

# ZUB Track Tester (ZUBTT)

## User Manual

### FCC WARNING

- a. Parts of this device have been tested and found to comply with the limits of Part 18 of the FCC rules.
- b. Parts of this device have been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 subpart B of the FCC rules.

These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

**RF Exposure:** The results of all measured configurations and locations yield a minimum separation distance of 20 cm from any system component in order to comply with FCC RF exposure requirements when used as specified by the manufacturer, installed on top of a Track Coupling Coil. A minimum separation distance of 30 cm is required if the device is used in a standalone configuration transmitting at 100 kHz.

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# 1 Introduction

## 1.1 Purpose and scope

This document describes how to handle the ZUB Track Tester (Equipment Under Test) for commissioning and maintenance of the TGMT Zub wayside equipment (Track Coupling Coil) and the Imu100 track receiver equipment.

### NOTICE

This operation manual is targeted at qualified staffs who are instructed to perform the commissioning or maintenance work of the fix located TGMT Zub wayside equipment only.

Qualified personnel in the sense of this instruction are persons who:

- have an education qualifying them to maintain TGMT Zub wayside equipment and
- have an authorization to commission circuits and instruments according to security standards.

## 1.2 Terms and abbreviations

The following terms and abbreviations are used in this document:

Term / abbreviation	Explanation
BG	Board
FIFO	Storage Operation: First In First Out
FPGA	Logic chip: field programmable gate array
PC	Personal Computer
TCC	Track Coupling Coils
TLG	Telegram
TN	Telegram Number
TT	Telegram part text
TGMT Zub	Traiguard Mass Transit Zub wayside equipment
ZUBTT	Zub Track Tester

**Table 1 Abbreviations**

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## 1.3 References

### 1.3.1 Other valid documents

Reference	Document title	Document ID
[1]	ATP TGMT Zub Operation manual for ZUB TT-Record Program	A6Z00044417005
[2]	ATP TGMT Zub Commissioning Instruction Wayside	A6Z00043050012

Note: Always the latest document version is valid.

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## 2 Safety notices

### 2.1 Overview

To avoid injury or damage, you must carefully observe the safety regulations below. Familiarize yourself with the contents of this document in order to ensure work is carried out safely and correctly.

This section contains general safety information which is of fundamental importance. Specific safety information is given in context.

### 2.2 Typographical representation of safety information

If hazards to persons and material cannot be excluded in the work described, attention is drawn to such hazards by specially highlighted safety notices. The safety notices used are classified according to the severity of the hazard and have the following significance:

**DANGER**

Death or serious injury will occur if you do not take the precautions described.

**WARNING**

Death or serious injury can occur if you do not take the precautions described.

**CAUTION**

Slight injury may occur if you do not take the precautions described.

**NOTICE**

Damage or an undesirable result or state may occur if you do not take the precautions described.

### 2.3 Qualified Staff

**Definition**

As qualified staff as defined in this document, you must meet the following conditions:

- Due to your technical education, know-how and experience as well as knowledge of the relevant regulations, you are able to perform the tasks given to you independently and identify potential risks.
- You have been specially trained and examined for the given work on the described equipment.
- You have been authorized by the operator to perform work on the described equipment in

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accordance with the standards governing railway signaling and safety systems.

## Work to be performed by qualified staff only

- Work on described equipment may only be performed by qualified and authorized staff.

## 2.4 Safety minded work



### WARNING

#### Dangerous operating conditions and risk of accidents due to improper work!

Improper work may cause serious personal injury. As qualified staff, you are responsible for safety.

Observe all regulations and work rules in order to avoid any hazards.

### Observance of regulations

- Observe all safety regulations for your personal safety and for protection of the described equipment.
- Also observe the provisions of the operator and the statutory regulations for the prevention of accidents.

### Work rules

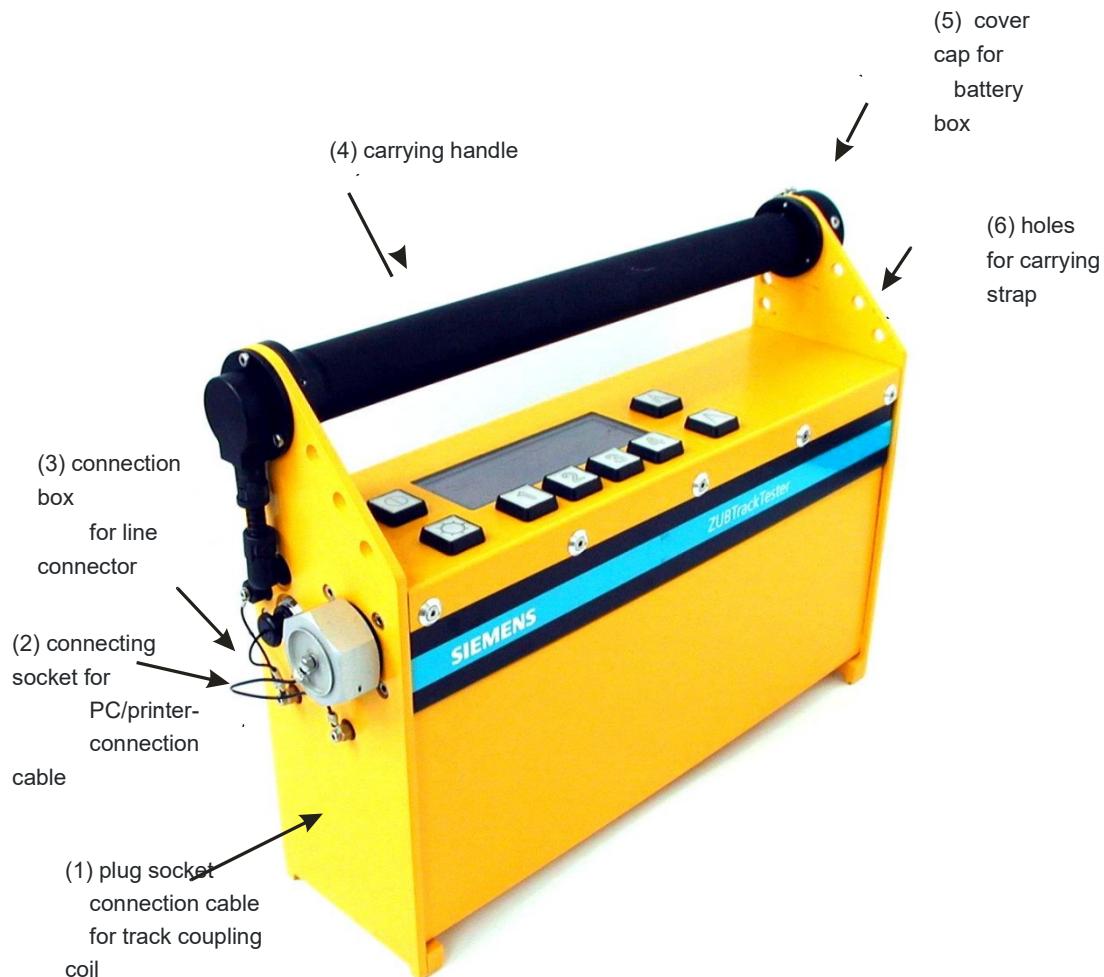
- Only operate the described equipment if it is in perfect working order. Report any defects which have been detected to the authority or person responsible.
- Only carry out the work in such a way that human safety is not compromised or that operation of the described equipment is not impaired in any way.
- Do not carry out any work not described in the document.
- Inform staff of possible incorrect action.

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## 3 Description of parts

### 3.1 ZUB TT-case

The housing of the ZUBTT contains the required hardware components including the rechargeable batteries for the power supply, the transmission and receiving antenna and the factory-configured ZUBTT user-software.



**Figure 3-1** ZUB Track Tester, overview of case

- (1) 14-pin plug socket to connect a connection cable between the ZUBTT and the TCC (see chapter 3.2.4).
- (2) Female connector to connect a connection cable for the communication between the ZUBTT and a PC (see chapter 3.2.5).

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- (3) Connection box for power supply (see chapter 3.2.3).
- (4) Carrying handle with integrated battery box  
It contains the (rechargeable) batteries (7 pieces) for the battery supplied operation of the ZUBTT.
- (5) Cover cap for battery box
- (6) Holes to equip the ZUBTT with the carrying strap.

