Metro

P3010
Los Angeles LRV

TOA COMMUNICATION SYSTEM

Section 1401
RUNNING MAINTENANCE & SERVICING MANUAL

LIST OF EFFECTIVE PAGES

Insert latest changed pages; dispose of superseded pages in accordance with applicable regulations.

NOTE: On a changed page, the portion of the text affected by the latest change is indicated by a vertical line.

Total number of pages in this section (1401) is **117** consisting of the following:

Original	0	June, 2021
Revision	1	October, 2021
Revision	2	October, 2021
Revision	3	December, 2021
Revision	4	January, 2022
Revision	5	February, 2022
Revision	6	December, 2022
Revision	7	April, 2023

PAGE	CHANGE NO.	PAGE	CHANGE NO.
i through x	7		
1-1 through 1-3	6		
2-1 through 2-19	6		
3-1 through 3-30	7		
4-1 through 4-2	6		
5-1 through 5-11	7		
6-1 through 6-10	7		
Appendix A	7		

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SAFETY SUMMARY

Some of the procedures in this section are preceded by warnings/cautions regarding potential hazards in handling this equipment. These warnings/cautions should be carefully read and understood before proceeding. Failure to observe these precautions may result in serious injury to personnel performing the work and/or bystanders. The key warnings for this equipment are as follows:

Electrical - The electrical equipment described in this section operates at voltages and currents that are extremely dangerous to life. Personnel should closely observe all generally prescribed cautions and warnings before performing any work on the LRV.

Chemicals – Follow safety precautions for handling hazardous chemicals as provided by the manufacturer. The manufacturer's warnings should be closely heeded to avoid personal injury.

Location – Special caution should be taken when accessing or servicing equipment located on the roof and under the car.

Weight – To prevent possible personal injury when attempting to remove or install equipment on the vehicle, adequate support of a lifting device must be used to prevent the equipment from falling. Personnel' Personnel's failure to heed these warnings could result in severe injury or death and or damage to the equipment.

Contact – Some components in this equipment attain temperatures that can cause severe burns. Closely follow all warnings and recommended procedures for handling these components.

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TABLE OF CONTENTS

Chapter/Para **Page**

LIST OF EFFECTIVE PAGES i
SAFETY SUMMARY iii
TABLE OF CONTENTS v
LIST OF ILLUSTRATIONS viii
LIST OF TABLES ix
1.0 GENERAL DESCRIPTION 1-1
1.1 Introduction 1-1
1.2 Abbreviations and Acronyms 1-1
2.0 FUNCTIONAL DESCRIPTION 2-1
2.1 Introduction 2-1
2.2 ACP, Audio Control Panel 2-4
2.3 CCH, Communications Control Head 2-7
2.4 TOA Independent Ethernet network 2-13
2.4.1 IFU - Interface Unit 2-14
2.4.2 Ethernet Switch, Viper-112A 2-16
2.4.3 Ethernet Interface Module, DDW-002-B1 2-17
3.0 EQUIPMENT LOCATION, INSTALLATION AND REMOVAL 3-1
3.1 Introduction 3-1
3.2 Special Tools and Materials 3-1
3.3 ACP, Audio Control Panel 3-3
3.3.1 Location 3-3
3.3.2 Removal 3-4
3.3.3 Installation 3-5
3.4 IFU, Interface Unit 3-6
3.4.1 Location 3-6
3.4.2 Removal 3-6
3.4.3 Installation 3-7
3.5 CCH, Communications Control Head 3-9
3.5.1 Location 3-9
3.5.2 Removal 3-9
3.5.3 Installation 3-10
3.6 Ethernet switch, Viper-112A 3-11
3.6.1 Location 3-11
3.6.2 Removal 3-12
3.6.3 Installation 3-12

3.6.4 Setup Procedure for Ethernet Switch....3-13
3.7 Ethernet Interface Module, DDW-002-B1.... 3-24
3.7.1 Location....3-24
3.7.2 Removal....3-25
3.7.3 Installation....3-26
3.7.4 Set up Procedure for Ethernet Interface Module....3-26
4.0 SCHEDULED MAINTENANCE TASKS....4-1
4.1 Introduction.... 4-1
4.2 Scheduled Maintenance Index.... 4-1
5.0 CORRECTIVE MAINTENANCE....5-1
5.1 Introduction.... 5-1
5.2 Safety Information.... 5-1
5.3 Corrective Maintenance Procedures.... 5-4
5.3.1 TOA ACP....5-4
5.3.2 TOA IFU....5-4
5.3.3 TOA CCH....5-4
5.3.4 Ethernet Switches....5-4
5.3.5 Ethernet Interface Module....5-5
5.4 Onboard Test.... 5-6
6.0 TROUBLESHOOTING....6-1
6.1 Introduction.... 6-1
6.2 Troubleshooting.... 6-1
6.3 Passenger Information Displays (PIDS) Troubleshooting.... 6-0
6.4 Fault List.... 6-0
Appendix A Drawings....1

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LIST OF ILLUSTRATIONS

Figure	Title	Page
Figure 2-1:	System Outline of Overall Communication System	2-3
Figure 2-2:	ACP Appearance	2-4
Figure 2-3:	ACP Drawing	2-5
Figure 2-4:	TOA CCH Appearance	2-7
Figure 2-5:	TOA CCH Screen Transition Diagram in Auto Mode (Default Mode)	2-9
Figure 2-6:	TOA CCH Screen Transition Diagram in Manual Mode	2-10
Figure 2-7:	Drawing of CCH	2-12
Figure 2-8:	TOA Independent Ethernet network (Car level)	2-13
Figure 2-9:	TOA Independent Ethernet network (Multiple-Cars level)	2-13
Figure 2-10:	IFU – The appearance of Interface Unit	2-14
Figure 2-11:	IFU Drawing	2-15
Figure 2-12:	The appearance of TOA Ethernet Switch, Viper-112A	2-17
Figure 2-13:	Ethernet Interface Module, DDW-002-B1	2-18
Figure 3-1:	USB type CF card reader	3-1
Figure 3-2:	Torque Type M12 Driver	3-2
Figure 3-3:	Installed ACP Location	3-3
Figure 3-4:	Location of ACP in the right cabinet	3-4
Figure 3-5:	Detail View of ID Plug installation in the ACP	3-5
Figure 3-6:	Detail view of ID plug for the ACP	3-5
Figure 3-7a:	Detail View of IFU installed without SmartDrive system	3-6
Figure 3-7b:	IFU installed with SmartDrive System	3-6
Figure 3-8:	Detail View of ID Plug installation status in IFU	3-7
Figure 3-9:	Detail view of ID plug for the IFU	3-8
Figure 3-10:	Location of CCH installed	3-9
Figure 3-11:	Detail view of installed Communication Control Head	3-10
Figure 3-12:	Location of installed Ethernet switch	3-11
Figure 3-13:	Detail location of Ethernet switch installed	3-12
Figure 3-14:	System configuration	3-13
Figure 3-15	“Communication Control” Circuit Breaker location on A car	3-13
Figure 3-16	“Communication Control” Circuit Breaker location on B car	3-14
Figure 3-17	Window screen for Network Setting	3-15
Figure 3-18	Window screen for Internet Protocol Version 4 (TCP/IPv4) Setting	3-15
Figure 3-19：	WeOS log in	3-16

Figure 3-20：WeOS Maintenance > Backup&Restore page 3-16
Figure 3-21 DHCP Server Screen 3-18
Figure 3-22 Static Lease 1 Screen for each Static ID 3-19
Figure 3-23 Static Lease 2 Screen for each Static ID 3-20
Figure 3-24 Static Lease 3 Screen for each Static ID 3-21
Figure 3-25 Identity Screen 3-22
Figure 3-26: Location of Ethernet Interface Module installed 3-24
Figure 3-27: Detail Location of Ethernet Interface Module installed 3-25
Figure 3-28: Detail view of Ethernet Interface Module installed 3-26
Figure 3-29: DDW-002-B1 3-27
Figure 3-29: WeConfig Main Screen 3-28
Figure 3-30: WeConfig Screen after scan 3-28
Figure 3-31: WeConfig Powerline Configuration screen 3-29
Figure 5-1: LED indicators for Ethernet Switch, Viper-112A 5-4
Figure 5-2: LED indicators for Ethernet Interface Module, DDW-002-B1 5-5
Figure 5-3: Sample LED signs display during Onboard Test 5-9
Figure 5-4: Cyclic PID LCD automatic test patterns during Onboard Test 5-10

LIST OF TABLES

Table Title Page

Table 1-1: Abbreviations 1-1
Table 2-1: ACP Technical Specifications 2-6
Table 2-2: TOA CCH Functions 2-8
Table 2-3: CCH Technical Specifications 2-11
Table 2-4: IFU Description 2-14
Table 2-5: TOA Ethernet Switch Technical Specifications 2-16
Table 2-6: Destination from each port of the TOA Ethernet Switch 2-16
Table 2-7: Ethernet Interface Module Technical Specification 2-17
Table 3-1: TOA System Equipment 3-1
Table 4-1: Maintenance tasks 4-1
Table 6-1: TOA Communication System Troubleshooting 6-0
Table 6-2: Fault List 6-1

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1.0 GENERAL DESCRIPTION

1.1 Introduction

The information contained in this manual includes a functional description, scheduled maintenance tasks, corrective maintenance / troubleshooting, component removal and installation information for the TOA Communication System components.

The information for the existing communication equipment such as Public Address (PA), Passenger Intercom (PIC), Passenger Information Display (PID), and LED sign, including Front Destination Sign (FDS) and Side Destination Sign (SDS) functions shall be referred to in Section 1400 Communications.

