Installation and Operation
Battery Management System
IMPORTANT!
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The installation instructions are only produced for professional use and are not intended for non-professional use. Volvo Penta will not assume any liability whatsoever for damage incurred, either damage to materials or personal injury, which may result if the installation instructions are not followed or if the work is carried out by non-professional personnel.

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Battery Management System

Introduction

This document contains the instructions for installation, connection, configuration and operation of Volvo Penta’s Battery Management System.

The system can be installed with the Volvo Penta’s EVC system or as Stand-alone system, non EVC.

The Battery Management System monitors, remotely controls and manages power supply from the boat’s battery groups.

The system helps to ensure availability and robustness in power supply to the engine(s) and other DC power consuming devices on board.

Components

- BCM (Battery Control Module).
- Battery Sensor.
- Battery Management display.
- e-Key Remote Sender with e-Key Remote Receiver.

Basically the system consists of one or more BCM-units to which batteries and other power consuming devices are connected.

Batteries may be start or power-usage batteries. With power-users this refers to i.e. start engines, instrument wiring and accessories.

The system can be controlled locally on the BCM, via a Battery Management display or via another external button panel.

Each driveline’s start battery/ engine shall have at least one BCM connected to ensure redundancy and maximum availability.

Each BCM is configured after installation depending on intended function, see: Network position, page 25.
The table below shows the number of BCM for different installations.

<table>
<thead>
<tr>
<th>Installation (number of drivelines in the boat)</th>
<th>Minimum quantity BCM</th>
<th>Maximum quantity BCM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Double</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Triple</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Quadruple</td>
<td>4</td>
<td>6</td>
</tr>
</tbody>
</table>

Determine the units based on the boat's type and desired system level.

<table>
<thead>
<tr>
<th>Desired system level</th>
<th>Accessories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard control (basic level)</td>
<td>X</td>
</tr>
<tr>
<td>Extended control</td>
<td>X X</td>
</tr>
<tr>
<td>Control and monitoring</td>
<td>X X X</td>
</tr>
<tr>
<td>Complete battery control</td>
<td>X X X X</td>
</tr>
</tbody>
</table>

Installation order

1. Install the BCM (Battery Control Module).
2. Install and connect other Battery Management System-components to the BCM.
3. Install fuse (F4) in applicable cases.
4. Connect the BCM to the battery terminals, connect to battery - (minus) last.
5. Configure the system:
   a. Set each BCMs position in the network.
   b. Select desired function for each BCMs switches.
BCM (Battery Control Module)

BCM switching functions

1 (BATTERY 1+IN): Switch for battery 1 (usually between the start battery and the starter motor). Connection to EVC systems (if installed).

2 (BATTERY 2+IN): Switch for battery 2 (usually switch between accessory battery and accessory devices i.e. fridge, lights and other electrical equipment)

3 (CROSS OVER): Cross over function, connects switch 1 to switch 2 i.e. when in need of emergency start support. Connect both BATTERY 1+IN and BATTERY 2+IN for full functionality.

Refer to: Twin installation with three BCM, page 20.

NOTICE! BATTERY 2 switch (2) may not be used for the engine’s start battery.

Loads

Up to 300 A
The BCM-unit is dimensioned for 300A continuous load on each of the two channels BATTERY 1+IN and BATTERY 2+IN.

For safety reasons, each channel is also dimensioned to be able to handle shorter periods of overload. The BCM-unit is thus dimensioned to work together with all Volvo Penta starter motors (and other starter motors of equivalent power character).

Above 300 A
Components with higher continuous usage, i.e. anchor winches, should be assigned their own BCM. Both channels are configured to control the same power-user to support 600 A continuous load.

Refer to: BCM for large consumers, page 18.
Battery Sensor

The battery sensor monitors battery charge, status, current and voltage. Measured values are shown in the Battery Management display.

The battery sensor is dimensioned for up to 300 A load.

Current and voltage must be read continuously so that reliable data can be shown. Therefore, do not disconnect the battery sensor except in exceptional cases, i.e. upon changing a battery.

