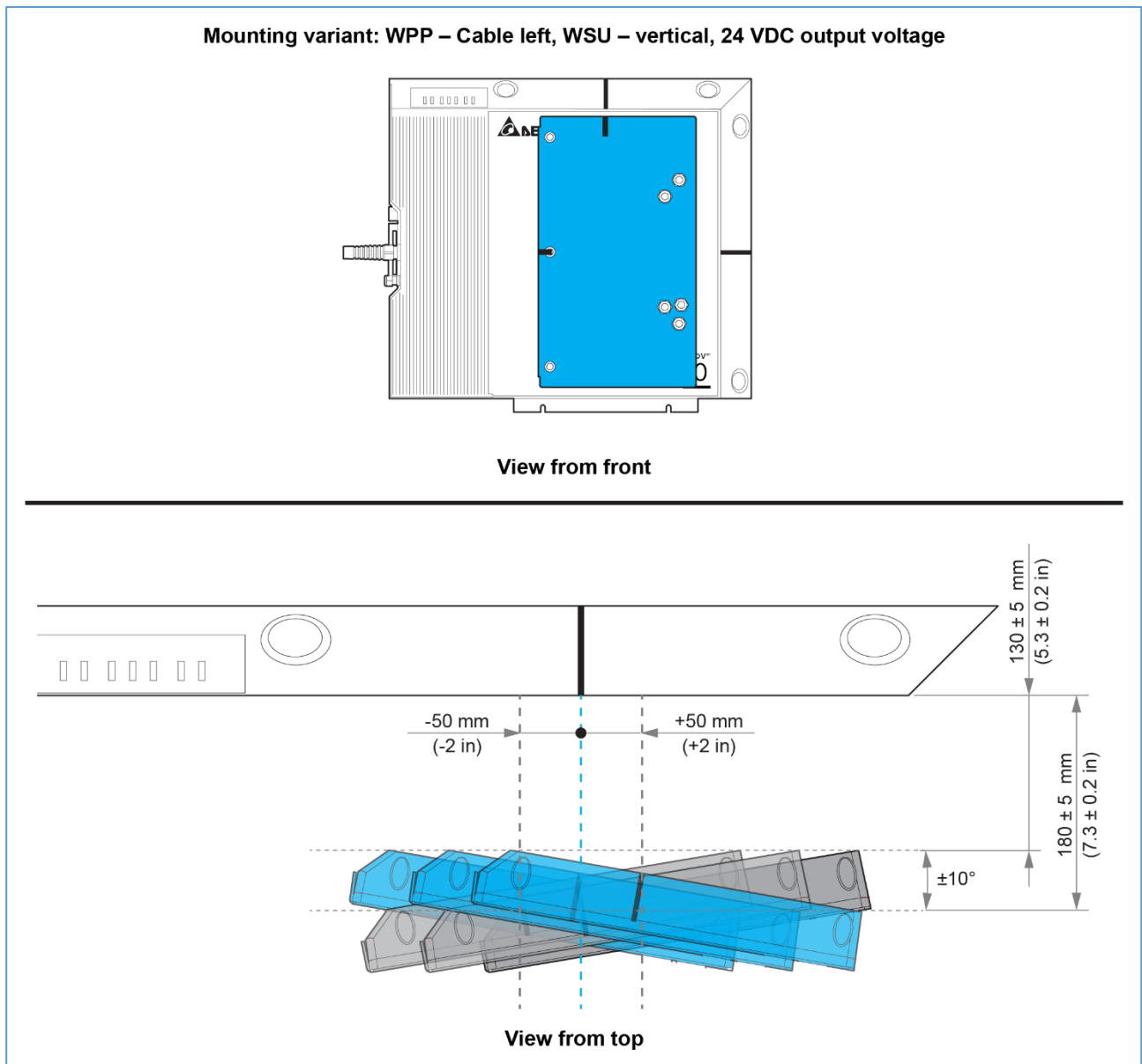
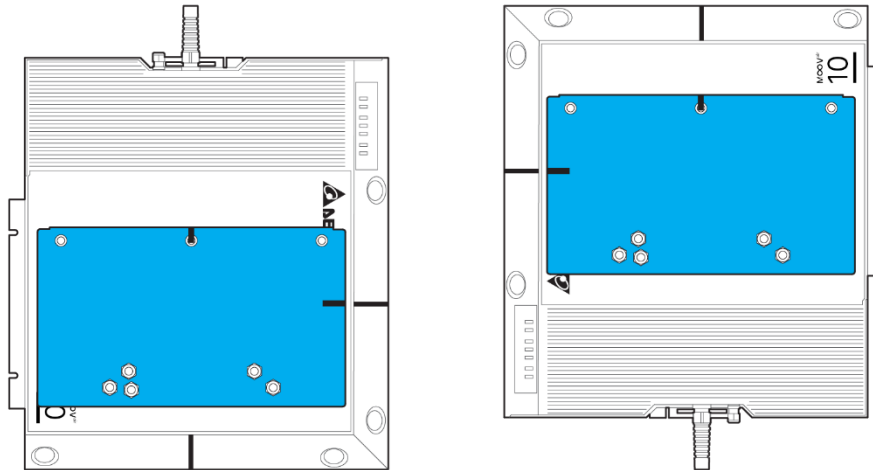
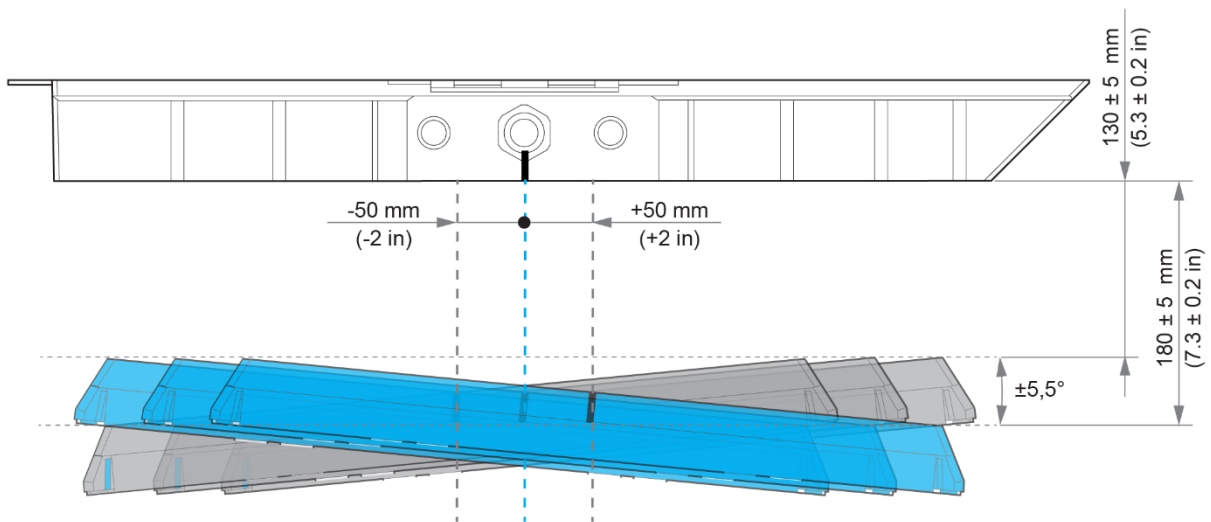


