

TRAILER SAFETY CONTROL INSTALLATION GUIDELINE

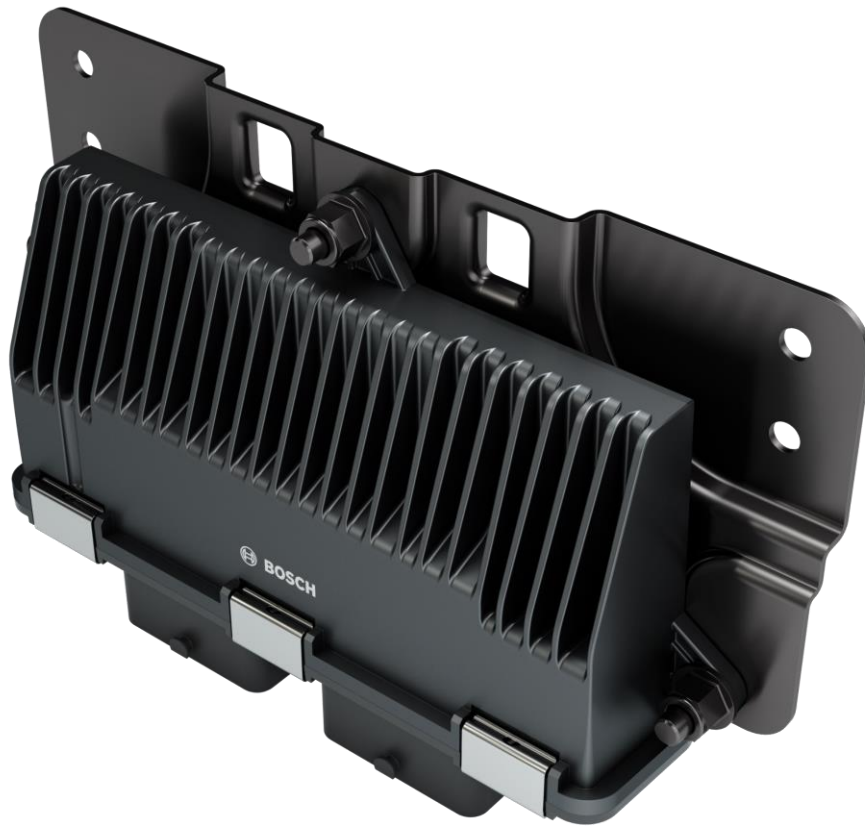


Image represents the product family.

Product Designation:	Trailer Safety Control ECU
Product Generation:	1.0
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INTRODUCTION

CAUTION

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

The purpose of this document is to detail the installation requirements and guidelines for the Bosch Trailer Safety Control (TSC). Detail within this document is provided by Bosch as a guideline to the proper and correct installation for trailer manufacturers and installers.

CAUTION

The Bosch TSC system should only be installed by a qualified technician.

Installation steps listed in this manual are not meant to cover every trailer type, but provide the required elements needed to install the Bosch TSC successfully. Each trailer type may require steps not individually stated but implied.

CAUTION

Please review and understand all installation manual instructions before beginning installation. Many steps are sequential, so it is necessary to complete all elements as instructed.

SUGGESTED INSTALLATION TOOLS

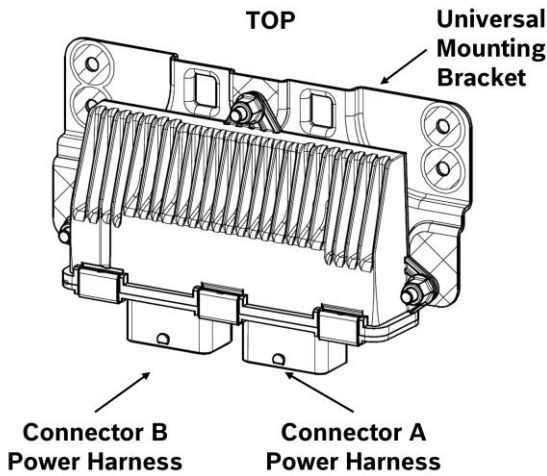
- Zip Ties
- Wire/Cable Clamps (strain relief for wires at ECU)
- Non-Abrasive Cleaner "Rubbing Alcohol"
- Phillips Screwdriver/Drill Bit
- Nut Driver Bit
- Drills & Drill Bits
- Tape Measure
- Side Cutters
- Hole Saw

ORIENTATION CLARIFICATION

Throughout this document **left** and **right** directions are specified. All directions are considered as if facing forward from the rear of the trailer toward the tow hitch at the front of the trailer.

TSC BRAKE CONTROL MODULE - "ECU"

Below is a model of the TSC Brake Control Module. This will be referred to throughout the manual as the ECU (Electronic Control Unit).



connectors from on-coming projectiles and the rigidity of a rectangular steel or aluminium section provides a solid mounting surface with a reduction of ECU vibration.