Lower than the carrying handle, at the topside of the case there are the controls (see Figure 3-2) of the ZUBTT. The functions of the LCD-Display and the pushbuttons will be explained in chapter 3.2.

On the bottom of the side panels of the case there is a positioning facility.

It ensures the correct positioning of the ZUBTT on a TCC. Besides it enables the observance of the gap between the TCC and the integrated antenna for the inductive telegram transmission.

## 3.2 Controls



Figure 3-2 Controls

### NOTICE

The following text will give an explanation of every button and a reference to the chapter in the document, where the button will be explained explicitly.

#### Button „ON/OFF“

By actuating this button the ZUBTT will be switched on or off. (See chapter 4.4.1 and 4.4.2).

#### Button ☀ (Light on)

By actuating this button the background illumination of the LCD-display and the pushbuttons

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will be switched on or off.

60 sec. after switching on the background illumination, the ZUBTT will switch it off automatically (energy saver mode).

#### NOTICE

During power-up of the ZUBTT background illumination of buttons and display is off.

#### **Button $\triangleleft$ „Choose function“**

This button enables to abort the actual function and switch to the main menu “choose function” (see chapter 5.1)

#### **Button $\wedge$ „Back“**

By actuating this button the display will change to the last displayed view. This button is active until the main menu “choose function” will be reached.

#### **Buttons 1-4**

Within the chosen menu the buttons 1-4 have differently assigned functions.

#### **LCD**

The LCD of the ZUBTT is an eight line display. It is possible to display 40 signs per line.

#### **Following equipment will be part of the delivery:**

- 14 batteries
- 2 battery chargers
- power adapter
- connection cable ZUBTT/TCC
- connection cable ZUBTT to PC
- carrying strap

These listed components are separately available as spare parts.

### **3.2.1 Batteries**

There will be needed 7 batteries (type 1.2V NiMH Mono D) for battery operation. For a better availability the ZUBTT is delivered with 7 batteries for the replacement.

### **3.2.2 Battery charger**

The battery chargers will be needed to charge the batteries (see chapter 7.3). It is possible to charge 4 batteries with one battery charger at once. Fully equipped chargers will need a charge time of approx. 6 hours (with delivered batteries).

### **3.2.3 Power adapter**

Alternatively, to the battery operation of the ZUBTT can be supplied by using the

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power adapter (G81001-L3114-H964 - 100-240 V / 50-60 Hz). (See chapter 4.2)

### **3.2.4 Connection cable ZUBTT/TCC**

By using the connection cable ZUBTT/TCC (G81001-L3114-H962-\*) all telegrams stored on the telegram storing units can be read out directly, without switching on the signal aspects.

The connection and the procedure to read out the telegram storing units are described in chapter 0.

### **3.2.5 Connection cable ZUBTT to PC**

It is possible to communicate from the ZUBTT to a PC by using the connection cable (G81001-L3114- H064-\*)�

The connection and the operation will be described in chapter 5.5.4.2 and 5.5.4.3.

### **3.2.6 Carrying strap**

The carrying strap is used for the transport of the ZUBTT.

### **3.2.7 ZUBTT record program**

The “ZUBTT record program” is required to store the telegrams read out from track coupling coils in a database.

From this database it is possible to print the stored contents anytime. The handling of the “ZUBTT record program” will be explained in [1].

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## 4 Operation

For outdoor use the ZUBTT can be employed in battery operation (via batteries). For indoor use it can be supplied by the power adapter.

**DANGER**

At all works at the TGMT Zub system, both the legitimated safety regulations and the instructions by the operator have to be considered.

Works at the TGMT Zub system may only be performed by qualified staff (see 1.1)

**DANGER**

The ZUB Track Tester must not be interconnected with the track coupling coil during the normal operating sequence for read out all telegrams.(via plug X1).

The read out of single telegrams via the air gap is permitted, because this happens nonreactive.

**DANGER**

The safety of the infrastructure cannot be guaranteed after unauthorized intervention of the wiring or the saved programs (Zub telegram store unit).

**NOTICE**

After repair, caused on disturbance of the TGMT Zub wayside equipment, a commissioning has to be performed again and has to be documented.

### 4.1 Battery operation

During the mobile usage of the ZUBTT the power supply will be realized by 7 batteries within the carrying handle. It is possible to use commercially available batteries (1.5 V Mono D, min. 5000 mAh) or rechargeable batteries (1.2 V NiMH Mono D, min. 5000 mAh).

For a better availability it is recommended to use rechargeable batteries.

Therefore, the delivered rechargeable batteries have to be used (see chapter 3.2.1). The charging of the batteries is described in chapter 7.3.

To insert the batteries, the cover cap must be opened by turning to the left and pushing the back of the cap simultaneously.

Afterwards the charged batteries have to be entered (+ in direction to the battery box) and the cap has to be fitted by pushing and turning to the right.

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**NOTICE**

Ensure the correct input voltage setting of 110 V AC at the power adapter before use.

## 4.2 Mains operation

For stationary using of the ZUBTT the power supply can be realized with the delivered power adapter (100-240 V / 50-60 Hz).

After replacing the protecting cap and insertion of the power adapter cable plug into the connection box for power supply, the power supply (Figure 3-1) from batteries will be stopped automatically.

**NOTICE**

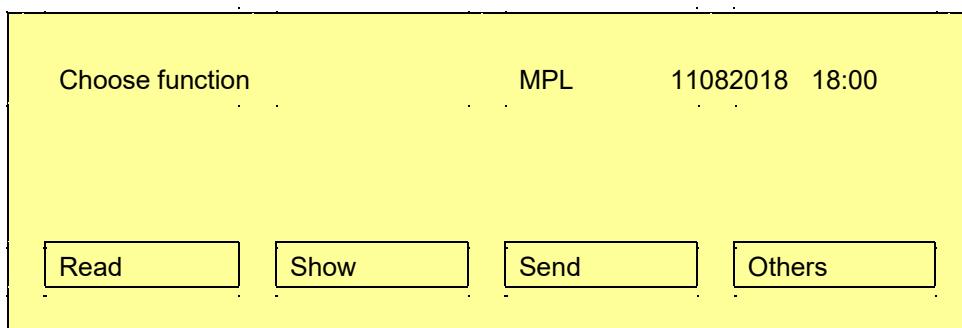
There is no automatic charging action during the mains operation.

For protection against dirt or surface moisture after using the mains operation the protection cap has to be screwed onto the connection box again.

## 4.3 Configuration of ZUBTT

Before delivering the ZUB Track Tester the operator-specific telegram structure application software will be configured and installed to the Track Tester.

The factory provided configuration of the ZUBTT will be displayed in the first display line on the right in all views with name “MPL”.



**Figure 4-1** Display view after switching on the ZUBTT

**NOTICE**

Changing the configuration data of the application software are barred by the software.

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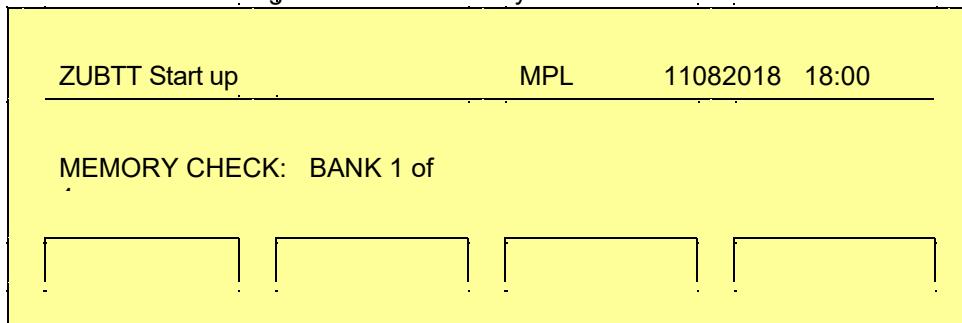
The date next to the name "MPL" and the time are preset during the configuration of the ZUBTT by the producer. Should this data be out of date it is possible to change them as described in chapter 5.5.4.6.

## 4.4 Availability

Before using the ZUBTT, it should be tested if it is operable. This will be generally proofed by an automatic check of the memory and the batteries state of charge during startup.

### 4.4.1 Switch-ON

The ZUBTT turns on by pressing the "ON/OFF" button (see Figure 3-2). The ZUBTT then is starting with a CRC memory check.



**Figure 4-2** Display view "Switch-ON"

After the successfully realized memory check (bank 1-4) the display changes to the view "choose function" automatically.