Figure 19 Maximum misalignment (horizontal shift + angle) at 24 VDC, WSU vertically mounted

Mounting variant: WPP – Cable at top or at bottom, WSU – horizontal, 36/50 VDC output voltage



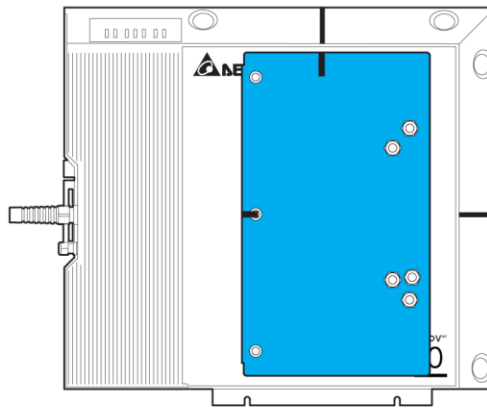
View from front



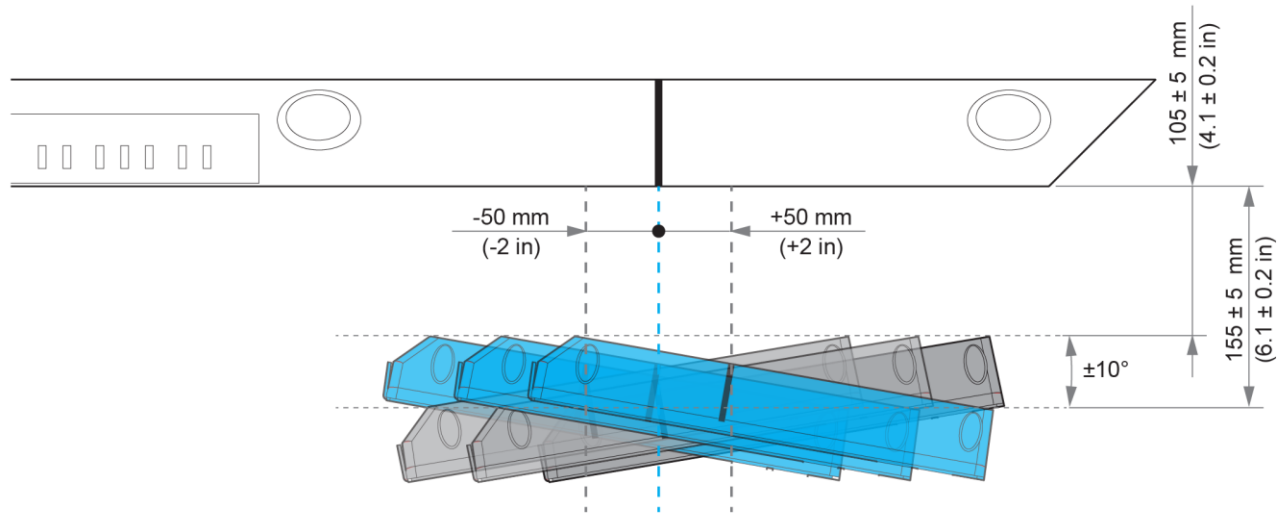
View from top

Figure 20 Maximum misalignment (horizontal shift + angle) at 24 VDC, WSU horizontally mounted

Mounting variant: WPP – Cable left, WSU – vertical, 36/50 VDC output voltage



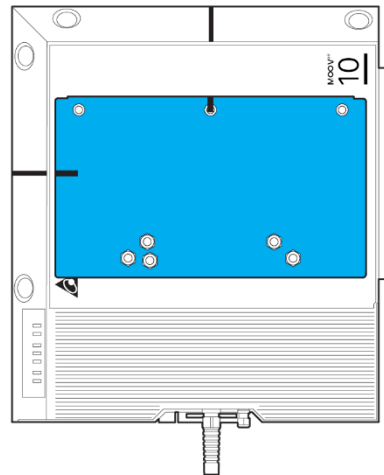
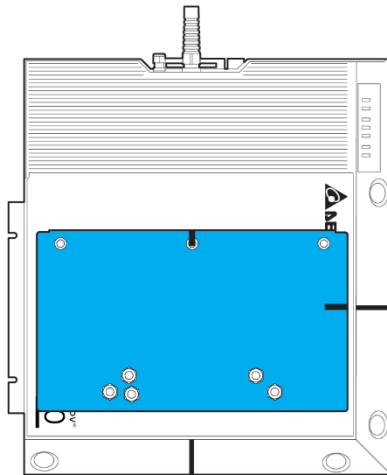
View from front



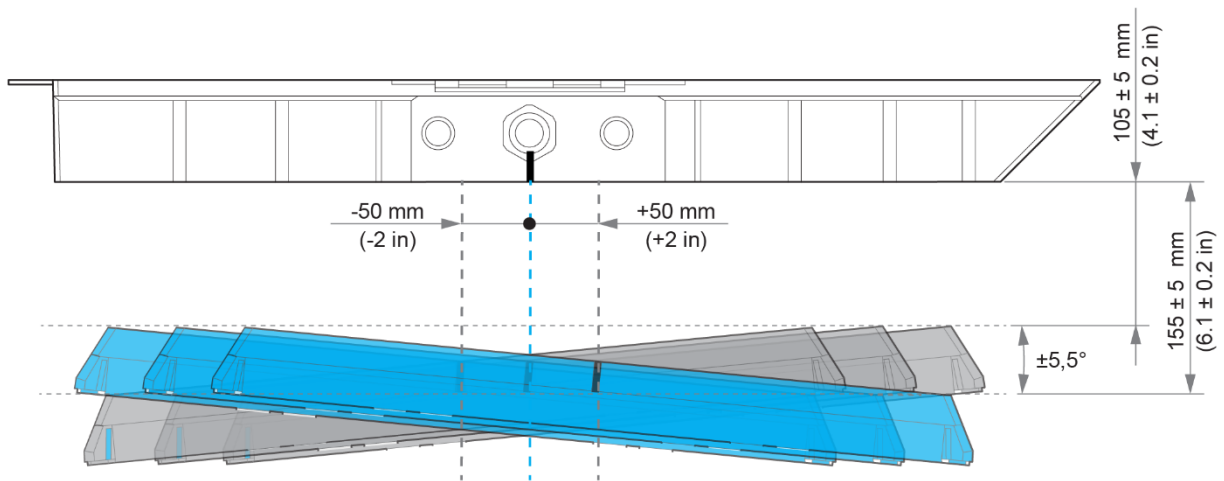
View from top

Figure 21 Maximum misalignment (horizontal shift + angle) at 36/50 VDC, WSU vertically mounted