Other C-Section, short height RHS, Truss and Z-Section chassis rails are allowed with a minimum height of 45mm to meet mounting requirements. Additional mounting and/or protection surface (i.e. an adapter plate) solidly fixed on the chassis rail to accommodate the vibration and protection requirements of the ECU may be required. See ECU chassis mounting examples in the following section.

⚠ CAUTION

Unsuitable structural integrity of the mounting location can result in vibration, damage to the ECU and internal sensor faults.

⚠ CAUTION

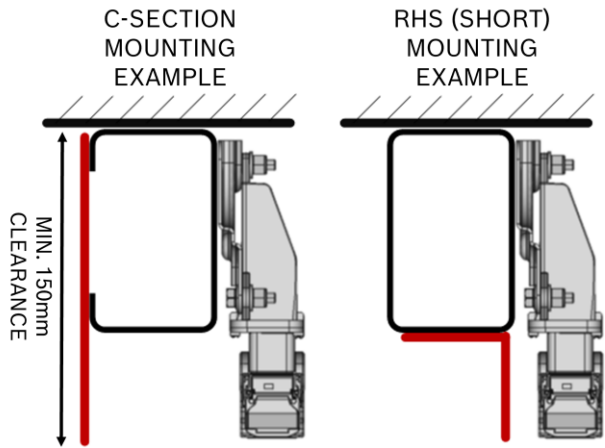
The ECU is an electric device and sensitive to electrical discharge. Do not touch the connector pins of the ECU.

⚠ CAUTION

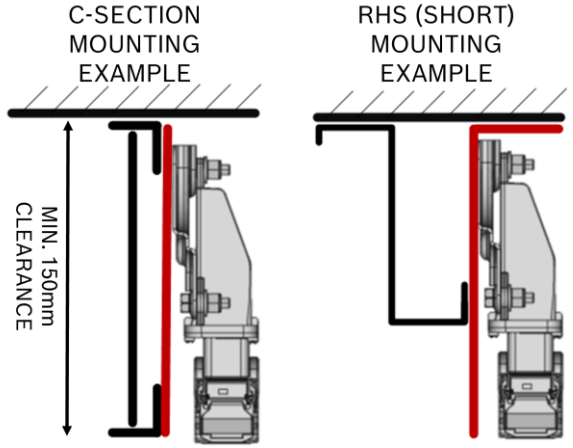
Any ECU dropped during trailer manufacture must be discarded and not used.

MOUNTING EXAMPLES

It is mandatory to provide an adequate solution to protect the ECU, axle/power harness against road debris or vertical impact. Each trailer design is unique and must be addressed individually upon installation. Failure to do so will influence product life and performance. Examples of additional mounting/protection highlighted in red. Minimum 150mm of vertical clearance is needed to protect the ECU and harness plug from road debris.



← FRONT OF TRAILER



← FRONT OF TRAILER

TRAILER REQUIREMENTS

Wheel Speed Sensor Availability

The trailer to which TSC is to be fitted must have axles equipped with specific wheel speed sensor integrated brakes and hub-drums. Wheel speed sensors are custom designed into the specific brake assemblies and are an integral part of the system.

Chassis Rail Mounting Suitability

Trailer chassis rail material and structure can vary significantly between different manufacturers and types of trailers. The chassis rail or cross member of the trailer is where you will mount the ECU and is therefore the major mechanical interface between the trailer and the ECU. It is important that the structural integrity of the chassis rail or cross member is suitable since it is where the ECU mounts.

Ideal mounting surface is a Rectangular Hollow Section (RHS) chassis rail with a minimum height of 150mm. Area of chassis rail that contacts bracket to be within a flatness of 0.3mm. A minimum material thickness of 2mm for steel and 3mm for aluminium is required. The height of the chassis rail protects the ECU and

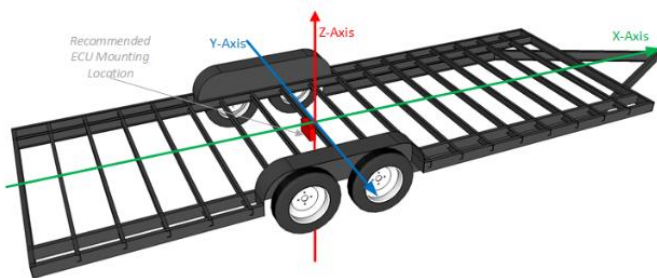
MOUNTING

UNIVERSAL BRACKET

The ECU is supplied with a pre-attached Universal Mounting Bracket. The bracket provides a mounting interface between the ECU and the trailer chassis. The bracket is designed to meet the strength, stiffness and vibration requirements. The pre-attached universal mounting bracket must not be removed, adjusted, or modified during installation. Selection of the ECU mounting location should always accommodate the mounting bracket as well as space to work. Damage or removal of the bracket may affect the performance of the TSC system.

