



## Deliverable 5.4 - Appendix I

### Coupler common interface specification

|                                  |                                                          |
|----------------------------------|----------------------------------------------------------|
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## Table of Contents

|     |                                                                             |    |
|-----|-----------------------------------------------------------------------------|----|
| 1   | Introduction .....                                                          | 6  |
| 2   | Abbreviations and Acronyms.....                                             | 6  |
| 3   | Wagon Interface.....                                                        | 7  |
| 3.1 | Considerations regarding Wording & Orientation .....                        | 7  |
| 3.2 | Wagon interface definition .....                                            | 8  |
| 3.3 | Junction Box Installation .....                                             | 9  |
| 3.4 | Junction Box Grounding Point and Wire.....                                  | 14 |
| 3.5 | Interoperable Connector X1 on Junction Box: Pin Assignment and Wiring ..... | 15 |
| 3.6 | SPE Connector X5: Pin Assignment and Wiring .....                           | 18 |
| 3.7 | 400 VAC Connector X9: Pin Assignment and Wiring.....                        | 19 |
| 3.8 | Grounding Point for X5 and X9 .....                                         | 20 |
| 4   | Locomotive.....                                                             | 21 |
| 4.1 | Locomotive interface definition .....                                       | 21 |
| 4.2 | Junction Box Installation .....                                             | 22 |
| 4.3 | Junction Box Grounding Point and Wire.....                                  | 23 |
| 4.4 | Interoperable Connector X1 on Junction Box: Pin Assignment and Wiring ..... | 24 |
| 4.5 | SPE Connector X5: Pin Assignment and Wiring .....                           | 26 |
| 4.6 | 400 VAC Connector X9: Pin Assignment and Wiring.....                        | 27 |
| 4.7 | Grounding Point for X5 and X9 .....                                         | 29 |
| 4.8 | Interface for an electrical lifting device (X11) .....                      | 29 |
| 5   | Outlook: Dimensions of CCU .....                                            | 30 |

## List of Figures

|                                                                                                                                             |    |
|---------------------------------------------------------------------------------------------------------------------------------------------|----|
| Figure 1: Consist Coordinate System (source: EN12663) .....                                                                                 | 7  |
| Figure 2: Interface Definition between Wagon and Junction Box .....                                                                         | 8  |
| Figure 3: Buffer Interface (Source: EN15551:2017) .....                                                                                     | 9  |
| Figure 4: Front View of Setup with Junction Box and Connectors X1, X5, X9 (Source: KB) .....                                                | 10 |
| Figure 5: Max. allowable space in x-direction (Source: KB).....                                                                             | 10 |
| Figure 6: Mounting Interface for the Junction Box incl. connector interface position<br>(connector shown as example only) (Source: KB)..... | 11 |
| Figure 7: Example for additional Sheet Metal for mounting Push-Button-Box (Source: KB)..                                                    | 12 |
| Figure 8: Envelope for possible Push-Button Box – must stay within Structural Gauge<br>(Source: KB).....                                    | 13 |
| Figure 9: Side View of Sheet Metal for Push-Button Box and an envelope of a possible<br>solution (Source: KB).....                          | 13 |
| Figure 10: Front View of Sheet Metal for Push-Button Box and an envelope of a possible<br>solution (Source: KB).....                        | 14 |
| Figure 11: Possible Are for Grounding Point on Junction Box (Source: KB).....                                                               | 15 |
| Figure 12: Pin Assignment of E-Coupler .....                                                                                                | 19 |
| Figure 13: Pin Assignment of E-Coupler .....                                                                                                | 20 |
| Figure 14: Grounding Possibilities for X5 and X9.....                                                                                       | 20 |
| Figure 15: Interface between Locomotive and Junction Box (X1 and X11) .....                                                                 | 22 |
| Figure 16: Max. Dimensions of a possible Junction Box (exemplary picture) .....                                                             | 23 |
| Figure 17: Pin Assignment of E-Coupler .....                                                                                                | 27 |
| Figure 18: Pin Assignment of E-Coupler .....                                                                                                | 28 |
| Figure 19: Grounding Possibilities for X5 and X9.....                                                                                       | 29 |
| Figure 20 Max. Dimensions of a possible CCU (exemplary picture) .....                                                                       | 30 |

List of Tables

Table 1 Pin Assignment of X1 connector for Wagons..... 15

Table 2 Pin Assignment of X5 connector for Wagons ..... 18

Table 3 Pin Assignment of X9 connector for Wagons..... 19

Table 4 Pin Assignment of X1 connector for Locos ..... 24

Table 5 Pin Assignment of X5 connector for Locos ..... 26

Table 6 Pin Assignment of X9 connector for Locos ..... 27

## 1 Introduction

This document defines the interface between the DAC and the wagon/locomotive and its DAC related equipment and serves as a supplement (appendix I) to the FP5-TRANS4M-R Deliverable 5.4 "Technical Specification of Wagon Power System and Communication System" V3.0.

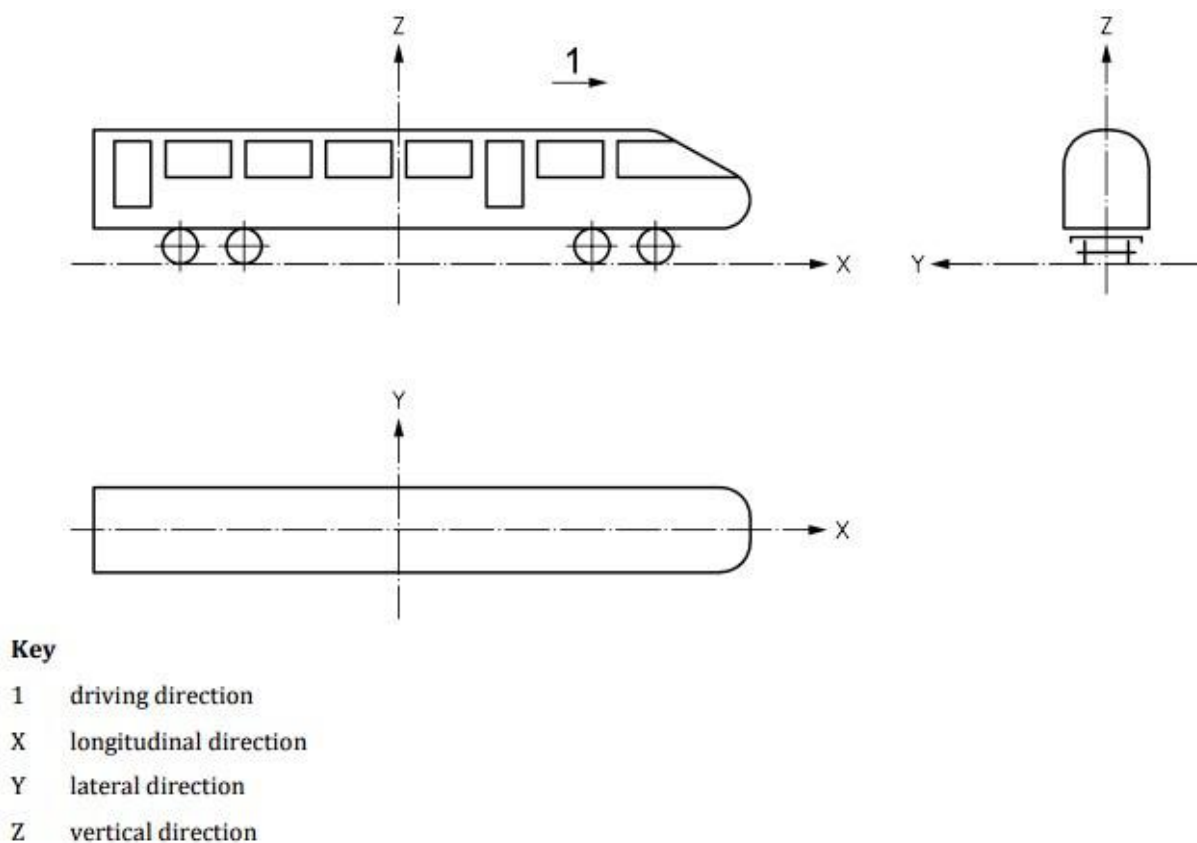
## 2 Abbreviations and Acronyms

See /WP5 D5.4/ chapter 2.