1.2 Abbreviations and Acronyms

Table 1-1: Abbreviations

Acronym	Description
ACP	Audio Control Panel
AGC	Automatic Gain Control
APC	Automatic Passenger Counter
CCH	Communications Control Head
CF card	Compact Flash card
CONT	Control
DC	Direct Current
DI/DO	Digital Input/ Digital Output
Doc.	Document
FDS	Front Destination Sign
ESS	Environmental Stress Screening
GPS	Global Positioning System
IC	Intercommunication
ID	Identification
IFU	Interface Unit
LACMTA	Loss Angeles County Metropolitan Transportation Authority
LRV	Light Rail Vehicle
Max.	Maximum
MCC	Metro Control Center
MDS	Monitor and Diagnostic System
MIC	Microphone

Acronym	Description
ACP	Audio Control Panel
Min.	Minimum
No.	Number
PA	Public Address
PIC	Passenger Intercom
PID	Passenger Information Display
PIDS	Passenger Interior Display System
PoE	Power over Ethernet
PTE	Portable Test Equipment
PTT	Push To Talk
PTU	Portable Test Unit
Qty.	Quantity
RIO	Remote I/O
RME	Route Management Editor
SDS	Side Destination Sign
SP	Speaker
SW	Switch
TOD	Train Operator Display
TS	Technical Specification
V	Volt

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2.0 FUNCTIONAL DESCRIPTION

2.1 Introduction

The train-born hardware in the TOA Communication System consists of the Audio Control Panel (ACP), Communications Control Head (CCH), Ethernet switch, Ethernet Interface Module and Interface Unit (IFU).

TOA's design is comprised of an ACP with an ID plug, CCH, and IFU designed to interface with the existing equipment. The existing equipment includes the Public Address (PA), Passenger Intercom (PIC), Passenger Information Display (PID), and LED sign functions. Figure 2-1 shows the overall system outline and configuration of TOA's Communication System and the existing Communication System.

The IFU receives signals of train information through the train network and transmits these signals to the TOA Communication System. One of those train information is Timestamp which the MDS provides. If any of fault and PIC status in the TOA Communication System is changed, the IFU transmits the fault information and PIC status information to the MDS. The Train Control Network (TCN) will periodically send the status of the Doors and wheel diameter to the IFU. The IFU periodically checks the status of the PA speaker selector, door close announcement button, and the Push To Talk (PTT) switches to RIO(A) and RIO(B). Note that the IFU will separate the train network between the existing communication system, and the TOA Communication System to isolate transmission signals.

The ACP calculates running distance with a speed pulse signal from a speed pulse generator and triggers pre-recorded announcements and visual text messages. The Operator can also trigger pre-recorded special announcements manually on the CCH. Additionally, the Operator can make manual PA announcements via an in-dash microphone.

Text messages will be displayed on LED signs based on the route selected on the CCH, and signals from the ACP. Route information will be shown on the LCDs with PA announcements, according to the train traveling distance or by manual operation of the CCH in a cab car.

The following functions may be conducted by manual operation of the CCH:

- Select a PIC to answer
- Monitor fault information
- Start Onboard test
- Monitor speaker volume and wheel diameter

Note that the CCHs in trail cars are disabled for operation and display nothing.

The following existing components interface with the TOA Communication System:

- Monitor and Diagnostic System (MDS)
- Ethernet switches
- RIOs
- TCN Controller

2.2 ACP, Audio Control Panel

The ACP calculates running distance with a speed pulse signal from the speed pulse generator, and triggers pre-recorded announcements and visual text messages.

The ACP controls the following functions of the TOA Communication system:

- Broadcast PA (automatic announcement, manual PA, radio PA)
- Indicate on PIDS and LED signs (FDS, SDS)
- Conduct PIC communication between operator and passengers
- Calculate running distance
- Trigger against APC functions
- Detect faults in controlled equipment

The ACP in the Active Cab (Key On) becomes the Master ACP and all other ACP become Slave ACP. The Master ACP conducts the following functions:

- Interface with CCH
- Manage train information (current station, next station, running distance, running status, and door opening/closing)
- Interface with buttons on Cab Console Panel via IFU
- Decode pre-recoded audio stored in CF card

Table 2-1 shows the detail technical specifications of the TOA ACP. Figure 2-2 and Figure 2-3 shows the TOA ACP Appearance and Drawing.

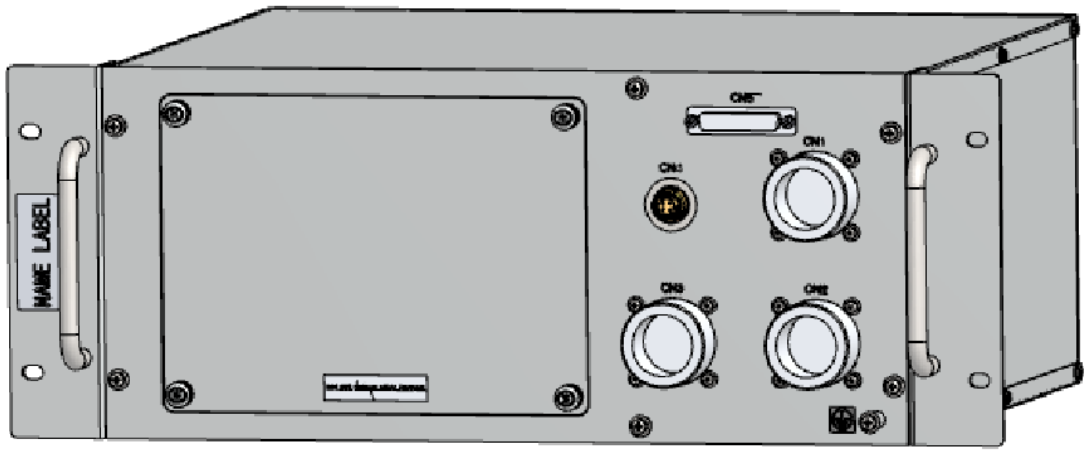


Figure 2-2: ACP Appearance

Table 2-1: ACP Technical Specifications

Item	Description
Power Requirements	
Power source	28.5V DC (17V DC to 30V DC)
Input	
Input sensitivity level (from in-dash microphone)	-46 dB +/- 3 dB
Input impedance (from in-dash microphone)	2.2k ohms +/- 10 %
Input sensitivity level (from Train Radio)	Less than 0dBm
Input impedance (from Train Radio)	10k ohms at balanced
Input sensitivity (from PIC)	-57 dB
Audio output	
Speaker output wattage (to cab speaker)	10W
Output impedance (to PIC)	1W
Speaker output	
Output noise level (at no signal input)	Less than -25 dB (IHF A-weighted)
Distortion at 1 kHz, output ration	Less than 1 %
Output level of speaker line	70 V (37dB)
Signal to noise ratio	60 dB
Frequency response	100 Hz to 8 kHz (+/- 4 dB)
Output volume adjustment	25% (min) to 100 % (max)
Amplification	37 dB +/- 2 dB
Wattage	
Amplifier wattage	20W × 1 (interior speaker) 10W × 1 (exterior speaker)
Power Distribution	
Power output to in-dash microphone	1.5V
Storage	
CF card capacity	512 M bytes
Sound recording method	MP3
Bitrate	64 kbps (Constant bit rate)
Sampling frequency	16 kHz
Audio Codec	
PA announcement and IC	G.711
Pre-recorded announcement	MP3
Interface	
Ethernet communication	100BASE-TX
Interface with PIC	Output: LED Control 24V Input: Pushbutton (Contact with Com)
Interface with Speed pulse generator (Odometer)	Digital Input signal (pulse signal)
Interface with train side	Digital Input (28V DC)
Interface (spare line)	Digital output signal
Other	
Outer material	SECC (Electrolytic zinc-coated steel sheets)
Paint color	RAL 1500 Gloss 20% to 30% (Black color)

2.3 CCH, Communications Control Head

The TOA CCH is installed to the cabs of both A and B cars to operate the PA and PIDS. Figure 2-4 shows the TOA CCH.

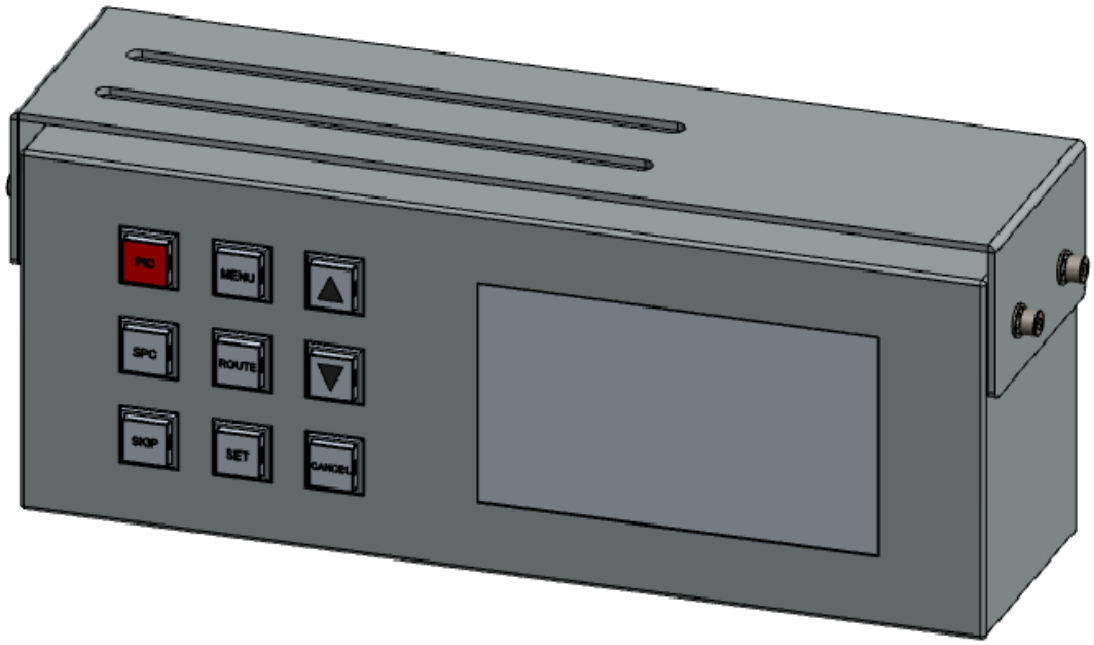


Figure 2-4: TOA CCH Appearance

The Operator can select functions from the TOA CCH only in the cab where the master key has been inserted. When the master key is removed, the master TOA CCH changes to a temporary master TOA CCH, until the master key is inserted in another cab.