MOUNTING LOCATION ON THE TRAILER

The recommended mounting location for the ECU is shown below:



Trailer Y-Axis

As close as possible to the centreline of the trailer, +/- 300mm is allowed. Midway between the left and right wheels.

Trailer X-Axis

On a chassis rail which is closest to all the braked wheels. For example, locate the ECU nearest the axle for a single axle trailer, in between the axles on a tandem axle trailer and over the centre axle on triple axel trailer.

Locate the ECU on the backside of the chassis rail or designated mounting structure. Orient the universal mounting bracket supplied on the ECU towards the front of the trailer.

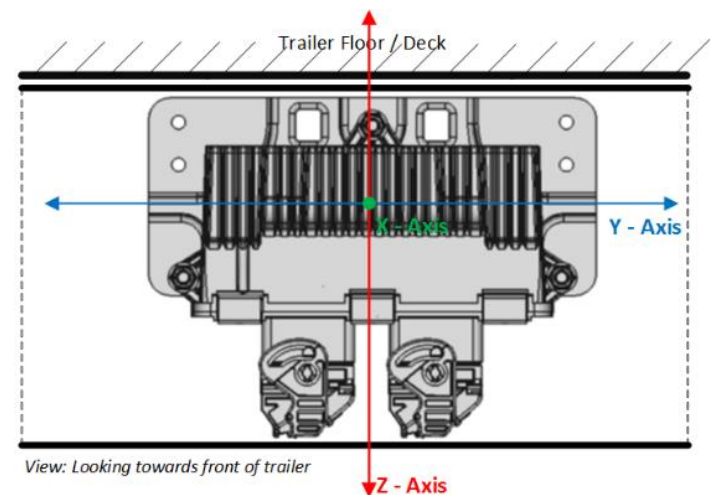
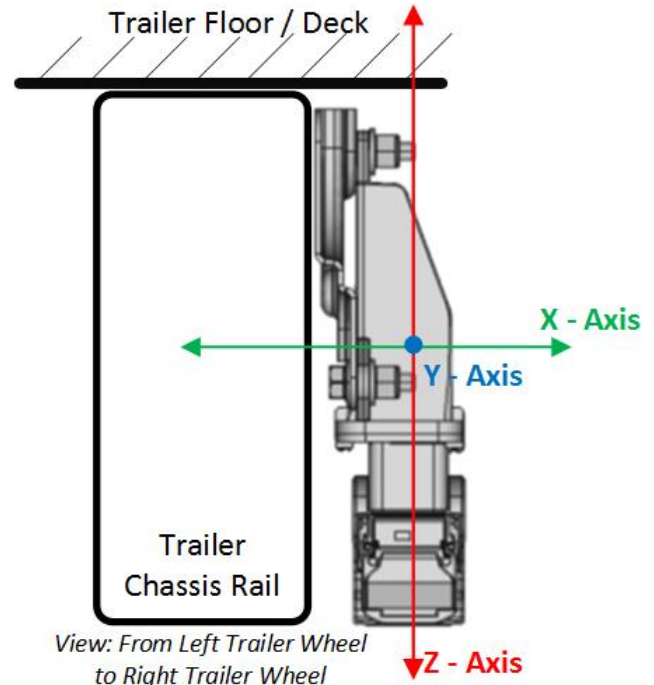
Trailer Z-Axis

Vertical mounting position should locate the ECU as close to the floor as possible to ensure adequate protection.

Other mounting locations on the trailer are possible if they meet the mounting example requirements and axle harness limits. On a multi-axle installation, do not mount the ECU behind the rear axle as the increased vibration may result in performance issues.

MOUNTING ORIENTATION & ACCURACY

TSC mounting orientation must be strictly adhered to, any deviation from these instructions may result in reduced system performance. The ECU must be mounted in the same manner as the figure below.



ECU Orientation Requirements

- The ECU must be mounted perpendicular to the ground. This vertical orientation (Z-Axis) should be with the harness connectors facing downward.
- The ECU should be mounted so the top edge of the Universal Mounting Bracket is parallel to the chassis or carrying surface of the unit. When mounted on a finished unit this should place the X and Y axis no more than $\pm 5^\circ$ from parallel to the ground.

NOTE: THE UNIVERSAL MOUNTING BRACKET SHOULD NOT CONTACT THE TRAILER FLOOR.

Allowance of 3mm air gap is appropriate to avoid transmission of unwanted vibration.

- The mounting location should allow for proper clearance of the axle and power harness connections as well as mounting hardware.
- Variation from the recommended tolerances and requirements for mounting the ECU may result in misoperation.
- In general, the best performance and robustness is achieved when the bracket is mounted with minimum tolerance. Exceeding the tolerances of these mounting requirements may result in poor performance or malfunction.