In the case that the test does not end successfully, the display is showing the following message:

MEM ERR: CRC, BANK X, CRC=XXXXX(XXXXX)

BANK X X stands for the bank, which was causing the CRC-failure

CRC XXXXX stands for the calculated CRC and (XXXXX) is showing the correct CRC

If the message 'BAT.LOW' is shown in the display the batteries are almost empty. It is recommended to change the batteries as soon as the message is shown for the first time. For changing the batteries see chapter 7.2.

### 4.4.2 Switch-OFF

The ZUBTT is turned off by pressing the button "ON/OFF" (see Figure 3-2). Caused on a better availability the ZUBTT switches off after a pre-defined programmed time (when no button is actuated). To program the time of an autonomous switch-OFF see chapter 5.5.4.7.

#### NOTICE

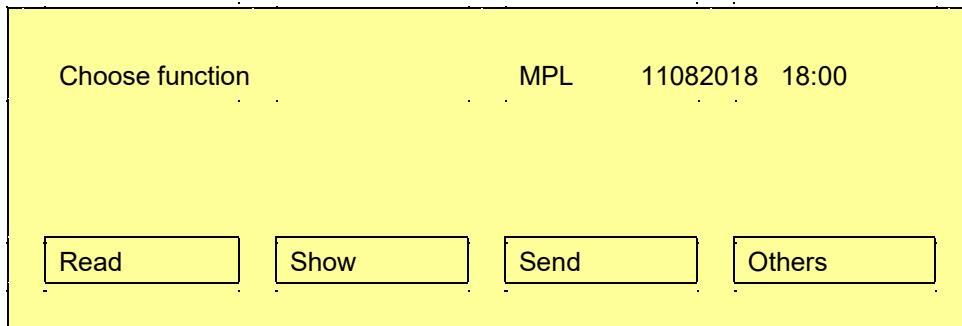
Earlier read out telegrams, which were stored in the memory buffer 1 - 3 (see chapter 5.2.4) will be kept in the storage after the switch-off. Telegrams stored in the read out buffer will be deleted after switching off the ZUBTT.

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## 5 ZUBTT functions

### 5.1 Main menu “Choose function”

After switching on the ZUBTT and successfully passed memory test the ZUBTT changes into the main menu “choose function”.



**Figure 5-1** Display view “Choose function”

The “Read” button is used if the ZUBTT has been prepared for reading out a track coupling coil or a loop.

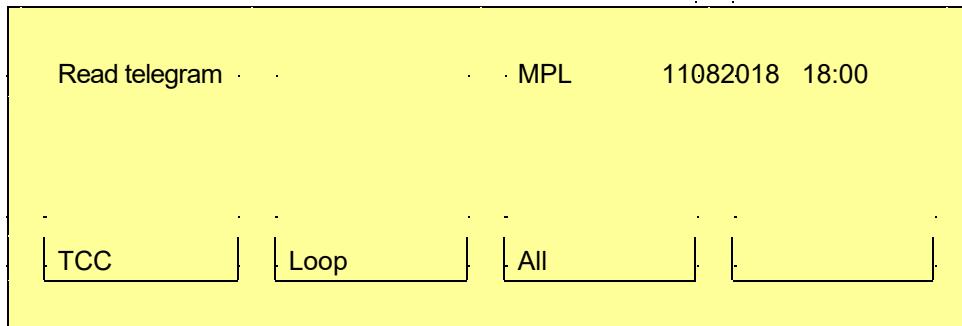
The “Show” button is used to show a telegram when a telegram has previously been saved or a reading just made.

The “Send” button is used to transmit an IMU-telegram stored on the ZUBTT to an IMU-receiver terminal (see chapter 5.4).

The “Others” button has to be chosen if other functionalities, as described in chapter 0, will be used.

### 5.2 Menu “Choose function/Read”

When a telegram from a track coupling coil or a loop shall be read, actuate the button “Read” in the menu “choose function” (see Figure 4-1). After actuating the ZUBTT automatically changes to the “Read telegram” view.



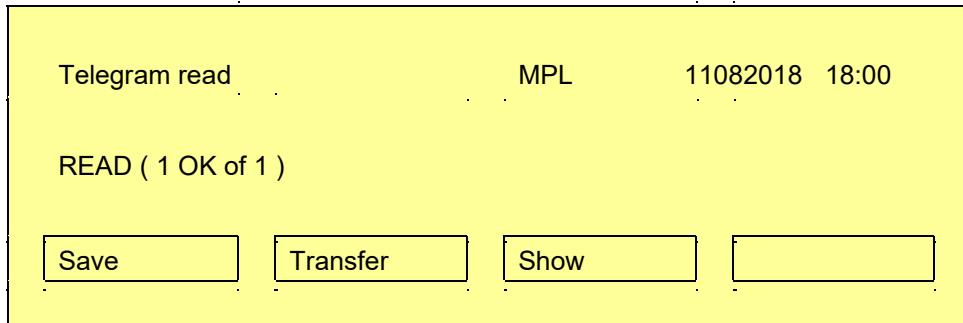
**Figure 5-2** Display view “Read telegram”

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### 5.2.1 Function “Read telegram/TCC”

If a telegram shall be read from a track coupling coil, the ZUBTT has to be placed in the middle of the track coupling coil. The positioning facilities on the side panels enable the precise positioning.

By choosing the button “TCC” in the menu “Read telegram” (see Figure 4-2) the telegram from the track coupling coil will be read out. During the reading procedure the display emits the text “In progress”. After reading out the telegram, the ZUBTT-display view changes to “Telegram read”.



**Figure 5-3 Display view “Telegram read”**

The read telegram will be stored to the read out buffer automatically. Actually, existing telegrams in the read out buffer are overwritten.

When the reading has ended it is possible to save, show or transfer (PC connection required) the read telegram to a PC. The required conditions and operations for the data transmission are explained in chapter 5.2.5 and 5.5.4.2.

#### NOTICE

It is recommended to store the telegram on a permanent buffer 1-3, because data stored on the read out buffer will be overwritten after a new reading or deleted after switching off the ZUBTT.

### 5.2.2 Function „Read telegram/Loop”

– This function is not used.

### 5.2.3 Function „Read telegram/All”

The ZUBTT allows the possibility to read all telegrams stored to a telegram storage device of a track coupling coil with one reading operation. To realize this reading operation, the connection between Zub- Interface BG and the track coupling coil must be cut. Then the track coupling coil must be directly connected to the ZUBTT.

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## CAUTION

By cutting the connection between the track coupling coil and the Zub-Interface BG the secure function of the facility cannot be guaranteed.



## DANGER

This reading operation must be carried out with direct agreement by the responsible in-house staff and outside the operating time of the passenger transportation.

Preparation work for reading:

- Remove the locking plate of terminal-plug X1 from the track coupling coil
- Loosening and pull down the terminal plug X1 by using a spanner (size 46)
- Insert the 6-pin plug of connection cable ZUBTT/TCC (G81001-L3114-H962-\*) and fasten the cap nut hand tight
- Screw off the hex screw cap from the plug socket of the ZUBTT (Figure 3-1)
- Insert the 14-pin plug of the connection cable to the socket plug and fasten the cap nut hand-tight
- Place the ZUBTT in the middle of the TCC

After confirming the button “All” in the submenu “Read telegram” (Figure 5-2) all possible code-combinations will be triggered successively and the stored telegrams of the telegram storing units are read out.

During read out of the telegrams, the following message is displayed:

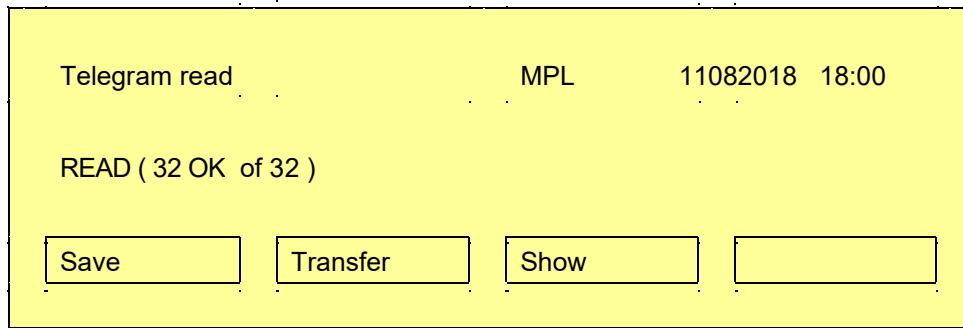
Reading TLG: X of XX (X = numeral)

The actual read out process can be cancelled by actuation of the button “Cancel”.