### 3 Wagon Interface

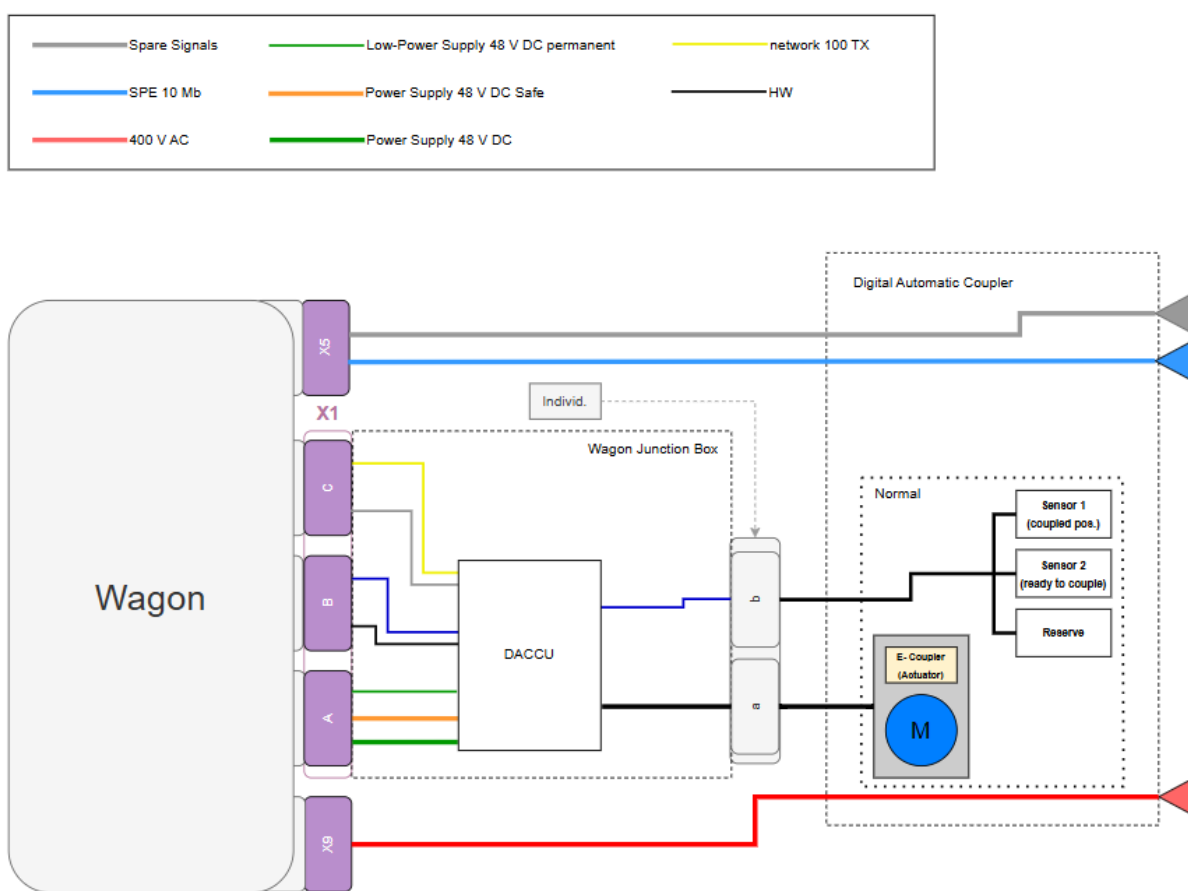
#### 3.1 Considerations regarding Wording & Orientation

Each consist features the identical interface, point-symmetric to its centre. To avoid misunderstanding we will describe the head-side (in the direction of travel) of each consist only. The vehicle coordinate system shown in Figure 1 is a right-handed system where the x-axis describes the longitudinal direction, the z-axis the vertical direction, and the y-axis the transverse direction of the vehicle. The x-axis points in the direction of movement, and the z-axis points upward.



**Figure 1: Consist Coordinate System (source: EN12663)**

### 3.2 Wagon interface definition



**Figure 2: Interface Definition between Wagon and Junction Box**

Analogue to the mechanical interfaces between the DAC suppliers, also the electrical interfaces must be harmonized.

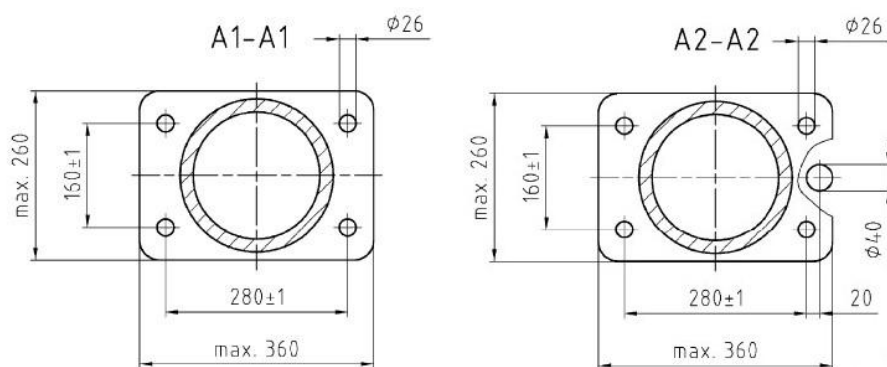
Therefore, the purple connector X1 (with the inlays A, B, C as former X6, X7, X8), X5 and X9 are reserved for this purpose.

Interfaces between the CCU and its subsystems to the wagon and interface between said CCU and cabling on the wagon behind the harmonized interface is not scope of this document.

### 3.3 Junction Box Installation

About the installation and placement of these components, especially regarding the Junction Box, the following considerations have been made:

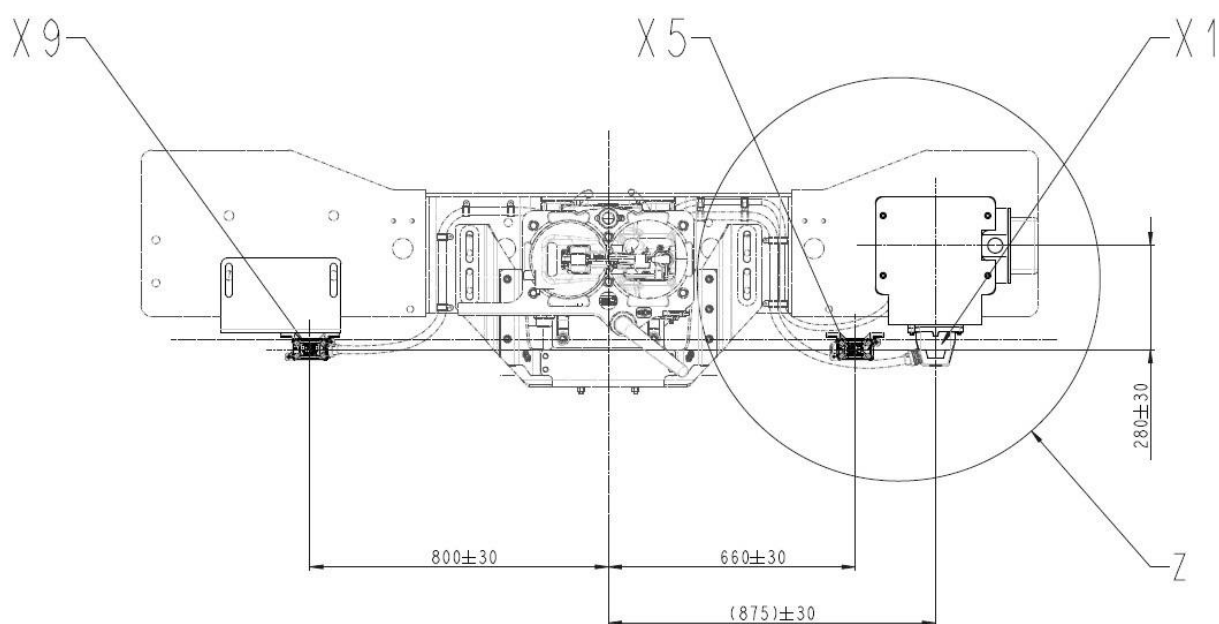
- The recommendation is to define a standardized interface for placing the Junction Box.
- The area of the buffer interface is standardized according to EN15551:2017.