RECOMMENDED ECU MOUNTING HARDWARE

The recommended mounting hardware is a #12-14 x 25mm, Hex Flange Head screw. Screws should be torqued to 6 ± 1.5 Nm (4.4 ± 1 ft lbs) to ensure secure mounting to the chassis rail.

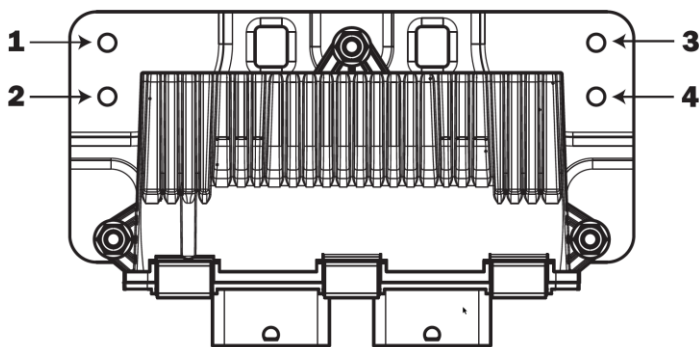


RECOMMENDED ECU MOUNTING TECHNIQUE

Upon determining the proper location and orientation, the final attachment is important. All four holes should be pre-drilled to avoid shift during installation. All four attachment points must be used during installation.

NOTE: DRILLING OR WELDING OF THE UNIVERSAL MOUNTING BRACKET IS NOT ALLOWED.

ECU Mounting Holes



Light Module Mounting Location

The TSC uses an indicator light module to notify the driver of system function and potential diagnostic codes. Driver notification is an essential part of a safety system. The light module does not have a regulated location. Bosch recommends that it's located in a place easily visible to the driver through the tow-vehicle mirror(s) while sitting in the driver's seat. Please see suggested locations marked in red in Figure 1 and Figure 2 (Shown for countries with left-hand traffic, for countries with right-hand traffic, the light module shall be mounted on the right side of the trailer).

Figure 1:

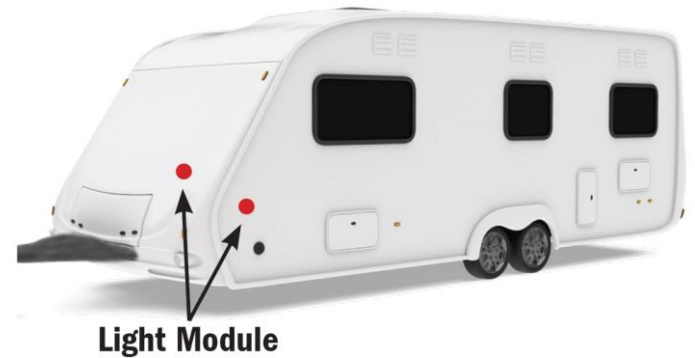
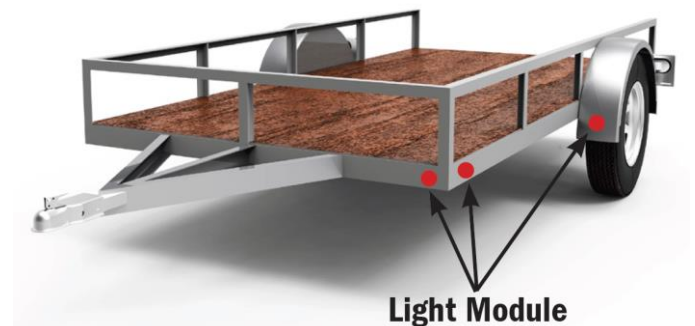


Figure 2:



WIRING

The wiring diagram and colour code chart on page 7 provide a general understanding to perform the harness installation.

Make sure that the wiring harness

- is fixed at least 200mm after each ECU connector,
- is supported at intervals of not more than 600mm,
- is located in a position that it cannot become overheated, cannot contact moving parts, nor constitute a fire hazard owing to its proximity to a fuel system,
- is protected from chafing. The edge of all holes in metal through which the wiring passes shall be rolled or bushed with a grommet of rubber or other equivalent insulating material.

⚠ CAUTION

Only an experienced technician should route and install wiring.

⚠ CAUTION

Proper harness must be used based on number of axles in installation. Using the incorrect harness may result in malfunction.

Trailer configuration wiring is dependent on the number of braked axles on the trailer. Please note that the TSC system requires all axles to be equipped with TSC compatible brakes. The following configurations are valid for the TSC system:

- **Single Axle Trailer:** A single front axle (LABELLED: Front Left FL & Front Right FR) is selected and controlled by TSC.
- **Tandem Axle Trailer (all axles braked):** Both braked axles Front & Rear (LABELLED: Front Left FL, Front Right FR, Rear Left RL, Rear Right RR) are selected and controlled by TSC.
- **Triple Axle Trailer (all axles braked):** All braked axles Front, Centre & Rear (LABELLED: Front Left FL, Front Right FR, Centre Left CL, Centre Right CR, Rear Left RL, Rear Right RR) are selected and controlled by TSC.