On a temporary master TOA CCH, information will be continuously shown, but any push-button operation will not be accepted.

On the master CCH, the route, special announcement, and other functions may be selected. According to the selected route, the FDS/SDS shows the destination station name and the PID shows the route information. The list of functions for TOA CCH is shown in Table 2-2.

Table 2-2: TOA CCH Functions

	Function	Description
1	Emergency intercom	When a passenger presses the call button on the PIC station in a car, the "PIC" button on the CCH blinks and an audible alarm is output from cab speaker. The Operator can acknowledge the emergency call from the master CCH only. Note) Emergency intercom is half-duplex and "point to point."
2	Emergency intercom (Multiple)	When passengers press the call buttons on the PIC stations in the cars, the "PIC" button on the CCH blinks and an audible alarm is output from the cab speaker. The Operator can acknowledge emergency calls one by one from the master CCH.
3	Pre-recorded announcement	The Communication system can broadcast pre-recorded announcements of departure, arrival, door closing, and others according to the route setting on the master CCH. Default mode is "Auto" mode which is triggered automatically according to the train traveling distance. For back-up purpose, "Manual" mode is available, which can be triggered manually.
4	Special message	The Communication system can broadcast special announcements. The Operator can select a special message on the master CCH.
5	Skip station	The Communication system can stop pre-recorded announcements until the train is passing over the next station. After passing over the next station, normal station announcement can be re-started correctly. (Skip station function is disabled under "Manual" mode.)
6	Volume control	The Operator or maintenance personnel can adjust the volume level of the cab speaker from the CCH.
7	Fault Status information	The Operator or maintenance personnel can check the following fault status information on the master CCH; ACP, IFU, PIC, Interior Speaker, Exterior Speaker, FDS, SDS, MDS, RIO, TCN, PIDS, and Internal Network Switch. Note) These active fault information will also be sent to the Active fault screen of the TODs.
8	Onboard test function	The Communication system can run the Onboard local diagnostic test. The Operator or maintenance personnel can activate the Onboard test and start test message from the master CCH.
9	Destination sign	The Communication System can display the line and destination station name on signs according to the route setting on the master CCH.
10	Route setting	The Operator can select the traveling route for automatic station announcement on the master CCH. In addition, the Operator can also change the current station and destination station if necessary.
11	Passenger information display	The Communication System can display the route information on LCD monitors according to the route setting on the master CCH.

Figure 2-5 and Figure 2-6 shows the TOA CCH screen maps which identify button operation and screen transition sequence under Auto and Manual mode of station announcement (Auto mode is default).

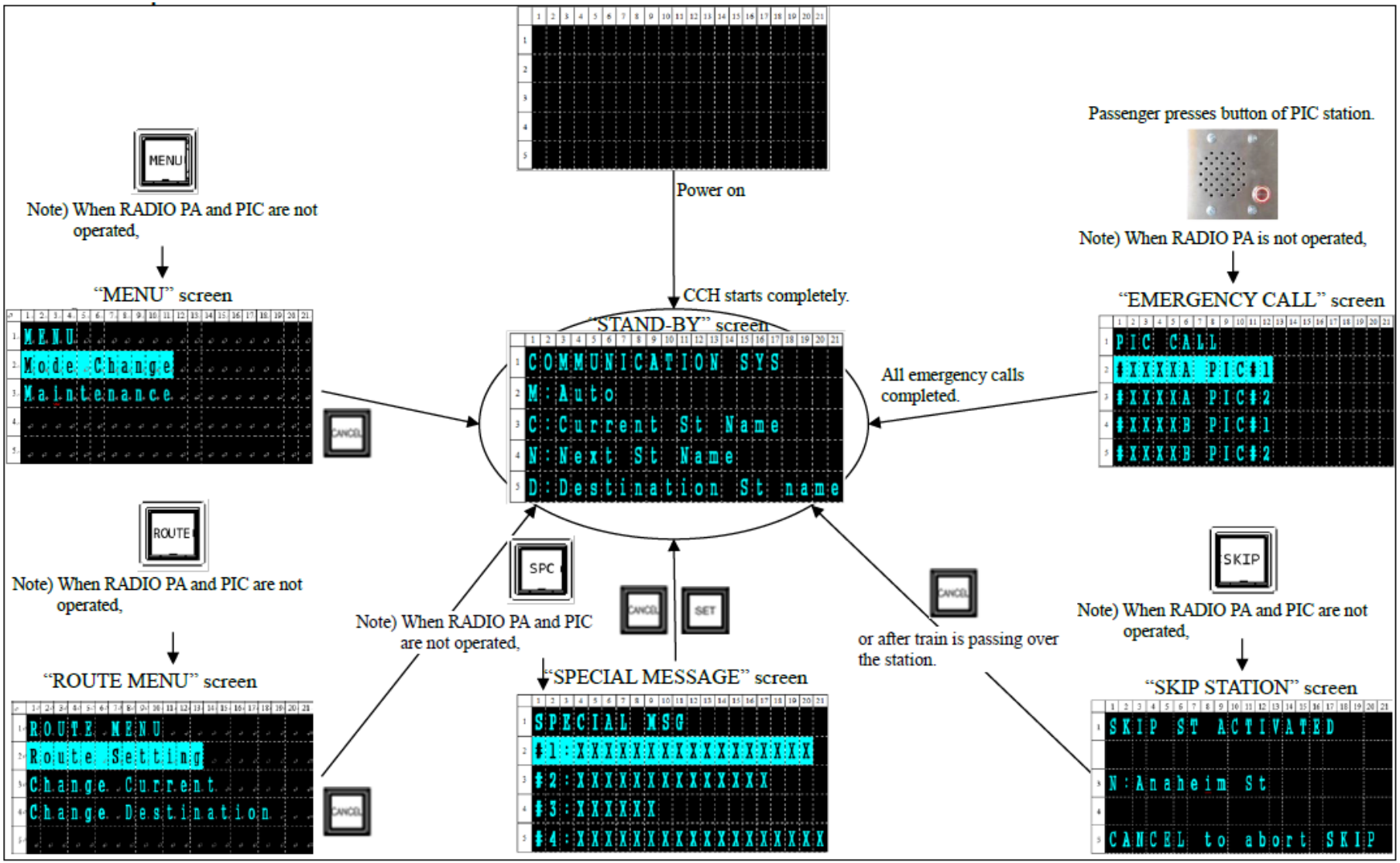


Figure 2-5: TOA CCH Screen Transition Diagram in Auto Mode (Default Mode)

