M9.4 Maintenance Manual

for STM ATB

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Contents

1 Preface

Text, STMA-76732 - This document contains the generic requirements concerning maintenance on STM ATB systems installed in vehicles. The STM ATB doesn't require preventive maintenance and is considered to be a "Line Replaceable Unit". Based on the content of this document and the vehicle specific installation, the system integrator shall compose a vehicle specific maintenance manual for the onboard ATP systems (as far as STM ATB specific items are concerned), taking into account customer requirements.

1.1 What is an STM ATB

Text, STMA-65625 - An STM ATB is a train protection system providing ATB functionality in cooperation with an ETCS system. When integrated with an onboard ETCS system, the combination of STM ATB and the ETCS onboard system ensures all ATB-EG and ATB-Vv functionalities on ATB-EG equipped lines. The specific characteristics of the embodiment "STM" is explained below.

An STM (a “Specific Transmission Module”) is an embodiment of a (national) automatic train protection (ATP) or automatic train control (ATC) system, with the feature of being manageable by an ETCS on-board system. I.e. the ETCS on-board system is master over the STM and can activate and deactivate it. This way transitions between different national ATP/ATC areas, and between national ATP/ATC areas and ETCS areas can be managed in a harmonized way. It allows ETCS equipped trains to operate on conventional (non ETCS) lines.
To optimize the overall configuration, a standard has been developed for the interface between ETCS and the STMs. This interface not only allows the ETCS system to switch on/off the specific ATP/ATC functionality, but also to share generic ATP/ATC facilities provided by the ETCS on-board system:

- Train specific parameters: Parameters entered during "Data Entry" and fixed parameters are sent by ETCS to the STMs
- Speed and distance measurement (odometry): Speed and distance information is sent by ETCS to the STMs
- Driver Machine Interface (DMI): information sent by an STM to ETCS will be presented at the ETCS DMI and inputs given by the driver will be passed by ETCS to the addressed STM.
- Control of traction and brakes (Traction Cut Off and Service/Emergency Brake Commands): Commands to cut of traction of to initiate braking sent by the STM will be passed to the traction and/or braking systems by the ETCS system.
- Cabin selection and driving direction: information concerning the currently selected cabin and the driving direction is sent by ETCS to the STMs.
- Juridical data and diagnostic data storage: The ETCS on-board will take care of storing juridical data and diagnostic data sent by the STM to the ETCS on-board.

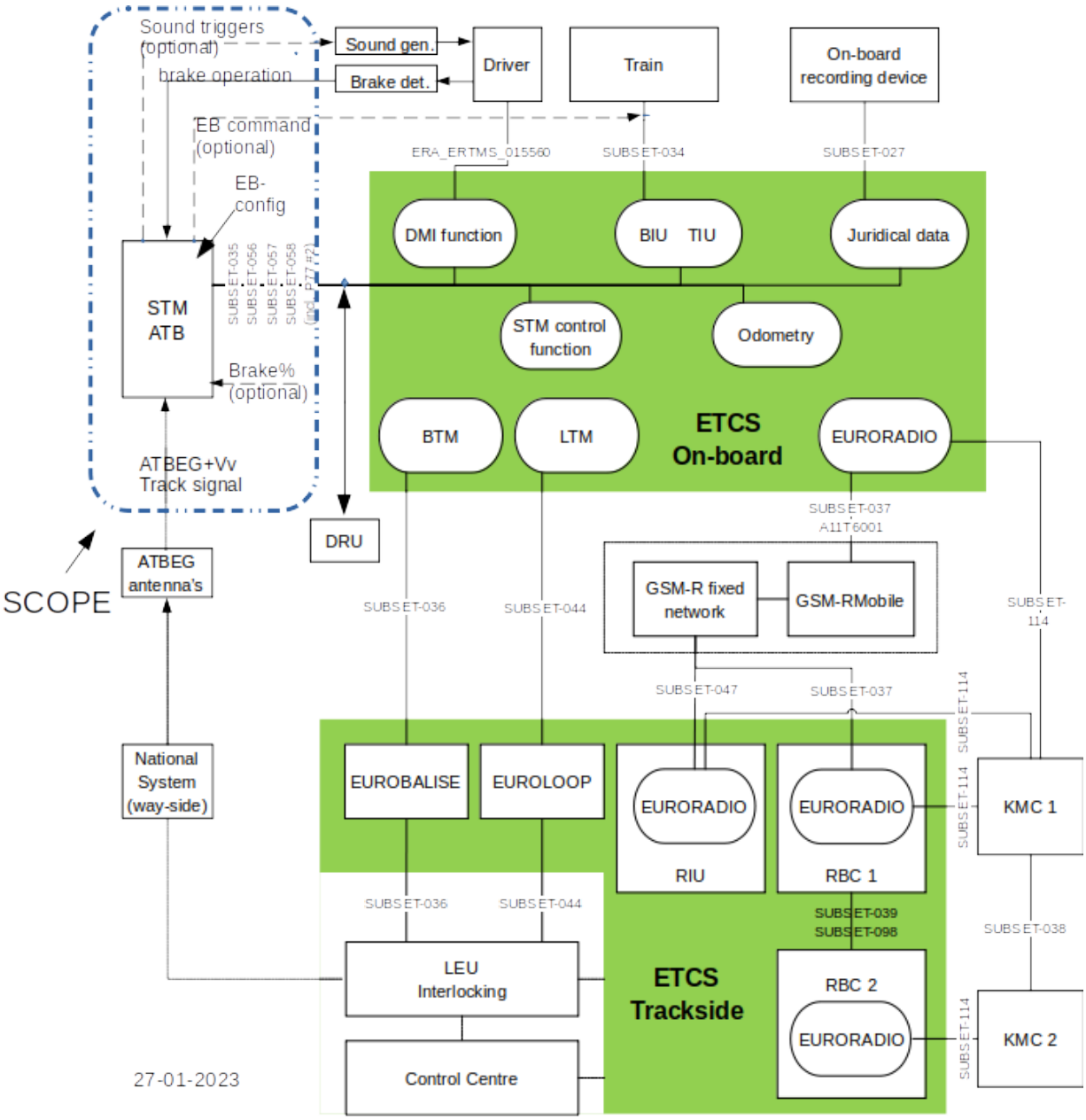
The standardized interface specifications and the way ETCS and STMs should cooperate is defined in ERA ERTMS specifications, specifically in subsets-035/056/057/058/059.

