

15.3.2 Components

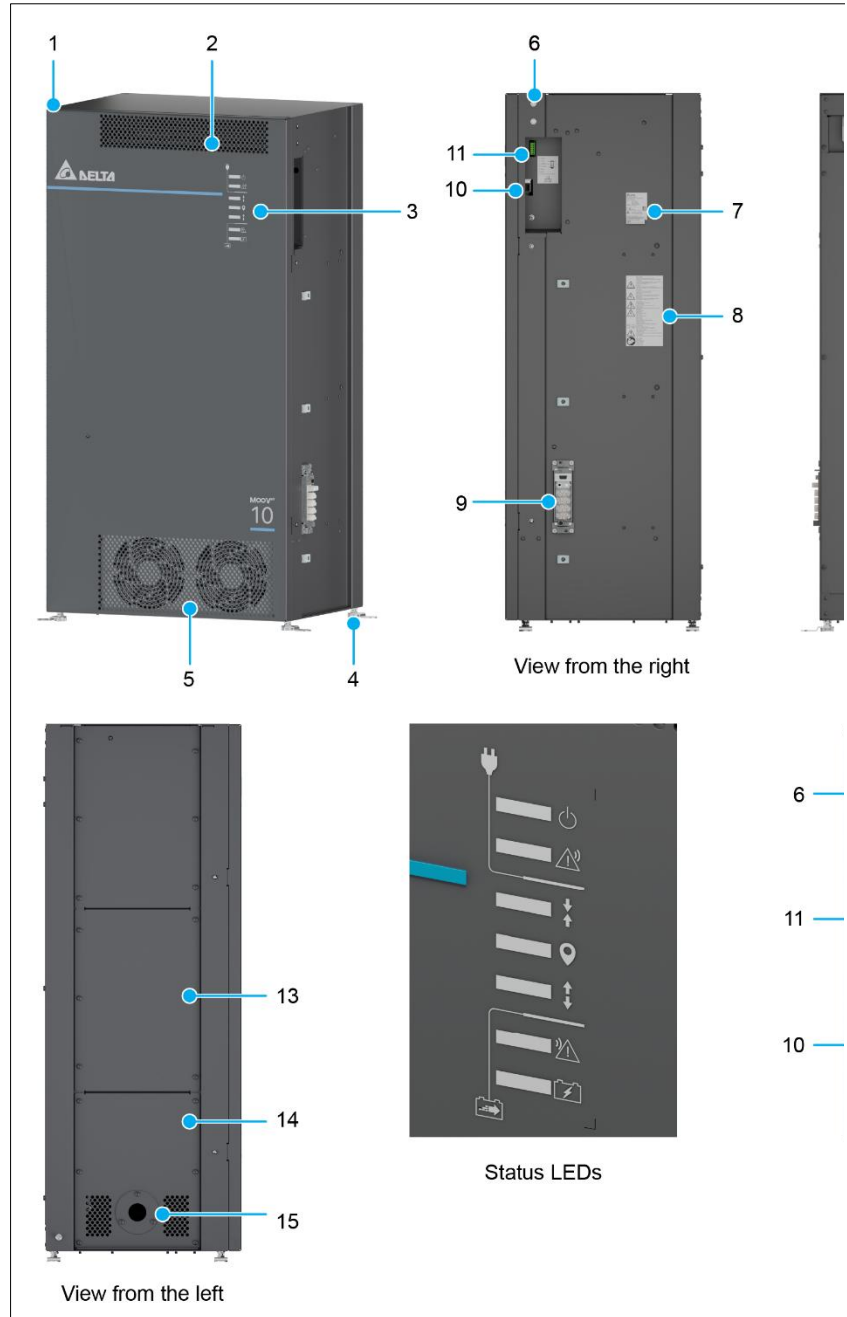


Figure 2 External components of the Wireless Primary Box

Threads for lifting the WPB with a crane or pulley

et

s LED panel

ing feet for mounting to the floor and leveling

tlet

ds for stack light

abel 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

15.3.3 Status LED Panel

The Status LED Panel indicates system and operating status.

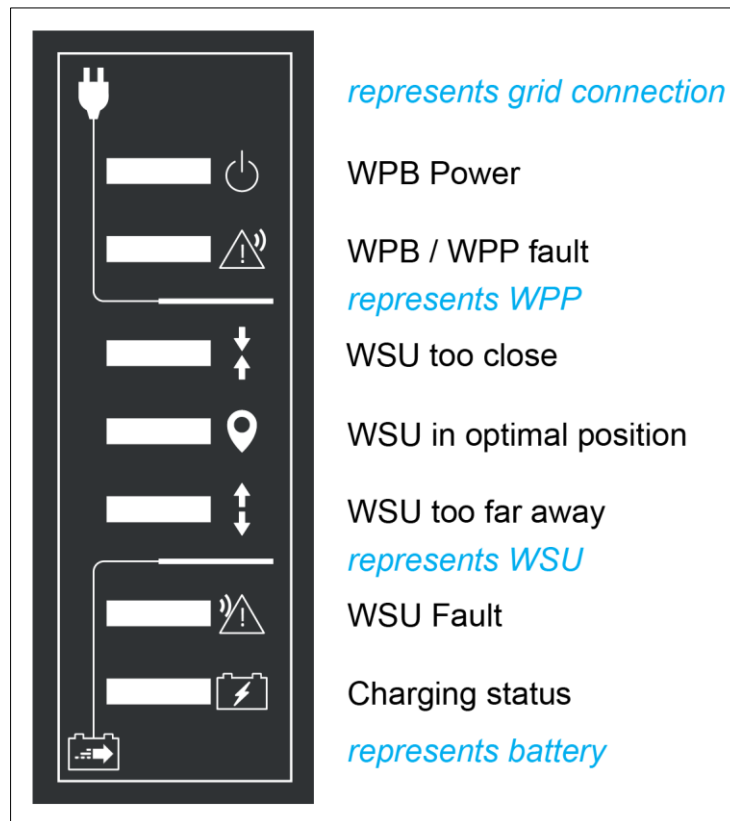


Figure 3 Status LED Panel on WPB

15.3.4 AC Input

15.3.4.1 Field Wiring Terminals

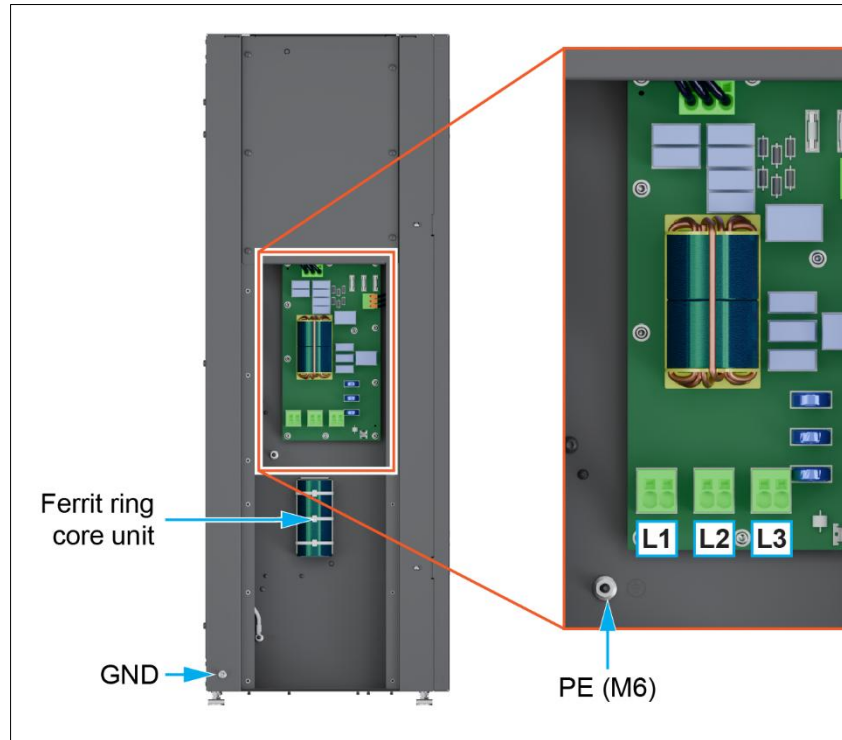


Figure 4 Field wire terminals on WPB

L1, L2, L3	Phases of the AC Supply Grid with ground Voltage 400 / 480 V, 47 to 63 Hz.
PE/GND	PE/GND connected to star point of the / PE/GND Bolt on Chassis part close to X

Fused supply line with SDD (Supply Disconnecting Device)	For installation and operation of the WPB, a fused supply line according to the following specifications is required		
	Region	Supply Voltage	Fuse
	Europe	400 VAC/47 Hz	32 A
	US and Canada	480 VAC/63 Hz	20 A

Table 1 Required supply disconnecting device (SDD)

15.3.4.2 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.

15.3.5 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.