The read telegram will be stored to the read out buffer automatically. Actually, existing telegrams in the read out buffer are overwritten.

After reading operation “All”, the result of the reading operation is shown.

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**Figure 5-4 Display view „Telegram read (32 of 32)“**

When the reading has ended it is possible to save, show or transfer (PC connection required) the read telegrams to a PC. The required conditions and operations for the data transmission are explained in chapter 5.2.6 and 5.5.4.2.

**NOTICE**

It is recommended to store the telegrams on a permanent buffer 1-3, because data stored on the read buffer will be overwritten after a new reading or deleted after switching off the ZUBTT.

After reading the telegrams the connection cable between ZUBTT and TCC must be removed to renew the previous condition:

- Remove the connection cable from plug socket of the ZUBTT
- Place the screw cap on the plug socket and fasten it hand tight
- Remove connection plug from the TCC socket X1
- Insert connection-plug 1 of the connection cable between Zub-Interface-BG and TCC to plug socket 1 of the TCC
- Tighten the cap nut of the connection cap with a torque wrench to 29.5 lb-ft (40 Nm)
- Mount the locking plate and fix it with hose clamps



**DANGER**

Before opening the Zub-wayside equipment for the operational use in the passenger transportation, all safety relevant functions have to be checked according the [2].

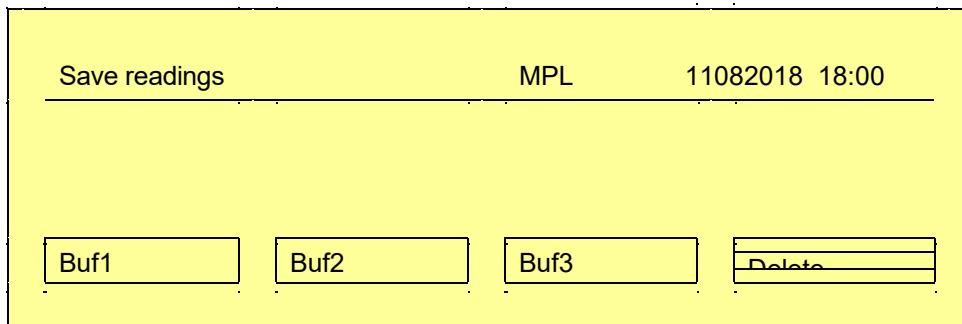
## **5.2.4 Function “Read telegram/.../Telegram read/Save”**

After reading operation (chapter 5.2.1, 5.2.2, 5.2.3) the read data are saved in the read out buffer. Actually, existing telegrams in the read out buffer become overwritten.

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If read telegrams will be needed later, for example for documentation (Transmission to PC), they should be saved to the permanent buffer.

After actuating the “Save”-button in the submenu “Telegram read” (Figure 5-1) the ZUBTT changes to the view “Save readings”.



**Figure 5-5 Display view “Save readings”**

By actuating the button (Buf 1-3) dedicated to the memory location (1, 2 or 3) the saving to the chosen buffer will be affected. In the menu line of the display the approval “Reading saved” appears.

#### NOTICE

The occupied buffer is marked after reading a TCC and actuating the “Save” button with the hint “Data”.

#### NOTICE

There is no request before saving the telegram to an occupied buffer.

If the buffers 1-3 are occupied by saved telegrams before, the possibility to delete all buffers at the same time is given by actuating the “Delete”-button and then the “All”-button.

The button “Delete” will be shown as passive after actuating the button “All” (crossed out text in the box over the function button). The button “Delete” becomes active as soon as a telegram is saved again.

## 5.2.5 Function “Read telegram/.../Telegram read/Transfer”

The ZUBTT offers the possibility from menu “Read telegram/.../Telegram read” by actuating the button “Transfer” to transmit a telegram directly from a TCC or a loop to a PC.

To realize the communication between the ZUBTT and PC, the communication cable ZUBTT/PC (G81001-L3114-H064-\*) must be used.

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In addition, the data interface between ZUBTT and PC must be configured. The procedure is explained in chapter 5.5.4.2.

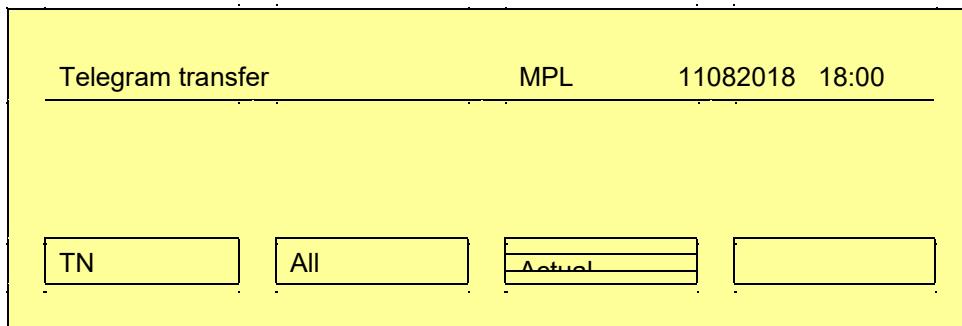
#### Preparation work for reading

- Loosen the screw cap of the plug socket at the side plate of the ZUBTT (Figure 3-1).
- Insert the 9 pin connector in the plug socket (red marking on the connector to the top)
- Plug in the 9-pin Sub-D connector to the PC
- Configure the interface ZUBTT/PC (acc. to chapter 5.5.4.2)

If only one telegram was read, the transmission to the PC is effected immediately after actuating the button "Transfer" in the submenu "Telegram read" (Figure 5-1).

After the correct transfer the ZUBTT changes into the menu "Telegram transfer" automatically.

If more telegrams than 1 were read, it is possible to choose the telegram, which should be transferred, by actuating the "TN" (telegram number) button. For the case that all telegrams in memory should be transferred, the button "All" can be actuated.



**Figure 5-6** **Display view "Telegram transfer"**

During the transfer, the button "All" is active and the display shows, the following information:

Printing TLG: X of 31 (X = numeral).

After the correct transfer the ZUBTT changes into the menu "Telegram transfer" automatically.

#### **NOTICE**

The button "Actual" has no function in the MPL project.

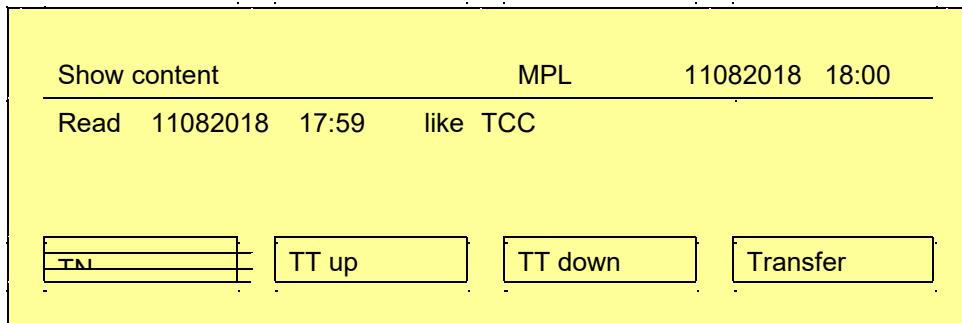
The data, which will be transferred to the PC, have the same format as explained in chapter 5.5.1.

### **5.2.6 Function "Read telegram/.../Telegram read>Show"**

After actuating the button "Show" in the menu "Read telegram/.../Telegram read" the display changes, dependent of the reading (TCC, Loop or All), into the following view.

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Sample display view after reading a telegram from a track coupling coil (TCC):



**Figure 5-7 Display view “Show content” after function “Read as TCC”**

The views from function “Show content” are only different in the explanatory text in the menu line “Read...Time...like TCC, Loop or All”.

The button “TN” will be marked as inactive after reading one telegram of a “TCC”. If “All” telegrams are read, the “TN” button is active.