Mounting variant: WPP – Cable at top or at bottom, WSU – horizontal, 36/50 VDC output voltage



View from front



View from top

Figure 22 Maximum misalignment (horizontal shift + angle) at 36/50 VDC, WSU horizontally mounted

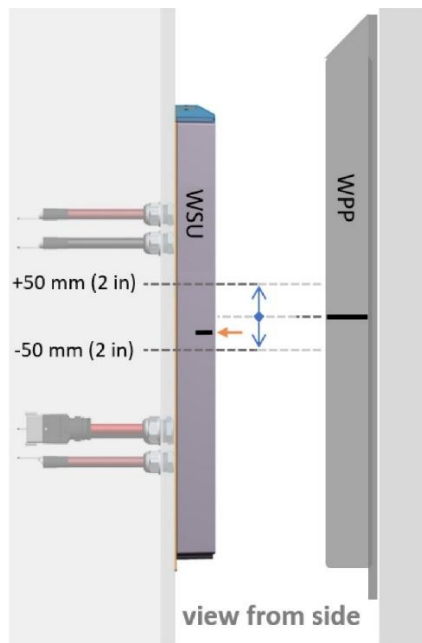


Figure 23 Pad Alignment with Vertical Offset

8.5.2 Efficiency and Losses

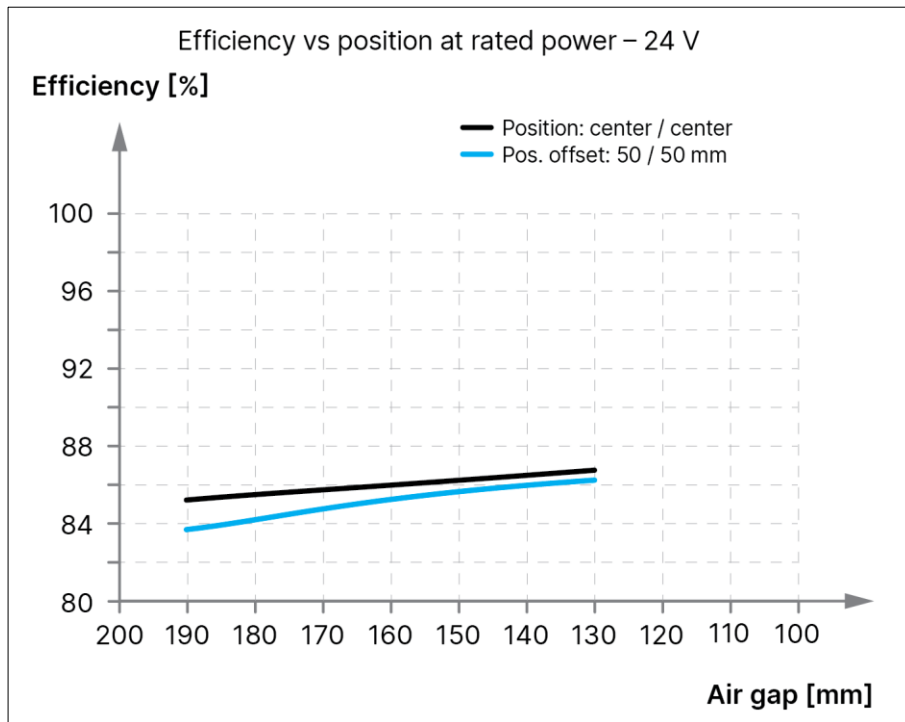


Figure 24 Efficiency vs. Air gap - 24V

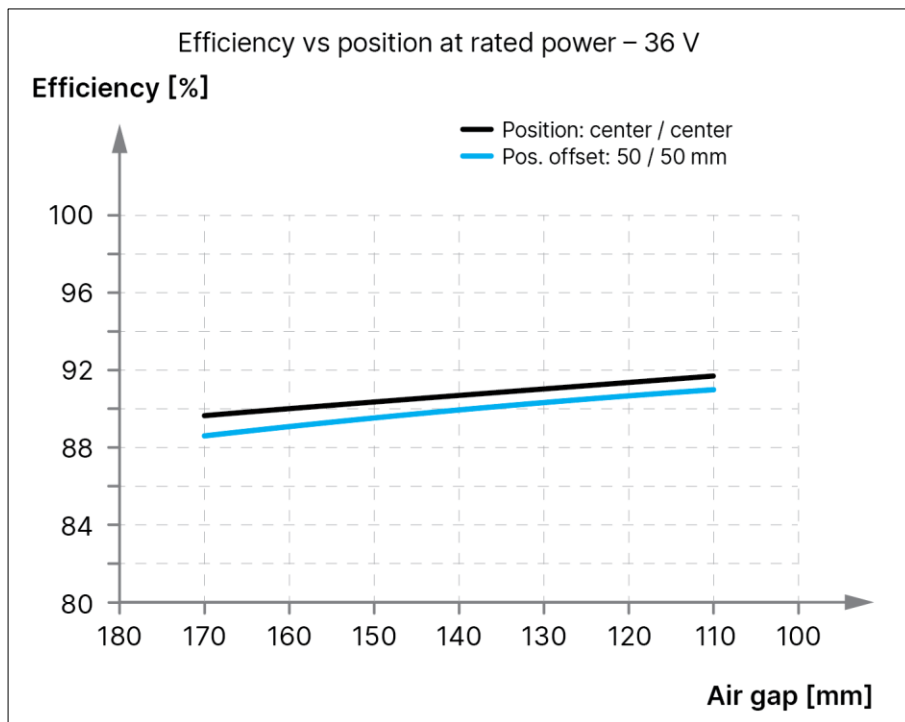


Figure 25 Efficiency vs. Air gap - 36V

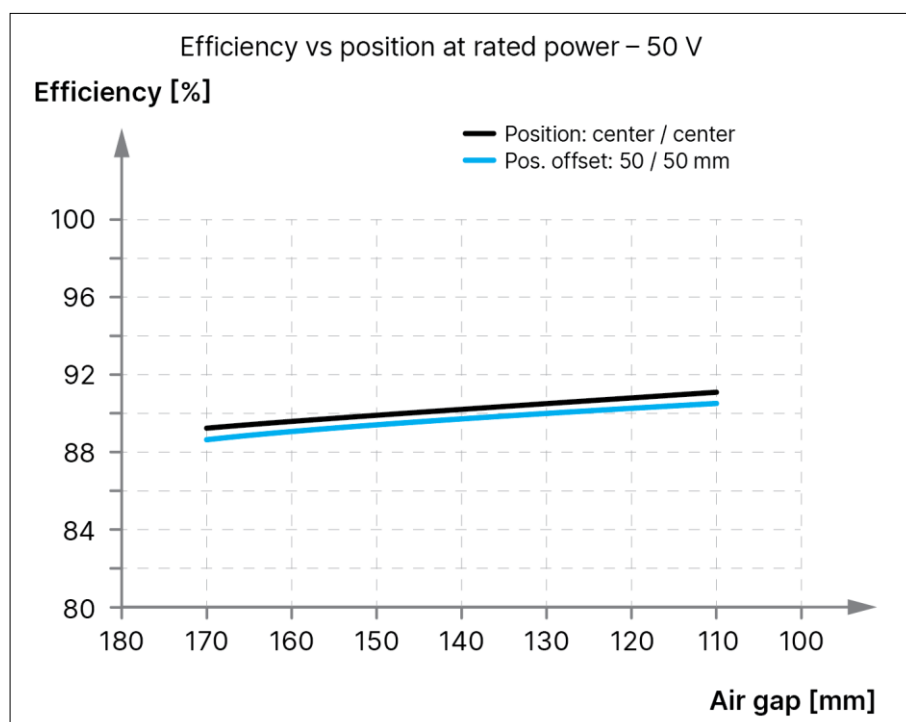


Figure 26 Efficiency vs. Air gap - 50V

System	36 V		50 V	
	Losses	Efficiency	Losses	Efficiency
Input power	10.9 kW		11 kW	
WPB	470 W	99,6%	510 W	95,4%
WPP	230 W	97,8%	250 W	97,6%
WSU	200 W	98,0%	240 W	97,7%
Total losses	900 W	91,7%	1000 W	90,9%
Output power	10.0 kW		10.0 kW	

Table 10 Efficiency and Losses with WPP and WSU perfectly centered

8.5.2.1 Factors that Influence Losses

Following table gives information regarding the factors influencing the losses.

When the input voltage raises losses at WPB goes down. Similarly, when the output voltage raises losses at WPB and WPP raises.

Criteria	Losses per Subsystem		
	WPB	WPP	WSU
Input voltage ↑	↓	-	-
Output voltage ↑	↑	↑	-
Output Power ↑	↑	↑	↑
Misalignment ↑	↑	↑	-
Airgap ↑	↑	↑	-

8.5.2.2 Temperature of the WPP

As well as the ambient temperature, four other factors can influence the WPP temperature:

- Airgap, misalignment, output power and output voltage.
- Up to +40 °C (+104 °F) the WPP can run under all conditions with full power. Above +40 °C (+104 °F), air gap and output voltage are limited.

8.6 Factors that influence charging process

The speed and efficiency of the charging process depend on various factors, including:

- Temperature – both the ambient temperature and the internal temperature of the subsystems.