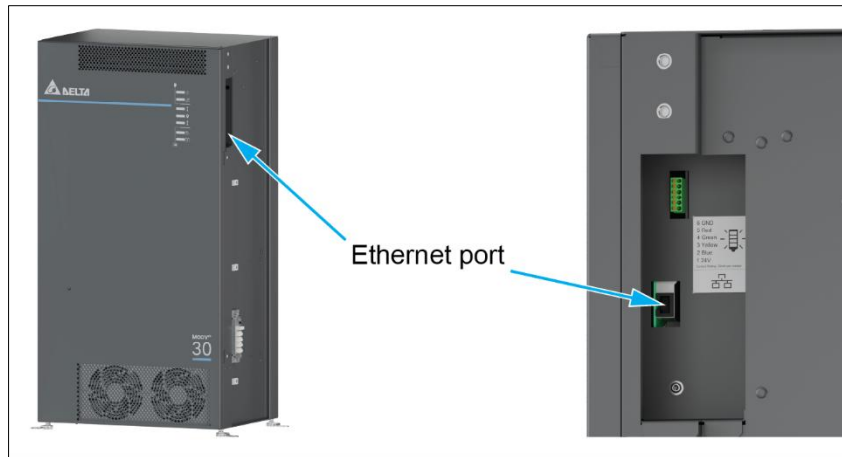


Figure 5 WPB – Ethernet Service Interface

ATTENTION:



Ethernet service interface must be used by qual during the service and should be disconnected c done.

The ethernet service cable length is restricted to

15.3.6 Heavy-duty Connector

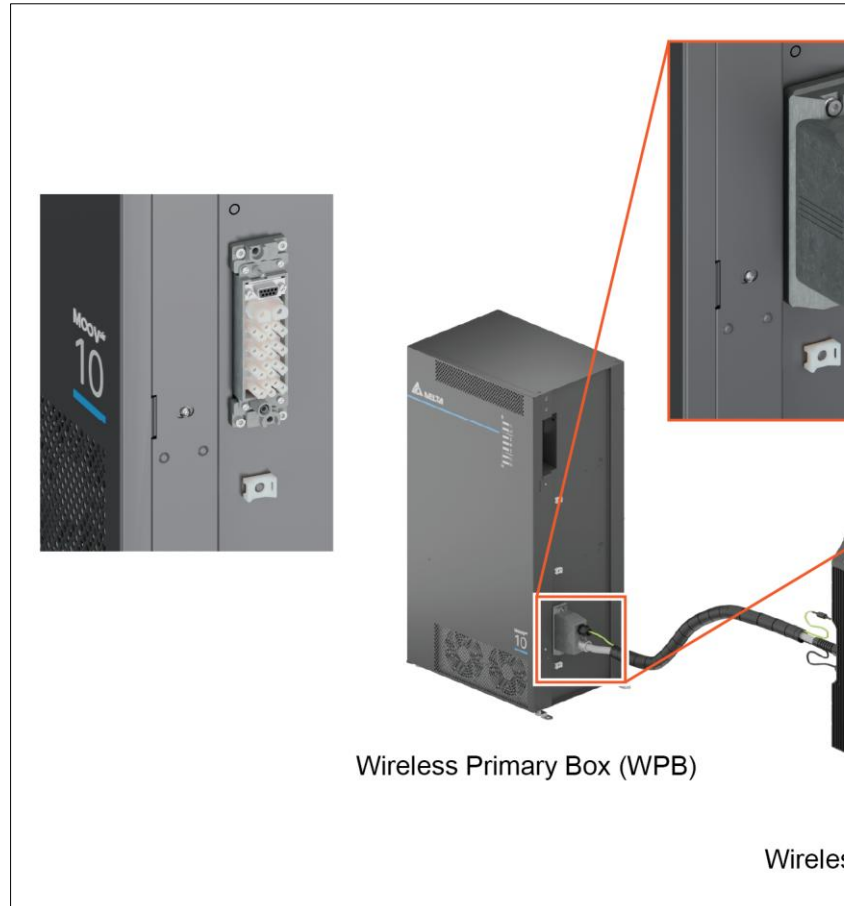


Figure 6 WPP – Heavy-duty connector

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

15.3.7 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
Noise levels emitted	Up to 75 dB(A), depending on the distance

	Fans will operate if internal temperature is
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 /
AC Input rated Voltage	400 VAC 3PH 400 to 480 VAC 3PH ~	480 V
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
	Note: Installed externally to the WPB	
Branch fuse	Use 125 Amp. Branch protection is fuse. Note: Installed externally to the WPB	
Required SDD (Supply Disconnecting Device)	CEKON (IEC 60309) plug	A SDD with
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

15.4 Wireless Primary Pad (WPP)

15.4.1 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.

15.4.2 Components

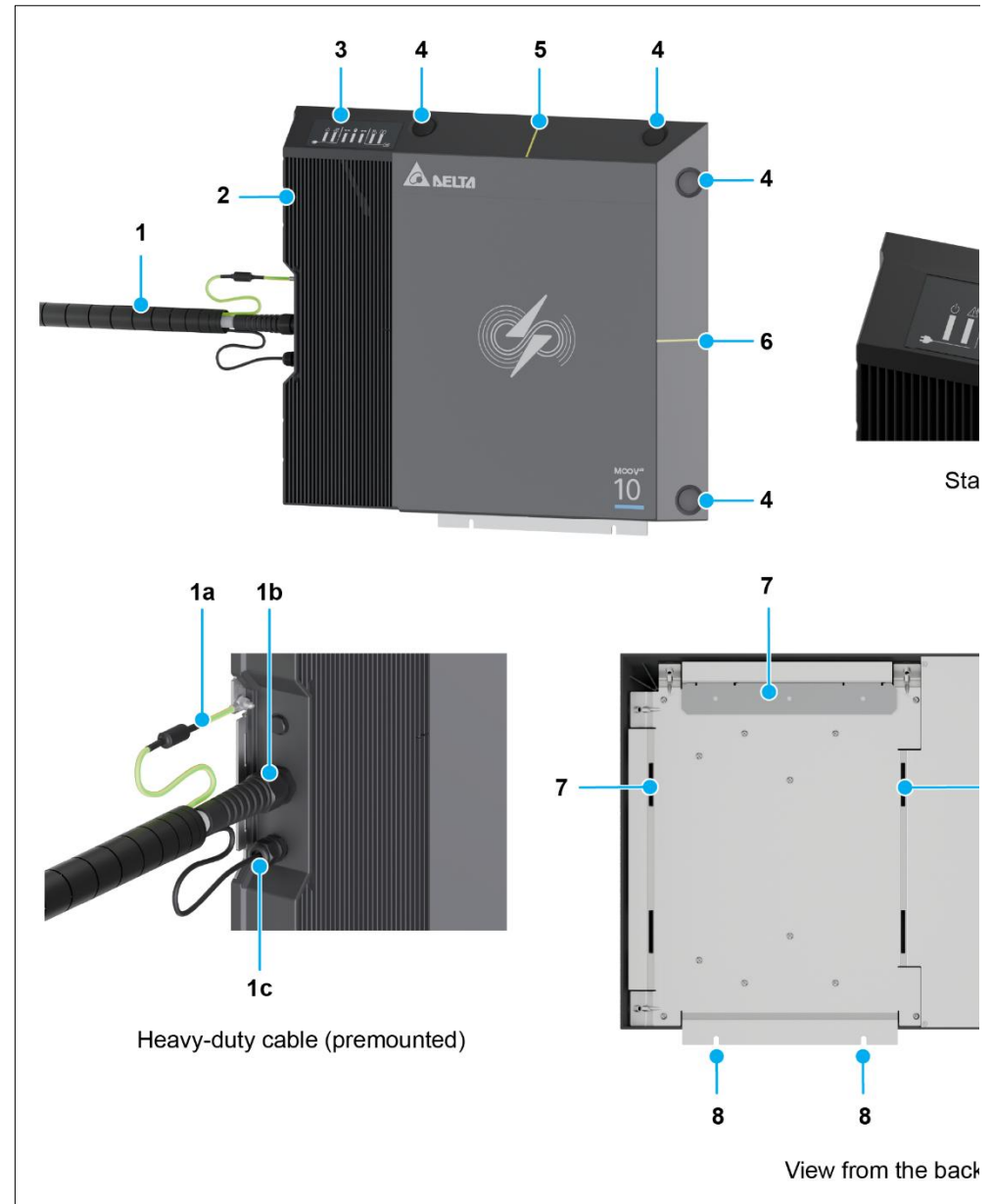


Figure 7 Components of the Wireless Primary Pad (WPP)

1	Heavy-duty cable (connected to WPB) with grounding cable (1a), 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
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

15.4.3 Status LED panel

The Status LED Panel indicates system and operating status.

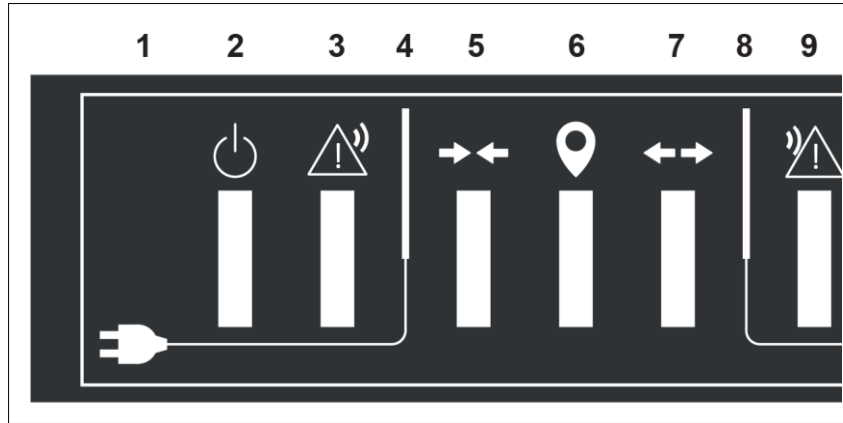


Figure 8 Status LED Panel on WPP

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

15.4.4 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).