The battery sensor is installed on the battery's negative terminal. Refer to the battery sensor's included installation instructions.

Connections to BCM

To each BCM, up to two battery sensors can be connected to the inputs BS 1 and BS 2.

Input BS 1 is used for BATTERY 1+IN.

Input BS 2 is used for BATTERY 2+IN.

Connected batteries

The battery sensor works with most batteries: AGM, GEL or flooded battery.

In the Battery Management display, settings are made regarding the battery's type and capacity, refer to: Battery Management display, page 30.

NOTICE! Follow the guidelines the battery manufacturer recommends. The battery sensor's optimum precision is achieved after around 20 charging/discharging cycles.
Battery Management display

Remote battery control and information for up to four drive lines and 12 different battery groups can be presented. The display shows battery status, BCM switching functions and warning messages. For settings, refer to: Battery Management display, page 30.

e-Key Remote Sender

e-Key Remote Sender locks and unlocks the boat’s electrical system and turns on the engine’s ignition via the e-Key Remote Receiver.

The key has two buttons that control relays to optional functions such as deck light or anchor winches.

- **ON** – turns on the ignition switch and other selected switches.
- **OFF** – turns off the ignition switch and other selected switches.
- **1** and **2** – the buttons are used to turn optional boat functions off and on.

Refer to provided Installation instruction for installing and connecting of e-Key Remote Receiver to BCM.

Battery replacement

Undo the screw on the battery cover and replace the battery. Battery types: CR2032.

First place the battery cover’s back fastener on e-Key Remote Sender and secure it by pressing on it. Tightening torques 0,25 Nm (0.18 lbf ft).
External accessories

To control the BCM buttons BATTERY 2+IN and BATTERY 1+IN, it is possible to connect an external button panel with LEDs. The buttons must be spring-loaded normally OFF-(ON). Max 500 mA for the indicator.

1  Fused battery (+).
2  Button BATTERY 1+IN.
3  Battery (–).
4  Indication BATTERY 1+IN.
5  Button BATTERY 2+IN.
6  Indication BATTERY 2+IN.
Installation Instruction

Contents in kit

<table>
<thead>
<tr>
<th>Number</th>
<th>Quantity</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>1</td>
<td>BCM (Battery Control Module)</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
<td>Nut M10</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>Nut M6</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>Seal plug, 6 pole**</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>Seal plug, 2 pole**</td>
</tr>
</tbody>
</table>

**Installed on BCM**

4 bolts and 4 washers are required for installation.

Optional

Main fuse (position 3 in figure above) is not included in the kit.

Dimensions: Main fuse.
Location of the BCM

- BCM must be installed horizontal on a bulkhead in the boat.
- The base must be flat and sufficiently strong to support the unit's weight, approx. 4.5 kg (10 lbs)
- Place the BCM as close to the batteries as possible. The cable length may be max 1.8 m (6 ft).
- To divert heat, the air stream should flow upwards between the cooling fins.

Clearance around BCM unit

BCM should be installed so that free space is created for the connectors, cable connections and service according to specified measurements.
Installing the BCM unit

1. Mark the screw's placement according to the figure.
2. First position the two lower screws and screw them in half way. (1)
3. Place BCM's lower slots over the screws.
4. Screw in and tighten all four screws.

Connecting cable harness

**IMPORTANT!** For gas engines: Ventilate the space well before starting work with the connectors.

Connectors (1) and (2):
Install the cables using M10 nut:
**Tightening torque:** 24 Nm (17.7 lbf.ft)

Connector (3):
Install the cables using M6 nut:
**Tightening torque:** 10±0.5 Nm (3.7±0.4 lbf.ft)

Attach the upper the clamps (4A) so that the cable length is sufficient to allow bypass of BCM when necessary. Refer to the arrows' marking in the illustration to the left.

Clamp the other the cables at a maximum of 150 mm (6") from the connections.

**IMPORTANT!** Make sure the locking mechanism between the connectors closes with a click to ensure a proper water-tight connection.