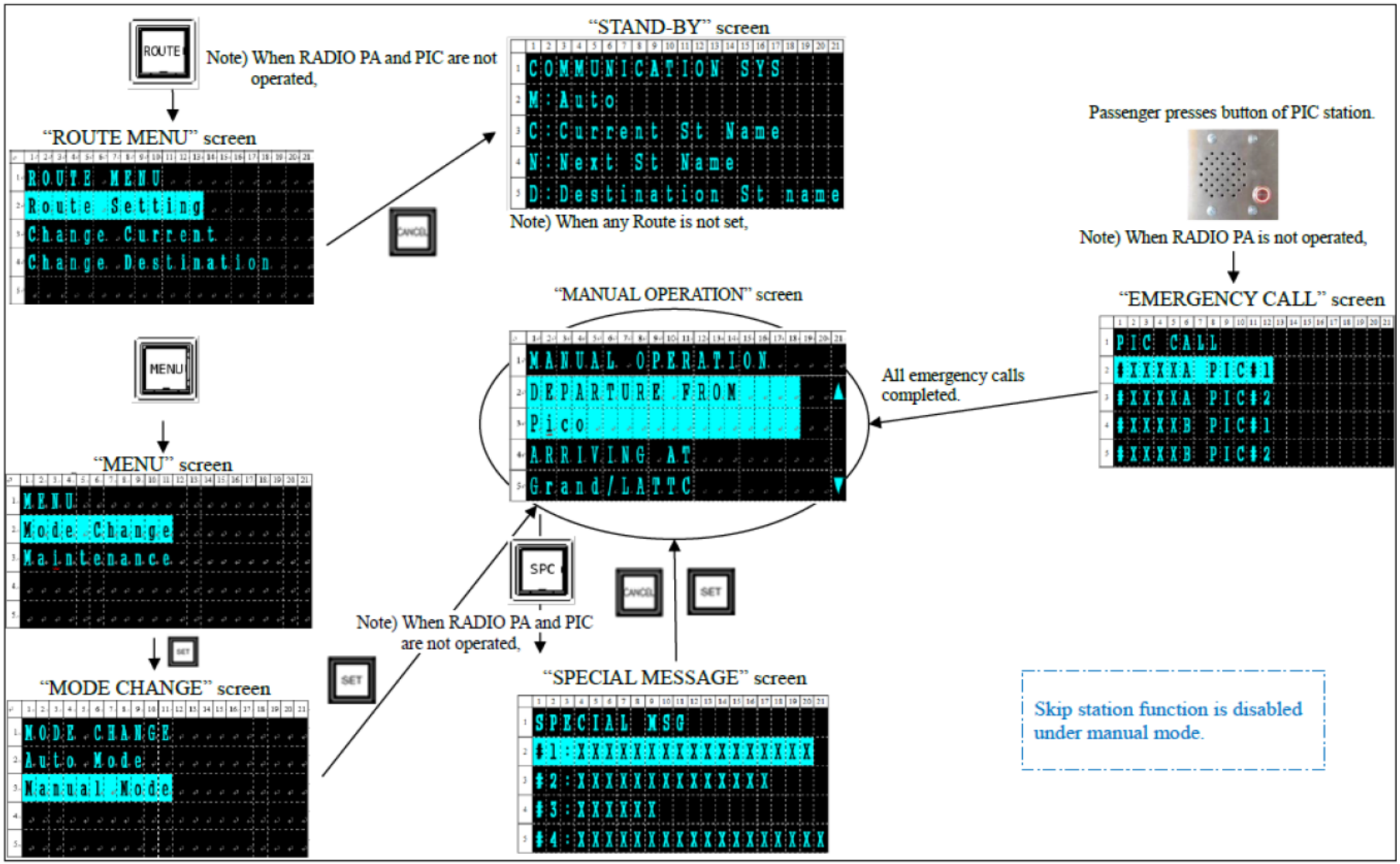
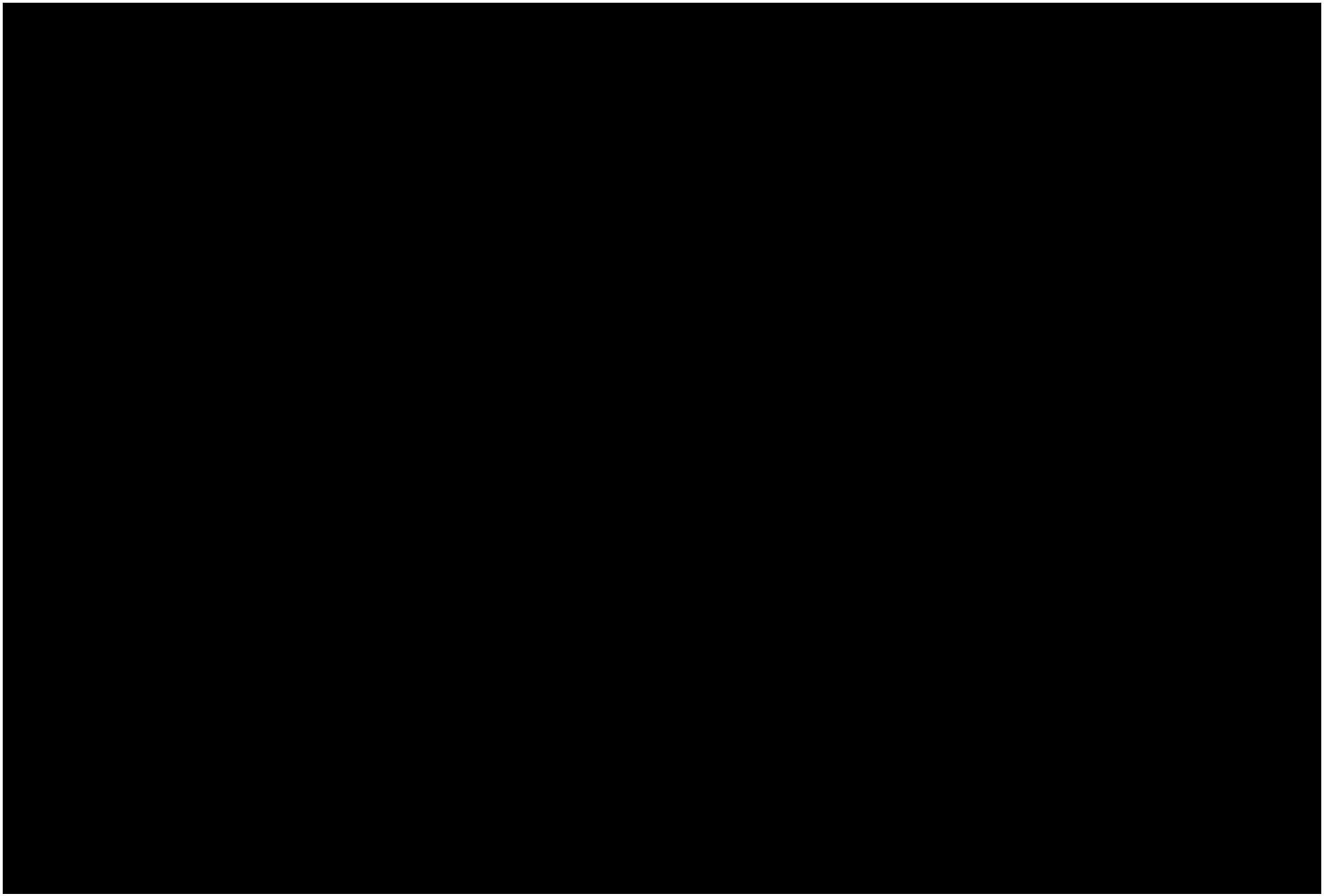


Figure 2-6: TOA CCH Screen Transition Diagram in Manual Mode

Table 2-3 shows the detailed technical specification of the CCH and Figure 2-7 shows the Drawing of CCH.

Table 2-3: CCH Technical Specifications

Item	Description
Power Requirements	
Power source from ACP	24VDC
Interface	
Serial communication with ACP	RS485
Push-button	
Other	
LCD monitor	High-definition fluorescent display tubes 256x128 dot (Dot pitch 0.325x0.325 mm)
Outer material	SECC (Electrolytic zinc-coated steel sheets)
Paint color	RAL 1500 Gloss 20% to 30% (Black color)



2.4 TOA Independent Ethernet network

The TOA Communication System uses an independent Ethernet trainline network which consists of dedicated TOA Ethernet Switches and Ethernet Interface Modules, which convert the signal and pass it to next train through the train coupler.

The IFU separates the train network between the existing communication system and the TOA Communication System to isolate transmission signals.

The IFU receives signals of train information through the existing train network and transmits those signals to the TOA Communication System. One of those train information is Timestamp, which the MDS provides.

Figure 2-8 and Figure 2-9 shows the network diagram of the TOA independent Ethernet network at Car and Train (Multiple-Cars) Level respectively.

2.4.1 IFU - Interface Unit

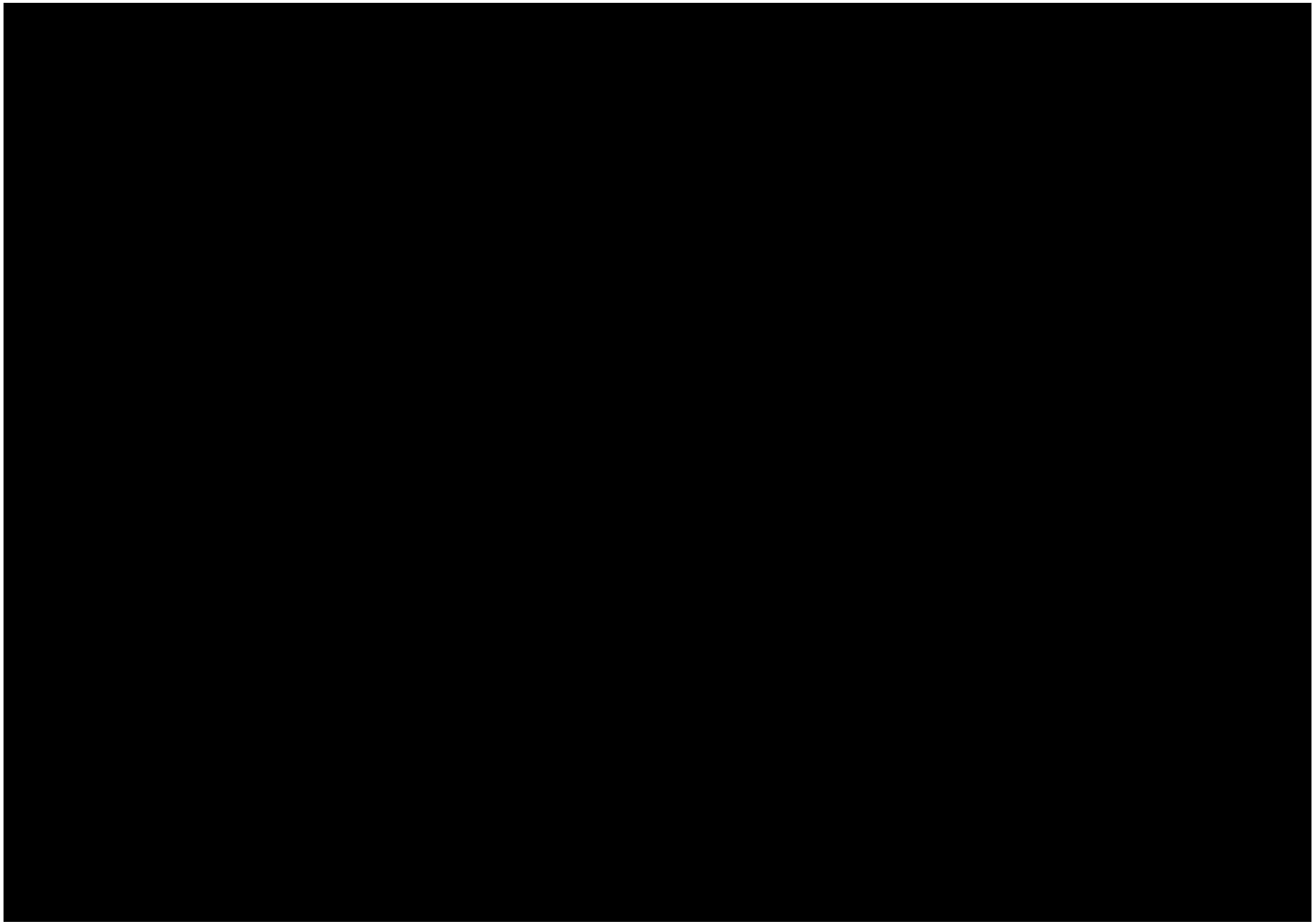
The IFU receives signals of train information through the train network and transmits these signals to the TOA Communication System. One of those signals of train information is Timestamp, which the MDS provides. If any of fault and PIC status in the TOA Communication System is changed, the IFU transmits Fault information and PIC status information to the MDS. The TCN sends the Door status and wheel diameter to the IFU periodically. The IFU asks the status of the PA speaker selector, door announcement button, and PTT switches to RIO(A) and RIO(B) periodically.