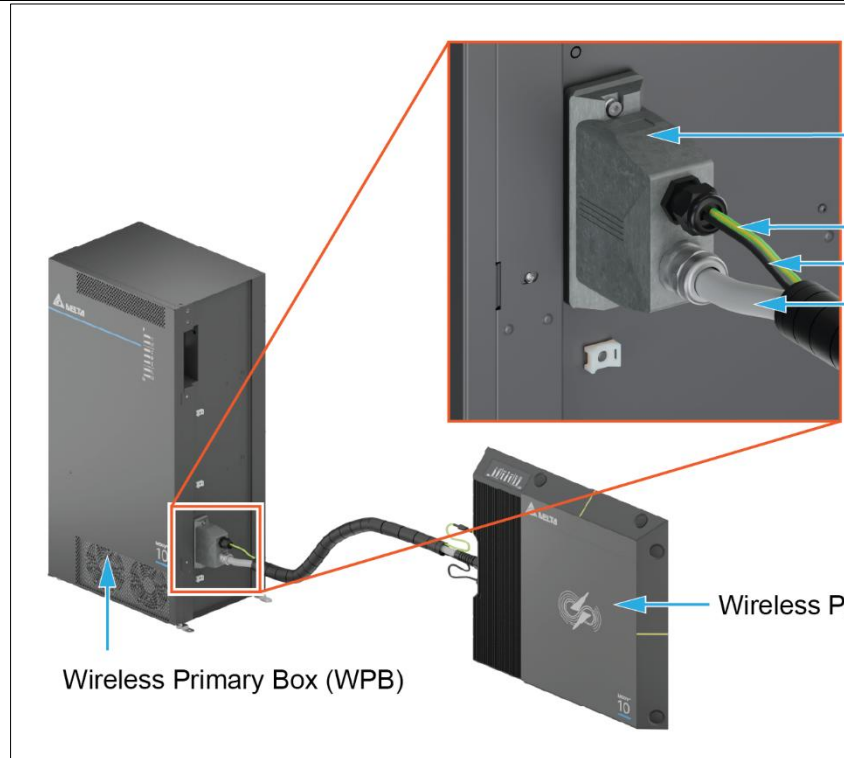


Figure 9 Heavy-duty plug on WPP with cables

15.4.5 Technical specification

Dimensions (H x W x D)	691 x 750 x 70 mm (27.2 x 29.5
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 (
Ambient relative humidity	4 to 100 %
Maximum operating altitude	3000 m (9842 ft) above sea level
Shock and vibration (operating)	EN IEC 60721-3-4:2018, Class
Shock and vibration (transport and handling)	EN IEC 60721-3-2:2018, Class
Impact resistance	IEC 62262 Code IK07: 2 J WPP tested with higher impact with IEC 62368-1, UL 1564, CS to standards or contact Delta fo
Storage temperature	-45 to +70 °C (-49 to +158 °F)

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

15.5 Wireless Secondary Unit (WSU)

15.5.1 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.

15.5.2 Components

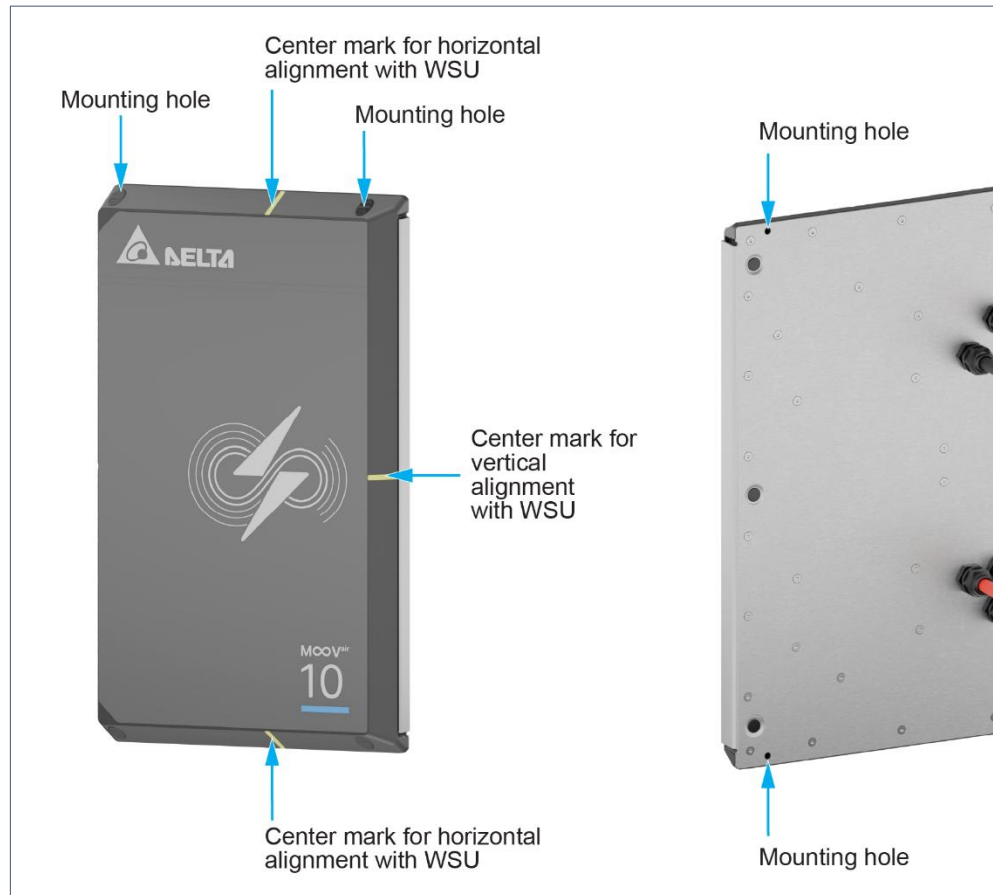


Figure 10 Components of the Wireless Secondary Unit (WSU)

15.5.3 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

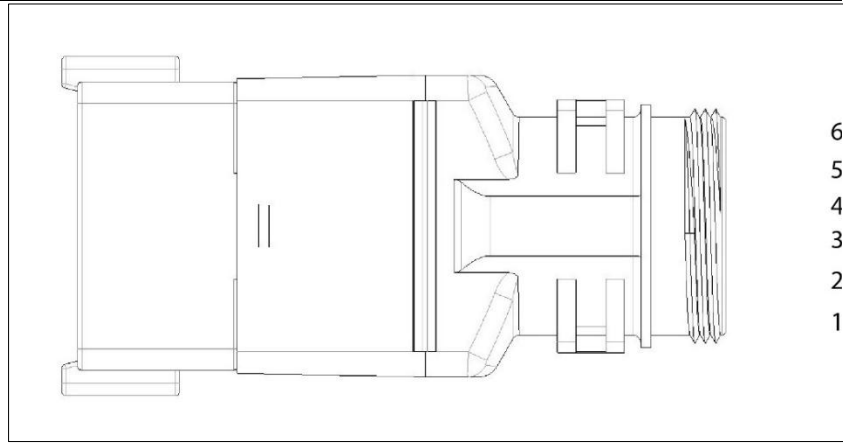


Figure 11 WSU Control cable

Pin	Signal	Function
1	AUXIN+	AUX supply from battery, fused 2A at V _{batt}
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 i
6	CANOUT_L	BMS Vehicle CAN/2nd WSU/120 Ohm i
7	CANIN_H	BMS Vehicle CAN
8	CANIN_L	BMS Vehicle CAN
9	NC	-
10	AUXOUT-	AUX supply reference for external device
11	NC	Reserved
12	NC	Reserved

Table 5 Pin assignment WSU Deutsch Connector

15.5.3.1 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

15.5.3.2 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

15.5.3.3 CANopen® Interface

15.5.3.4 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.

Technical specification

Dimensions
(H x W x D)

565 x
12.9 x

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 IEC 60068-2-64:2008) Shock test 100g IEC 60068-2-27:2009 Shock test 25g IEC 60068-2-27:2009 Shock test 50g IEC 60068-2-27:2009
Shock and vibration (transport and handling)	EN IEC 60721-3-2 Class 2M4
Impact resistance	IEC 62262 Code IK08 WSU tested with 5J impact force in accordance with IEC 62341, UL 1564, CSA 22.2 and others. For more details refer to standard Delta contact Delta information.
Storage temperature	-45 to +70 °C (-49 to +158 °F)

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

Nominal output voltage	24 & 48 VDC
Output voltage range	18 to 54 VDC
Absolute maximum DC voltage on power output and auxiliary input	44 VDC
Maximum charge current (For more details refer 8.5.1.1 Output Operating Area).	275 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
	<i>Table 9 Specifications – Wireless Secondary Unit (WSU) – DC Output</i>	
Safety.		