Plan cable length for possible bypass connection.
Installation

- First connect the system's components and accessories.
- Lastly connect BAT-IN (12) to battery negative terminal (–).
- When BCM starts, the button's diodes light up for two seconds.
- Insert the accompanying seal plugs in the connectors not being used.

1 Input to BATTERY 1+IN.
2 Input to BATTERY 2+IN. Not for start battery.
3 BATTERY 2+ OUT B.
   Power-user low current. Max continuous usage 300 A.
   Connect to 3A when fuse is used (recommended).
   Connect to 3B if no fuse is used.
4 F4. Fuse for cabling to output 3B.
5 ALT+. Alternator.
   Benefits the charge between two battery groups with retained isolation.
6 BATTERY 1+ OUT. Starter engine.
   Output from BATTERY 1+IN.
   Max continuous usage 300 A.(1)
7 OUT 2, continuous output (max 20 A). External fuse.
   Direct supply from BATTERY 2+IN.
8 OUT 1, continuous output (max 20 A). External fuse.
   Direct supply from BATTERY 2+IN.
9 AUX 1 and AUX 2. AUX bus components.
10 EXT. Connection to external button panel for the buttons
    BATTERY 2+IN and BATTERY 1+IN.
    Refer to: External accessories, page 7.
11 BS 1 and BS 2. Inputs for battery sensors for each battery.
12 BAT-IN. Battery minus (minimum 10 mm² cable)
   Minus-connection for power-users connected to
   OUT 1 and OUT 2.
   Refer to: Single installation with two battery groups, page 16.

1. For connecting a power-user continuously with a load over 300 A,
   refer to: BCM for large consumers, page 18.
Dimensioning of fuses

Dimension fuses based on cable size and length according to the table.

The calculation is based on the maximum permissible voltage drop in all cables between the positive terminal to the consumer and back to the negative terminal.

A: Cable length.
B: Cable area.

Total voltage drop when applying the table
12 V system: 0.4 V
24 V system: 0.6 V
Installation Examples

Installation variants
The following pages show a selection of possible example installations. Adapt based on selection, depending on the number of:

- Engines.
- Battery groups.
- Battery sensors.
- Components.
Aux bus termination

- The Aux bus may run in any order between the nodes: Engine, BCM, e-Key Remote Receiver and Battery Management display.
- The Aux bus must begin and end with a termination plug (3 in the figure).
- Other components are also connected to the Aux bus.
- The maximum length of the Aux bus in an installation is 40 m (130 ft).
1 Aux bus connections.
2 Engine.
3 Termination plug.
4 e-Key Remote Sender.
5 Battery Management display.
6 Battery Sensor.
7 BCM (Battery Control Module).

Aux bus.
Single installation with two battery groups
1 e-Key Remote Sender.
2 Battery Sensor.
3 External switch.
4 Battery Management display.
5 Battery group (Consumer Battery)
6 Battery group (Starter battery)
7 Shore Power Charger.
8 Consumer group 1 (i.e. Lighting)
9 BCM (Battery Control Module).
10 Terminal block.
11 Bilge pump.
12 Starter motor.
13 Alternator.

Battery positive +
Battery negative –
External connection
Aux bus
Battery sensor cable, alternator
Battery sensor adapter, cable harness

Refer to provided Installation instruction, Battery Sensor.
BCM for large consumers

- To larger power-users, which demand more than 300 A continuous power supply, for safety reasons a separate battery/battery group should be connected to a BCM with two synchronized switches.
- Connect according to figure so that the fuse (F4) is included in the circuit.
- Upon increased monitoring and control, two battery sensors shall be installed.
1 Battery / Battery group.
2 Aux bus connections (to additional BCM or Battery Management display if installed)
3 BCM (Battery Control Module)
4 Terminal block.
5 Large consumers (>300 A)
6 Alternator.

Positive connection +
Aux bus connections
Alternator + IN (May be shared with a start-BCM)
Connection between BATTERY 1+ OUT and BATTERY 2+ OUT B
Twin installation with three BCM
A power-user battery can be divided by several BCM’s if the loads are unique.