Wheel Speed Sensor Connectors

Wheel Speed Sensors will connect at the brakes to the wiring harness with a 2-pin Molex® connector.



Brake Magnet Connectors

Brake magnets will connect to the wiring harness with a 2-pin Weather Pack® connector and are adjacently located to the wheel speed sensor connector.

WIRING HARNESS

The TSC system requires a two-piece wiring harness that provides cabling to connect to the tow vehicle connections, ECU and braked wheels. Due to the variation of trailer types, this is meant as an overview, not as step-by-step instructions.

⚠ CAUTION

The TSC ECU Power Supply must be protected with a suitable fuse (max. 40A), located between the trailer power supply terminal and the TSC wiring harness supply wire.

Part 1 - Axle Harness

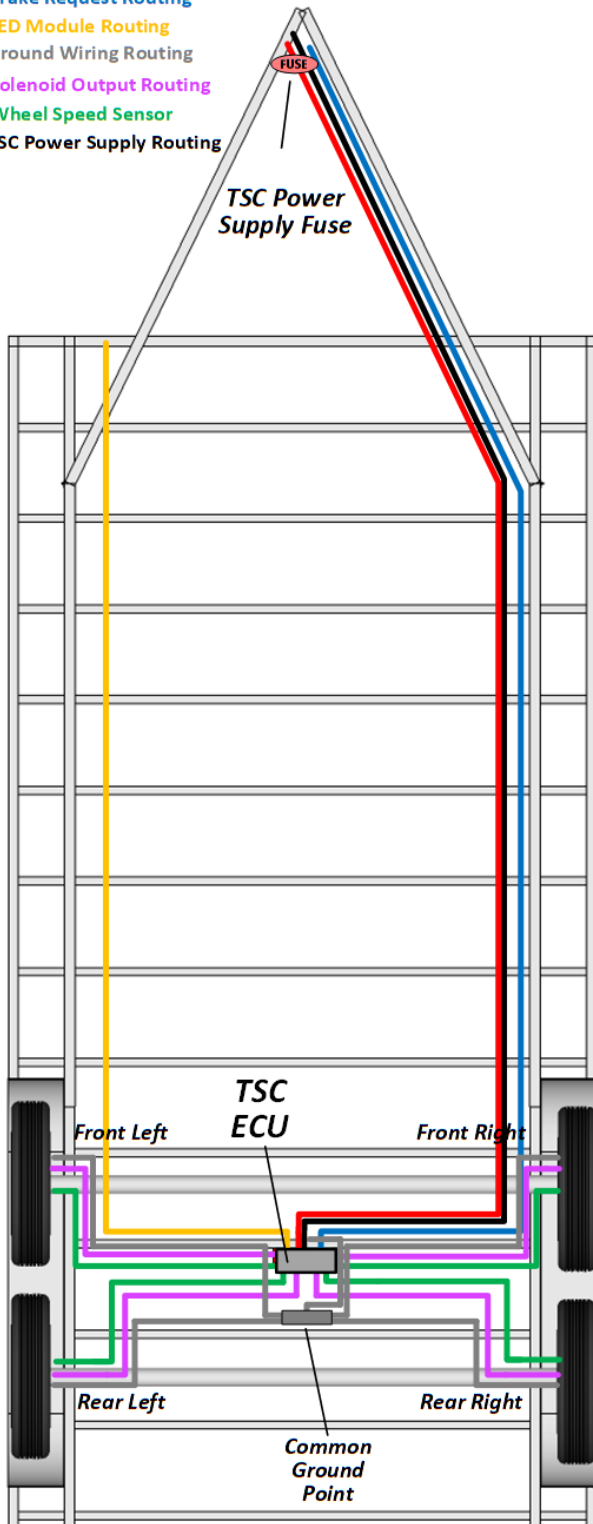
One part of the harness is the axle harness that comes in single, tandem, and triple configurations. This harness connects the wheel speed sensors and brake magnets from each wheel to the ECU. Install the harness only after the ECU and axles have been securely mounted.

Part 2 - Power Harness

The power harness consists of a power/communication wires for power supply, service brake signal, common ground connection, OBD2 communication cable with fuse and the indicator light cable.

ROUTING EXAMPLE

- Brake Request Routing
- LED Module Routing
- Ground Wiring Routing
- Solenoid Output Routing
- Wheel Speed Sensor
- TSC Power Supply Routing



When routing the wiring harness, take care that the wiring harness is not damaged by routing via sharp corners or edges.