1. Put clean PVC or polythene gloves on your hands to protect your hands from cleaning agents.
2. Wipe off any dirt with a clean dry cloth or soft brush. Use a microfiber or a soft lint-free cloth only. Do not use abrasive cloths, towels, paper towels or similar items.
3. Dirt, oil and grease may require a solvent to be removed. If this is required use an alcohol solution consisting of 70% isopropyl alcohol and 30% water. Keep liquids away from the WPB. Moisten (not wet) a microfiber or soft lint-free cloth with the cleaning agent and wipe clean.
4. Dry all of the equipment before use.

15.5.4 Cleaning WPP & WSU

WARNING: 	Make sure to switch OFF WPB.
CAUTION: 	Do not use heated pressure washer or a steam cleaner on WPP and WSU.

1. Put clean PVC or polythene gloves on your hands to protect your hands from cleaning agents.
2. Wipe off any dirt with a clean dry cloth or soft brush. Use a microfiber or a soft lint-free cloth only. Do not use abrasive cloths, towels, paper towels or similar items.
3. Dirt, oil and grease may require a solvent to be removed. If this is required use an alcohol solution consisting of 70% isopropyl alcohol and 30% water. Keep liquids away from the WPB. Moisten (not wet) a microfiber or soft lint-free cloth with the cleaning agent and wipe clean.
4. For cleaning by cold water pressure washer, either clean without cleaning agent or use a cleaning agent as referred in [Error! Reference source not found.](#), items 2 & 3 with a dosage of up to 3%. Pressure washer suitability as follows:
 - Flow rate: 15 liter/minute max
 - Impact force: 1.2 N max

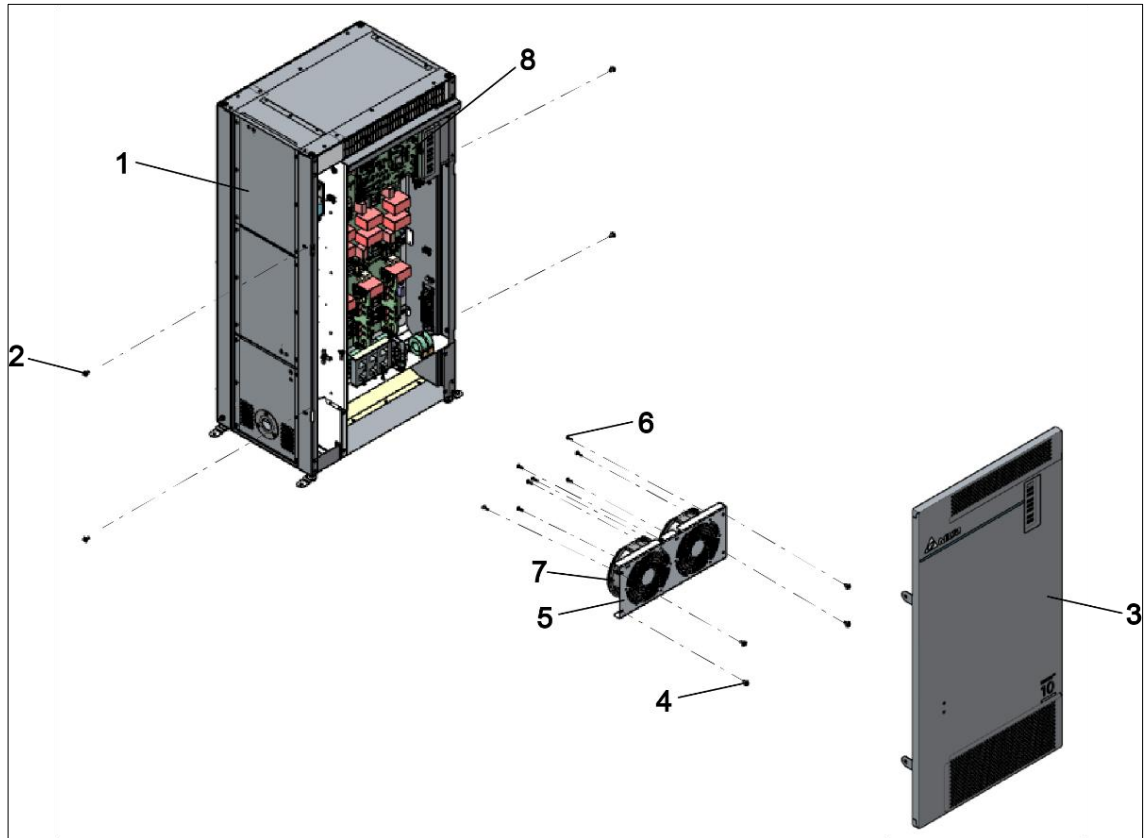
15.5.5 Cleaning Fans of WPB

DANGER: 	Electric Shock Make sure to disconnect the main power supply and wait for 30 min before opening WPB, as it may lead to death of Personnel.
WARNING: 	Make sure not to disconnect the fan cables, while replacing Fan Assembly. Pull the receptacle not the cable.

Special tools needed

- Vacuum cleaner
- Screwdriver Torx T30. **Note:** Use a magnetic screwdriver as the screws can easily fall down.

Procedure



1	WPB
2	M6 Screws
3	Front Cover
4	Screws M M6*1*12 FPH TORX SUS
5	Fan Panel Assembly
6	Screws
7	Fans
8	Control Board

1. Power off the system and wait for 30 minutes until the WPB cools down.
2. Remove the four screws M6 (2) and remove the front cover (3). See [Error! Reference source not found.](#)
3. Unplug the Fan Panel Assembly (5) from the control board (8).
4. Remove the four screws (4) and remove Fan Panel Assembly (5).
5. Clean the fans (7) with a dry cotton cloth or with a vacuum cleaner.

6. Do not use any cleaning agents or solvents to clean the fans, this may damage the fans.
7. Once cleaning is complete, connect the Fan Panel Assembly (5) to the control board (8).
8. Install the fan panel assembly (5) with screws (4). Fix the cables to the cable holders with cable ties.
9. Install the front cover (3) with the four screws M6 (2).
10. Make sure that everything is installed and connected. Now turn on the power supply to the WPB.

15.6 Corrective Maintenance

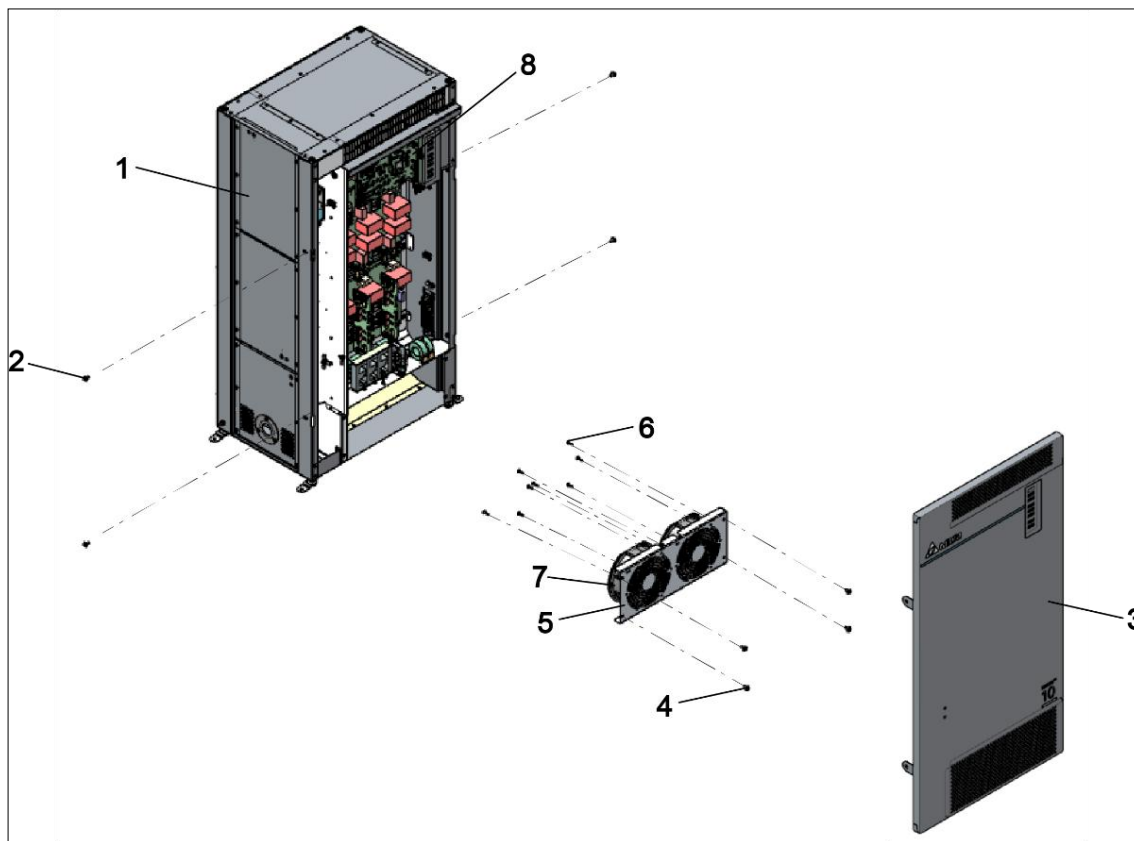
15.6.1 Replacing Fans of WPB

DANGER:



Electric Shock

Make sure to disconnect the main power supply and wait for 30 min before opening WPB, as it may lead to death of Personnel.