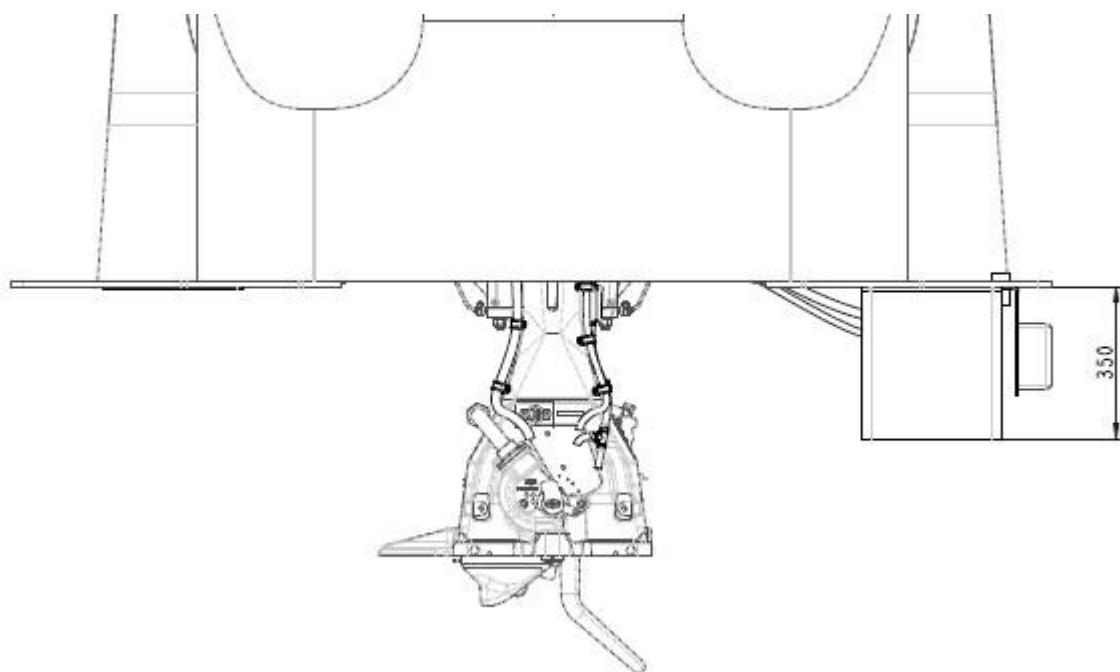
**Figure 3: Buffer Interface (Source: EN15551:2017)**

- With the usage of DAC on the wagon, the area of buffer interface is always free after removing both side buffers.
- The buffer mounting area on the inside of the wagon is not free, as here is a structure to lead the buffer forces.
- Cable routing to DAC is easier, because the individual structure of the wagon has less influence.
- The mandatory removal of handles under the side buffers increase the available free spaces for Junction Box installation. Therefore, their interface should be used to attach other parts, for instance plugs, cables fasteners etc.
- As the end steps are usually placed on the right side of the wagon, it would be better to place the Junction Box on the right side of the wagon. (This means that the box does not easily serve as an additional step thread, if the personal is already on that end step on the left side of the wagon.

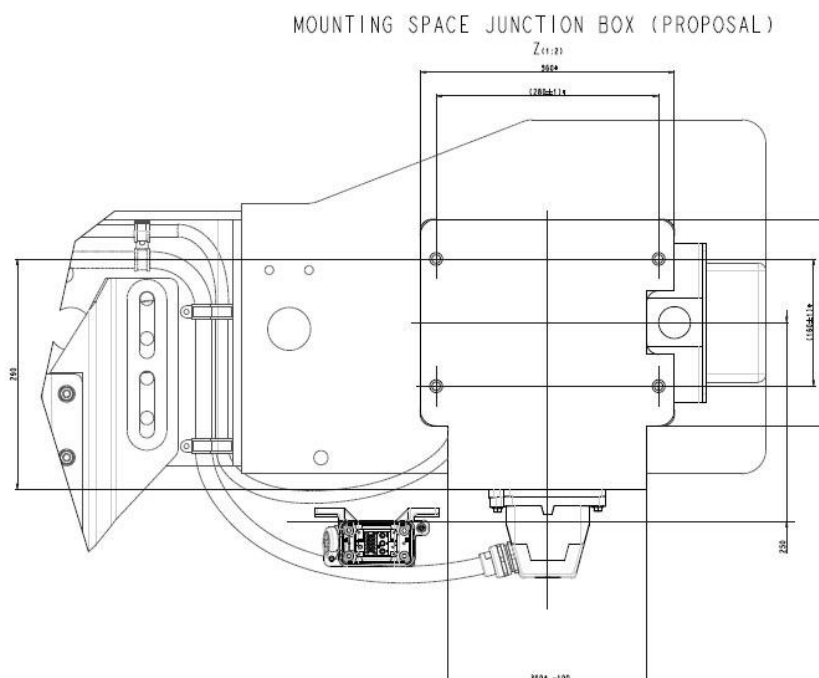
From these advantages, the following design draft has been produced:



**Figure 4: Front View of Setup with Junction Box and Connectors X1, X5, X9 (Source: KB)**



**Figure 5: Max. allowable space in x-direction (Source: KB)**



**Figure 6: Mounting Interface for the Junction Box incl. connector interface position (connector shown as example only) (Source: KB)**

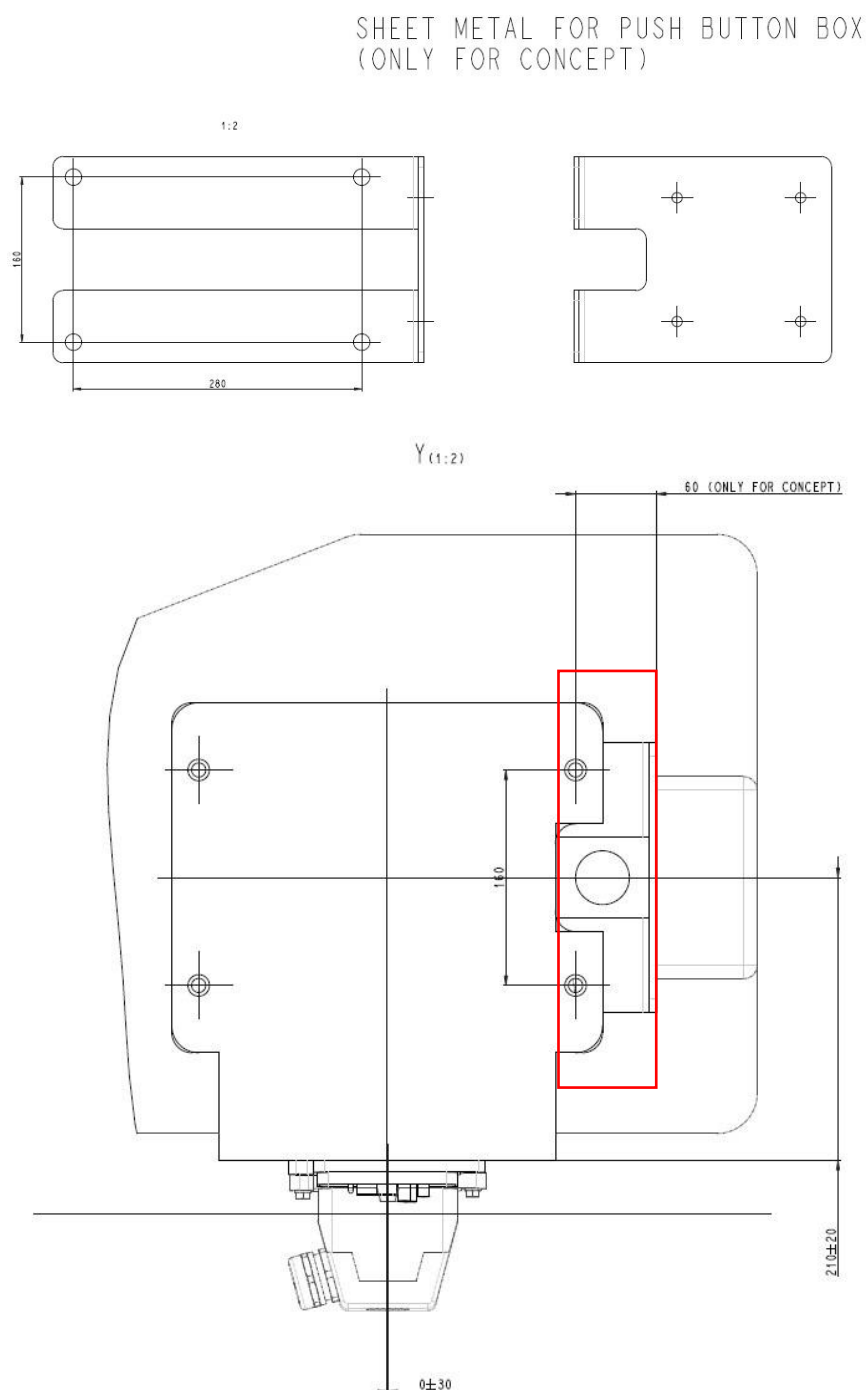
From this proposal, some requirements for the mounting and size of the Junction Box can be derived:

- The Junction Box is held by a metal plate or similar, which fits to the buffer interface including the 4 screws for fixation according to EN15551:2017.
- The extent of the topside of the Junction-Box is limited due to certain variants of wagons (e.g. car transporter), so that it should not exceed the size of the max. allowable footprint shown in Fig. 6.
- On the downside of the box, the interoperable connector X1 is placed according to Fig. XX.
- Moreover, the connector X5 for SPE lines shall be also placed in proximity to X1 at the downside of the Junction Box.
- The width of the whole box is limited by the screw interfaces of the metal sheet to the existing buffer interface.
- Therefore, only the length of the Junction Box can be more flexible for each DAC supplier, whereas the minimum length is defined by the interoperable connector

Misuse of the Junction Box as a step shall be prevented by sufficient measures, such as application of warning stickers in line with the state of the art and normative requirements. The max. allowable dimensions of the Junction Box can be defined as follows:

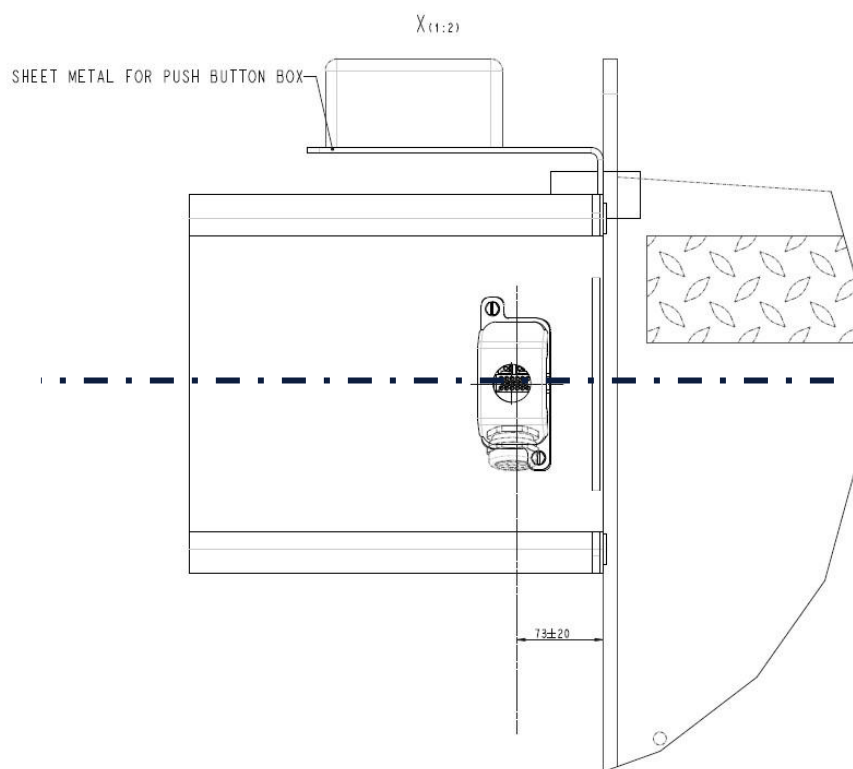
- Extension in Z-direction: 320 mm
- Extension in Y-direction: 340 mm
- Extension in X-direction: 350 mm

Moreover, the possible space and installation area for a possible Push-Button Box to decouple locally are also considered. According to the following drawing, as proposal / concept, the Push-Button Box is held by a separate metal sheet with 4 screws. This metal sheet can be additionally attached to the side of the buffer interface towards wagon side. Installation of Push-Button Box remains responsibility of the party responsible for installation of the CCU and must not affect the safe connection of the Junction-Box to the vehicle.

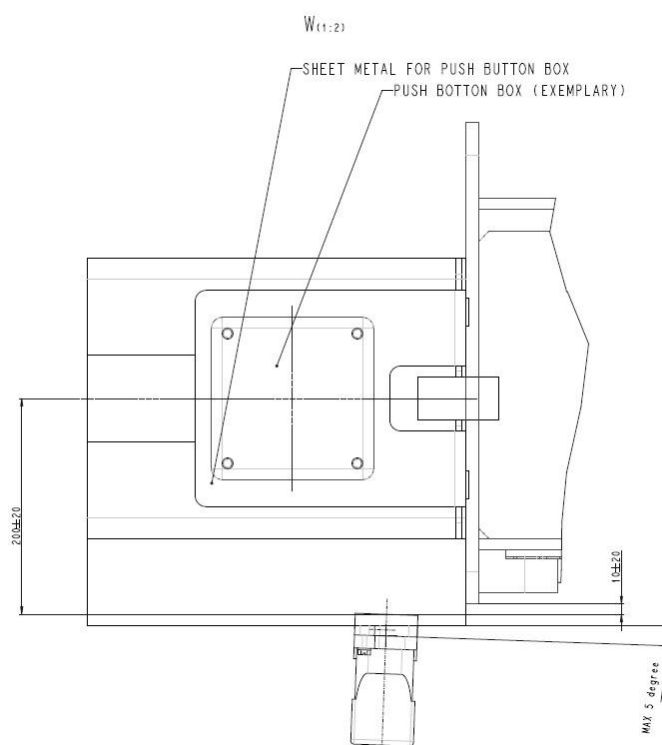


**Figure 7: Example for additional Sheet Metal for mounting Push-Button-Box (Source: KB)**

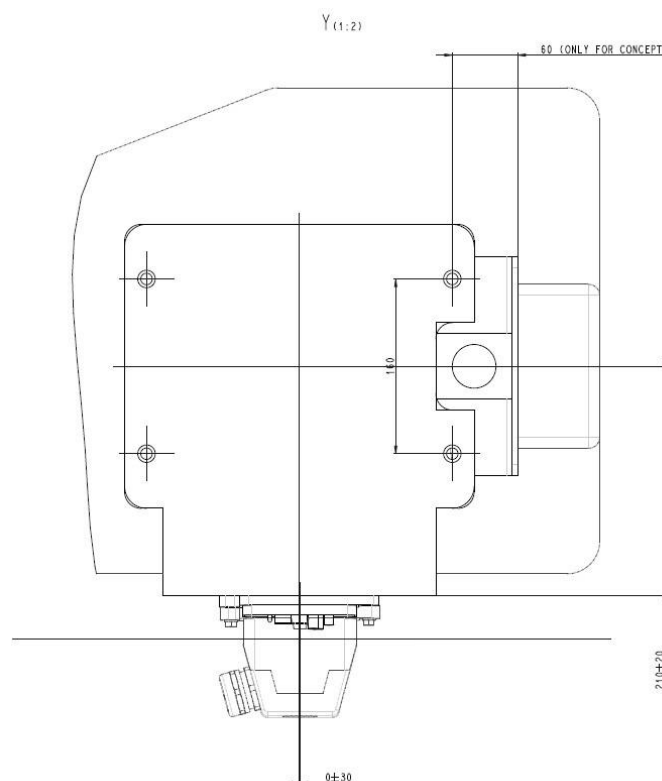
The following drawings visualize the installation of this metal sheets with an example of such a Push-Button Box as envelope model.