Table 2-4 shows the detailed technical specifications of the TOA IFU. Figure 2-10 and Figure 2-11 show the appearance and drawing of TOA IFU.

Figure 2-10: IFU – The appearance of Interface Unit

Table 2-4: IFU Description

Item	Description
Power Requirements	
Power source	28.5 VDC (17VDC to 30 VDC)
Input Current	Typical 200mA (MAX 300mA) @28.5 VDC
Interface	
Ethernet for RTC network	100BASE-TX
Ethernet for TOAE network	100BASE-TX
Protection	1.5 kV magnetic isolation
Protocols	UDP/IP, Modbus TCP/IP
Other	
Outer material	SECC (Electrolytic zinc-coated steel sheets)
Paint color	RAL 1500 Gloss 20% to 30% (Black color)



2.4.2 Ethernet Switch, Viper-112A

Table 2-5 shows the detailed technical specifications of the TOA Ethernet Switch. Table 2-6 shows the port configuration of the TOA Ethernet Switch. Figure 2-12 shows the appearance of the TOA Ethernet Switch.

Table 2-5: TOA Ethernet Switch Technical Specifications

Item	Description
Power Requirements	
Rated voltage	24 to 110VDC
Rated current	Max 350mA @ 24V, max 90mA @ 110V
Interface	
X1-X12 Ethernet ports	IEEE std 802.3. 2005 Edition 10 Mbit/s, 100 Mbit/s, manual or auto 8-pin M12 X-code
USB, USB port	USB 2.0 host interface Up to 480 Mbit/s (high-speed mode) Maximum supply current: 500 mA 5-pin M12 female A-code, use Westermo USB plug 3641-0190
CON, Console port	RS-232 115.2 kbit/s 5-pin M12 female B-code, use Westermo cable 1211-2215

Table 2-6: Destination from each port of the TOA Ethernet Switch

Ethernet Switch (A-Unit LAN A)						
Port No.	Port X1	Port X2	Port X3	Port X4	Port X5	Port X6
Destination	TOA Ethernet Switch B	TOA Ethernet Switch B	ACP A			
Port No.	Port X7	Port X 8	Port X9	Port X10	Port X11	Port X12
Destination		TOA Ethernet Interface Module A1	FDS	SDS	PIDS Controller	TOA Ethernet Interface Module A2
Ethernet Switch (B-Unit LAN B)						
Port No.	Port X1	Port X2	Port X3	Port X4	Port X5	Port X6
Destination	TOA Ethernet Switch A	TOA Ethernet Switch A	ACP B	IFU		
Port No.	Port X7	Port X8	Port X9	Port X10	Port X11	Port X12
Destination		TOA Ethernet Interface Module B1	FDS	SDS	PIDS Controller	TOA Ethernet Interface Module B2

Figure 2-12: The appearance of TOA Ethernet Switch, Viper-112A

2.4.3 Ethernet Interface Module, DDW-002-B1

Table 2-7 shows the detailed technical specification of the TOA Ethernet Interface Module. Figure 2-13 shows the appearance of the TOA Ethernet Interface Module.

Table 2-7: Ethernet Interface Module Technical Specification

Item	Description
Power Requirements	
Rated voltage	24 to 110VDC
Operating voltage	16.8 to 143 VDC (14.4 VDC for 100 ms, 154 VDC for 1 s)
Rated current	350 mA at 24 VDC and 90 mA at 110 VDC
Interface	
X1	1 x 10/100 Mbit/s
X2	1 x 2-wire interface up to 70 Mbit/s, distance up to 300 m (depending on cable characteristics). The wire may be powered, up to 143 VDC.

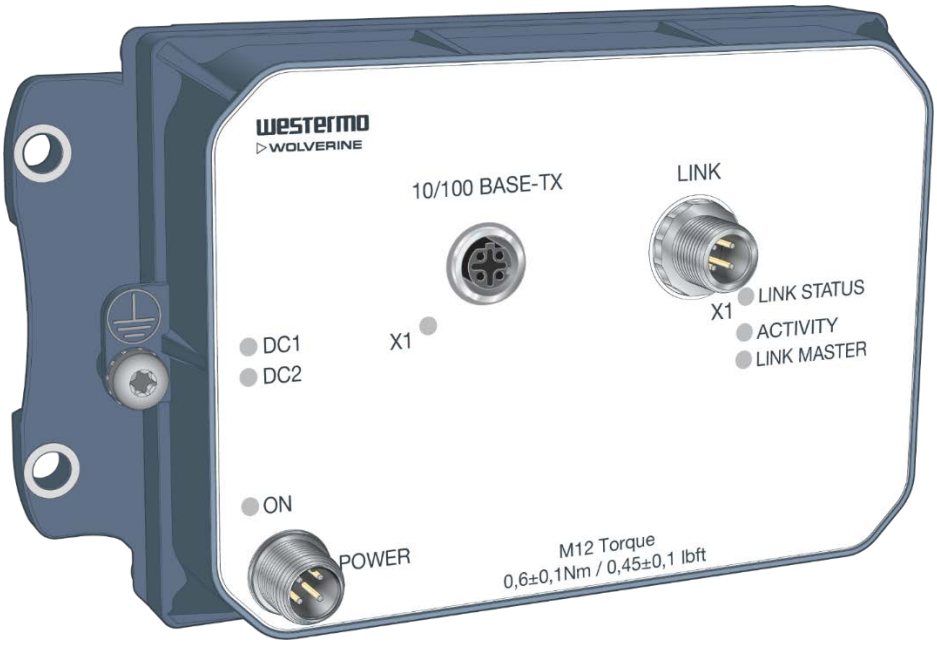


Figure 2-13: Ethernet Interface Module, DDW-002-B1

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3.0 EQUIPMENT LOCATION, INSTALLATION AND REMOVAL

3.1 Introduction

The following table includes the TOA system equipment installed on each car.

Table 3-1: TOA System Equipment

EQUIPMENT	Product No.	Quantity per LRV	LOCATION
ACP	Q-C9037X	2	Right side locker in the cab of A car and B car
IFU	Q-X9183X	1	Inside ceiling of the cab in B car
CCH	Q-I9058X	2	Bottom of the console in A car and B car
Ethernet switch	Viper-112A	2	Inside ceiling of the cab of A car and B car
Ethernet Interface Module	DDW-002 B1	4	Right side locker in the cab of A car and B car

3.2 Special Tools and Materials

The route information is generated by the Route Management Editor (RME) and stored in a CF card set in each Audio Control Panel (ACP). For this purpose, the following special tool is required and supplied by KI.

- USB type CF card reader to connect with PC

Figure 3-1: USB type CF card reader

Also, it is strongly recommended that a torque type M12 driver be used to tighten and remove the M12 style connectors used in the Ethernet circuitry.

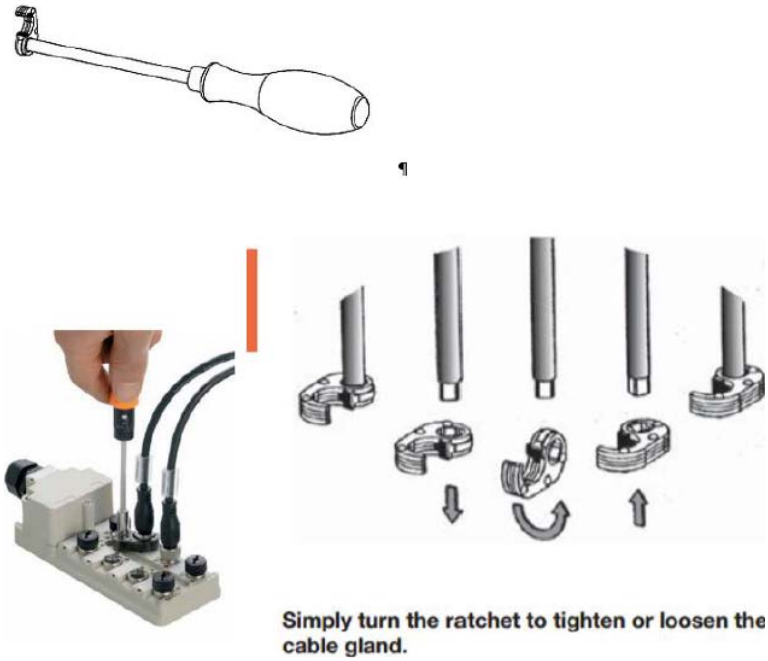

Figure 3-2: Torque Type M12 Driver

3.3 ACP, Audio Control Panel

3.3.1 Location

The ACP is installed in the right-side locker in the cab as shown in Figure 3-3 and Figure 3-4. One is installed in A car, and another in B car.