1. Battery Management display.
2. External switch.
4. EVC components.
5. VODIA tool.
6. Starter battery, Port Side.
7. Accessory Battery.
8. Starter battery, Starboard Side.
9. Battery for larger power-users.
10. BCM (Battery Control Module).
11. BCM for large consumers.
12. Connection between BATTERY 1+ OUT and BATTERY 2+ OUT B.
13. Power-user group (i.e. radio)
14. Consumer group (i.e. lighting)
15. Engine.
17. Large consumers (>300 A) (i.e. Windlass)
18. Alternator.
19. Termination plug.

Refer to provided Installation instruction, Battery Sensor.
1 Battery Management display.
2 External switch.
3 Battery Sensor.
4 EVC components.
5 VODIA tools.
6 Consumer Battery.
7 Starter battery, Port Side. Also supplies Electrical Rudder Actuator.
8 Starter battery, Starboard Side.
9 BCM (Battery Control Module)
10 Consumer group 1 (i.e. lighting)
11 Electrical Rudder Actuator.
12 Engine.
13 Starter motor.
14 Alternator.

Positive connection +
EVC bus
Aux bus
VODIA
Battery sensor cable, alternator
External connection
Battery sensor adapter, cable harness. Refer to provided Installation instruction, Battery Sensor.
**Configuration**

**Configuration Order**

For the battery control system to work, and information to be shown in the Battery management display, a configuration needs to be performed. This is done locally on each BCM-unit's button panel.

All BCM-switches has to be in position off to be able to activate configuration mode: the buttons LED are switched off.

1. Give the BCM a function and position in the network.
2. Configure the buttons for the installation's battery and accessories.
3. Note any customer-adapted settings. Refer to: *Preferences, page 28*

For configuration the drivelines are designated as illustrated on the left.

- On the following pages, activated buttons are shown in gray with a lit LED as illustrated in the image.
- Press each button individually until the correct LEDs lights up according to desired function in the table.
- If no buttons are pressed within 30 seconds configuration mode will be left automatically without settings being saved.
Network position

1. Activate the configuration mode: Press and hold the REMOTE DISABLE button for five seconds until all LEDs light up for two seconds. A red, flashing LED on REMOTE DISABLE button indicates entering configuration mode.

2. Set position: Press the BCMs button panel according to the table below to select the BCM:s unique function.

   **NOTICE!** The selected position function for the BCM will be shown in the Battery Management display.

3. Save settings and leave configuration mode: Press and hold the REMOTE DISABLE button for five seconds until all LEDs light up for two seconds to indicate that the settings have been saved.

The BCM is now ready to use according to factory settings. Refer to table overview on the next page.

**NOTICE!** If the BCM does not work correctly, the function is already assigned to another BCM. Redo the procedure to for an unique function.

- No allocated function
- BCM for driveline 1 (starter motor and any power-user)
- BCM for driveline 2 (starter motor and any power-user)
- BCM for driveline 3 (starter motor and any power-user)
- BCM for driveline 4 (starter motor and any power-user)
- BCM 1 Only power-user (not starter motor)
- BCM 2 Only power-user (not starter motor)
Configuration of Batteries and Accessories

It is possible to select own functions for the power-user batteries. For future use, fill in this information on page: Preferences, page 28.

When the start battery's button/buttons are assigned, an automatic configuration of the battery groups occurs. LEDs light up according to the pattern shown in the table to the right.

- If no buttons are pressed within 30 seconds configuration mode will be left automatically without settings being saved.
- If two breakers are configured to the same name on an unique BCM, these will be synchronized, (opens/closes simuntaneously). Refer to: BCM for large consumers, page 18.

BATTERY 1
(Only applies to BCM connected to power-users, not Starter motor)

NOTICE! All BCM switches need to be off in order to enter switch configuration mode.

1 Activate the configuration mode: Press and hold BATTERY 1 for five seconds. When all LEDs light up for two seconds, the configuration mode is active. A yellow LED on button BATTERY 1 flashes when the configuration mode is active.