In this submenu, with the function buttons 1-4 the following specified views can be generated:

- **Function button “TN” (telegram number):**  
By actuating this button, the telegram to be shown can be chosen.  
If only one telegram was read before, then the textbox “TN” becomes inactive.  
If the function button “TN” is active, the telegram number can be increased by actuating the “TN” button. After reaching the highest value, the counting starts again.
- **Function button “TT up” (showing the telegram text from down to top):**  
By actuating the button “TT up” once, the last line of telegram content will be shown. By repeated actuating the following upper lines will be shown
- **Function button “TT down” (showing the telegram content from top to down):**  
By actuating the button “TT down” once, the first line of telegram content will be shown. By repeated actuating the following subjacent lines will be shown
- **Function button “Transfer”**  
By actuating this button “Transfer” it is possible to transfer the shown telegram directly to a connected PC (see chapter 5.2.5)

After transferring, the ZUBTT changes in the submenu “Show content”

### 5.3 Menu “Choose function/Show“

This menu will be chosen, if the telegrams saved to the buffer should be shown on the display or transmitted to a PC.

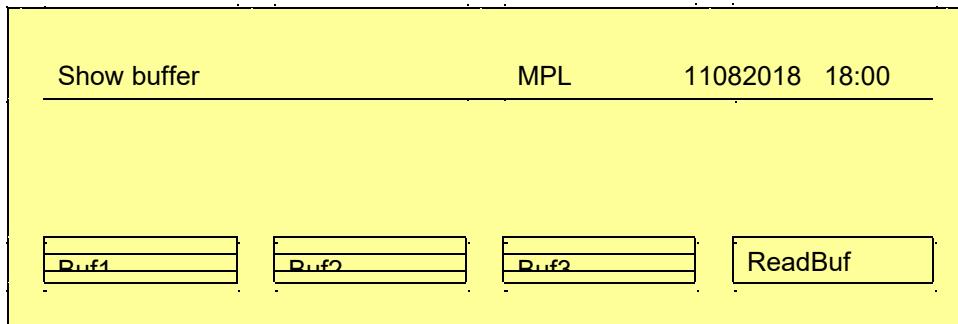
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## NOTICE

If there was no reading operation after switching on the ZUBTT (read buffer not occupied) and the permanent buffers are not occupied, then the button "Show" in the view "Choose function" is inactive (Crossed out text in textbox over the function button).

### Function "Show/Show buffer"

After actuating the "Show" button in the main menu "Choose function" the ZUBTT changes to the submenu "Show buffer"

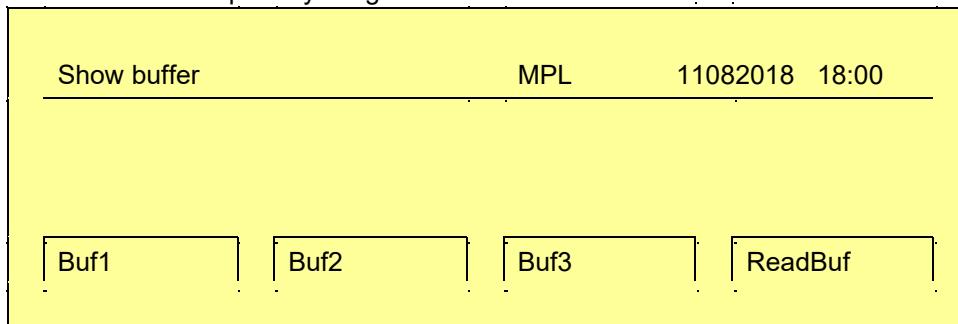


**Figure 5-8 Display view "Show buffer" (only read buffer occupied)**

If there is no telegram stored to the buffer (1-3) then the text boxes are inactive as shown in Figure 5-8. The read buffer is shown in Figure 5-8 as occupied with a telegram.

The content of the read buffer can be shown by actuating the "ReadBuf" button.

In the following display view the buffer 1, buffer 2 and buffer 3 and the read buffer are occupied by telegrams.



**Figure 5-9 Display view "Show buffer" (all buffers are occupied)**

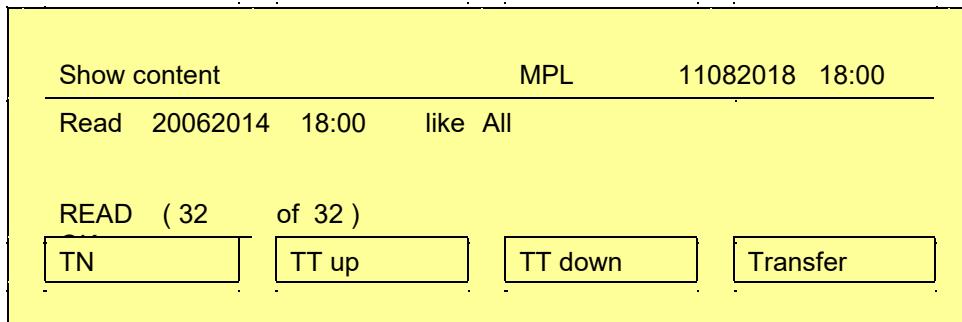
To select the needed buffer content, the dedicated function button to the buffer has to be actuated.

### 5.3.1 Function "Show/Show buffer/Content" (Content of the buffer)

After actuating the dedicated function button the display view underneath the menu line is showing the receipt of the reading with date, time and kind of telegram and the message if the telegram has been read accurately.

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In the following exemplary display view (Figure 5-10) the content of the buffer would be generated by reading “All” (all telegrams from TCC). All 32 telegrams could be read accurately.



**Figure 5-10 Display view “Show buffer/show content”**

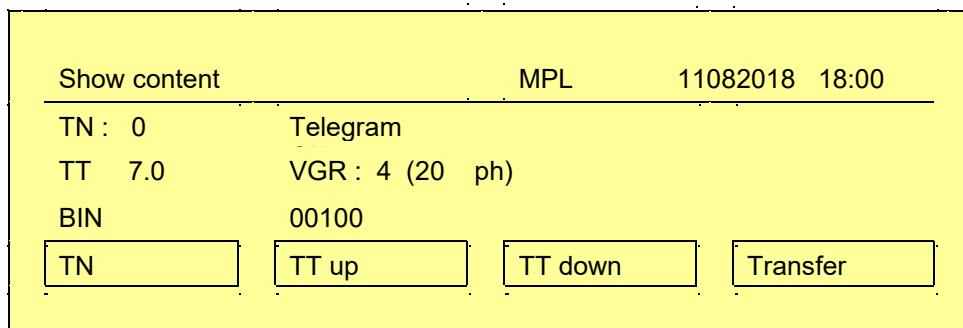
By actuating the function buttons 1-4 in this submenu (Figure 5-10) the following views can be generated:

- If the chosen buffer contains only one telegram (from TCC or loop), then the function button “TN” (next telegram number) is not active. If the function button “TN” is active (all telegrams from TCC are read out), the actuating causes the increasing of the telegram number. After reaching the last telegram number, the counting starts again.
- **Function button “TT up” (showing the telegram text from down to top):**  
By actuating the button “TT up” once, the last line of telegram content will be shown. By repeated actuating the following upper lines will be shown.
- **Function button “TT down” (showing the telegram content from top to down):**  
By actuating the button “TT down” once, the first line of telegram content will be shown. By repeated actuating the following adjacent lines will be shown.
- **Function button “Transfer”**  
By actuating this button “Transfer” it is possible to transfer the shown telegram directly to a connected PC (see chapter 5.2.5).

By actuating the function buttons “TT up” and “TT down” it is possible to show all telegram parts of the read telegram in the display.

If the displayed telegram bases on the reading “Read telegram/All”, by actuating the function button “TN” it is possible to change to the next read telegram, as explained before.

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**Figure 5-11 Display view “Show buffer/show content”**

Instead of the telegram content one of the following messages

can appear: EMPTY TELEGRAM

- Will be shown if the actual telegram is empty NO TELEGRAMS RECEIVED
- Will be shown if no telegram is received

Explanation of the display view using the example of Figure 5-11:

- First line:  
shows the actual menu (Show content)  
Configuration of ZUBTT (MPL)  
actual date (can be set acc. to  
chapter 5.5.4.5) actual time (can  
be set acc. to chapter 5.5.4.5)
- Second line:  
Is showing the telegram number (TN) of displayed telegram  
Status of the displayed telegram after completed reading  
operation
- Third line: Telegram part of the telegram and its  
description.
- Fourth line: Binary code of the read telegram part

**NOTICE**

By actuating the buttons  $\bowtie$  „Choose function“ or  $\wedge$  „Back“ the view can be aborted.

## 5.4 Function “Choose function/Send”

The function “Send” enables to send pre-defined telegrams to the receiving facility in the track.