- Pad positioning – both the distance (air gap) and the alignment of the pads, refer [8.5.1.2 Output power derating vs. charge time](#).

Influence of the temperature

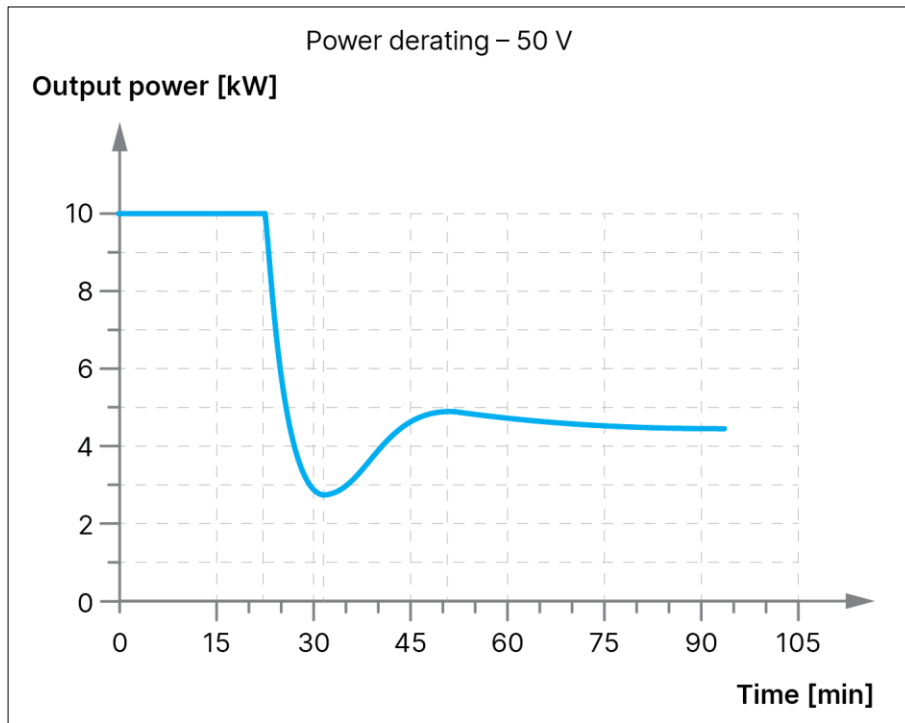


Figure 27 Curve – Output Power Derating vs Charge Time – 50 V

8.7 Communications

8.7.1 WPP & WSU Interface – Pad to Pad Link (PPL)

The communications interface between WPP and WSU is referred as Pad to Pad Link (PPL). In the default mode the WPP is chosen to be inactive and the WSU is actively looking for WPP using the PPL. Neither the WPP nor WSU are transferring/receiving power until there is a charging request via CANopen®. Also, WPP and WSU are within nominal proximity (<160 mm) of each other and successful communication between the two has been established. If the communication is interrupted (i.e. vehicle/WSU moves away) then the power transfer stops.

8.7.2 WPB – Webpage + Ethernet

8.7.2.1 Overview

Ethernet is a way to control, monitor, and configure the WCS.

The WPB has a webpage that can be accessed via a computer connected directly to the Ethernet port or located on the same network.

Type its IP address (standard: 192.168.1.100) into a web browser to access the web page.

The IP address of the computer accessing the WPB must be within the local IP ranges shown in the table below.

IP Range	Sub Netmask
10.0.0.0 – 10.255.255.255	255.0.0.0 (or /8)
172.16.0.0 – 172.31.255.255	255.240.0.0 (or /12)
192.168.0.0 -192.168.255.255	255.255.0.0 (or /16)

8.7.2.2 Ethernet Protocols

If the WCS is being controlled by an external system, WMS/AGV/etc. then software can control the WCS using the WCS protocols.

- The *Control protocol* allows control, configuration, and monitoring of the WCS.
- The *Discovery protocol* is used by the Delta Charger Discovery Tool to detect IP addresses of Delta chargers in a network.