Make sure that the wiring harness is fixed after each connector at the ECU as described in the axle harness section.

IMPORTANT: TSC power supply ground and trailer connector ground must be connected.

Signal	Connections	Start Point	End Point
Power Supply	Positive	Trailer Power Supply	ECU Connector
	Negative	Trailer Power Supply	Common Ground Point
Indicator Light	Operation Signal Warning Signal Ground	ECU Connector	LED Module
Brake Request	Service Brake Wire (from tow vehicle EBC)	Tow Vehicle Brake Signal (Trailer Plug)	ECU Connector
Wheel Speed Sensors	Wheel Speed Signal/Power (1-6)	ECU Connector	Wheel Speed Sensor (1-6)
Magnet Brake	Brake Magnet Signal (1-6)	ECU Connector	Brake Magnet (1-6)
Common Ground Point	ECU Ground	ECU Connector	Common Ground Point
	Brake Magnet Signal (1-6)	Brake Magnet (1-6)	Common Ground Point
	Trailer Supply Ground	Trailer Power Supply (on-board battery or tow vehicle power)	Common Ground Point

AXLE HARNESS

⚠ CAUTION

Proper harness must be used based on number of axles in installation. Using the incorrect harness may result in malfunction.

Cable bundles must be routed to the corresponding wheels as labelled.

Single Axle Trailer: Front Left FL, Front Right FR.

Tandem Axle Trailer: Front Left FL, Front Right FR, Rear Left RL, Rear Right RR.


Triple Axle Trailer: Front Left FL, Front Right FR, Centre Left CL, Centre Right CR, Rear Left RL, Rear Right RR.

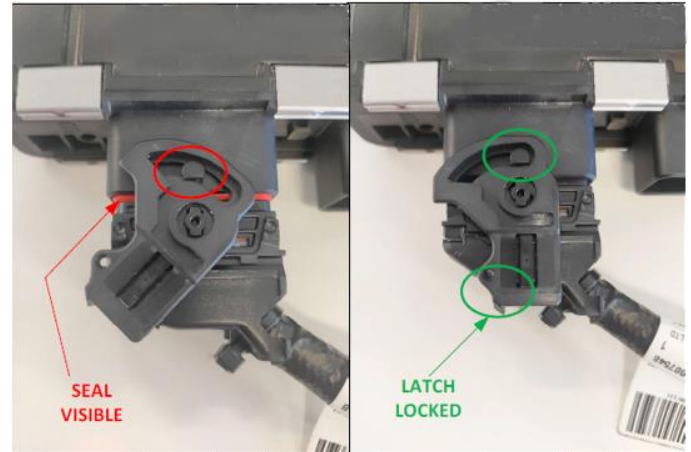
The axle harness has lengths of cable bundles with the speed sensor connector and brake magnet connector that run to each wheel. The harness also has provisions for lengths of harness that are bundled to run to the axles from the ECU connection to front or back of the trailer, primarily from the centre of the trailer.

- Identify wheel identification for each individual cable bundle.
Single Axle Trailer: Front Left FL, Front Right FR.
Tandem Axle Trailer: Front Left FL, Front Right FR, Rear Left RL, Rear Right RR.
Triple Axle Trailer: Front Left FL, Front Right FR, Centre Left CL, Centre Right CR, Rear Left RL, Rear Right RR.
- Select the routing path of each wheel end harness run. Much of this path will be determined by the mounting location of the ECU.
- Allow slack wire at the wheel ends to account for suspension movement.
- Secure wheel end run to frame rails or other secure points on the trailer as need to prevent harness sagging.
- Ensure that the cable bundle identification match the wheel location (Front, Centre, Rear, Left, Right).
- Plug in brake magnet connector and wheel speed sensor connector to provided connector from backing plate.
- Repeat for each wheel end.
- At the ECU, insert the PLUG A connector to the right-side PLUG A receptacle and secure the connector latch. The latch locks on a feature on the wire retention cap as identified. Make sure there is no red seal sticking out of connector.

- To ensure proper connection, the latch mechanism of the connectors must not be damaged and must be fully engaged (refer to attachment & locking diagram below). Ensure that the connector is only removed or plugged in when it is dry and clean in the vicinity. Do not put any liquids or other materials onto the connectors.

 Partially Latched / Inserted

 Correctly Latched / Inserted



Connector inserted and latch partially closed.


Connector inserted and latch completely closed.

Connector will NOT stay in the ECU.