2 Select function: Press the BCMs button panel according to the table to obtain corresponding breaker function.

3 Save settings and leave configuration mode: Press and hold BATTERY 1 for five seconds. All of the button LEDs will flash for two seconds to indicate that settings have been saved.

BATTERY 2
Configure according to the same procedure as for BATTERY 1.

NOTICE! All BCM switches need to be off in order to enter switch configuration mode.

1 Activate the configuration mode: Press and hold BATTERY 2 for five seconds. When all LEDs light up for two seconds, the configuration mode is active. A yellow LED on button BATTERY 2 flashes when the configuration mode is active.

2 Select function: Press and hold BCMs button panel according to the table to obtain corresponding breaker function.

3 Save settings and leave configuration mode: Press and hold BATTERY 2 for five seconds. All of the button LEDs will flash for two seconds to indicate that settings have been saved.
Customer adaption of breaker function for button BATTERY 2 and BATTERY 1

- No allocated function
  (No values or function-ID appears in the display)

- Battery group 1

- Battery group 2

- Battery group 3

- Battery group 4

- Accessory 1

- Accessory 2

- Accessory 3

- Accessory 4

- Information and entertainment

- Navigation

- Windlass 1

- Windlass 2

- Stern thruster

- Bow thruster

- A/C, climate facility
## Preferences

Note the customer-adapted settings below.

<table>
<thead>
<tr>
<th>BCM position</th>
<th>BATTERY 1</th>
<th>BATTERY 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCM for driveline 1 (start engine and any power-user)</td>
<td>Start battery/Port start battery*</td>
<td>Default: Accessories 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BCM for driveline 2 (start engine and any power-user)</td>
<td>Starboard start battery*</td>
<td>Default: Accessories 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BCM for driveline 3 (start engine and any power-user)</td>
<td>Center start battery/Port center start battery*</td>
<td>Default: Accessories 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BCM for driveline 4 (start engine and any power-user)</td>
<td>Starboard center start battery*</td>
<td>Default: Accessories 4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*) Locked, automatic assignment upon BCM configuration.

<table>
<thead>
<tr>
<th>BCM position</th>
<th>BATTERY 1</th>
<th>BATTERY 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCM 1 only power-user (not start engine)</td>
<td>Default: Battery group 1</td>
<td>Default: Battery group 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BCM 2 only power-user (not start engine)</td>
<td>Default: Battery group 3</td>
<td>Default: Battery group 4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Changes to the System

After any change of the system, a System identification is to be performed if:

- Components are added, removed or changed. This applies to BCM, Battery Sensor, e-Key Remote Receiver, fuse F4 or battery voltage (12 or 24V).
- The configuration has been changed.

Stand-alone system, non EVC installations

Go to Settings in the Battery Management display and select Set System Configuration. Press OK for verification.

EVC-installations

System identification of the EVC-system is performed during Auto configuration. Refer to booklet: Calibration and Settings EVC.
### Operation

#### Local Control

**NOTICE!** The function Remote disable (button REMOTE DISABLE) is active and default.

- **BATTERY 1:** Turns off/on the power supply for start motor and any power-user.
- **BATTERY 2:** Turns off/on the power supply for selected accessories.
- **CROSS OVER:** Cross over function. Activates cross over function between the batteries connected to the BCM. To secure power-supply.

##### Remote disable

In order to prevent inadvertent activation of the breakers (via the Battery Management display) when working on the boat's electrical system, remote control of the breakers can be deactivated.

Press REMOTE DISABLE (red LED on the button lights up) for deactivation of remote control. The breakers can still be controlled locally on the BCM.

Deactivation/activation is synchronized between all BCMs in the network.

#### Battery Management display

The menus are dynamic depending on the installation. Information about the battery’s voltage as well as menus for battery control and settings are shown as standard.

Warning messages and other pop-up messages are also shown here. At start or during standby mode the display reverts to the view last shown.

- ⏪ ⏫ ⬅️ ⬆️ Scroll through the menus.
- ⬅️ Return to the previous menu.
- ✓ Proceed through the menus/confirm selection(s).
**Settings**

Manage and set viewing of drivelines, groups, batteries and alarm levels in the Battery Management display.