After actuating the “Send” button in the main menu “Choose function” the ZUBTT changes to the submenu “Choose telegram”.

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### 5.4.1 Function „Send/Choose telegram“

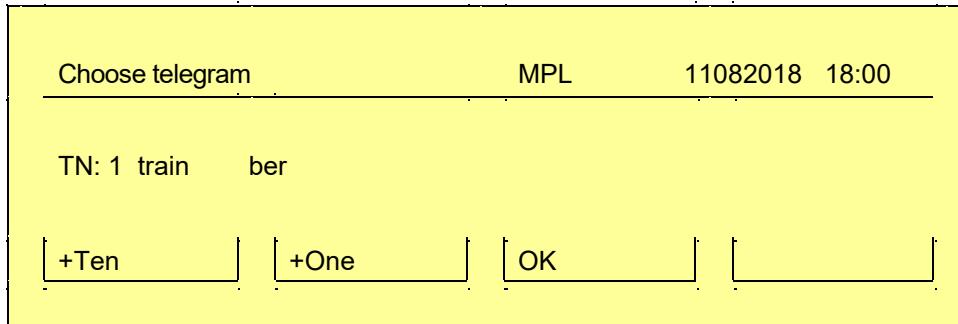


Figure 5-12 Display view “Choose telegram”

By actuating the function buttons “+Ten” or “+One” the telegram to be send can be chosen. By actuating the function button “OK” the ZUBTT changes to the view “Send type”.

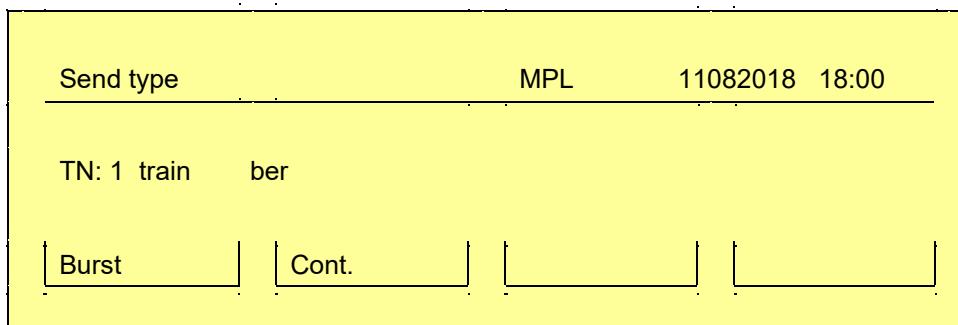


Figure 5-13 Display view “Send type”

It can be chosen, if the telegram should be send continuously (Cont.) or intermittent (Burst). If the telegram should be sent continuously (Cont.), the telegram is send over a period of 10 min every 10 ms. The actual send process can be cancelled by actuation of the button “Cancel”. If the telegram should be sent intermittent (Burst), the telegram is send over a period of 500 ms every 10 ms.

## 5.5 Function “Choose function/Others”

After actuating the function button “Others” in the menu “Choose function” (Figure 5-1) the ZUBTT changes to the view “Choose others” (Figure 5-14).

The function button “Print” will not be used in this project (5.5.1).

The function button “Save” is used to save the last read telegram to a permanent buffer (5.5.2).

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The function button “Test” is causing a functional self-test of the ZUBTT (5.5.3).

The function button “Setup” will be used for different parameterization actions of the ZUBTT. These are described in chapter 5.5.4.

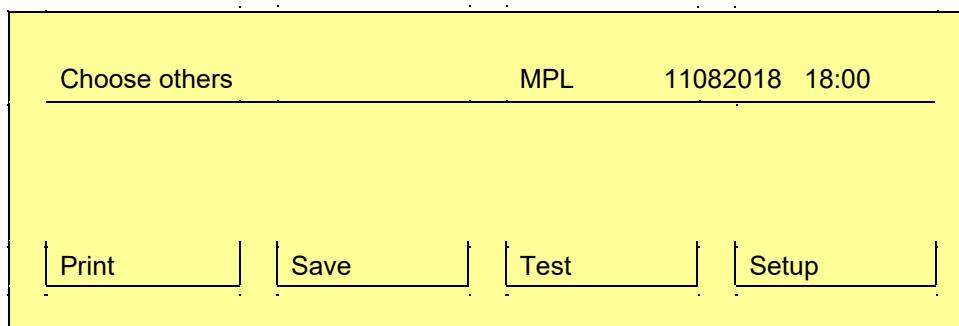


Figure 5-14 Display view “Choose others”

### 5.5.1 Function “Others/Print”

This function will not be used.

### 5.5.2 Function “Choose others/Save”

This function is consistent to the described function “Read telegram/.../Telegram read/Transfer” (see 5.2.4).

### 5.5.3 Function “Choose others/Test”

After actuating the button “Test” in the menu “Choose function” (Figure 5-14) the ZUBTT changes to the menu “Self test activated” (Figure 5-15).

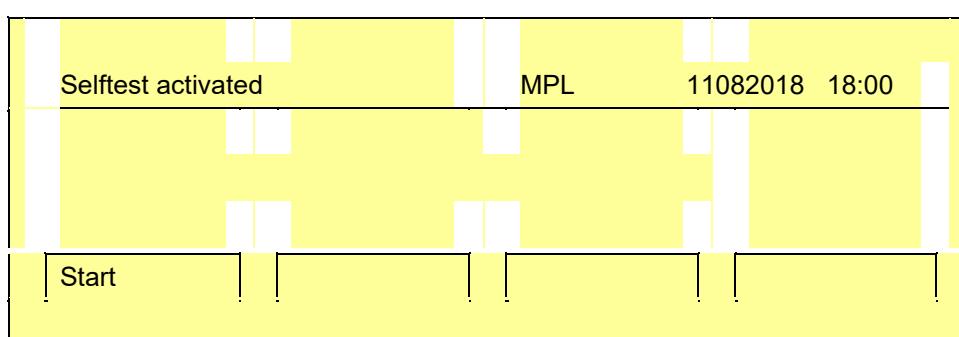


Figure 5-15 Selftest activated

From this menu the self-test can be started by actuating the function button “Start”.

During the self-test the following elements will be checked.

- Display: All pixels of the display will be switched on and off. The user has to check optically, if the pixels work correct.

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**NOTICE**

For this check no error messages will appear. The user has to decide whether the display has a pixel fault.

- Program memory (EPROM):

At the test of the program memory a test value will be calculated and checked to a saved original test value. If both values differ, the program memory is defective and an error indication (see chapter 6.2) will be displayed.

- Memory (RAM)

All memory elements will be checked one after another, to check if they work correctly. During this test data will be written in each element and read out after it.

This test will be operated so that the saved telegrams saved to the buffers will be available after the test too.

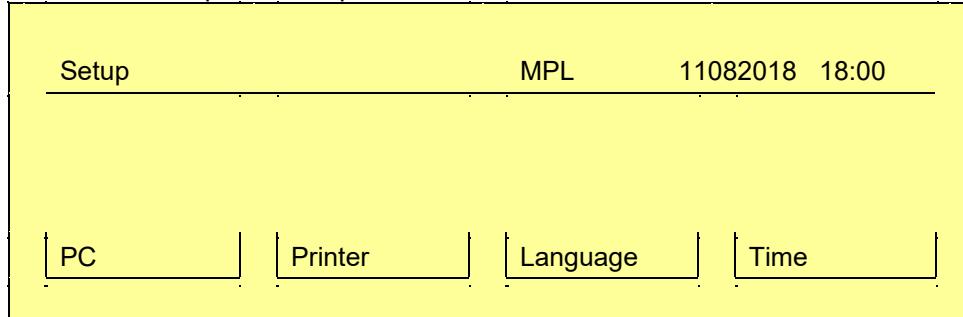
The self-test ends successfully if the following message appears on the display:

Self testing: OK

If the self-test was not successful, an error message appears on the display (see chapter 6.2).

### 5.5.4 Function “Choose others/Setup”

In this menu it is possible to parameterize the ZUBTT.



**Figure 5-16 Setup**

The function button “PC” will be used to configure the communication connection to a PC.

The function button “Printer” will not be used in this project.