Sharing facilities allows the design of lean STMs which only provide the specific national functionality, mostly analyzing trackside data sent by the national wayside systems and performing the specified protection/control functions.
The use of the ETCS facilities is not mandatory for an STM (only the control of switching on/off is), therefore not all STMs are lean systems.

1.2 Scope

Text, STMA-65620 - Figure STMA-4891 is taken from the ETCS specifications (subset-035 STM FFFIS Specific Transmission Module). It shows the ETCS reference architecture and the integration of STM ATB with the ETCS onboard system. The scope for this installation manual is marked.

Definition, STMA-4891 - (figure)
STM ATB system scope



1.3 References

Text, STMA-14296 - Reference documents

All the documents references used in this document can be found in the document P6.1 Bibliography available in the Polarion folder Processes

Abbreviations, definitions and terminology

An overview of the abbreviations, definitions and terminology used in this document can be found in document P6.2 List of abbreviations, definitions and terms available in the Polarion folder Processes

Requirement identification

The STM ATB project makes use of an automated requirement management system. In this system each requirement has been identified as a work item. Each work item has been automatically assigned with a unique ID, with the format "STMA-<number>". As a result requirement ID's are not in logical order. An overview of all the used STMA-numbers is given in document P6.3 Requirement Overview available in the Polarion folder Processes

1.4 Audience

Text, STMA-80468 - This STM ATB maintenance manual is intended to be used by technical staff responsible for compiling a train type specific maintenance manual for equipment including the STM ATB (mostly an ERTMS onboard equipment).

2 Introduction

Text, STMA-76730 -

The STM ATB has been designed in a way no preventive maintenance is required. This includes the superfluity of calibration of the ATB signal inputs after replacing ATB coils (by a same type), changing the height of the ATB coils after re-profiling the wheels etc. Therefore maintenance is limited to checking the LED status at the front of the unit and analyzing the diagnostic data recorded in the DRU/JRU. The diagnostic data is helpful for fault finding.
In case an STM ATB system fault is detected which cannot be solved by restarting the system, the STM ATB unit shall be exchanged. The latter doesn't require any configuration, i.e. the unit can be exchanged by any STM ATB of the same vendor and version (no rolling stock type dependencies).

Text, STMA-76733 -

The STM ATB has been designed as "line replaceable unit", i.e. the complete system can be exchanged at the line (e.g. at a station). The unit itself shall only be repaired in a workshop or by the supplier.

Text, STMA-76734 -

In case of replacing an STM ATB the replacement shall be a valid version for the concerning vehicle, i.e. a version compliant to the STM ATB specification version with which the vehicle has been homologated.

2.1 Health and safety requirements for maintenance

STMA-76731 - Before removing connectors from the STM ATB the power supply shall be switched off. A description how this shall be done shall be provided per rolling stock type by the system integrator, as this is vehicle specific.

2.2 Electrical environment

Text, STMA-75519 -

For a specific vehicle the system integrator has to determine which STM ATB versions from which vendors can be used in the concerning vehicle.