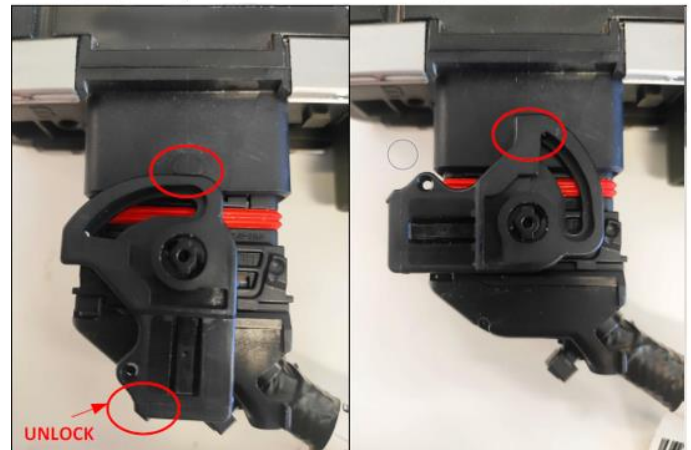
Latch will lock and not be moveable until the latch is unlocked.

Electrical connection may be intermittent and could results in unwanted behaviour/faults.

Correct operation of TSC can only be guaranteed with this connection.

 Unattached / Barely Inserted

 Unlatched / Inserted



Connector latch closed and will not insert into ECU.

Connector inserted into ECU, latch completely open.

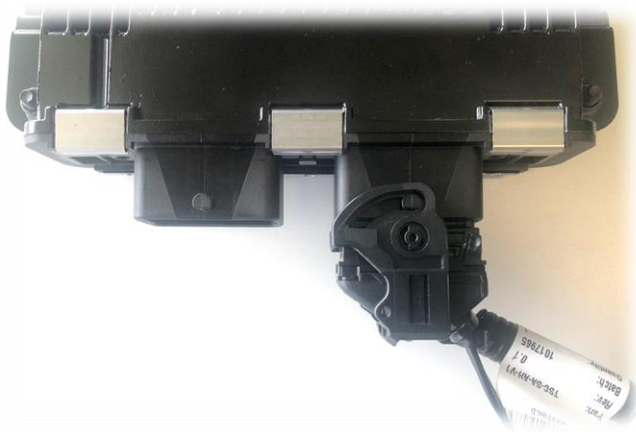
Connector will NOT stay in the ECU when mounted vertically.

Connector will NOT stay in the ECU.

Electrically this will NOT be connected.

Electrically this will NOT be connected.

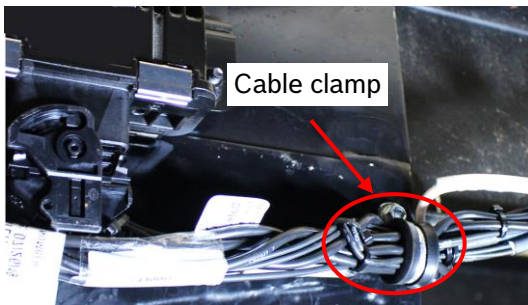
If latch is locked in this position it must be unlocked before attachment.



⚠ CAUTION

If red connector seal is visible and latch is NOT locked from moving, the connector is NOT inserted correctly and must be corrected.

- Mount an appropriate cable clamp with a rubber insert approximately 150mm away from the axle harness exit from the ECU (but no more than 200mm). The clamp must be large enough to accommodate the axle harness and the power harness. This clamp will rigidly fix the cable assemblies for vibration resistance.



⚠ CAUTION

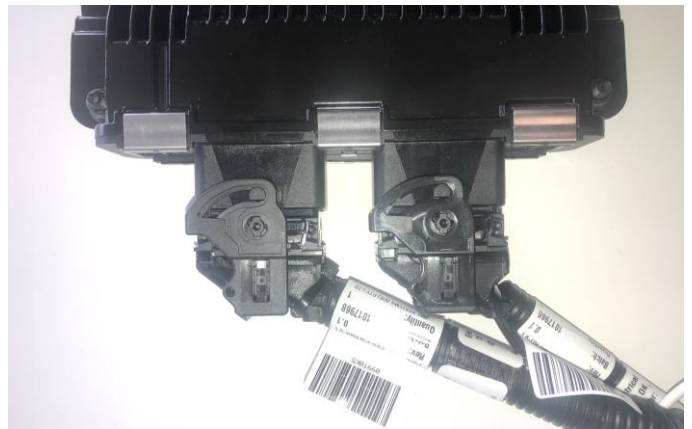
Improperly mounting the cable clamp may result in vibration and damage to the product.

POWER HARNESS

The power harness can be routed as application dictates. Harness Installation Steps:

- Select routing path for trailer power harness.
- Identify location that the power, brake request, and ground wires will be mounted and connected.
- Identify further routing for the indicator lamp. The lamp cable extends further from the harness sheath for mounting location of the lamp.
- Identify an environmentally protected area on trailer to mount the OBD2 communication connector. The connector can be mounted inside the trailer or in its own enclosure in an accessible location on the trailer provided there is approximately 100mm of clearance in front of the connector for the OBD2 plug to be inserted. This connector will need to be used to complete the configuration of the ECU at the end of installation. Failure to protect OBD2 connector and/or Bluetooth® adapter from the environment will result in decreased connectivity.
- Route the harness as desired avoiding tight bends and excessively sharp edges locating the power wires, light harness and OBD2 extension. Route it through the cable clamp at the ECU. Utilize cable clamps as needed to avoid pinch points and sagging areas.
- DO NOT apply power to power harness until all connections are made.