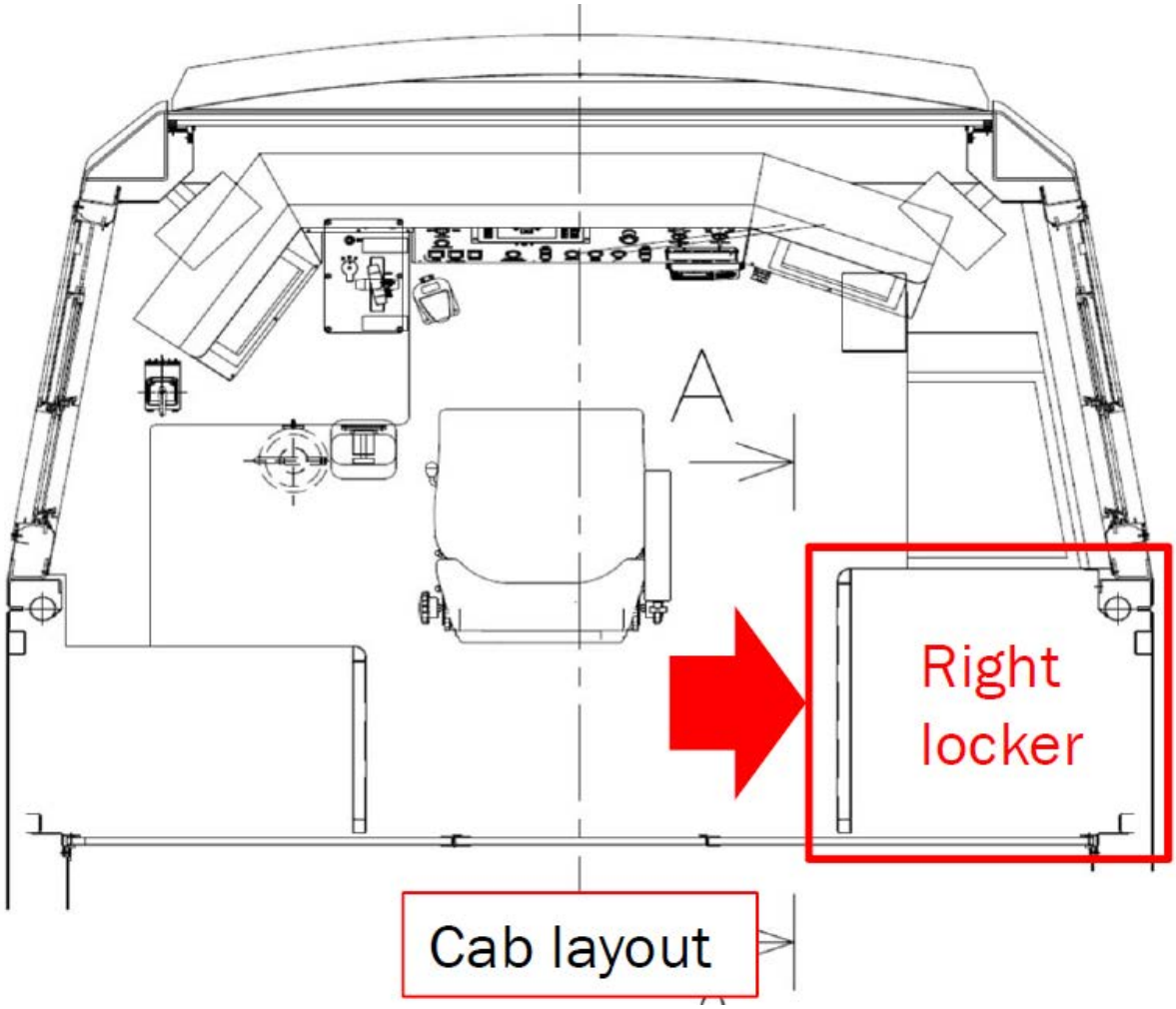

Figure 3-3: Installed ACP Location

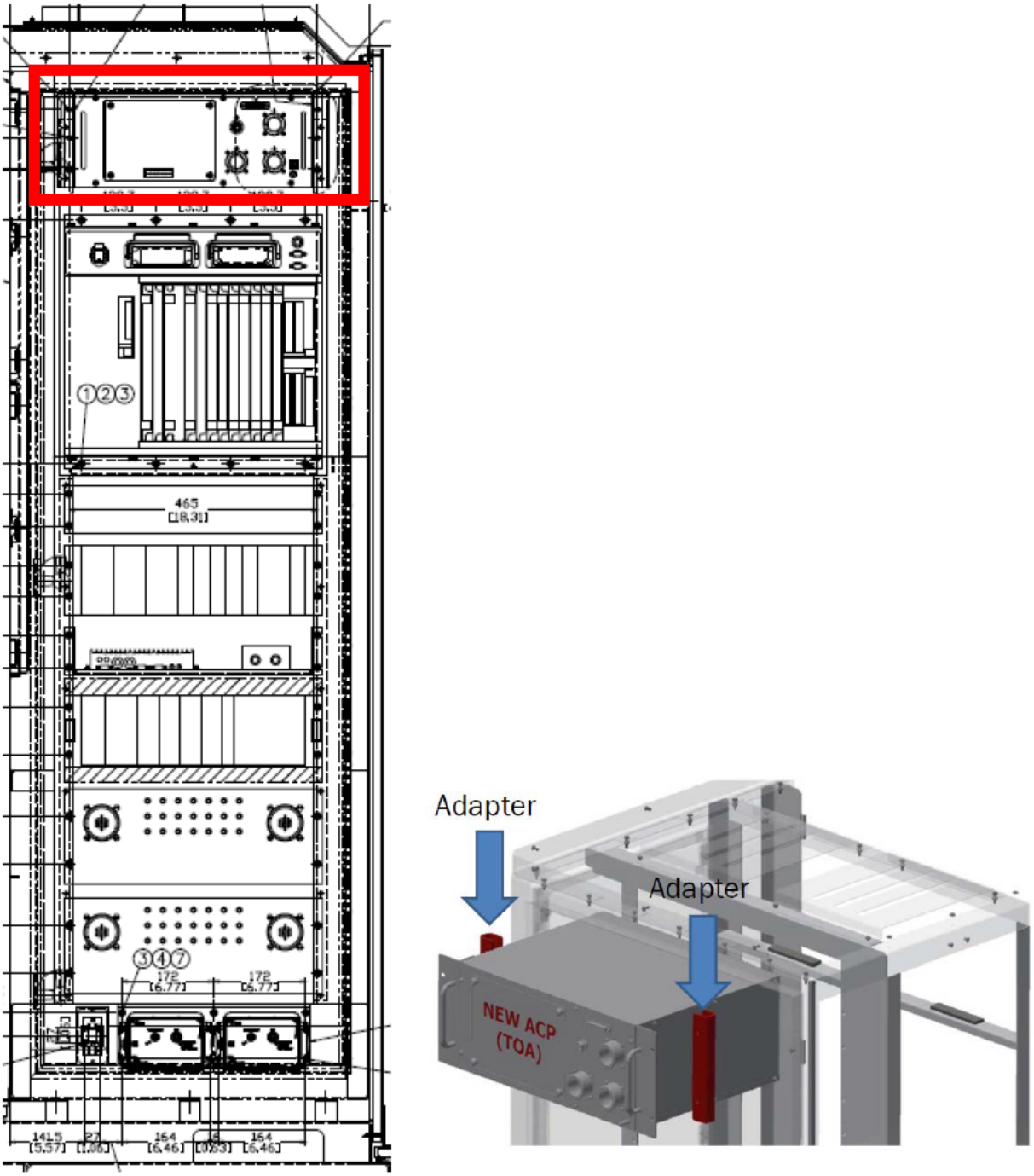

Figure 3-4: Location of ACP in the right cabinet

3.3.2 Removal

1) Open the right-side cab locker shown in Figure 3-3 by unlocking the three locks using a maintenance key. The ACP is located at the top of the rack shown in Figure 3-4.

2) Disconnect the ID plug from the ACP. Figure 3 5 shows the installation detail of the ID plug for the ACP. First, disconnect the ID plug from the ACP, Second, release the lanyard from the ACP handle. Third, the ID plug is secured to the rack frame. The

disconnected ID plug will be reused for an ACP replacement. Therefore, the ID plug should be secured to the rack frame.

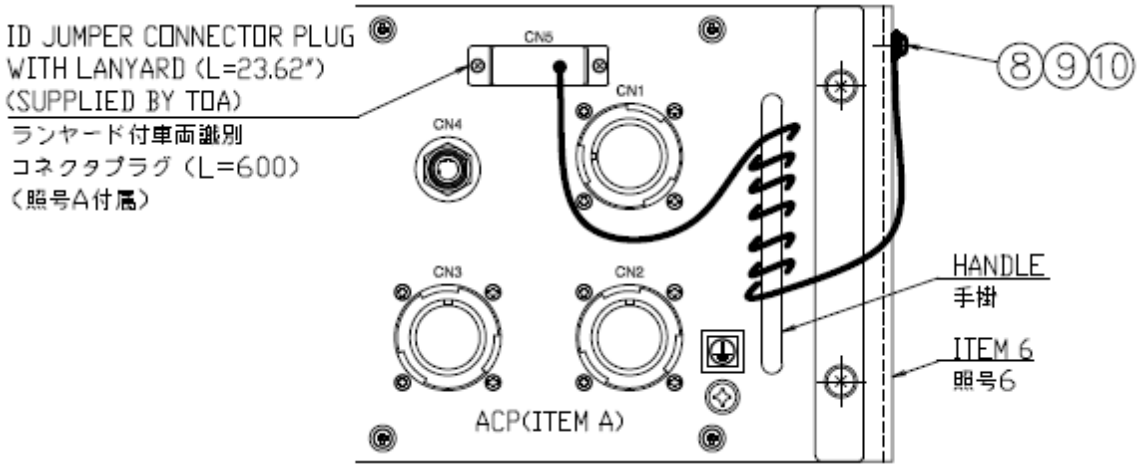

Figure 3-5: Detail View of ID Plug installation in the ACP

3) Disconnect electrical connections from the ACP, including M12 connector in CN4.

4) Release each four of the M6x20 bolts, M6 lock washers, and M6 plain washers and remove the ACP from the adapter brackets.

3.3.3 Installation

1) Install the ACP onto the adapter brackets using each four of the M6x20 bolts, M6 lock washers, and M6 plain washers.

2) Reconnect electrical connections to the ACP including M12 connector in CN4.

3) Reconnect the ID plug to the ACP. Figure 3-5 shows the installation detail of ID plug for the ACP. First, check the car number label on the ID plug secured to the rack frame whether its car number is the same as the actual LRV car number (e.g., Label Example “Car0125”). The ID Plug acts as an identifier of the car number to the ACP. Please refer to Figure 3-6. Second, wrap the lanyard around the ACP handle. Third, reconnect the ID plug to ACP.