- | | |
|---|-------------------------------|
| 1 | WPB |
| 2 | M6 Screws |
| 3 | Front Cover |
| 4 | Screws M M6*1*12 FPH TORX SUS |
| 5 | Fan Panel Assembly |
| 6 | Screws |
| 7 | Fans |
| 8 | Control Board |

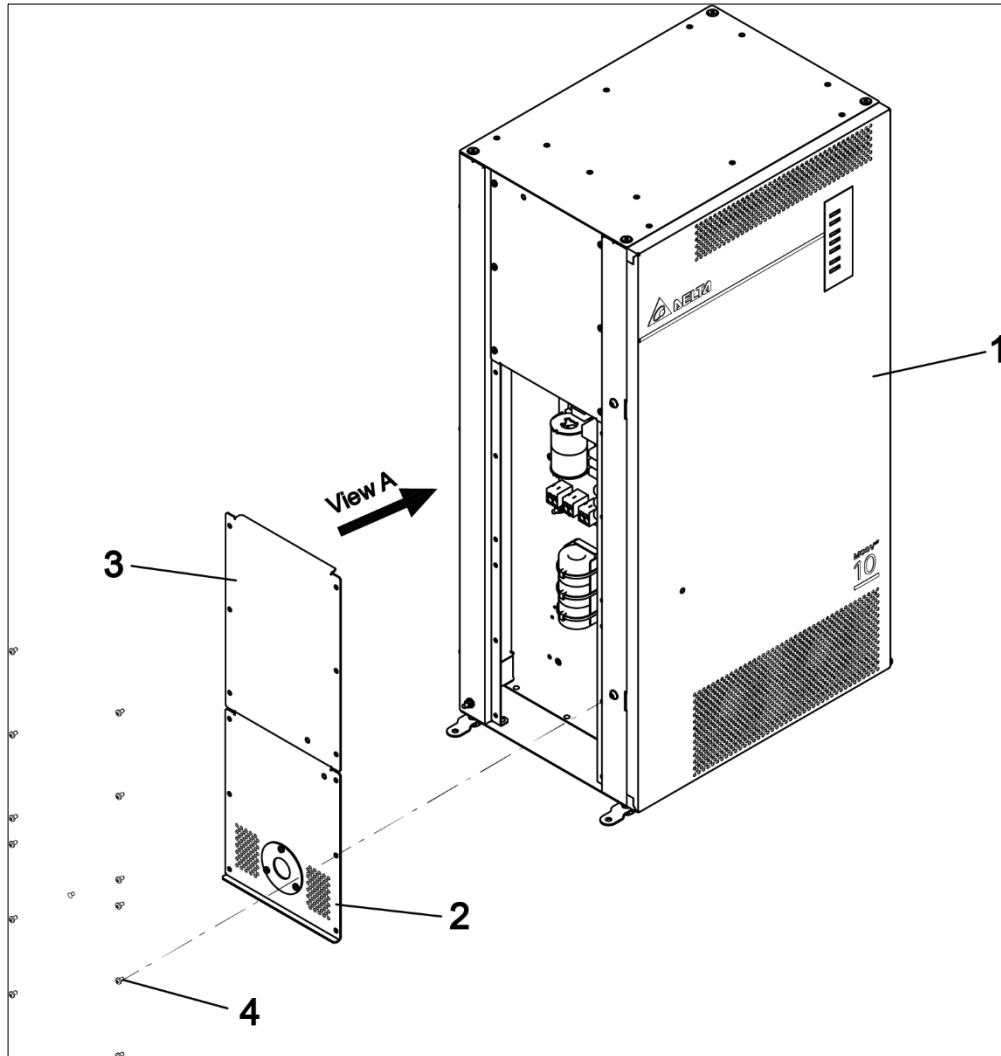
1. Make sure to power off the system and wait for 30 minutes until the WPB cools down.
2. Remove the four screws M6 (2) and remove the front cover (3).
3. Unplug the Fan Panel Assembly (5) from the control board (8).
4. Remove four screws (4) and remove Fan Panel Assembly (5).
5. Remove the press button screws (6) and remove the fans (7).
6. Install the new fans (7) with press button screws (6).
7. Connect the Fan Panel Assembly (5) to the control board (8).
8. Install the Fan Panel Assembly (5) with four screws (4).
9. Fix the cables to the cable holders with cable ties.
10. Install the front cover (3) with the four screws M6 (2).
11. Make sure that everything is well installed and connected. Now turn on the power supply to WPB.

15.6.2 Replacing Fuses of WPB

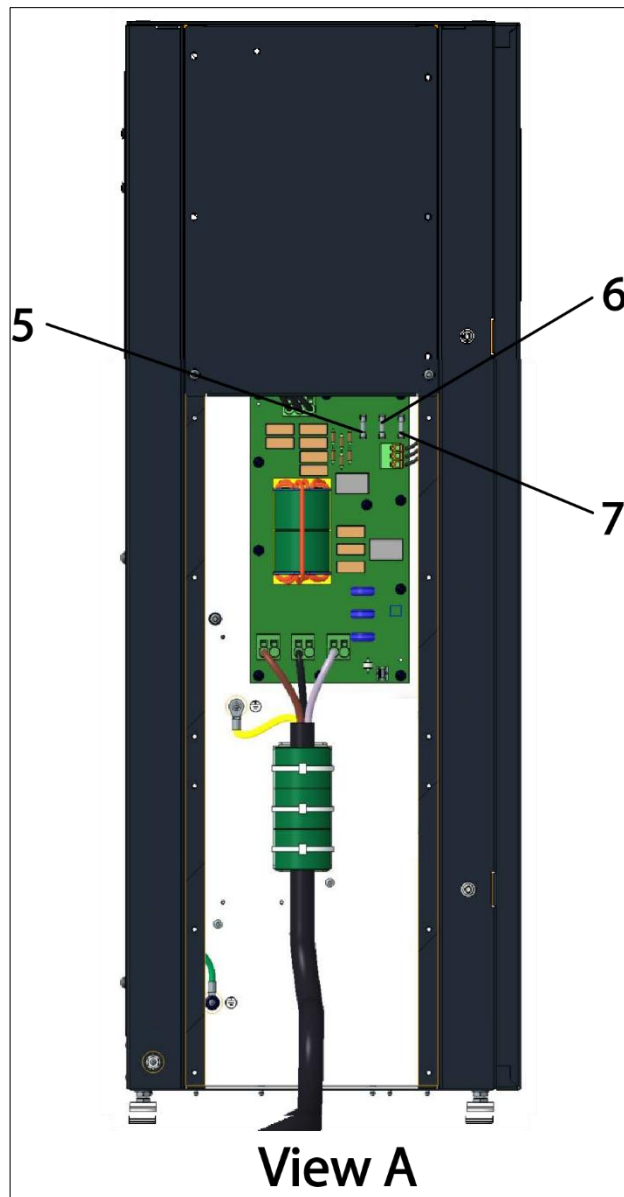


Electric Shock

Make sure to disconnect the main power supply and wait for 30 min before opening WPB, as it may lead to death of Personnel.



- | | |
|---|--------------|
| 1 | WPB |
| 2 | Lower Cover |
| 3 | Middle Cover |
| 4 | Screws |



5 Fuse for L1

6 Fuse for L2

7 Fuse for L3

1. Power off the system and wait for 30 minutes until the WPB cools down.
2. Unscrew (4) and remove the middle cover (3) and lower cover (2). See [Error! Reference source not found.](#)
3. Disconnect all electrical connection around the fuses L1, L2 and L3 (5, 6, 7).
4. Replace all the three fuses with the new Fuses.
5. Reconnect all electrical connections around the fuses.
6. Install middle cover (3) with six screws (4).
7. Check that everything is installed and connected. Now turn on the power supply to WPB.
8. Install lower cover (2) with six screws (4).

15.7 Firmware Updates

Please contact your charger dealer/sales representative for information.

15.7.1 WPB and WPP Firmware Update

Configure your laptop or PC to use the static IP address 192.168.1.n, where n may be any number from 0 to 255 other than 100 (e.g. 99) and subnet mask 255.255.255.0.

Connect your laptop to the WPB via an Ethernet cable.

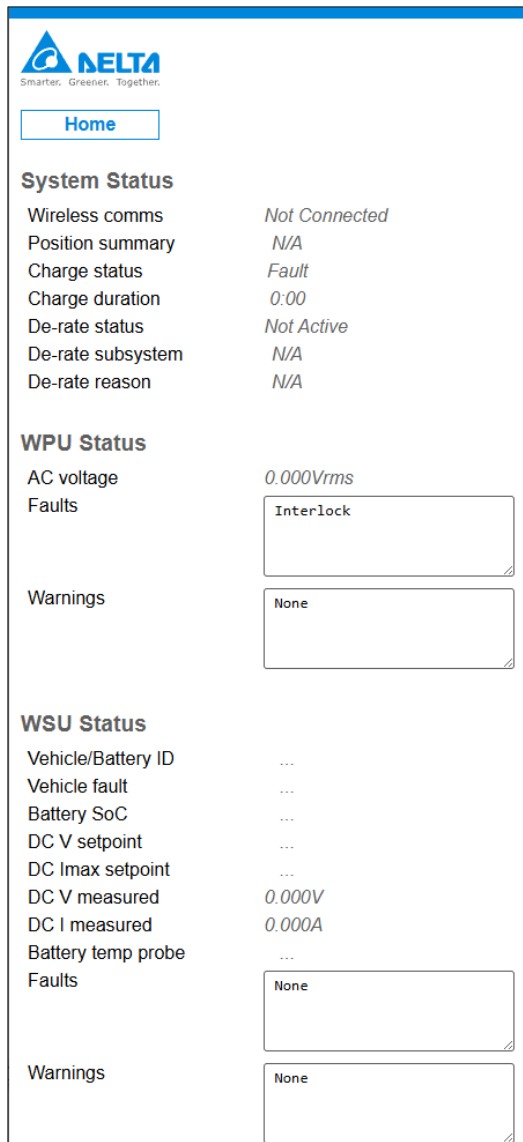
1. Turn on the WPB.
2. Open the WPB webpage by entering the IP address 192.168.1.100 in your browser.
3. Enter the following credentials when prompted.