Contact your WCS dealer or sales representative for the protocol documentation.

Note: Ask your sales contact for the EXE file.

8.7.2.3 Identifying the charger IP address with the Delta Charger Discovery Tool

Each Delta charger comes with a standard IP address (192.168.1.100). If the IP address has been changed, for example because multiple Delta chargers are on the network, the Delta Charger Discovery Tool can be used to find the IP address of a Delta charger.

Prerequisites

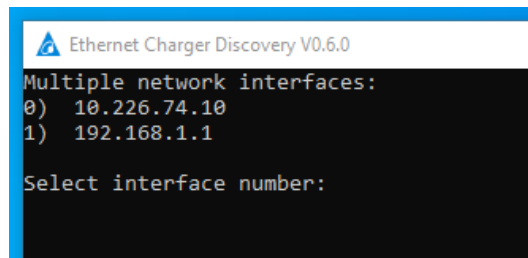
The PC must be either directly connected to the Ethernet port of a Delta charger or in the same network as the Delta chargers.

The chargers must be detectable in the network.

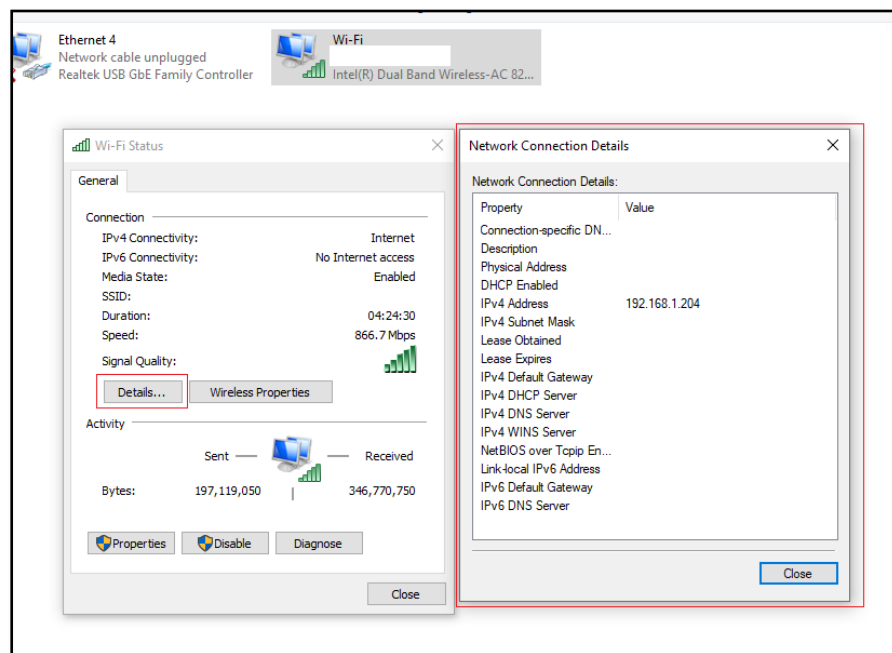
Note: Ask your local IT department for help. They should be able to view the Delta charger IP address by logging into a network switch or router.

To run the Delta Charger Discovery tool on Windows:

1. To run the Delta Discovery tool, double click on the executable file (e.g. EthernetChargerDiscovery_V1.0.0.exe).



The number of available networks (Ethernet, Wi-Fi, etc.) depends on the networking settings of your PC.



2. Type in the number of the interface to which the WPB is connected to and press <ENTER>.

```

Ethernet Charger Discovery V0.6.0
Multiple network interfaces:
0) 10.226.74.10
1) 192.168.1.1
Select interface number:
    
```

3. After a moment, the Delta Charger Discovery tool will list all the Delta chargers found in the network.

IP Address	MAC Address	Part Number	Serial Number	Control Protocol	Discovery Protocol	Identifier
192.168.1.100	02:DE:5C:00:00:83	EOE0000000	YYMM000000	V2.0	V1.0	MSC ID test 1

If no Delta chargers are found, check that you use the correct network interface.

IP Address	MAC Address	Part Number	Serial Number	Control Protocol	Discovery Protocol	Identifier

4. For each Delta charger, the following information is listed:
 - IP Address – The address of the WPB, used to connect to via a browser.
 - MAC Address – This is the unique identifier of the WPB.
 - Part Number – The part number of the WPB.
 - Serial Number – The serial number of the WPB.
 - Control Protocol – The control protocol version the WPB is conforming to.
 - Discovery Protocol – The discovery protocol version the WPB is conforming to.
 - Identifier – A user-configurable identifier can be used to give the WPB a name or location label to identify it more easily than by using MAC/IP/SN.

The identifier example is from the **Admin** webpage:

User Data

Identifier

MSC ID test 1

Data

MSC data test 1

Email

...

Telephone

...

5. Enter the IP address of the Delta charger you want to connect to in your web browser.

8.7.2.4 Get IT Help

Ask the location IT for help, since logging into a network switch or router they ought to be able to view the Delta charger IP address.

8.7.2.5 Webpage

The WPB can serve a webpage via the Ethernet. This can be accessed by a laptop on the same network as the WPB, accessing the WPB IP address in the web browser. For most of the user operations refer to the following procedure.

Accessing the WPB Webpage

Recommend use of Google Chrome or Microsoft Edge to access the charger webpage at 192.168.1.100.

8.7.3 WSU - CANopen®

8.7.3.1 Overview

For controlling the WCS with External Commanded CANopen® mode, the WSU to BMS CANopen® interface is to be configured. The following instructions detail the necessary steps to establish a basic form of the communications interface to start and stop a charge cycle using Process Data Objects (PDO), as defined within CiA 419. Refer to 4. CANopen® Protocol Specification for detailed information including the Object Dictionary.

8.7.3.2 Protocol

This section explains the CANopen® protocol in order to control and monitor the charging process. The protocol complies with CANopen® standards CiA301.

8.7.3.3 Bitrate

Note: For a complete list of sample points, refer to the CANopen protocol document.

Bitrate explains the number of bits processed in a given unit of time. Considering two different cases, below tables shows the supported bit rates.

Sample Point 87.5% (Recommended by CiA-301)

Supported bitrates: 125 kBit/s, 250 kBit/s, 500 kBit/s

8.7.3.4 How to initialize CANopen®

The WSU has a default bitrate of 125 kbit/s and has no configured node ID. These can be updated using the Layer Settings Services (LSS) defined in CiA 305.