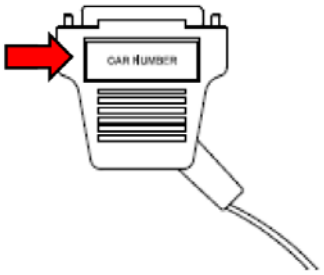

Figure 3-6: Detail view of ID plug for the ACP

4) Close the right-side cab locker by locking the three locks using a maintenance key.

3.4 IFU, Interface Unit

3.4.1 Location

IFU is installed inside ceiling of the cab in the B car as shown in Figure 3-7a and Figure 3-7b.

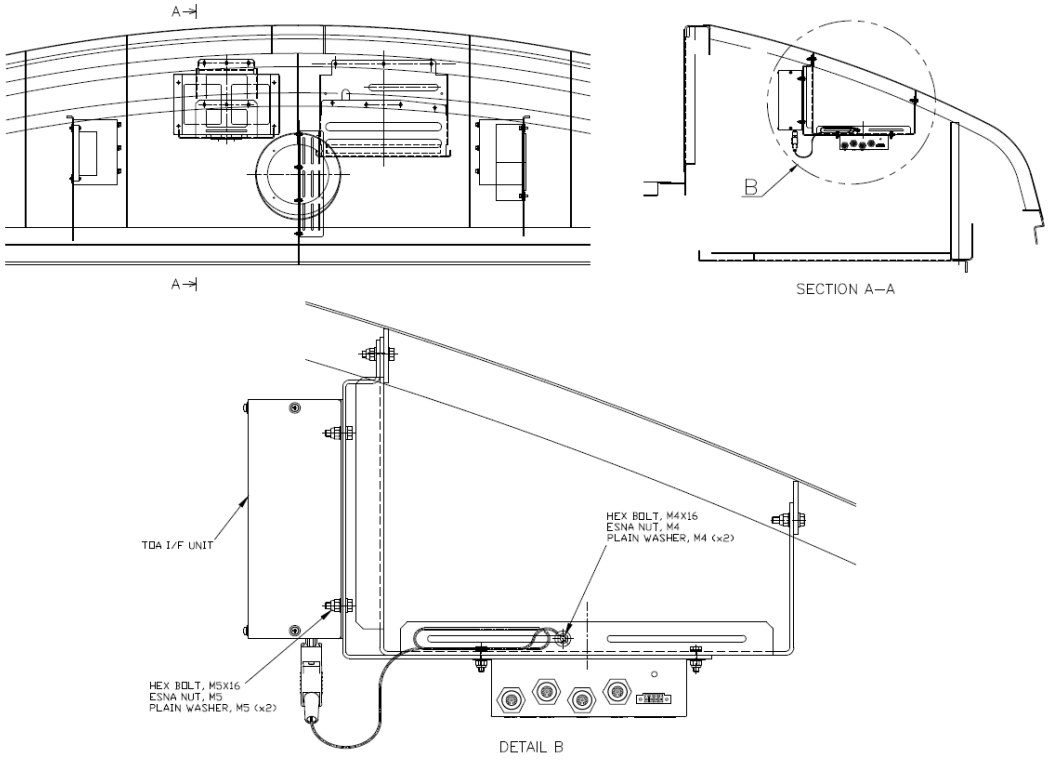

Figure 3-7a: Detail View of IFU installed without SmartDrive system

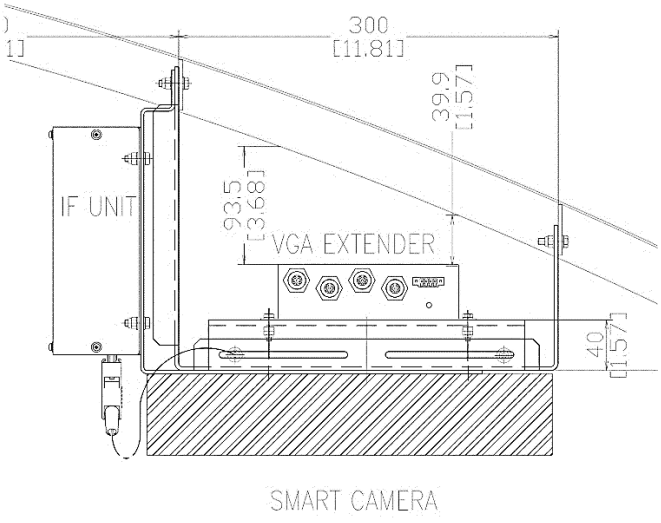

Figure 3-7b: IFU installed with SmartDrive system

3.4.2 Removal

1) In the B-Unit cab, unlock the two locks on the cab ceiling panel using a maintenance key, lower the cab ceiling panel, and release the two safety chains to fully open the panel.
2) Disconnect the ID plug from the IFU. Figure 3-8 shows the installation detail of the ID plug for the IFU. First, release the fixed bolt with washers. Second, disconnect the ID plug from the IFU. The disconnected ID plug will be reused for the replaced IFU, therefore, the ID plug should be secured to the rack frame (using M4 hex bolt, nut and washer shown in Figure 3-7) if the IFU is not immediately replaced with a new device.

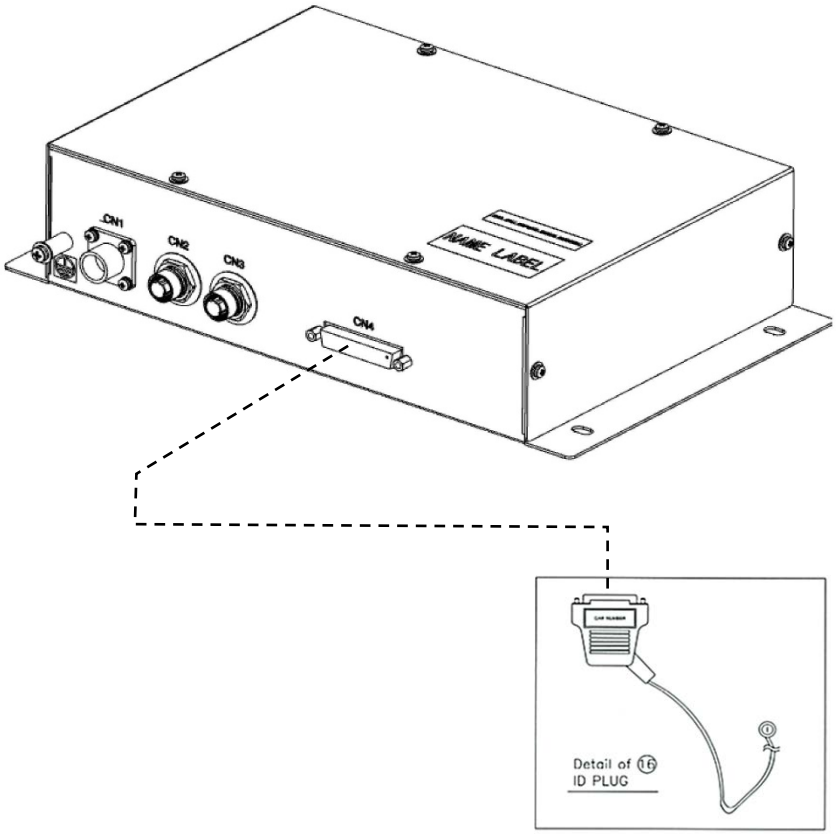

Figure 3-8: Detail View of ID Plug installation status in IFU

3) Disconnect all electrical connections from the IFU including M12 connectors in CN2 and CN3.
4) Release four each of M5x16 bolts, M5 nuts, and M5 plain washers and remove the IFU from the brackets.

3.4.3 Installation

1) In the B-Unit cab, unlock the two locks on the cab ceiling panel using a maintenance key, lower the cab ceiling panel, and release the two safety chains to fully open the panel.
2) Install the IFU onto the brackets using each four of the M5x16 bolts, M5 nuts, and M5 plain washers.
3) Connect all electrical connections, including the ID plug on the IFU, and M12 connectors in CN2 and CN3.
4) Reconnect the ID plug to the IFU. Figure 3-8 shows the installation detail of the ID plug for the IFU. First, reconnect the ID plug on the IFU. Second, wrap the lanyard around the bracket. Third, fix the end of lanyard by using bolt with washers. The ID Plug acts as a car number identifier to the IFU. The car number label should be checked on the ID plug whether its car number is the same as the actual LRV car number (e.g., Label Example “Car0125”). Please refer to Figure 3-9.

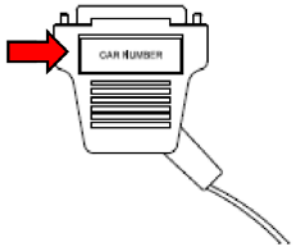

Figure 3-9: Detail view of ID plug for the IFU

5) Close and lock the cab ceiling panel.

3.5 CCH, Communications Control Head

3.5.1 Location

The CCH is installed on the bottom of the console panel 4 in the cab as shown in Figure 3-10. One CCH is installed in A car, and another in B car.