User: Delta

PWD: G745Pxy, where xy correspond to the last two digits of the MAC address (default is 00).

Note: The label with the MAC address is below the WPB type label.

The **Home** page is shown



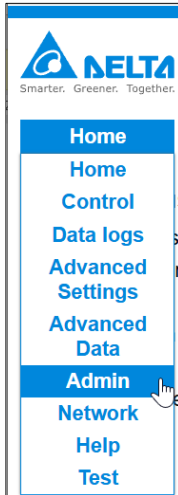
The screenshot shows the DELTA WPB Home page. At the top is the DELTA logo with the tagline 'Smarter. Greener. Together.' and a 'Home' button. Below this is the 'System Status' section, which lists various parameters and their current values: Wireless comms (Not Connected), Position summary (N/A), Charge status (Fault), Charge duration (0:00), De-rate status (Not Active), De-rate subsystem (N/A), and De-rate reason (N/A). The 'WPU Status' section shows AC voltage (0.000Vrms) and a list of faults (Interlock). The 'WSU Status' section shows various vehicle and battery parameters, including Vehicle/Battery ID, Vehicle fault, Battery SoC, DC V setpoint, DC I max setpoint, DC V measured (0.000V), DC I measured (0.000A), Battery temp probe, and a list of faults (None). There are also warning sections for both WPU and WSU, both showing 'None'.

System Status	
Wireless comms	Not Connected
Position summary	N/A
Charge status	Fault
Charge duration	0:00
De-rate status	Not Active
De-rate subsystem	N/A
De-rate reason	N/A

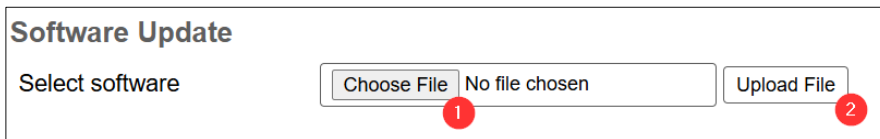
WPU Status	
AC voltage	0.000Vrms
Faults	Interlock
Warnings	None

WSU Status	
Vehicle/Battery ID	...
Vehicle fault	...
Battery SoC	...
DC V setpoint	...
DC I max setpoint	...
DC V measured	0.000V
DC I measured	0.000A
Battery temp probe	...
Faults	None
Warnings	None

4. Open the **Admin** page.



5. Navigate to bottom of the **Admin** page,



6. Click *Choose File* and select the provided .BIN file (1) update the Ethernet or WPB/WPP controllers by selecting the and by clicking on the Upload File (2) button:

The WPB or WPP controller update process typically takes around 5 minutes each!

When updating the Ethernet controller, the web will go down for about 30 seconds!

7. The displayed firmware version numbers refer to the three WPU controllers:

WPB	
Model name	...
Part number	EOE00000000
Hardware version	000000
Serial number	YYWW000000
SW - App1 version	(1) V3.1.2
SW - App2 version	(2) V22.1
WPP	
Model name	...
Part number	...
Hardware version	...
Serial number	...
SW - App1 version	(3) V7.0

(1) WPB Ethernet Controller version

(2) WPB Controller version

(3) WPP Controller version (not displayed if no WPP is connected to the WPB)

For more detailed version information use any of these URLs in your web browser:

<http://192.168.1.100/api/firmware/wpb>

<http://192.168.1.100/api/firmware/wpp>

16 Troubleshooting

This section provides information for identification and correction of malfunctions and faults of the WCS.

16.1 Identifying Subsystems to Troubleshoot

The following are different ways to identify a faulty subsystem:

- Status LED panel
- CANopen®
- Ethernet (Webpage)
- Stack Light (if fitted)

16.2 Fault indication on status LED panels

10kW WCS - Status LEDs									
Category	WPB / WPP		POSITIONING					WSU	
Symbol									
Description	Power	WPB/WPP Fault	Position Too close	Position Optimal	Suboptimal Too close	Suboptimal Too far	Position Too far	WSU Fault	Charging Status
Power Not OK									
Power OK									
Power OK, Position OK, Charging									Flash
Power OK, Position Suboptimal Too far, Charging									Flash
Power OK, Position Suboptimal Too close, Charging									Flash
Power OK, Position too far, not charging									
Power OK, Position too close, not charging									
Power OK, Data communication to WSU is established and BMS doesn't require charging.									
Power OK, WPB / WPP Fault									
Power OK, WSU Fault									
Power OK, WPB / WPP & WSU Fault									

Figure 57 Possible Status LED Panel Scenarios

Note: Further diagnostics for troubleshooting can be acquired from the CANopen® interface e.g. PPL Connection Status, detailed Positioning Status etc.

16.3 Troubleshooting on WPB

Symptom	Probable Cause	Corrective Action
No power to WPB	WPB is not connected properly to grid.	Check the connection between WPB and grid.
	Supplementary Fuses (supply line fuses) are blown OFF.	Check the supplementary fuses (supply line fuses) and if necessary, replace them. (32 A for Europe and 20 A for US and Canada).
	Fuses to Auxiliary supply are blown OFF.	Check the fuses to Auxiliary supply and replace them if necessary.
	One phase connection is missing.	Check for any missing grid connection (Phase 1, 2 and 3) to WPB or improper connection. In this case charging starts but B6 voltage drops and WCS shuts down
	WPB Internal defect	Verify with Delta and request a replacement if necessary.

Table 13 Troubleshooting of WPB

16.3.1 WPB Event Class 0

All events in class 0 lead to the system being switched off. This also opens the contactor. The system is kept in the switched-off state until it is actively reset.

Event Log	Description	Action
HW Temperature Monitoring = Overtemperature	Temperature exceeded defined hardware limit	Contact service
Board connection Monitoring	Internal board connection fault	Contact service

Table 14 Events – WPB – Event class 0

16.3.2 WPB Event Class 1

All events in class 1 lead to the system being switched off. This also opens the contactor. If the last start process was less than 1 minute ago, there is a maximum waiting time of 1 minute until the system is restart.

Item	Event Log	Description	Action
1	Internal loss Monitoring = Error	Internal losses of WPB exceeded defined limit	Contact service.
2	Buck Power Monitoring = Overpower	Buck Power exceeded defined limit	Contact service.
3	PFC Power Monitoring = Overpower	Buck Power exceeded defined limit	Contact service.
4	HW Boost Current Monitoring = Overcurrent	Boost current exceeded defined hardware limit	Contact service.
5	HW Buck Current Monitoring = Overcurrent	Buck current exceeded defined hardware limit	Contact service.
6	HW Bulk Voltage Monitoring = Overvoltage	Bulk voltage exceeded defined hardware limit	Contact service.
7	HW Inverter Voltage Monitoring = Overvoltage	Inverter voltage exceeded defined hardware limit	Contact service.
8	HW Inverter Current Monitoring = Overcurrent	Inverter current exceeded defined hardware limit	Contact service.
9	HW Interlock Monitoring = Error	Interlock Monitoring detected not connected WPP	Check cable connection from WPB to WPP.
10	Rectifier Temperature Monitoring = Overtemperature	Rectifier temperature exceeded defined software limit.	Check if fans are dirty or defect. Check if ambient temperature is within specification.
11	Rectifier Temperature Monitoring = Undertemperature	Rectifier temperature below defined software limit.	Check if ambient temperature is within specification
12	DC Temperature Monitoring = Overtemperature	DC temperature exceeded defined software limit.	Check if fans are dirty or defect Check if ambient temperature is within specification.
13	DC Temperature Monitoring = Undertemperature	DC temperature below defined software limit.	Check if ambient temperature is within specification.