The system integrator shall document the vendor-versions compatible with the vehicle.

Text, STMA-76735 -

The system integrator shall provide all vehicle specific documentation to the maintenance organization. This documentation shall at least include:

- onboard system design documentation
- hard- and software configuration of STM ATB
- cable assembly of STM ATB
- Bill of Materials
- installation test report
- integration test report
- maintenance guidelines/manual

2.3 Mechanical environment

Text, STMA-76746 - The STM ATB shall be mounted/unmounted only with all cabling removed. The connection and disconnection of the cabling is for a large part depending on the system integration in the vehicle. The system integrator shall describe the way the different connectors shall be (dis)connected. The description shall at least include one picture per connector showing the way the connectors are fixed on the unit.

Text, STMA-76747 - Generic requirements concerning mounting the connectors are equal to the mounting during installation as described in M9.3 Installation Manual

(for description of the cabling, see STMA-68361 - Figure: STM ATB connectivity (schematic / front view)

Text, STMA-74439 - Connecting the STM ATBEG

8. The sequence and way of securing the cabling is vehicle specific and shall therefore be described in the vehicle specific design, choose a convenient sequence for connecting all cables based on the spatial limitations in the CCS cubicle.

Check which sequence for connecting the 8 (or 9) cables STM ATB cables (A/B/C/D/E/F/G/H/J) has been specified in the design.

Text, STMA-74437 - Secure cabling

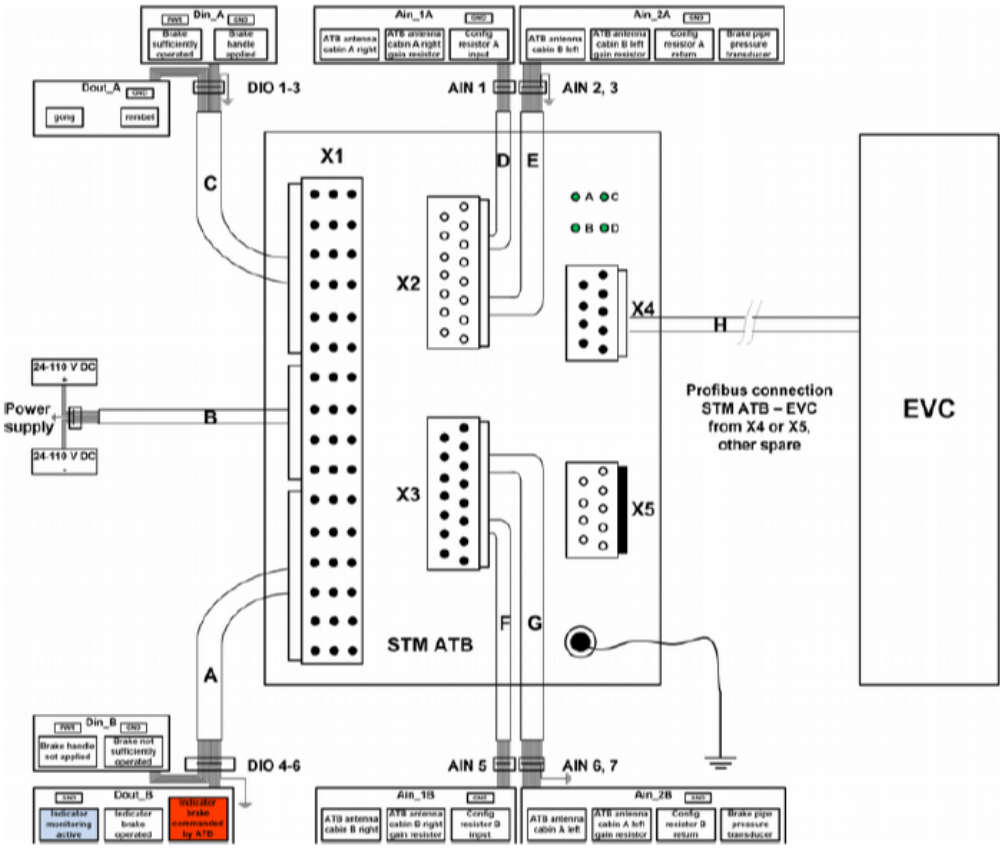
9. Connect all STM ATB cables (8 or 9, according to the design) in the sequence established in step 8:

- 9 cables if both Profibus connectors are used and 8 if only one Profibus connector is used:
- If only one Profibus connector (X4 or X5) is used, cover the spare connector (X5 or X4) with a termination;
- Fasten each cable where appropriate with cable fasteners so that the connectors fit onto the STM ATB and that the connections with the interfaces on the opposite side can be made without straining the cables, allowing for easy (de)installation of STM ATB;
- Connect each cable on the opposite side of STM ATB according to the vehicle specific design.
- Connect each cable connector to the corresponding connector on the STM ATB and fasten the connector hand-tightor as the design requires with the screws/bolts provided by the supplier;