**Figure 8: Envelope for possible Push-Button Box – must stay within Structural Gauge  
(Source: KB)**



**Figure 9: Side View of Sheet Metal for Push-Button Box and an envelope of a possible solution (Source: KB)**



**Figure 10: Front View of Sheet Metal for Push-Button Box and an envelope of a possible solution (Source: KB)**

On the other wagon side, the buffer interfaces will be also used to place the holder for connector X9 of 400 VAC, which should be considered as a possible example.

### **3.4 Junction Box Grounding Point and Wire**

For providing a proper grounding point and wiring for the Junction Box, the standard EN 50153 needs to be respected:

- In order to ground the enclosure with regards to EMC, at least M5 screwing and a wiring of 6 mm<sup>2</sup> is enough.

Therefore, the recommendation is to use M8 for grounding on the lower area of the Junction Box, or preferably, achieve this through direct contact surfaces of the mounting plate to the wagon chassis.

b)

# T:

|    |                                    |           |                           |     |
|----|------------------------------------|-----------|---------------------------|-----|
| A3 | Power Supply 48 VDC                | Max. 10 A | 0.14...4.0mm <sup>2</sup> | QMM |
| A4 | Power Supply GND                   | Max. 10 A | 0.14...4.0mm <sup>2</sup> | QMM |
| A5 | Low-Power Supply 48 VDC Permanent* | Max. 1 A  | 0.14...4.0mm <sup>2</sup> | QMM |
| A6 | Low-Power Supply GND Permanent*    | Max. 1 A  | 0.14...4.0mm <sup>2</sup> | QMM |
| A7 | n.c.                               |           | 0.14...4.0mm <sup>2</sup> | QMM |
| A8 | n.c.                               |           | 0.14...4.0mm <sup>2</sup> | QMM |
| B1 | n.c.                               |           | 0.14...2.5mm <sup>2</sup> | AU  |
| B2 | n.c.                               |           | 0.14...2.5mm <sup>2</sup> | AU  |
| B3 | n.c.                               |           | 0.14...2.5mm <sup>2</sup> | AU  |
| B4 | n.c.                               |           | 0.14...2.5mm <sup>2</sup> | AU  |
| B5 | n.c.                               |           | 0.14...2.5mm <sup>2</sup> | AU  |
| B6 | n.c.                               |           | 0.14...2.5mm <sup>2</sup> | AU  |
| B7 | n.c.                               |           | 0.14...2.5mm <sup>2</sup> | AU  |
| B8 | n.c.                               |           | 0.14...2.5mm <sup>2</sup> | AU  |
| B9 | n.c.                               |           | 0.14...2.5mm <sup>2</sup> | AU  |

|     |                                   |  |                           |    |
|-----|-----------------------------------|--|---------------------------|----|
| B10 | n.c.                              |  | 0.14...2.5mm <sup>2</sup> | AU |
| B11 | n.c.                              |  | 0.14...2.5mm <sup>2</sup> | AU |
| B12 | n.c.                              |  | 0.14...2.5mm <sup>2</sup> | AU |
| B13 | n.c.                              |  | 0.14...2.5mm <sup>2</sup> | AU |
| B14 | n.c.                              |  | 0.14...2.5mm <sup>2</sup> | AU |
| B15 | n.c.                              |  | 0.14...2.5mm <sup>2</sup> | AU |
| B16 | n.c.                              |  | 0.14...2.5mm <sup>2</sup> | AU |
| B17 | n.c.                              |  | 0.14...2.5mm <sup>2</sup> | AU |
| C1A | ECN (TX+)                         |  | 0.14...2.5mm <sup>2</sup> | AU |
| C2A | ECN (RX+)                         |  | 0.14...2.5mm <sup>2</sup> | AU |
| C3A | ECN (TX-)                         |  | 0.14...2.5mm <sup>2</sup> | AU |
| C4A | ECN (RX-)                         |  | 0.14...2.5mm <sup>2</sup> | AU |
| C1B | Wagon End<br>Monitoring<br>Common |  | 0.14...2.5mm <sup>2</sup> | AU |
| C2B | Wagon End<br>Monitoring 1         |  | 0.14...2.5mm <sup>2</sup> | AU |
| C3B | Wagon End<br>Monitoring 2         |  | 0.14...2.5mm <sup>2</sup> | AU |

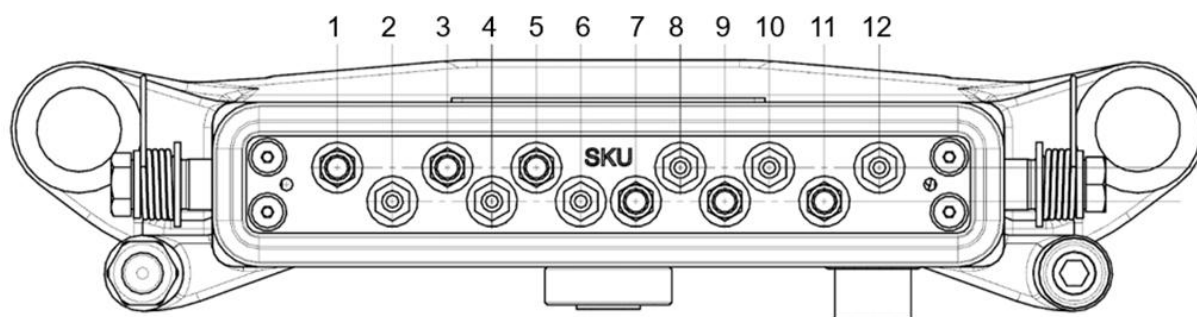
|         |             |  |                           |    |
|---------|-------------|--|---------------------------|----|
| C4B     | Reserve pin |  | 0.14...2.5mm <sup>2</sup> | AU |
| Housing | PE + Shield |  | 6.0mm <sup>2</sup>        |    |

### 3.6 SPE Connector X5: Pin Assignment and Wiring

Regarding the SPE connector, also a merged connector is considered. This connector should be compatible to and with Harting HPR.

**Table 2 Pin Assignment of X5 connector for Wagons**

| Pin      | 5  | Signal Name         | Max. Current Draw | Cross Section             | Contact Material |
|----------|----|---------------------|-------------------|---------------------------|------------------|
| A1A      | 5  | F-ETB Line A (DCV+) |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| A2A      | 6  | F-ETB Line A (DCV-) |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| A3A      |    | n.c.                |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| A4A      |    | n.c.                |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| A1B      | 8  | F-ETB Line B (DCV+) |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| A2B      | 7  | F-ETB Line B (DCV-) |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| A3B      |    | n.c.                |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| A4B      |    | n.c.                |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| B1       | 3  | Spare-pin           |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| B2       | 4  | Spare-pin           |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| B3       | 9  | Spare-pin           |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| B4       | 10 | Spare-pin           |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| B5 – B17 |    | n.c.                |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| Housing  |    | PE                  |                   | 6.0mm <sup>2</sup>        |                  |



**Figure 12: Pin Assignment of E-Coupler**

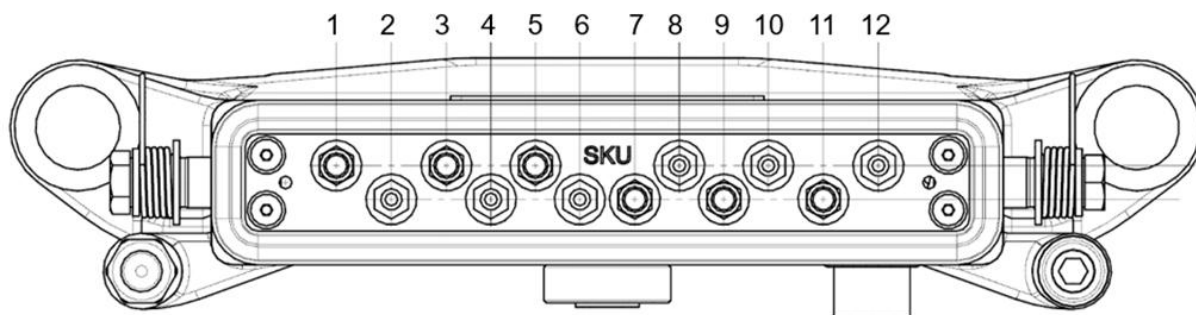
Moreover, the spare-pins should be connected isolated from the e-coupler to X5.