Item	Event Log	Description	Action
14	Inverter Temperature Monitoring = Overtemperature	Inverter temperature exceeded defined software limit.	Check if fans are dirty or defect. Check if ambient temperature is within specification.
15	Inverter Temperature Monitoring = Undertemperature	Inverter temperature below defined software limit.	Check if ambient temperature is within specification.
16	MCU Temperature Monitoring = Overtemperature	MCU temperature exceeded defined software limit.	Check if fans are dirty or defect. Check if ambient temperature is within specification.
17	MCU Temperature Monitoring = Undertemperature	MCU temperature below defined software limit.	Check if ambient temperature is within specification.
18	WPP Ferrite Overtemperature = TRUE	WPP Ferrite temperature exceeded defined software limit.	Let WPP cool down. Check if Ambient temperature is within specification. Avoid direct exposure to sunlight.
19	WPP Capacitor Overtemperature = TRUE	WPP Capacitor temperature exceeded defined limit.	Let WPP cool down. Check if ambient temperature is within specification. Avoid direct exposure to sunlight.
20	SW B6 overvoltage Monitoring = Overvoltage	B6 Voltage exceeded defined software limit.	Check if grid voltage is within specification.
21	Inverter Frequency and Phase Monitoring = Frequency error	Inverter frequency is out of defined limits	Check airgap / misalignment. Check for any damage on WPB or WPP.
22	Inverter Frequency and Phase Monitoring = Inverter sync timeout error	Inverter is not able to synchronize frequency and phase	Check airgap / misalignment. Check for any damage on WPB or WPP.
23	Inverter Frequency and Phase Monitoring = Inverter voltage discharge timeout error	Inverter not able to discharge within defined time	Contact support.

Table 15 Events – WPB – Event class 1

16.3.3 WPB Event Class 2

All events in class 2 lead to the system being switched off. As soon as the error is no longer present, the system is restarted up to 5 times. If the error is present 5 times in sequence, an event 1 is generated which leads to a waiting time of 1 minute.

Item	Event Log	Description	Action
1	Inverter Frequency and Phase Monitoring = Missing edge error	Inverter is not able to synchronize frequency and phase.	Check airgap / misalignment. Check for any damage on WPB or WPP.
2	Inverter Frequency and Phase Monitoring = Frequency jump error	WPB detects sudden change in resonance frequency.	Check airgap / misalignment. Check if WSU or Battery are in fault state.
3	Inverter Frequency and Phase Monitoring = Short edge delay error	Inverter is not able to synchronize frequency and phase.	Check airgap / misalignment. Check for any damage on WPB or WPP.
4	Inverter Frequency and Phase Monitoring = Long edge delay error	Inverter is not able to synchronize frequency and phase.	Check airgap / misalignment. Check for any damage on WPB or WPP.
5	SW Bulk overvoltage Monitoring = Overvoltage	Bulk voltage exceeded defined software limit.	Contact support.
6	SW Bulk undervoltage Monitoring = Undervoltage	Bulk voltage below defined software limit.	Contact support.
7	SW Inverter current Monitoring = Overcurrent	Inverter current exceeded defined software limit.	Check airgap / misalignment. Check for any damage on WPB or WPP.
8	SW Inverter voltage Monitoring = Overvoltage	Inverter voltage exceeded defined software limit.	Check airgap / misalignment. Check for any damage on WPB or WPP.
9	HW locked status = HW locked	Appears simultaneously to the monitorings above.	Check airgap / misalignment.

Table 16 Events – WPB – Event class 2

16.3.4 WPB Event Class 3

All events in class 3 do not lead to the system being switched off. These are warnings about non-critical errors or active deratings.

Item	Event Log	Description	Action
1	Fan 1 Monitoring = Error	Fan 1 error detected.	Check if fan is dirty. Replace fan.
2	Fan 2 Monitoring = Error	Fan 2 error detected.	Check if fan is dirty. Replace fan.
4	Available buck power Monitoring = Insufficient	Available output power lower than maximum output power.	Check airgap / misalignment.
5	Derated Power Vs Frequency Monitoring = Derated	Resonance frequency close to its defined limit.	Check airgap / misalignment. Check if battery voltage is within specification.
6	Derated Power Vs B6 Voltage Monitoring = Derated	Grid voltage too low.	Check if grid voltage is within specification.

Table 17 Events – WPB – Event class 3

16.3.5 WPB Event Class 4

All events in class 4 do not lead to the system being switched off. This is only information.

Item	Event Log	Description	Action
1	Max Grid Power Monitoring = Derated	Grid Power derating active.	Allow maximum Output power over Ethernet.
2	Position Monitoring = Too Close	WPP and WSU are positioned too close together.	Increase distance between WPP and WSU.
3	Position Monitoring = Too far	WPP and WSU are positioned too far apart.	Decrease distance between WPP and WSU.
4	Position Monitoring = Suboptimal too close	If the WPP and WSU are positioned between the optimal working area and too close, the WSU will not be able to support the maximum output current.	Increase distance between WPP and WSU.
5	Position Monitoring = Suboptimal too far	If the WPP and WSU are positioned between the optimal working area and too far away, the WSU will not be able to support the maximum output voltage.	Decrease distance between WPP and WSU.

Table 18 Events – WPB – Event class 4

16.4 Troubleshooting on WPP

Symptom	Probable Cause	Corrective Action
No power to WPP	WPP is not connected properly to WPB.	Check the connection between WPB and WPP.
	WPP Internal defect	Verify with Delta and request a replacement if necessary.
WPP LEDs not lit up	WPP internal defect	Verify with Delta and request a replacement if necessary.

Table 19 Troubleshooting on WPP

16.5 Troubleshooting on WSU

Symptom	Probable Cause	Corrective Action
No power to WSU	WSU is not installed properly and is not connected to battery.	Check the installation of WSU and make sure all connections to battery are right. Check AUXIN power.
	WSU internal defect	Verify with Delta and request a replacement if necessary.
Charging not happening	Battery connection to WSU is incorrect.	Make sure to securely connect both the red and black cables to the battery terminals. Make sure that the polarity is not reversed.
	Wrong battery	Check the voltage range of the battery, correct voltage range is (18V to 44V and 36V to 60V) Below or above this range is not accepted.
	Pad to pad positioning is wrong.	Check the position of both the pads and correct it as referenced in section 8.5.1.2 .
	Misalignment is too big.	Check the alignment between WPP and WSU, it must be within the range. Refer to sections Error! Reference source not found. and 0 .
	Battery is Full	Charging does not happen when battery is full, User should know this information via BMS or vehicle SoC gauge.

Table 20 Troubleshooting on WSU

16.5.1 WSU Event Class 1

All events in class 1 lead to the system being switched off within 100ms.

Item	Event Log	Description	Action
1	HW Rectifier Odd current monitoring = Overcurrent,	Rectifier Odd current exceeded defined hardware limit	Check connection to battery. Check battery status. Contact support.
2	HW Rectifier Even current monitoring = Overcurrent,	Rectifier Even current exceeded defined hardware limit	Check connection to battery. Check battery status. Contact support.
3	HW Rail Odd voltage monitoring = Overvoltage,	Rail Odd voltage exceeded defined hardware limit	Check connection to battery. Check if battery voltage is within specification. Check battery status. Contact support.
4	HW Rail Even voltage monitoring = Overvoltage,	Rail Even voltage exceeded defined hardware limit	Check connection to battery. Check if battery voltage is within specification. Check battery status. Contact support.
5	HW Rectifier Odd voltage monitoring = Overvoltage,	Rectifier Odd voltage exceeded defined hardware limit	Check connection to battery. Check if battery voltage is within specification. Check battery status. Contact support.
6	HW Rectifier Even voltage monitoring = Overvoltage,	Rectifier Even voltage exceeded defined hardware limit	Check connection to battery. Check if battery voltage is within specification Check Battery Status Contact Support
7	Aux voltage monitoring = Overvoltage,	Aux voltage exceeded defined software limit	Check connection to battery. Check if battery voltage is within specification Check Battery Status Contact Support
8	Aux voltage monitoring = Undervoltage,	Aux voltage below defined software limit	Check connection to battery. Check if battery voltage is within specification. Check battery status. Contact support.
9	FET Temperature monitoring = Overtemperature,	FET temperature exceeded defined software limits	Let WSU cool down. Check if ambient temperature is within specification. Avoid direct exposure to sun.

Item	Event Log	Description	Action
10	Rung Temperature monitoring = Overtemperature	Rung temperature exceeded defined software limits	Let WSU cool down. Check if ambient temperature is within specification. Avoid direct exposure to sun.

Table 21 Events – WPB – Event class 1

16.5.2 WSU Event Class 2

All events in class 2 lead to the system being switched off within 32 msec.

Item	Event Log	Description	Action
1	Rectifier 1 voltage plausibility = Too High, or	Voltage difference between Rectifier 1 and mean value exceeds defined software limit.	Contact support.
2	Rectifier 1 voltage plausibility = Too Low, or	Voltage difference between Rectifier 1 and mean value exceeds defined software limit.	Contact support.
3	Rectifier 2 voltage plausibility = Too High, or	Voltage difference between Rectifier 2 and mean value exceeds defined software limit.	Contact support.
4	Rectifier 2 voltage plausibility = Too Low, or	Voltage difference between Rectifier 2 and mean value exceeds defined software limit.	Contact support.
5	Rectifier 3 voltage plausibility = Too High, or	Voltage difference between Rectifier 3 and mean value exceeds defined software limit.	Contact support.
6	Rectifier 3 voltage plausibility = Too Low, or	Voltage difference between Rectifier 3 and mean value exceeds defined software limit.	Contact support.
7	Rectifier 4 voltage plausibility = Too High, or	Voltage difference between Rectifier 4 and mean value exceeds defined software limit.	Contact support.
8	Rectifier 4 voltage plausibility = Too Low, or	Voltage difference between Rectifier 4 and mean value exceeds defined software limit.	Contact support.
9	Rectifier 5 voltage plausibility = Too High, or	Voltage difference between Rectifier 5 and mean value exceeds defined software limit.	Contact support.
10	Rectifier 5 voltage plausibility = Too Low, or	Voltage difference between Rectifier 5 and mean value exceeds defined software limit.	Contact support.
11	Rectifier 6 voltage plausibility = Too High, or	Voltage difference between Rectifier 6 and mean value exceeds defined software limit.	Contact support.
12	Rectifier 6 voltage plausibility = Too Low, or	Voltage difference between Rectifier 6 and mean value exceeds defined software limit.	Contact support.