Text, STMA-74440 - Safety check on cabling

10. Check that all STM ATB connections are physically sound and safe:
    - perform both a visual check and mechanical locking of all interfaces;
    - check that the CCS cabinet door closes without putting strain on any cable;

Definition, STMA-68361 - Figure: STM ATB connectivity (schematic / front view)



3 Diagnostics

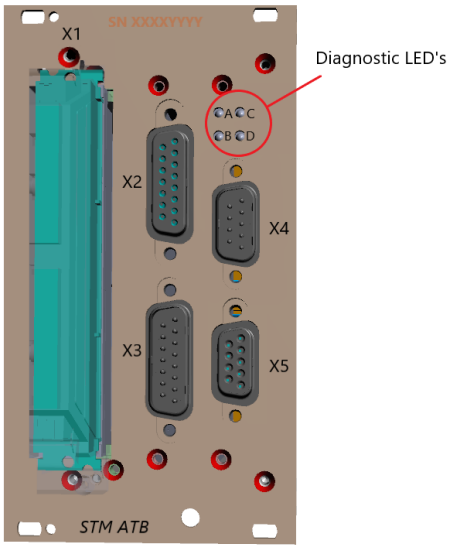
Text, STMA-77731 - Diagnostic information is provided via LED indications at the unit (STMA-75452 - Indications at the unit) and via the JRU interface. The latter consists of three different blocks of information sent using packet STM-161 to the JRU. In this chapter the meaning of the LEDs and each of the three JRU packets is described.
The content of the JRU packets and the meaning of LED A and C at the front are described in STMA-80418 - document containing the content of the JRU messages including text messages for...

Definition, STMA-80418 - document containing the content of the JRU messages including text messages for the DMI and the LED status

3.1 Indications at the unit

Text, STMA-77735 - At the front of the unit 4 three color LEDs are visible. Two of those LEDs (A and C, see STMA-36942) are controlled by the safety processor in the unit, the other LEDs (B and D, see STMA-44279) refer to the status AD converters.

The LEDs status can be used for fault finding.



Text, STMA-80485 -

Figure 1 Front of unit with diagnostic LEDs

Definition, STMA-36942 - The meaning of the LEDs (A and C, controlled by the functional processor) is defined in STMA-80418 - document containing the content of the JRU messages including text messages for...

Text, STMA-77732 - The meaning of LED B and D is defined in table STMA-44279. LED B is used for channel A (coils cabin A-right and cabin B-left) and LED D is used for channel B (coils cabin B-right and cabin A-left).

Text, STMA-44279 - During start-up of the STM ATB, status LEDs B and D blink shortly to indicate the status of the input channels.

LED B, D	Meaning
Red	Not active
Orange	Initialisation
Green	Operational

3.2 JRU format

Text, STMA-80365 - Layout JRU data for STM ATB version STMATB_V1.0914 and up is defined in STMA-80418 - document containing the content of the JRU messages including text messages for...

4 Maintenance activities

4.1 Preventive maintenance

Text, STMA-77738 - The STM ATB doesn't require preventive maintenance, nor configuration when (re)installing, except in case the direct EB outputs are used to control the EB, see STMA-80066 - The test period concerning the EB outputs shall be less than 5000 operational ho... .

The test period concerning the EB outputs shall be less than 5000 operational hours.
The test shall verify the correct behaviour and the effect (EB commanded) for each of the digital outputs separately.

4.2 Corrective maintenance

Text, STMA-77740 -
The STM ATB is a line replaceable unit.
It is up to the user in which cases the STM ATB has to be replaced. All events leading to a safety risk will automatically lead to de-activation of the STM ATB, except in case a direct connection to the EB is used (see STMA-80486 - The STMATB shall be replaced in case of : within 3 months or if one of the EB ou...)

Text, STMA-80486 -
The STMATB shall be replaced in case of
STMA-35270 - Event Flag "EB config input consistency fault": within 3 months or if one of the EB outputs is not effective,
and a direct connection to the EB is used.

4.3 System storage conditions

Text, STMA-77741 - The following storage conditions for STM ATB shall be taken into account:
Storage temperature:

- STM ATB nominal storage temperature is between 10^{o}C and 25^{o}C.
- The ambient temperature shall not change more than 3^{o}C / hour.

Humidity:

- STM ATB shall be stored in dry storage conditions; the humidity may vary between 5 % and 95% (non condensing).

4.4 System disposal

Text, STMA-77742 - System disposal shall comply with regulatory requirements:

- 2012/19/EU WEEE Directive