### **3.7 400 VAC Connector X9: Pin Assignment and Wiring**

For the 400 VAC lines, one connector is also the preferable solution at the moment. This connector should be compatible to and with Harting HPR.

**Table 3 Pin Assignment of X9 connector for Wagons**

| Pin     | EKU Pin | Signal Name                          | Max. Current Draw | Cross Section            | Contact Material |
|---------|---------|--------------------------------------|-------------------|--------------------------|------------------|
| A1      | 1       | Power Distribution Line 400 VAC L1_1 | Max. 40 A         | 1.5...6.0mm <sup>2</sup> | QMM              |
| A2      | 2       | Power Distribution Line 400 VAC L2_1 | Max. 40 A         | 1.5...6.0mm <sup>2</sup> | QMM              |
| A3      | 12      | Power Distribution Line 400 VAC L1_2 | Max. 40 A         | 1.5...6.0mm <sup>2</sup> | QMM              |
| A4      | 11      | Power Distribution Line 400 VAC L2_2 | Max. 40 A         | 1.5...6.0mm <sup>2</sup> | QMM              |
| B       |         | Dummy module                         |                   |                          |                  |
| Housing |         | PE                                   |                   | 6.0mm <sup>2</sup>       |                  |



### Figure 13: Pin Assignment of E-Coupler

### 3.8 Grounding Point for X5 and X9

For the connector housing, it is recommended for using either the contact surface of the housing or an M8 screw, as Harting already accommodates 500 VAC.

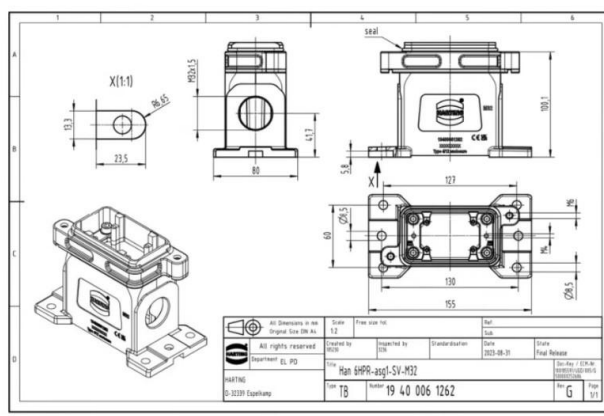
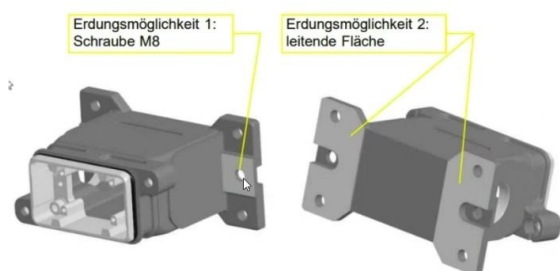
Specifically, X5 should only be used for EMC grounding, while X9 should incorporate additional protective earth - this can include grounding via the wire itself with a permissible screw size up to M8.



### Schutzerdung / EMV Potentialausgleich zum Wagenkasten

### Erdungsanschluss Harting:

1. Stecker X5: M8 oder leitende Fläche
2. Stecker X9: M8 oder leitende Fläche



**Figure 14: Grounding Possibilities for X5 and X9**

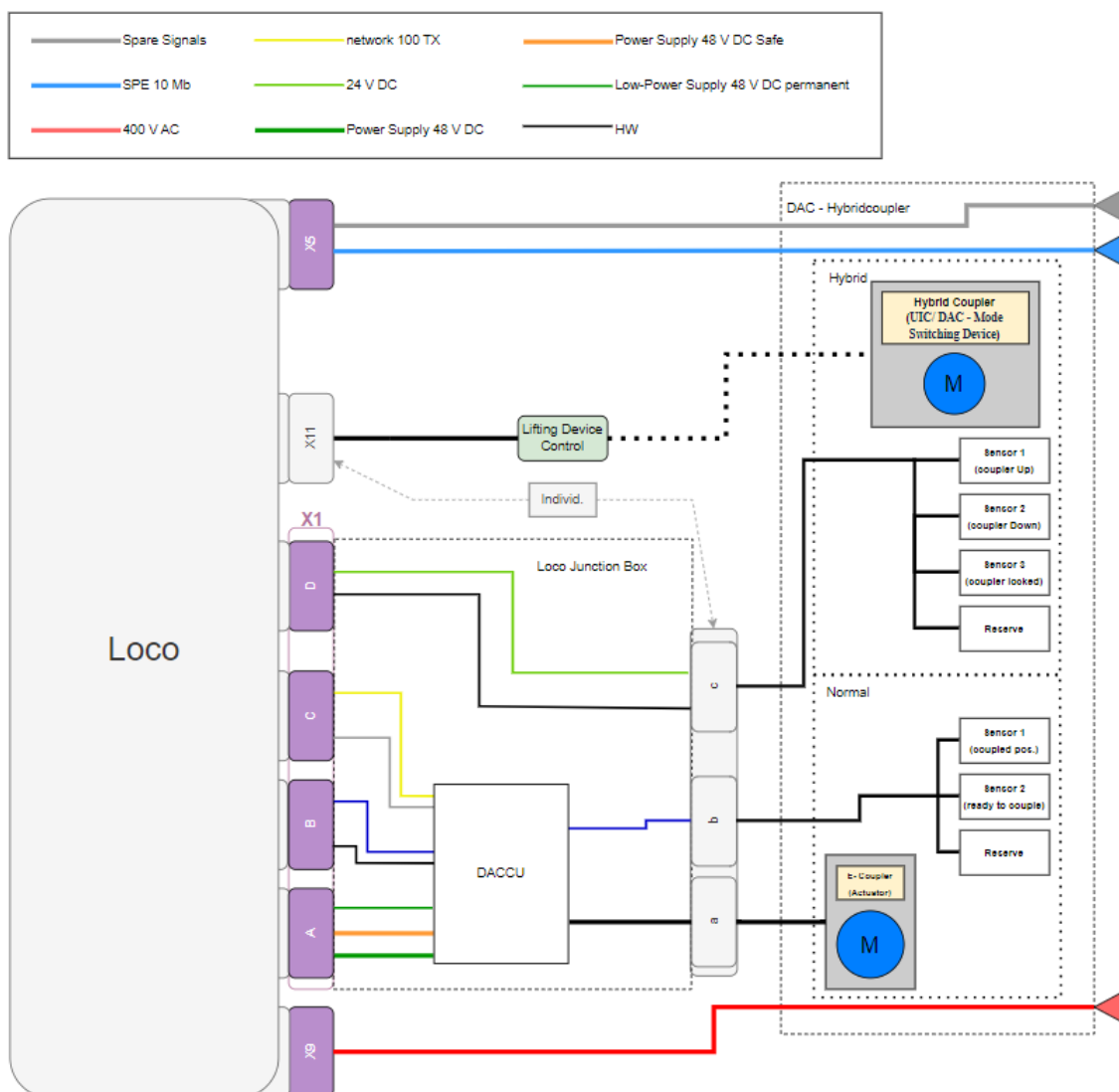
## 4 Locomotive

### 4.1 Locomotive interface definition

A junction box is used for the electrical connection of the locomotive to the respective coupler (one box per coupler). This allows sensor values to be read in and corresponding communication as well as supply voltages to be provided. The locomotive will use a hybrid coupler, which requires an extended interface (Connector X1). Additional sensors for position detection and the associated power supply (24 V DC) are required at interface X1 (see also Figure 15).

Furthermore, the locomotive must provide an interface for a possible electrical lifting device. This is described in more detail in chapter 4.8.