- At the ECU, insert the PLUG B connector to the left side PLUG B receptacle and secure the connector latch. It locks on a feature on the connector cap. Make sure there is no red seal sticking out of connector.



- Ensure power harness cable routes through the cable clamp adjacent to the ECU that has the axle harness.
- Secure the ECU cable clamp around the harness. This is needed to ensure harness tension is not transferred to the ECU well as limiting vibration input.
- ENSURE that common ground point connector is connected to its mate.

COMMON GROUND WIRING POINT

For correct operation of the ECU, the ground connector of the axle wiring harness must be connected to the mating plug of the power harness at the ECU.



⚠ CAUTION

Failure to connect Common Ground Wiring Point

- will cause loss of brake magnet function
- will cause a system fault at start up and require re-work

IMPORTANT: TSC power supply ground and trailer connector ground must be connected.

ADDITIONAL INSTALLATION STEPS

INDICATOR LAMP INSTALLATION

The indicator lamp can be installed following these steps:

1. Select an appropriate mounting location as per the mounting location advice.
2. Clean the mounting surface appropriately for adhesion.
3. Route the lamp cable through a hole / entry space in the mounting surface.
4. Secure the lamp to the mounting location with 2 methods:
 - o Remove lamp adhesive backing and press lamp to mounting surface, ensure lamp is orientated correctly.
 - o Additionally insert screws into the mounting surface on each lamp mounting hole and secure.
5. Connect lamp connector to harness connector.



DIAGNOSTIC INTERFACE INSTALLATION

Mount the OBD2 connector securely in an environmentally protected area using appropriate screws per application.



Plug-in Diagnostics Adapter.



Image represents the product family.

ECU INITIAL START-UP

If not pre-configured, the TSC system must be configured via the harness OBD2 connector and specific Bosch issued configuration tool.

At power-up, a **NON-CONFIGURED** ECU will display an amber lamp (no green lamp) and indicate a “configuration fault”.

The ECU must have parameters programmed including:

- Number of braked axles
- Brake Drum Type
- Trailer Tyre Size
- VIN (Optional)

At power up, a **CORRECTLY** configured ECU will check for the presence of the wheel speed sensors, magnets, indicator lamp and wiring harness. The system will perform the following steps:

- The ECU will check for lamp presence test via performing two short colour alternating bursts.
- Then the ECU will check for the presence of the sensors.
- Then the ECU will check for the magnets. You may be able to hear the magnets activating for a short burst at each wheel in turn. Also, one can hear the relays in the ECU activating.
- If the system is fault free the indicator lamp will turn off after the ECU completes these checks.
- To wake the system, the user/installer must apply a valid brake signal to the blue brake wire, this shall illuminate the green lamp and indicate system will be ready to drive.

NOTE: The brake signal could be a momentary +12V application to the blue wire or a valid signal from a brake controller.

VALID BRAKE SIGNAL FROM BRAKE CONTROLLER

Brake controllers available vary on the exact signal produced at standstill. TSC requires a signal that exceeds a threshold level. This level should be achieved by setting the gain to ‘3’ or higher. This should ensure that a given controller outputs a valid signal at standstill. If TSC does not go into normal operation do the following until the system indicator light is green:

1. Ensure the brake controller is powered and active.
2. Depress the brake pedal for more than 2 seconds or press and hold brake controller override switch for more than 2 seconds.
3. If required, increase the gain level to maximum and repeat step 3.
4. If TSC does not become active, check trailer plug connections, wire and power supply to the TSC and repeat steps above.

VERIFICATION START-UP AFTER CONFIGURATION

1. Remove power from the TSC ECU for 10 seconds, until indicator light is completely out.
2. Re-apply system power. The system should power up as described in TSC Start-Up description. The indicator lamp will not be on for either colour at the end of a successful start-up.
3. Apply tow vehicle power to the brake request wire momentarily (simulate a brake application by the tow vehicle). The magnets will pull in during power application and the indicator light should light green indicating the ECU has entered drive mode and has been successfully configured.

HISTORY

Release	Date	Edited by	Release description
4.0	1 st June 2023	M. Power / P. Frueh	Updates for AU market
3.0	16 th November 2022	M. Power / P. Frueh	Updates for AU/US market
2.0	3 rd August 2018	M. Power / H. Dao	Common Ground requirement added
1.0	1 st September 2017	M. Power / P. Frueh	Preliminary Edition