Item	Event Log	Description	Action
13	Rectifier current plausibility = Unbalanced, or	current difference between rectifiers exceeds defined software limit.	Check connection to battery. Contact support.
14	Rail voltage plausibility = Error, or	Voltage difference between Rail Even and Rail Odd exceeds defined software limit.	Check connection to battery. Check fuses if installed Contact support.
15	HW temperature monitoring = Overtemperature, or	Temperature exceeded hardware defined limits.	Let WSU cool down. Check if ambient temperature is within specification. Avoid direct exposure to sun.
16	PPL Error monitoring = Error, or	PPL connection disrupted.	Check airgap / misalignment.
17	Power transfer monitoring = Power Transfer Error	Power transfer not possible.	Check airgap / misalignment.
18	CANOPEN RPDO Timeout occurs is reached	WSU is missing RPDO messages.	Check CANopen settings.

Table 22 Events – WPB – Event class 2

16.5.3 WSU Event Class 3

All events in class 3 do not lead to the system being switched off. These are warnings or active deratings.

Item	Event Log	Description	Action
1	Power controller saturation monitoring = Saturation	Power transfer not possible	Check airgap / misalignment

Table 23 Events – WPB – Event class 3

17 Connecting a Stack Light

17.1 Overview

Note: The stack light is not available from Delta.

If the stack light is not directly mounted to the WPB, consider the maximum cable length.



Figure 58 WPB with stack light

17.2 Pin assignment



Pin (top-down)	Description	Usage
6	GND	WPB ground/screen connection
5	Red	Fault
4	Green	Power on
3	Yellow	Charge status
2	Blue	Charge process
1	24 V	24 VDC Power supply

Figure 59 Pin assignment of stack light connector

17.3 Technical specification

Connector type	Phoenix Contact; FMC 1,5/ 6-ST-3,81; P/N 1748011
Stack light type	ROGB/24V, e.g. Tend Technology TPTL4-L7ROGB-S
Suitable screws for mounting	
Type	2 × M8
Max. length	15 mm (0.6 in)
Pitch	34 mm
Max. cables length	3 m (9,84 ft)
Wire cross section	1.5 mm ² ,
Rated current	30 mA per contact

Table 24 Specifications – WPB – Stack light connector

17.4 Stack Light LED Indications During Charging

	Light indication	Event description
	No charging in progress	
1	BLUE ON	(PPL communication established equals TRUE) AND (Charging request equals FALSE) LED duration ON: constantly
	WSU – Charge status of battery	
2	BLUE PULSING	Pulse ON / OFF a number of times followed by a pause where each pulse represents 10% SOC, according to the following scheme: 0% ≤ WSU Battery SOC < 15%: 1 pulse 15% ≤ WSU Battery SOC < 25%: 2 pulses 25% ≤ WSU Battery SOC < 35%: 3 pulses 35% ≤ WSU Battery SOC < 45%: 4 pulses 45% ≤ WSU Battery SOC < 55%: 5 pulses 55% ≤ WSU Battery SOC < 65%: 6 pulses 65% ≤ WSU Battery SOC < 75%: 7 pulses 75% ≤ WSU Battery SOC < 85%: 8 pulses 85% ≤ WSU Battery SOC < 95%: 9 pulses LED duration ON / OFF: 250 ms LED duration OFF: 1500 ms
3	BLUE ON	WSU Battery SOC ≥ 95% LED duration ON: constantly
	Charging Monitoring	
4	BLUE ON	(WSU Battery SOC ≥ 95%) LED duration ON: constantly
5	BLUE PULSING	(WSU Battery SOC < 95%) LED duration ON / OFF: constantly
6	BLUE FLASHING	(WSU Battery SOC > 100) AND [(Charging Monitoring = LOW POWER) OR (Charging Monitoring = HIGH POWER)] LED FLASHING frequency: 2 Hz NOTE: WSU Battery SoC is typically set to 255 if not applicable, but any value greater than 100 is treated as invalid

18 Part numbers

18.1 Subsystems

Part name	Part number	Quantity
WPB	EOE17010813	1
WPP	EOE17010951	1
WSU 24/36 V	EOE17011077	1
WSU 50 V	EOE17010950	1

Table 25 Parts numbers for subsystems

18.2 Spare parts

Part name	Part number	Quantity
WSU Deutsch Mating Half (DT04-12PA-C015)	TBD	1
WPB Mounting Bracket (delivered with WPB)	TBD	1
WPP Mounting Bracket (delivered with WPP)	TBD	1

Table 26 Part numbers for spare parts

18.3 Development Kit

Part name	Part number	Qty
Development kit Scope of delivery: - WSU Cable Harness - CAN Bus Termination; D-Sub to D-Sub - Adapter for <i>PCAN-view</i> tool; D-Sub to USB	EOE99001072	1

Table 27 Part number for development kit

19 Warranty

The following section provides the information regarding warranty and non-warranty conditions. Make sure to go through these conditions before approaching Delta for warranty service.

19.1 Warranty Conditions

The limited warranty is applicable for physical goods/products purchased from Delta and covers the following conditions.

- The limited warranty applies only to material and production defects under normal use and maintenance during the warranty period.
- Delta repairs or exchange the defective parts under normal use and maintenance during the warranty period.
- The warranty period for the physical goods/products purchased from Delta is valid for 24 months from the date of manufacturing.

19.2 Non-Warranty Conditions

The limited warranty does not cover the following conditions:

- Any defects which is not resulting from material and production.
- Failed to obey the safety instructions and guidance given in this document.
- Scratches and wear due to improper handling or installation of the physical goods/products.
- Any indication that the enclosure for WPP and WSU has been opened.
- Cables or connectors has been removed or changed.
- Firmware being loaded is of an older version than the one indicated on the product label.
- Accidental damage or damage caused by other devices.

Kindly contact Delta to determine the problem and to provide with a most appropriate solution.

19.3 Return Procedure

In case of repair or return under limited warranty period, kindly contact your Delta sales representative who would assign a RMA number and provide packing and shipping details.

19.4 Product Life

Each subsystem product life is 10 years or 44,000 hours, whichever comes first.

20 Product Disposal

Disposal of system and subsystems

The WCS and its subsystems constitute industrial electronic equipment. Disposal must be in accordance with applicable local regulations.

Disposal of packaging materials

Packaging materials must be disposed of in accordance with applicable local regulation.

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23 Abbreviations and Acronyms

Acronym / Abbreviation	Definition
%	Percentage
°C	Centigrade
μH	Micro Henry
μT	Micro Tesla
A	Ampere
AC	Alternating Current
AGV	Automated Guided Vehicle
AMR	Automated Mobile Robot
approx.	Approximately
AUX	Auxiliary
AUXIN	Auxiliary Input
AWG	American Wire Gauge
BMS	Battery Management System
CAN	Controller Area Network
Cont.	Continued
dB(A)	The unit of measurement of the sound pressure level according to the internationally standardized frequency weighting curve A
DC	Direct Current
DIN	Deutsche Industrie Norm
e.g.	Example
EMF	Electromagnetic Field
EN	European Norm / European standard
EU	European Union
FMS	Fleet Management System
ft	Feet
Gnd	Ground
H x W x D	Height x Width x Depth
Hz	Hertz
i.e.	That is
in	Inch
kBit/s	Kilobit per second
kg	Kilogram
kV	Kilo Volt
KVA	Kilo Volt Amps
kW	Kilowatt
lb	Pound

Acronym / Abbreviation	Definition
LED	Light Emitting Diode
LV	Low voltage
m	Meter
M32	Metric Thread Diameter 32mm
mA	Milliampere
Max.	Maximum
MHz	Megahertz
mm	Millimeter
N connection	Neutral line
NC	Not Connected
NFPA	National Fire Protection Association
Nm	Newton meter
Ohm	Unit of Electrical Resistance
PE	Protective Earth
PG36	Pg thread DIN 40430 “Panzerrohrgewinde” (Armor pipe thread) size 36
PPL	Pad to Pad Link (communication between WPP and WSU)
RMA	Return Material Authorization
RMS	Root Mean Square
ROGB/24	Stack light type: Red Orange Green Blue, 24VDC
SDD	Supply Disconnecting Device
TN-CS	Terrestrial Neutral Combined and Separated
TN-S	Terrestrial Neutral Separated
USA	United States of America
V	Volts
V _{AC}	Volts Alternating Current
VDC	Volts Direct Current
VDE 0105-100	“Verband der Elektrotechnik Elektronik Informationstechnik e. V.” Standard 0105-100 “Association for Electrical, Electronic & Information Technologies e. V.” Standard 0105-100
V _{rms}	Volt Root Mean Square
w/o	Without
WCS	Wireless Charging System
WMS	Warehouse Management System
WPB	Wireless Primary Box
WPP	Wireless Primary Pad
WPU	Wireless Primary Unit (WPB and WPP)
WSU	Wireless Secondary Unit



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