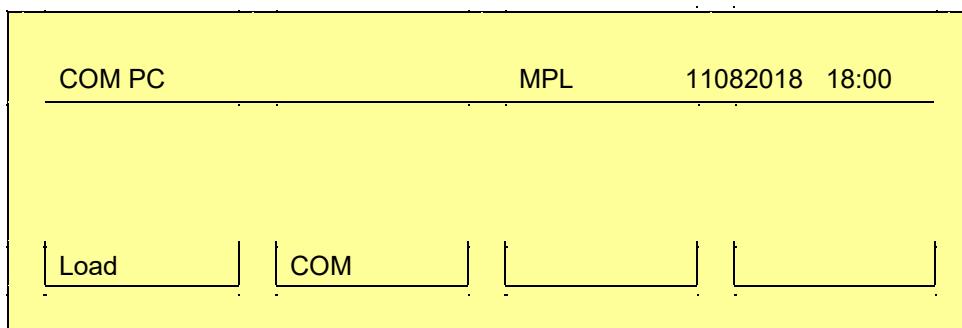
The function button “Language” will be used to change the language of the ZUBTT (German/English).

The function button “Time” will be used to actualize the date, the time and configure the switch off time of the ZUBTT if inactive.

#### 5.5.4.1 Function “Others/Setup/PC”

After actuating the function button “PC” in the submenu “Others/Setup” (Figure 5-16) the ZUBTT changes to the “COM PC” (Figure 5-17).

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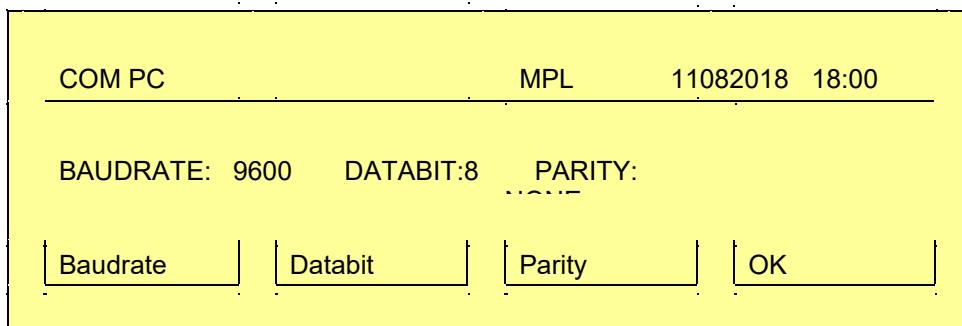


**Figure 5-17 Display view “COM PC”**

The function button “COM” will be used to configure the data communication to a PC.

#### 5.5.4.2 Function “Others/setup/PC/COM”

Before the ZUBTT can communicate with a PC, the data communication has to be configured. The adjustments, which must be chosen, are dependent on the COM-Interface configurations of the PC. The configuration of the ZUBTT and the COM-Interface of the PC must be identical.



**Figure 5-18 Display view “COM-PC”**

By actuating the function buttons (Baudrate, Databit or Parity) the dedicated values can be changed. Actuating the button once causes a step-up to the next highest value. If the maximum value is reached, the counting starts with the smallest value again.

- Baud rate: 300, 600, 1200, 2400, 4800, 9600, 19200 or 38400
- Data bit: 5, 6, 7 or 8
- Parity: ODD, EVEN or NONE

Actuate the button “OK”, if all adjustments are done. The data communication to the PC now is adjusted.

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## NOTICE

If the ZUBTT will be connected to another PC, the Adjustments must be checked and maybe corrected again.

## NOTICE

The adjustment in this menu is only valid for the connection with a PC. The transmission to a PC is characterized by the marking of the function button: "Transfer".

### 5.5.4.3 Function „Others/Setup/printer“

This function will not be used.

### 5.5.4.4 Function „Others/Setup/language“

A change of the language is possible within the given choice (German, English).

### 5.5.4.5 Function „Others/Setup/Time“

After actuating the function button "Time" in the menu "Others/Setup" (Figure 5-16) the ZUBTT changes to the menu "Time setup" (Figure 5-19).

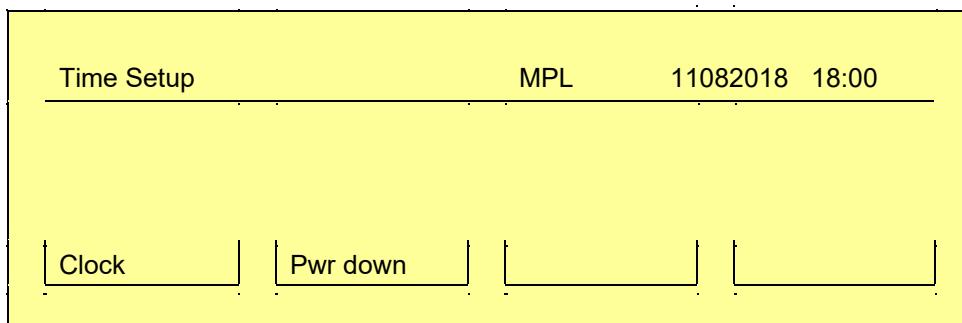
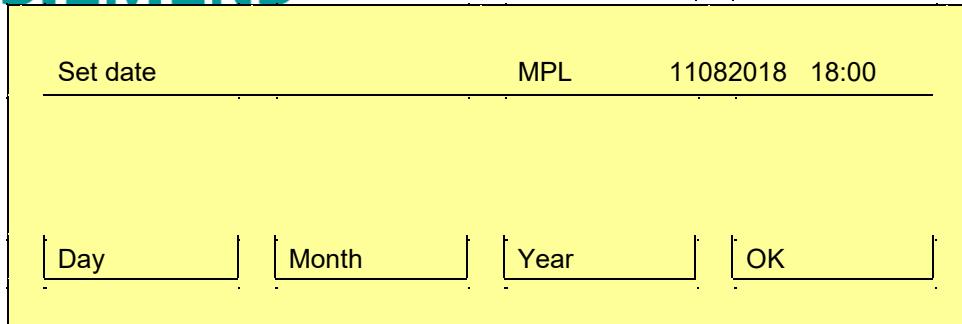


Figure 5-19 Display view "Time Setup"

### 5.5.4.6 Function „Others/Setup/Time/Clock“

The ZUBTT uses the date and the time, to give a time-stamp to the read telegrams. Therefore, it is important to keep these values up to date. To change the time or date, observe the following instructions: After actuating the button "Clock" in the menu "Others/Setup/Time" the ZUBTT changes to the view "Set date" (Figure 5-20).

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**Figure 5-20** Display view “Set date”

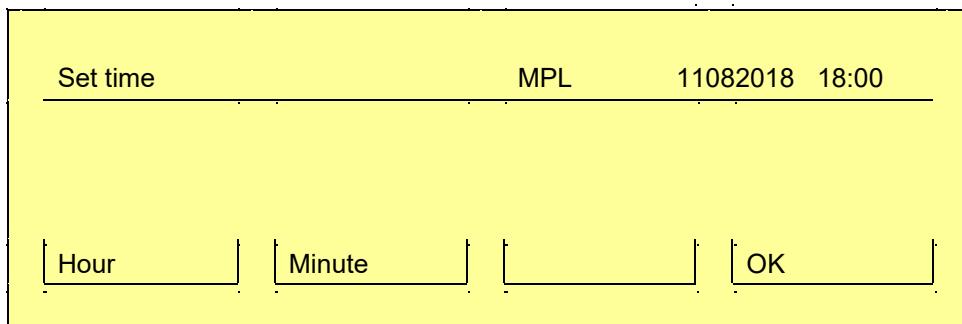
By using the function buttons it is possible to change the dedicated values (Day, Month, Year). Actuating the button once causes a step-up to the next highest value. If the maximum value is reached, the counting starts with the smallest value again.

**NOTICE**

The year dates are given from the year 2000 until the year 2030.

In the future an update of the ZUB TT software will ensure that it can still be used beyond 2050.

By actuating the function button “OK” the adjusted date will be saved and the ZUBTT changes to the view “Set time” ( ).



**Figure 5-21** Display view “Set time”

By actuating the function buttons (hour or minute) the dedicated values can be changed. Actuating the button once causes a step-up to the next highest value. If the maximum value is reached, the counting starts with the smallest value again.