**User Button Configuration.** Battery and Accessory Groups. Set selection of groups to be affected by User ON and User OFF.

**Battery protection.** Set alarm limits and levels for each battery. The values form the basis for when specified levels will alert/switch off to prevent total power loss or battery getting damaged or drained. The menu includes settings for Start Aid and Start Aid Level.

**Display Contrast.** Adjustment of contrast and backlighting.

**Stand-alone system, non EVC installations** also have the menus Language, System Information and Set System Configuration.
Crossover Activate/deactivate the function for each individual BCM.
Settings for Battery Sensor

⚠️ The symbol indicates that settings are required.

**Battery type/size.** State the values stated on the manufacturer's battery. These form the basis for the information shown in the display.

If a new battery or a battery sensor has been connected or removed, select **Reset** and set the current values.

**NOTICE!** Battery type/size is important so that the system is able to present accurate and correct information.

**View Voltage/current**
Relevant voltage and current in the battery.

Press ‹ to view:

**Charging**
Shows remaining capacity (%) (based on the battery's capacity when it was new) and hours remaining until battery is empty. During operations, the number of hours are shown until the battery is empty, and when the battery is charged, the number of hours are shown until a fully-charged battery.

Pressing ‼ again shows:

**The battery's health status**
The value shown is based on full capacity when the battery was new. The battery can have the following status:

- **Excellent** – no action required.
- **Good** – good status but the battery will not achieve its full capacity.
- **Poor** – replace the battery.

The batteries' status (On/Off) for the driveline is shown with a symbol at the bottom of the Battery Management display = Off.

---

**Battery Type/Size**
**Stbd Start battery**

**Battery Grp1 Type/Size**
**Unknown**
**Lead Acid - Flooded**

**Battery Grp1 Size**
**Reset Batt. Param.**

**Set Capacity**

**100 Ah**

---

**Stbd Start Battery**

**13.5 V**

**Stbd Start Battery**

**100 h**

**Stbd Start Battery**

**Excellent**
Factory Default reset

BCM

1: Activate the factory reset mode.
Press and hold CROSS OVER for five seconds. The mode is active when the buttons yellow LED flashes.

2: Request factory reset.
Press and hold all four buttons (BATTERY 2, BATTERY 1, CROSS OVER and REMOTE DISABLE) for five seconds.

The factory reset is complete when all LEDs light up for two seconds.

**NOTICE!** If no buttons are pressed within 30 seconds, factory reset mode will be left automatically without settings being saved.

Battery Management display

1: Activate the factory reset mode
In Settings menu, press and hold \( \Rightarrow \) for 10 seconds.

2: Select type of factory reset:
- Factory Default reset: Resets menu language to English. The other settings will be saved in the BCM.
- Make Stand-alone: The display shall be disconnected from the EVC-system before this selection can be performed.

Confirm selected with \( \text{OK} \).

Maintenance

At regular intervals, make sure the contact surfaces and cable connections are clean and properly tightened.
DECLARATION OF CONFORMITY


Declaration according to Article 3 and Annex II

<table>
<thead>
<tr>
<th>Manufacturer:</th>
<th>AB Volvo Penta</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S-405 08 Gothenburg, SWEDEN</td>
</tr>
<tr>
<td>Product description:</td>
<td>Battery Control Module</td>
</tr>
<tr>
<td>Part number(s):</td>
<td>22609393</td>
</tr>
<tr>
<td>EC-Type examination certificate</td>
<td>IGPVOLV001</td>
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<tr>
<td>EU- Notified Body</td>
<td>IMCI No: 0609</td>
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<tr>
<td>Other directives applied</td>
<td>EMC 2014/30/EU, EN 60945</td>
</tr>
</tbody>
</table>

It is hereby declared that the product described above conforms to the above mentioned Directive(s) and Standard(s).

Name and function:  
Tom Tveitan, Laws and Regulations

Signature:  
[Signature]

Date and place of issue: (yr/month/day) 2016/03/08 Göteborg
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