The product needs to be configured with the following parameters:

- Valid and free Node-ID in the CANopen® network
- Valid bitrate according to the other devices in the CANopen® network

8.7.3.5 How to Control the WSU via CANopen®

The product would need the following minimum controls:

Charger RPDO1 Mapping

COB-ID	Process data in binary code							
	Byte							
	0	1	2	3	4	5	6	7
RPDO1 200h + Node-Id	Battery status CiA-419 (Object: 0x6000)	Charge current request 1/16A CiA-419 (Object: 0x6070)		Not used				
COB-ID of Receive- PDO 1 (RPDO1)	0x220, (0x200 + Node-Id)							
Transmission type	0xFF (details see CiA-301)							
Timeout	If timeout is reached charging is stopped (charge request = 0) Battery must send this cyclic message within the timeout limit.							
Number of mapped objects	2							

Charger TPDO1 Mapping

COB-ID	Process data in binary code							
	Byte							
	0	1	2	3	4	5	6	7
TPDO1 180h + Node-ID	Charger status CiA-419 (Object: 0x6001)				Not used			
COB-ID of Receive-PDO 1 (RPDO1)	0x220, (0x200 + Node-Id)							
Transmission type	0xFF							
Inhibit Time (1/10ms):	0							
Event Timer:	200 ms							
Sync counter:	0							

Corresponding Battery RPDO1 Mapping

COB-ID	Process data in binary code							
	Byte							
	0	1	2	3	4	5	6	7
RPDO1 180h + Node-ID of charger	Charger status CiA-419 (Object: 0x6001)	Not used						

ATTENTION:


This is the minimum configuration for a charge process. Please add additional objects for your specific project. The charge process occurs only, when the NMT-Master commanded the WSU and battery to enter NMT operational state.

Byte 0: Battery status (here must be set to “1” for a valid charge request, is “0” then no charge request).

Recommendation: setup RPDOs on the WSU to receive TPDOs sent cyclically by the battery, with the Max current and Max voltage and battery ready being broadcast.

The WSU can receive these values in a number of formats (see Objects in EDS file) can be used according to the common voltage/current data scaling available and broadcast by CANopen® batteries).

The WSU will not operate unless the NMT master has commanded the WSU to enter NMT state Operational.

The normal sequence of operation is

- Un-configured System:
 - Setup Node-ID and bitrate, Layer Settings Services (LSS) defined in CiA 305.
 - Configuration of TPDO and RPDO (WSU and battery), refer [8.7.3.5 How to Control the WSU via CANopen®](#).
 - Save configuration (object: 0x1010, details see CiA-301).
 - NMT-Master commanded WSU and battery to enter NMT operational state.
 - Check the WSU and battery is operating.
- Configured System:
 - NMT-Master commanded WSU and battery to enter NMT operational state.
 - Check the WSU and battery is operating.

NOTE: A CANopen® virtual node can be setup and used to send set points to the WSU for assessment purposes if a battery / BMS is not available.

8.7.3.6 Charging Data Example

Precondition: Delta-product with Node-Id: 0x20

ATTENTION:


For a controlled charge, make sure to configure and use the Receive PDO only. For examples refer [8.7.3.5 How to Control the WSU via CANopen®](#).

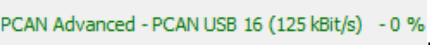
8.7.3.7 User Configuration (Example: Emotas CANopen® Device Explorer)

1. Power the WSU via connection to an battery with the appropriate voltage and connect the PC/Notebook to the CANopen®-Network from the WSU (Example: PCAN).
2. Make sure to install the **PEAK System Installation package** from here [PCAN-USB: PEAK-System \(www.peak-system.com/PCAN-USB.199.0.html\)](http://www.peak-system.com/PCAN-USB.199.0.html), if it is not already installed.
From Windows **Start**, open **Emotas CANopen® Device Explorer**.

ATTENTION:



- At the bottom right corner of the **CANopen® Device Explorer** window user could see , this means connection is not yet done.
- Emotas CANopen® Device Explorer is just for an example.

3. At first, go to **Connection -> CAN Interface Settings**, a window pops up.
4. In Current interface -> Interface Type -> select PCAN Advanced from drop down list and in BittRate select 125kbit/s -> click on Add new interface.
5. Now, select the newly added PCAN by clicking on the **Primary** column of the newly added PCAN -> next **Close** the window.
6. Import the EDS file supplied by Delta, **File -> Load EDS -> WSU.eds**.
7. Once the EDS is loaded, click on **Connect** button .
8. Once the connection is done, user would see .
9. Now go to **PDO Configuration** tab
Note: RPDO (Receive-PDO, cyclic messages from battery to WSU) and TPDO (Transmit-PDO, cyclic messages from WSU to battery).
10. In PDO segment select TPDO 1 (0x1800/0x1a00) - dynamic.
11. In PDO Properties (EDS) give values as:

Description	Values
COB-ID	0x1A0 Note: The battery must have a RPDO with this COB-ID. Otherwise the battery would not receive the data in the message.
Transmission Type	0xFF
Inhibit Time (1/10 ms)	0
Event Timer (ms)	User defined (Example 200 ms)
Sync Counter	0x0

Note: The information given in the table below is according to CiA-301.

12. In **PDO Mapping Table (EDS)** table double click on each **Name** to delete the default objects.
13. Now on the left side open the **Manufacturer Segment / Device Profile Segment** tree. Drag and drop the required objects.
14. Repeat this process until user could see the required objects, in the **PDO Mapping Table (EDS)**.
15. Based on number of objects available in the table, give the number value in **Number of mapped objects**. Give 4 if the number of objects in the PDO Mapping Table is 4.
16. Now Click on Write to Device followed by Read from Device.
17. Now go to **Network** tab -> click on **Update Network Overview**, let it complete by 100%.
18. Once the desired Device name is displayed, user could stop the process by clicking on **Stop** button.
19. Select the desired Device -> Start **Heartbeat** to update NMT state automatically then click on **Start Node**.
20. User could quit the process, File -> Quit.
Note: For RPDO and TPDO examples refer [8.7.3.5 How to Control the WSU via CANopen®](#).

9 Planning

9.1 System design

9.1.1 Introduction

The optimal alignment of the Wireless Primary Pad (WPP) and Wireless Secondary Unit (WSU) during the charging process is the key factor in system design.

Since the WSU is mounted on the vehicle, the vehicle design often limits the mounting options for the WSU.

The mounting orientation of the WSU on the vehicle then determines the mounting orientation of the WPP.

Keep in mind, that the WPP and WSU can only be aligned with each other in certain configurations.

The mounting location of the Wireless Primary Box (WPB) can be chosen relatively freely. However, the cable length of the WPP must be considered.

The following sections describe the various mounting options.

9.1.2 Mounting orientation of WPP and WSU

Cable connection	The WSU cable connections must be protected from access to unskilled persons.
Installation	Make sure to use appropriate screws and dowels while mounting the WSU to the vehicle with respect to the WSU weight.