The power and data connections of the e-coupling (400 VAC, train network SPE) are each provided with a separate plug connector.



**Figure 15: Interface between Locomotive and Junction Box (X1 and X11)**

## 4.2 Junction Box Installation

As the locomotive must still retain the side buffers, installation as described in previous chapters is not possible. For this reason, the locomotive manufacturer is required to find an individually suitable position and mechanical interface on his vehicle. This must be agreed with the relevant coupler supplier so that cable lengths and other factors can be adhered to.

The maximum dimensions of the junction box are not allowed to exceed the following specifications:

- Width: 280 mm
- Height: 110 mm
- Length: 230 mm



**Figure 16: Max. Dimensions of a possible Junction Box (exemplary picture)**

In the case that these dimensions cannot be realised by a coupler supplier or locomotive manufacturer, an individual solution must be agreed and developed.

### **4.3 Junction Box Grounding Point and Wire**

For providing a proper grounding point and wiring for the Junction Box, the standard EN 50153 needs to be respected:

- In order to ground the enclosure with regards to EMC, at least M5 screwing and a wiring of 6 mm<sup>2</sup> is enough.

Therefore, the recommendation is to use M8 for grounding on the lower area of the Junction Box, or preferably, achieve this through direct contact surfaces of the mounting plate to the loco chassis.

Both options must be aligned with the loco supplier.

## 4.4 Interoperable Connector X1 on Junction Box: Pin Assignment and Wiring

Regarding the interoperable connector X1 on the Loco Junction Box, a merged one with four inlays (A, B, C and D) is preferred towards other solutions with 2x single connectors.

**Table 4 Pin Assignment of X1 connector for Locos**

| Pin | Signal Name                        | Max. Current Draw | Cross Section             | Contact Material |
|-----|------------------------------------|-------------------|---------------------------|------------------|
| A1  | Power Supply 48 VDC Safe           | Max. 10 A         | 0.14...4.0mm <sup>2</sup> | QMM              |
| A2  | Power Supply GND Safe              | Max. 10 A         | 0.14...4.0mm <sup>2</sup> | QMM              |
| A3  | Power Supply 48 VDC                | Max. 10 A         | 0.14...4.0mm <sup>2</sup> | QMM              |
| A4  | Power Supply GND                   | Max. 10 A         | 0.14...4.0mm <sup>2</sup> | QMM              |
| A5  | Low-Power Supply 48 VDC Permanent* | Max. 1 A          | 0.14...4.0mm <sup>2</sup> | QMM              |
| A6  | Low-Power Supply GND Permanent*    | Max. 1 A          | 0.14...4.0mm <sup>2</sup> | QMM              |
| A7  | n.c.                               |                   | 0.14...4.0mm <sup>2</sup> | QMM              |
| A8  | n.c.                               |                   | 0.14...4.0mm <sup>2</sup> | QMM              |
| B1  | n.c.                               |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| B2  | n.c.                               |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| B3  | n.c.                               |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| B4  | n.c.                               |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| B5  | n.c.                               |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| B6  | n.c.                               |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| B7  | n.c.                               |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| B8  | n.c.                               |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| B9  | n.c.                               |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| B10 | n.c.                               |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| B11 | n.c.                               |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| B12 | n.c.                               |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| B13 | n.c.                               |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| B14 | n.c.                               |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| B15 | n.c.                               |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| B16 | n.c.                               |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| B17 | n.c.                               |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| C1A | ECN (TX+)                          |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| C2A | ECN (RX+)                          |                   | 0.14...2.5mm <sup>2</sup> | AU               |

|     |                                          |  |                           |    |
|-----|------------------------------------------|--|---------------------------|----|
| C3A | ECN (TX-)                                |  | 0.14...2.5mm <sup>2</sup> | AU |
| C4A | ECN (RX-)                                |  | 0.14...2.5mm <sup>2</sup> | AU |
| C1B | Wagon End Monitoring Common              |  | 0.14...2.5mm <sup>2</sup> | AU |
| C2B | Wagon End Monitoring 1                   |  | 0.14...2.5mm <sup>2</sup> | AU |
| C3B | Wagon End Monitoring 2                   |  | 0.14...2.5mm <sup>2</sup> | AU |
| C4B | Reserve pin                              |  | 0.14...2.5mm <sup>2</sup> | AU |
| D1  | Hybrid Coupler Sensor coupler-up NO      |  | 0.14...2.5mm <sup>2</sup> | AU |
| D2  | Hybrid Coupler Sensor coupler-up NC      |  | 0.14...2.5mm <sup>2</sup> | AU |
| D3  | Hybrid Coupler Sensor coupler-up GND     |  | 0.14...2.5mm <sup>2</sup> | AU |
| D4  | Hybrid Coupler Sensor coupler-down NO    |  | 0.14...2.5mm <sup>2</sup> | AU |
| D5  | Hybrid Coupler Sensor coupler-down NC    |  | 0.14...2.5mm <sup>2</sup> | AU |
| D6  | Hybrid Coupler Sensor coupler-down GND   |  | 0.14...2.5mm <sup>2</sup> | AU |
| D7  | Hybrid Coupler Sensor coupler-locked NO  |  | 0.14...2.5mm <sup>2</sup> | AU |
| D8  | Hybrid Coupler Sensor coupler-locked NC  |  | 0.14...2.5mm <sup>2</sup> | AU |
| D9  | Hybrid Coupler Sensor coupler-locked GND |  | 0.14...2.5mm <sup>2</sup> | AU |
| D10 | Hybrid Coupler Sensor reserve pin        |  | 0.14...2.5mm <sup>2</sup> | AU |
| D11 | Hybrid Coupler Sensor reserve pin        |  | 0.14...2.5mm <sup>2</sup> | AU |
| D12 | Hybrid Coupler Sensor reserve pin        |  | 0.14...2.5mm <sup>2</sup> | AU |
| D13 | N.C.                                     |  | 0.14...2.5mm <sup>2</sup> | AU |
| D14 | N.C.                                     |  | 0.14...2.5mm <sup>2</sup> | AU |
| D15 | N.C.                                     |  | 0.14...2.5mm <sup>2</sup> | AU |
| D16 | Hybrid Coupler Low-Power                 |  | 0.14...2.5mm <sup>2</sup> |    |

|                  |                                           |  |                           |  |
|------------------|-------------------------------------------|--|---------------------------|--|
|                  | Supply 24 VDC                             |  |                           |  |
| D17              | Hybrid Coupler<br>Low-Power<br>Supply GND |  | 0.14...2.5mm <sup>2</sup> |  |
| Housing + Shield | PE                                        |  | 6.0mm <sup>2</sup>        |  |

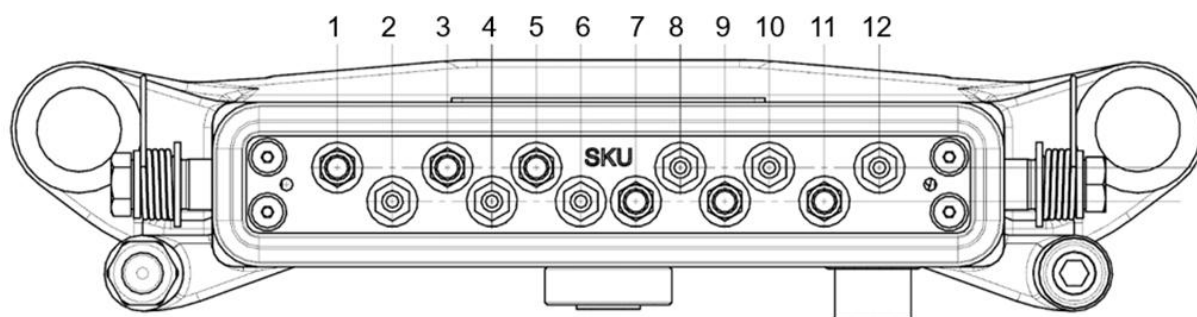
#### 4.5 SPE Connector X5: Pin Assignment and Wiring

The SPE Connector X5 will be the hand over point from the locomotive to the e-coupler. The wire from the e-coupler will be connected to this connector. Each side of the locomotive (Cab 1 and Cab 2) will have its own connector X5.