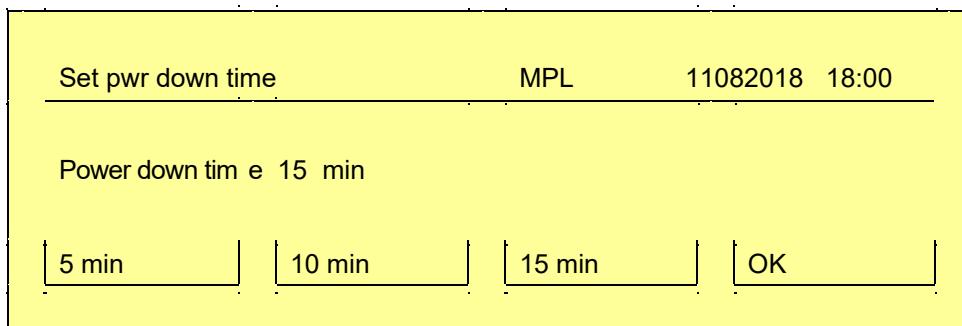
By actuating the function button “OK” the adjusted time will be saved and the ZUBTT changes to the view “Choose others” (Figure 5-14).

#### **5.5.4.7 Function “Others/Setup/Time/Pwr down”**

In this menu it is possible to change the pre-set time until the ZUBTT switches off automatically to save energy after the last button actuation.

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After actuating the button “Pwr down” in the menu “Others/Setup/Time” (Figure 5-19) the ZUBTT changes to the view “Set pwr down time” (Figure 5-22).



**Figure 5-22** Display view “Set pwr down time”

By actuating the function buttons (5 min, 10 min or 15 min) the switch off time of the ZUBTT can be changed. By actuating the function button “OK” the adjustment will be saved and the ZUBTT changes to the view “Choose function” (Figure 5-1).

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## 6 Error messages

### 6.1 Reading error messages

Error messages	Reason	Action
Error in 50 kHz control circuit	Given when the ZUBTT observes a wrong 50 kHz energy level	TCC is defective and has to be exchanged.
Error in 100 kHz energy circuit	Given when the ZUBTT observes a wrong 100 kHz energy level	TCC is defective and has to be exchanged.
Error in 850 kHz-data transfer circuit	Given when the ZUBTT observes a wrong 850 kHz energy level	TCC/Loop is defective and has to be checked.
No start block / stop block detected	Given when the ZUBTT can't observe any start/stop block in the telegram.	Check the TCC: 1. Check canned units 2. exchange TCC itself
Checksum error	Given when the ZUBTT observes an error in the data telegram CRC	Check the TCC: Check telegram store units
Only data from one channel rec: 1. TPR=0 2. TPR=1	Given when the ZUBTT receives data only from one telegram store unit out of 2	One telegram store unit is missing or both telegram store units are identical.
Difference between received telegrams	Given when the ZUBTT observes a difference between the received telegrams from channel 1 and 2	Two not paired telegram store units have been inserted into the TCC
TCC/Loop not detected (or empty TLG)	Given when no data at all is received or if an empty telegram is received	1. Check Interface-BG and connection towards TCC. 2. Check telegram store units
NO TELEGRAM RECEIVED	Shown when no telegram has been received	Check telegram store units

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## 6.2 System error messages

Error messages	Reason	Action
RAM TEST: error	RAM defective	The ZUBTT is defective and need to be repaired.
EPROM TEST: error	EPROM defective	The ZUBTT is defective and need to be repaired.
Internal error: 01	Given when a calibration error is detected.	The ZUBTT is defective and need to be repaired, but if the error message only is seen once, reparation is not necessary.
Internal error: 02	Given when FPGA not ready.	The ZUBTT is defective and need to be repaired, but If the error message only is seen once, reparation is not necessary.
Internal error: 03	Given when FIFO is filled up or FPGA not ready to send.	The ZUBTT is defective and need to be repaired, but if the error message only is seen once, reparation is not necessary.

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## 7 Maintenance

### 7.1 Functional test

To make sure the ZUBTT is always in available for operation it is important to run the Self-test (see sec. 5.5.3) before each use.

### 7.2 Changing batteries

Before exchange of the batteries, the ZUBTT has to be powered off via the button “ON/OFF” (Figure 3-2).

Open the battery box as described in chapter 4.1 and remove the empty/discharged batteries. Insert the 7 new/charged batteries (+ in direction to the battery box) and fit the cover cap again by pushing and turning it to the right.

The ZUBTT is now operational and can be powered on again.

### 7.3 Charging batteries

If rechargeable batteries are used, they can be recharged in the two accompanying chargers. Fully equipped chargers will need a charge time of approx. 6 hours (with delivered batteries).

All 7 batteries should be charged and used together to avoid different charge/discharge of single batteries which will decrease the working capacity of the ZUBTT.

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## 8 Technical specification / info

Technical specifications for the ZUBTT:

### 8.1 Case measures

- Height: 342,3 mm
- Width: 497 mm
- Depth: 128,6 mm
- Weight: 9 Kg (incl. batteries and Carrier strap)

### 8.2 External terminals

- Terminal for connecting TCC with 2/5 code.
- PC terminal (V24/RS232).
- External power supply

For maximum permissible cable lengths please see the EMC section in chapter 8.

### 8.3 Power

- Non rechargeable batteries
- Rechargeable batteries
- External power supply
  - Batteries, Non rechargeable
    - Type: 1,5 V Mono/D. It is recommended to use batteries with at least 5000mA/h to guarantee the min. no. of readings specified in "Battery life".
    - "Battery life": The possible number of telegram readings are > 200 per. "battery set" with a capacity >= 5000mA/h.
  - Batteries, Rechargeable:
    - Type: 1,2 V Ni/Mh mono/D. It is recommended to use batteries with at least 5000mA/h to guarantee the min. no. of readings specified in "battery life".
    - "Battery life": The possible number of telegram readings are > 200 per. "battery set" with a capacity >= 5000mA/h.
  - Charging time: 6 hours (when using the recommended charger and battery capacity)

### 8.4 External power supply

- Voltage, min: 11 VDC, measured at the power supply input of the ZUBTT.
- Voltage, max: 16 VDC, measured at the power supply input of the ZUBTT.
- Current consumption: 3,5 A for 2 ms  
1,4 A for 150 ms  
300 mA continuously (except for the above periods).

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## 8.5 Temperature range

The below mentioned ranges are only valid for the ZUBTT. Please consider the temperature range of the batteries.

Temperature, operating: -20°C to +45°C.

Temperature, storage: -30°C to +70°C.

## 8.6 Degree of protection

IP54 (when all connectors have been fitted with their corresponding protection caps). This is also fulfilled for the TCC connector when it is fitted with the cable G81001-L3114-H962-\*.

## 8.7 Clock

The clock in the ZUBTT is controlled by a RealTimeClock IC.

RTC IC: DS 1501 from Maxim Semiconductor.

Accuracy: Better than  $\pm 1$  Minute/Month at +25°C

## 8.8 CE-marking / EMC / Transmit frequencies

CE-marking: The ZUBTT conforms to the requirements in the EMC directive 2004/108/EC.

Transmit Frequencies: The ZUBTT transmits on the following frequencies:  
50 kHz, 100 kHz and 850 kHz (= 823,5 kHz + 875 kHz).

### NOTICE

The ZUBTT is only allowed to be operated in countries, where the frequencies 50 kHz, 100 kHz and 850 kHz for testing facilities of the Zub system are accepted.

## 8.9 EMC

- Environment The ZUBTT is only allowed to be operated in an environment which fulfills the EN50121-1 and 50121-4.
- Cable length: In order to fulfill the EMC requirements, the attached cables must be less than 9.8 ft (~3 m) of length.

## 8.10 RF Exposure

The results of all measured configurations and locations yield a minimum separation distance of 20 cm from any system component in order to comply with FCC RF exposure requirements when used as specified by the manufacturer, installed on top of a Track Coupling Coil.

A minimum separation distance of 30 cm is required if the device is used in a standalone configuration transmitting at 100 kHz.

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## 9 FCC Compliance Statement

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications to this product not authorized by Siemens Mobility Inc. could void the electromagnetic compatibility (EMC) and wireless compliance and negate your authority to operate the product.

This product has demonstrated EMC compliance under conditions that included the use of compliant peripheral devices and shielded cables between system components. It is important that you use compliant peripheral devices and shielded cables between system components to reduce the possibility of causing interference to radios, televisions, and other electronic devices.

Responsible party (contact for FCC matters only):

Siemens Mobility, Inc.  
One Penn Plaza  
New York, NY 10119  
USA  
[www.siemens.com/contact](http://www.siemens.com/contact)

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