9.1.2.1 Variant 1

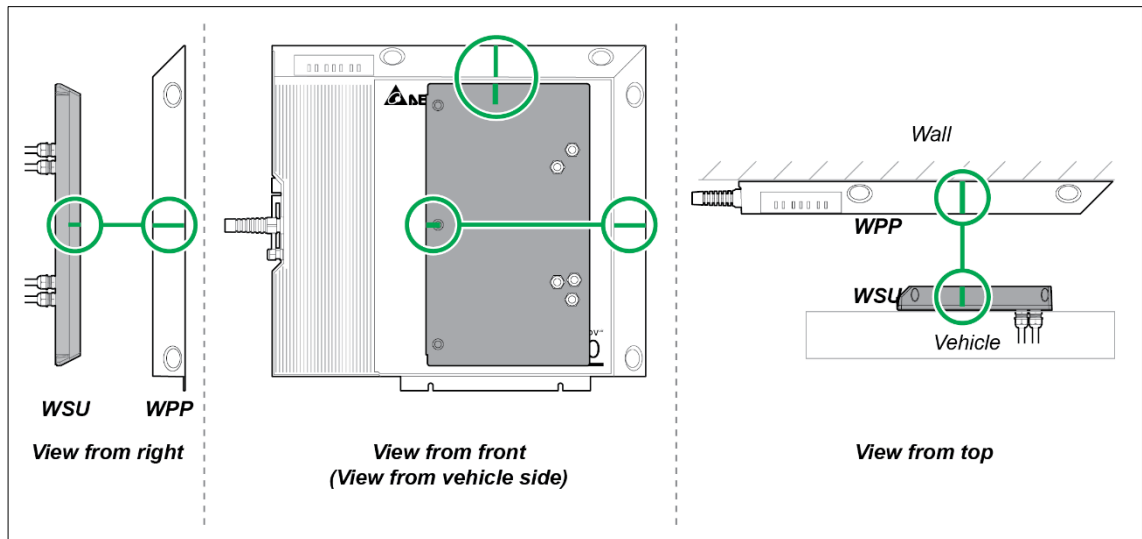


Figure 28 Mounting orientation of WPP and WSU – Variant 1

Description

WPP: cables on the left

WSU: vertically mounted; cables on the right

9.1.2.2 Variant 2

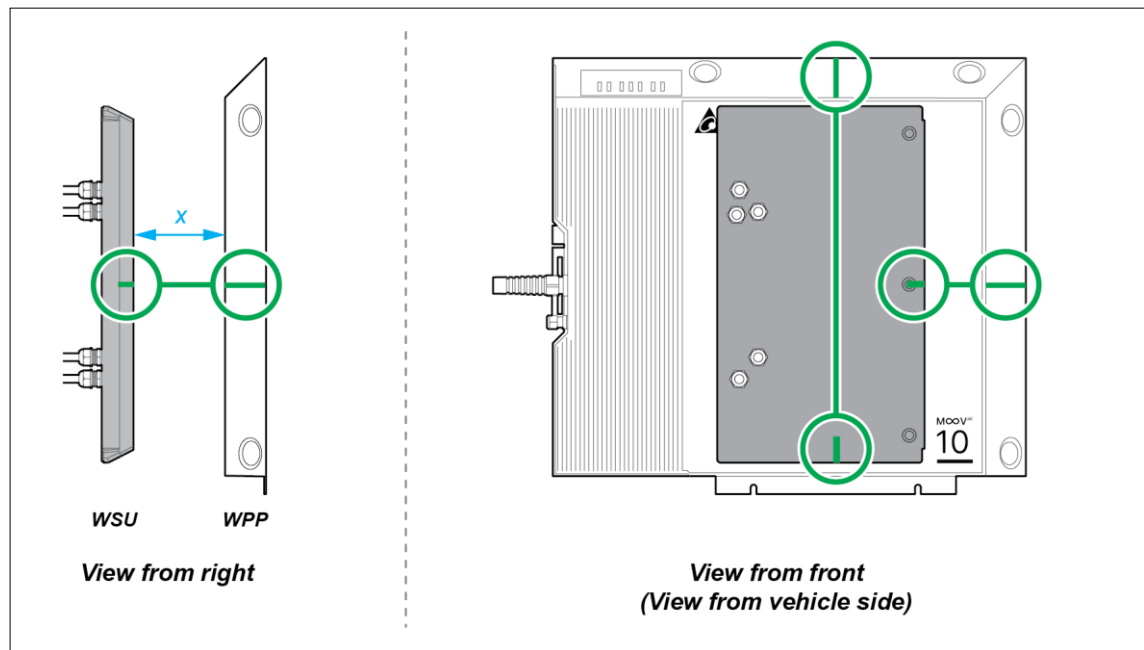


Figure 29 Mounting orientation of WPP and WSU – Variant 2

Description

WPP: cables on the left

WSU: vertically mounted; cables on the left

9.1.2.3 Variant 3

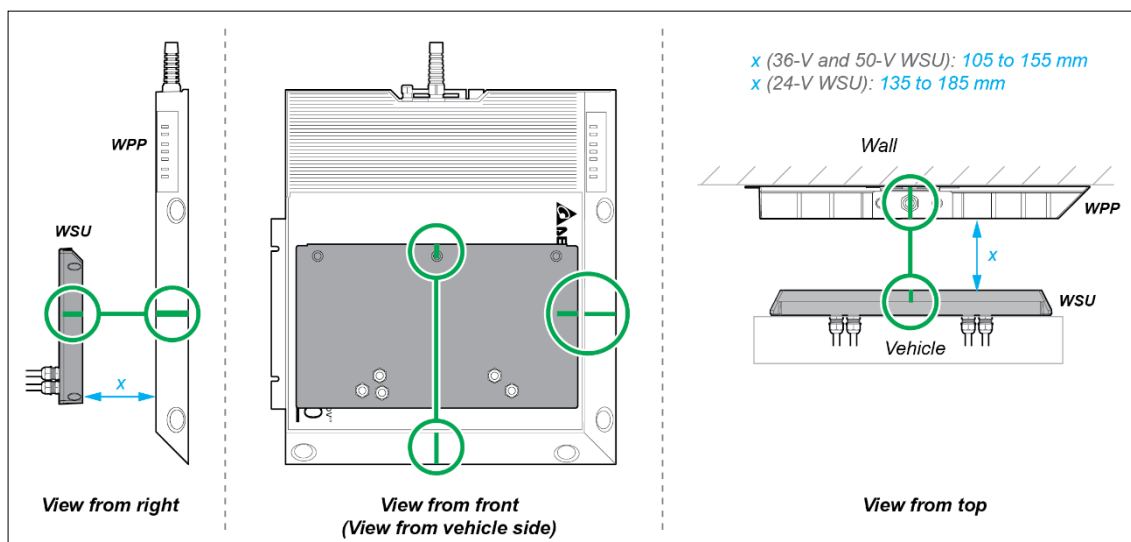


Figure 30 Mounting orientation of WPP and WSU – Variant 3

Description

WPP: cables on the top

WSU: horizontally mounted; cables at the bottom

9.1.2.4 Variant 4

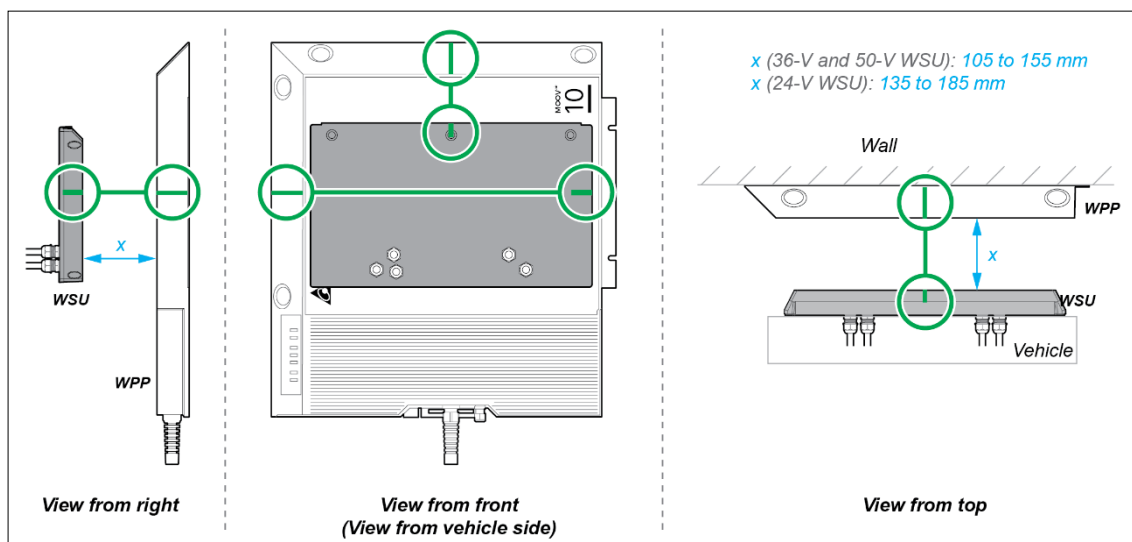


Figure 31 Mounting orientation of WPP and WSU – Variant 4

Description

WPP: cables at the bottom

WSU: horizontally mounted; cables at the bottom

9.2 Planning the installation

9.2.1 WPB

General information

- The WPB can be mounted standing or hanging.
- The WPB is very heavy. The wall, mounting system, or floor must be able to support the heavy weight.
- Always use the mounting plate supplied with the WPB for wall mounting.
- Use mounting materials (wall plugs, screws, etc.) that are suitable for the wall, mounting system, or floor and can support the heavy weight.
- The WPB has IP21 and must be installed in weather-protected and temperature-controlled enclosed location.
- For installation and operation of the WPB, a fused supply line with a Supply Disconnecting Device (SDD) according to the following specifications is required:

Region	Supply voltage	Fuse	SDD
Europe	400 V / 47 Hz	32 A	CEKON (IEC 60309) plug
US and Canada	480 V / 63 Hz	20 A	A Switch box in accordance with NFPA 70 and C22.1-15.

- The cables on the heavy-duty connector to connect the WPP to the WPB has a length of 5 m (16.4 ft). If the WPP is positioned closer to the WPB, the cables can be coiled up.