Regarding the SPE connector, also a merged connector is considered. This connector should be compatible to and with Harting HPR.

**Table 5 Pin Assignment of X5 connector for Locos**

| Pin      | EKU Pin | Signal Name           | Max. Current Draw | Cross Section             | Contact Material |
|----------|---------|-----------------------|-------------------|---------------------------|------------------|
| A1A      | 5       | F-ETB (DA+ Network 1) |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| A2A      | 6       | F-ETB (DA- Network 1) |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| A3A      |         | n.c.                  |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| A4A      |         | n.c.                  |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| A1B      | 7       | F-ETB (DA+ Network 2) |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| A2B      | 8       | F-ETB (DA- Network 2) |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| A3B      |         | n.c.                  |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| A4B      |         | n.c.                  |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| B1       | 3       | Spare-pin             |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| B2       | 4       | Spare-pin             |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| B3       | 9       | Spare-pin             |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| B4       | 10      | Spare-pin             |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| B5 – B17 |         | n.c.                  |                   | 0.14...2.5mm <sup>2</sup> | AU               |
| Housing  |         | PE                    |                   | 6.0mm <sup>2</sup>        |                  |



**Figure 17: Pin Assignment of E-Coupler**

Moreover, the spare-pins should be connected isolated from the e-coupler to X5.

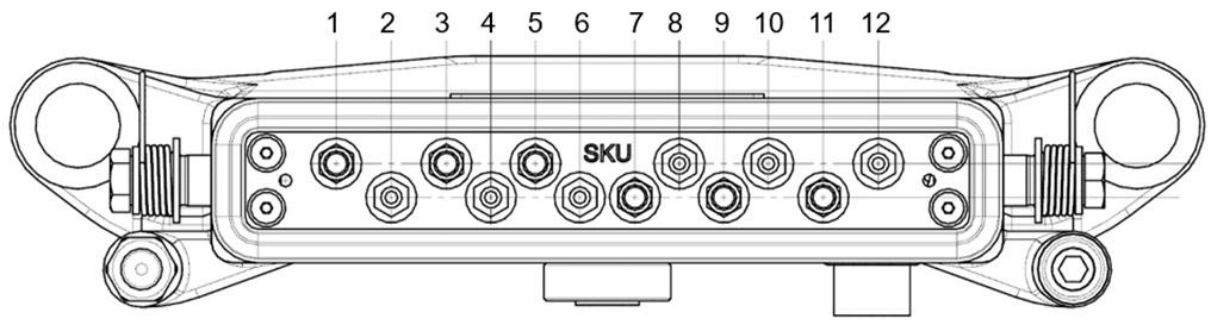
#### **4.6 400 VAC Connector X9: Pin Assignment and Wiring**

The 400 V AC Connector X9 will be the hand over point from the locomotive to the e-coupler. The wire from the e-coupler will be connected to this connector. Each side of the locomotive (Cab 1 and Cab 2) will have its own connector X9.

For the 400 VAC lines, one connector is also the preferable solution at the moment. This connector should be compatible to and with Harting HPR.

**Table 6 Pin Assignment of X9 connector for Locos**

| Pin     | EKU Pin | Signal Name                          | Max. Current Draw | Cross Section            | Contact Material |
|---------|---------|--------------------------------------|-------------------|--------------------------|------------------|
| A1      | 1       | Power Distribution Line 400 VAC L1_1 | Max. 40 A         | 1.5...6.0mm <sup>2</sup> | QMM              |
| A2      | 2       | Power Distribution Line 400 VAC L2_1 | Max. 40 A         | 1.5...6.0mm <sup>2</sup> | QMM              |
| A3      | 12      | Power Distribution Line 400 VAC L1_2 | Max. 40 A         | 1.5...6.0mm <sup>2</sup> | QMM              |
| A4      | 11      | Power Distribution Line 400 VAC L2_2 | Max. 40 A         | 1.5...6.0mm <sup>2</sup> | QMM              |
| B       |         | Dummy module                         |                   |                          |                  |
| Housing |         | PE                                   |                   | 6.0mm <sup>2</sup>       |                  |



**Figure 18: Pin Assignment of E-Coupler**

#### 4.7 Grounding Point for X5 and X9

For the connector housing, it is recommended for using either the contact surface of the housing or an M8 screw, as Harting already accommodates 500 VAC.

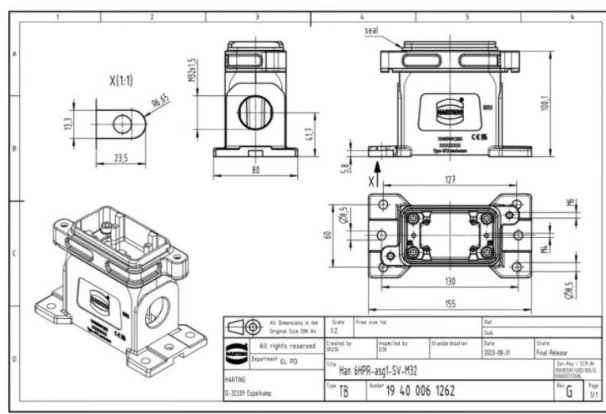
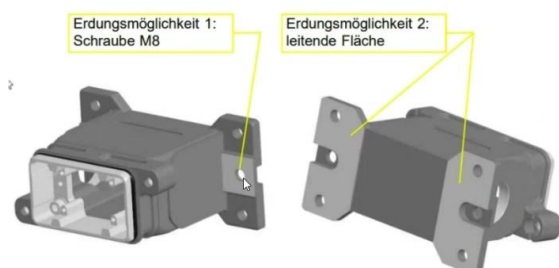
Specifically, X5 should only be used for EMC grounding, while X9 should incorporate additional protective earth - this can include grounding via the wire itself with a permissible screw size up to M8.



### Schutzerdung / EMV Potentialausgleich zum Wagenkasten

### Erdungsanschluss Harting:

- 1. Stecker X5: M8 oder leitende Fläche**  
**2. Stecker X9: M8 oder leitende Fläche**



**Figure 19: Grounding Possibilities for X5 and X9**

#### 4.8 Interface for an electrical lifting device (X11)

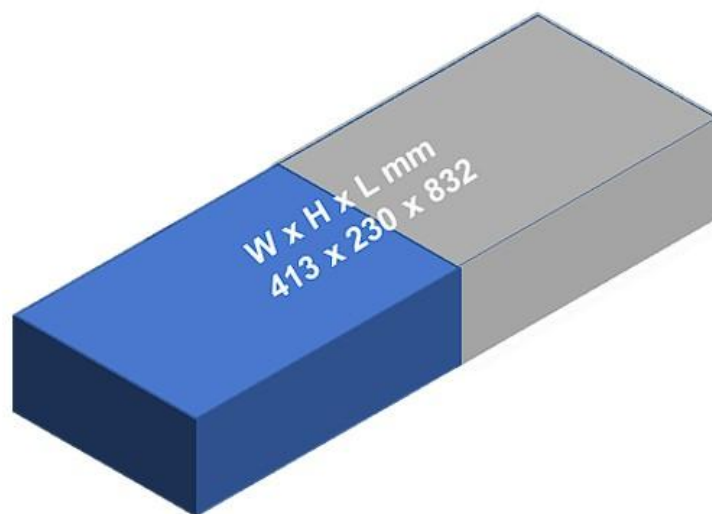
As there are several ways to raise or lower a hybrid coupler, this interface is only available if an electrical solution is used. That's why this interface is separate from the Junction Box. It only explains the basic requirements that the locomotive must fulfil, without detailing which connector to use or how to make the connection. The final connection will be agreed separately between the locomotive manufacturer and the coupling supplier.

- 24 V DC
- max. 15 A

The mechanical interface and the position of the lifting device controller must be defined individually between the coupler supplier and the locomotive manufacturer.

## 5 Outlook: Dimensions of CCU

As an outlook, the max. dimensions of a possible CCU are presented. The container for the CCU consists of the consist control, the battery & power management, the SPE communication node and many other functionalities.



**Figure 20 Max. Dimensions of a possible CCU (exemplary picture)**