ATTENTION: It's **forbidden** to shorten the cables on the WPP.
- Maintain a distance of 30 cm (11.8 in) to air inlet and air outlet for proper ventilation.
- The WPB can emit noise levels up to 75 dB(A), depending on the speed of the ventilation fans. The installation position of the WPB must be chosen accordingly (industrial workplace).
- The power supply cord must have a minimum conductor size of 4 mm² / 12 AWG.
- The minimum conductor size for the PE/GND connection is 6 mm² / 10 AWG. PE/GND wire shall be longer than L wires.

Material and tools needed for mounting the WPB

- For wall mounting: at least 4 screws (Ø 8 mm), spring washers, washers for the mounting plate
- For floor mounting: 4 screws (Ø 8 mm), spring washers, washers

9.2.2 WPP

General information

- The WPP is designed to withstand harsh climatic conditions, however a solar shield is recommended to protect it from direct sunlight, as overheating of WPP may result in de-rating of the output power.
- Always use the mounting plate supplied with the WPP for wall mounting.
- Use mounting materials (wall plugs, screws, etc.) that are suitable for the wall, mounting system, or floor and can support the heavy weight.
- The cables on the heavy-duty connector to connect the WPP to the WPB has a length of 5 m (16.4 ft). If the WPP is positioned closer to the WPB, the cables can be coiled up.
ATTENTION: It's **forbidden** to shorten the cables on the WPP.

Mounting on metals

The WPP can be mounted directly on ferrous (e.g. steel) and non-ferrous (e.g. aluminum) metals.

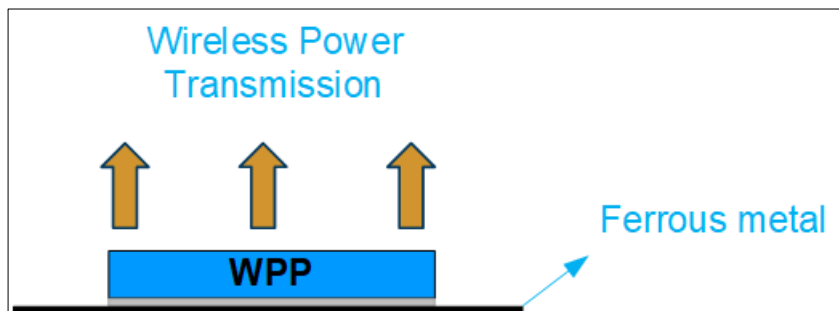


Figure 32 WPP – Mounting on ferrous metals

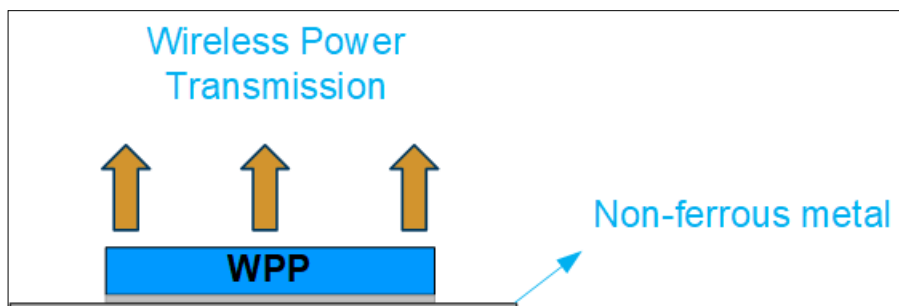


Figure 33 WPP – Mounting on non-ferrous metals