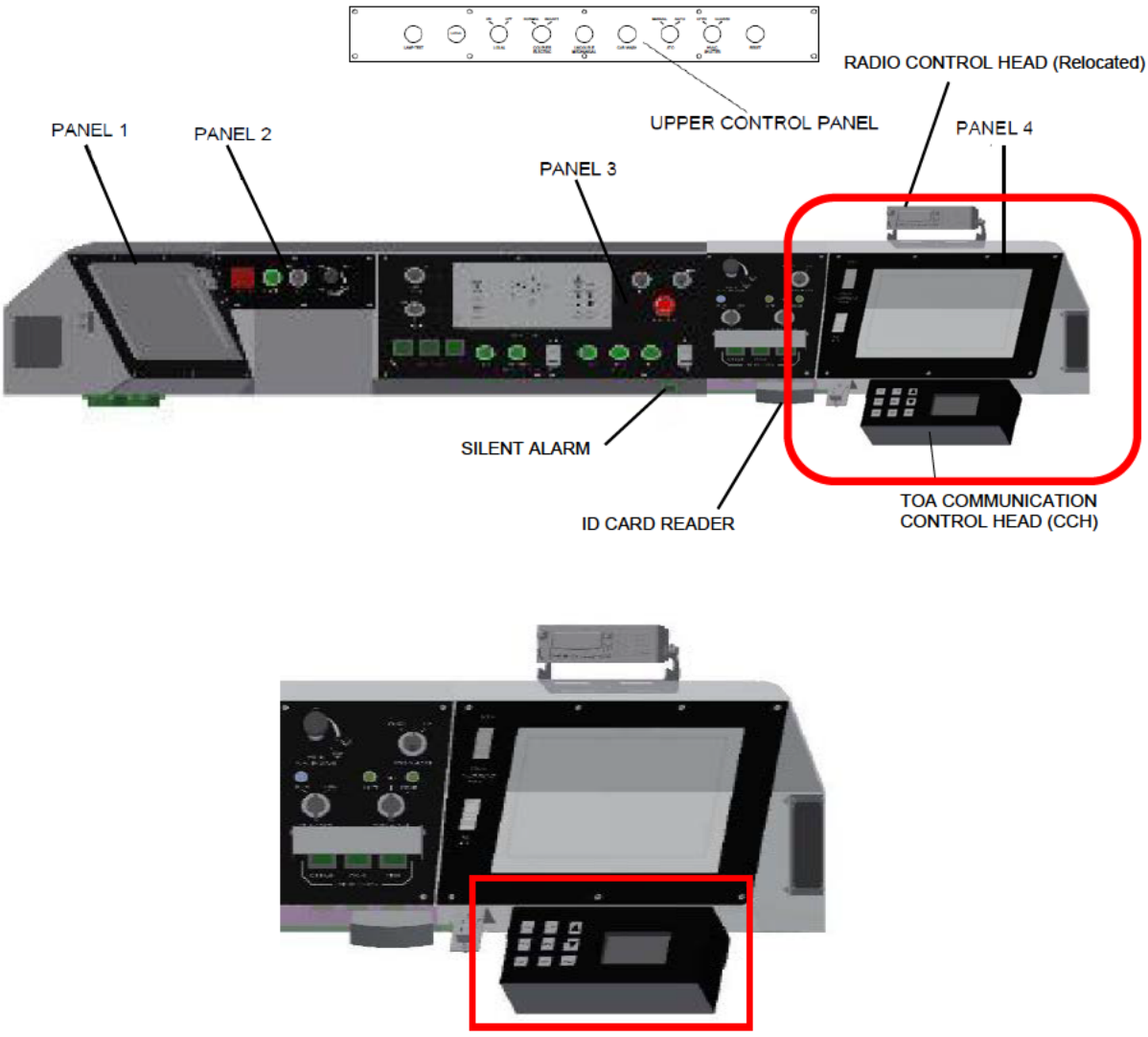

Figure 3-10: Location of CCH installed

3.5.2 Removal

1) Disconnect the CCH wiring, running the cable through the hole in the bottom of the console from the radio wiring.
2) Release screws with plain washers (two per each side of the CCH), and remove the CCH from the bracket.

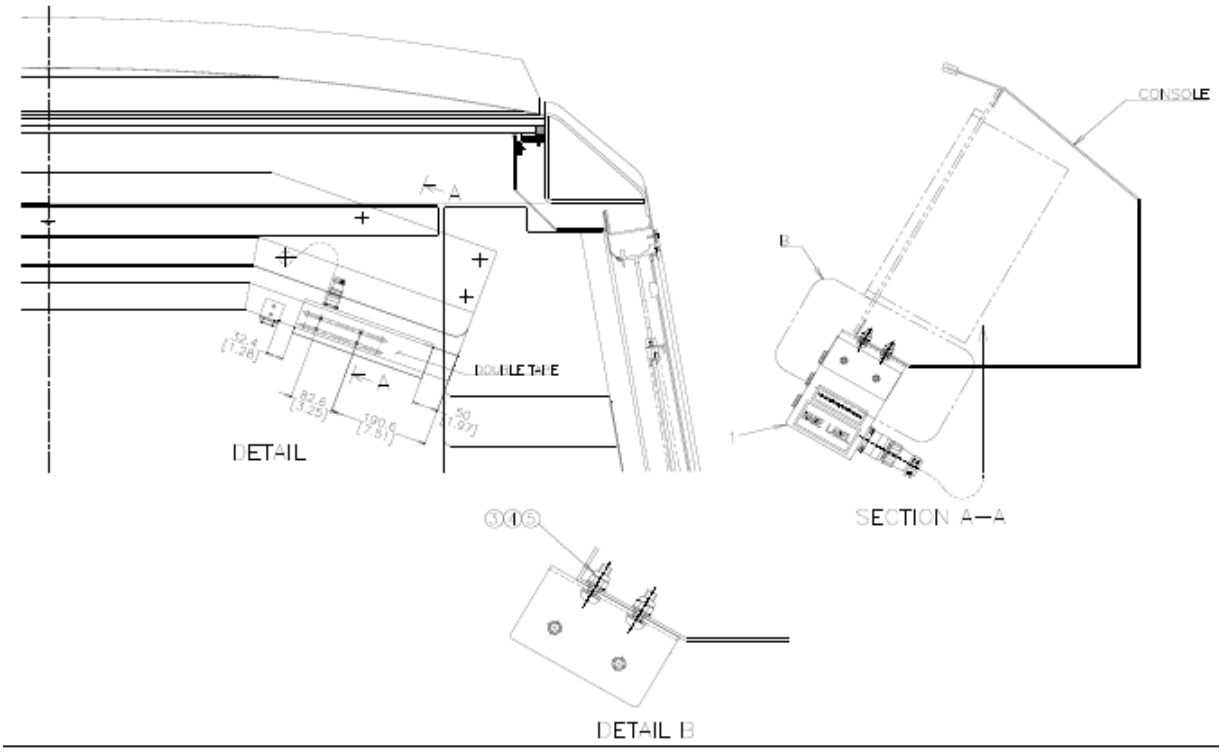

Figure 3-11: Detail view of installed Communication Control Head

3.5.3 Installation

1) Install the CCH on the bracket with screws with plain washers (two per each side of CCH).
2) Reconnect the CCH wiring, running the cable through the hole in the bottom of the console from the radio wiring.

3.6 Ethernet switch, Viper-112A

3.6.1 Location

The Ethernet switch is installed inside the ceiling of the cab as shown in Figure 3-12 and Figure 3-13. One Ethernet Switch in the A car, and another in the B car.

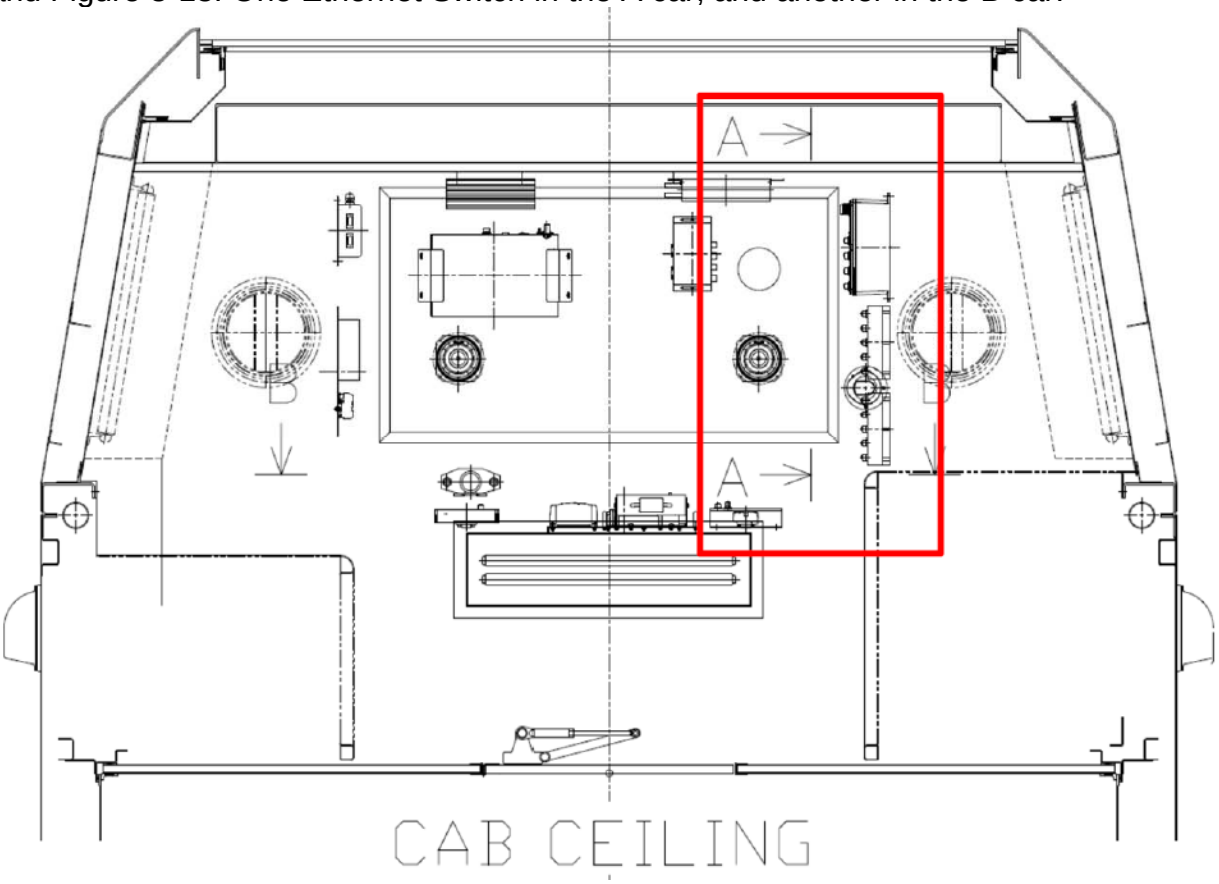

Figure 3-12: Location of installed Ethernet switch

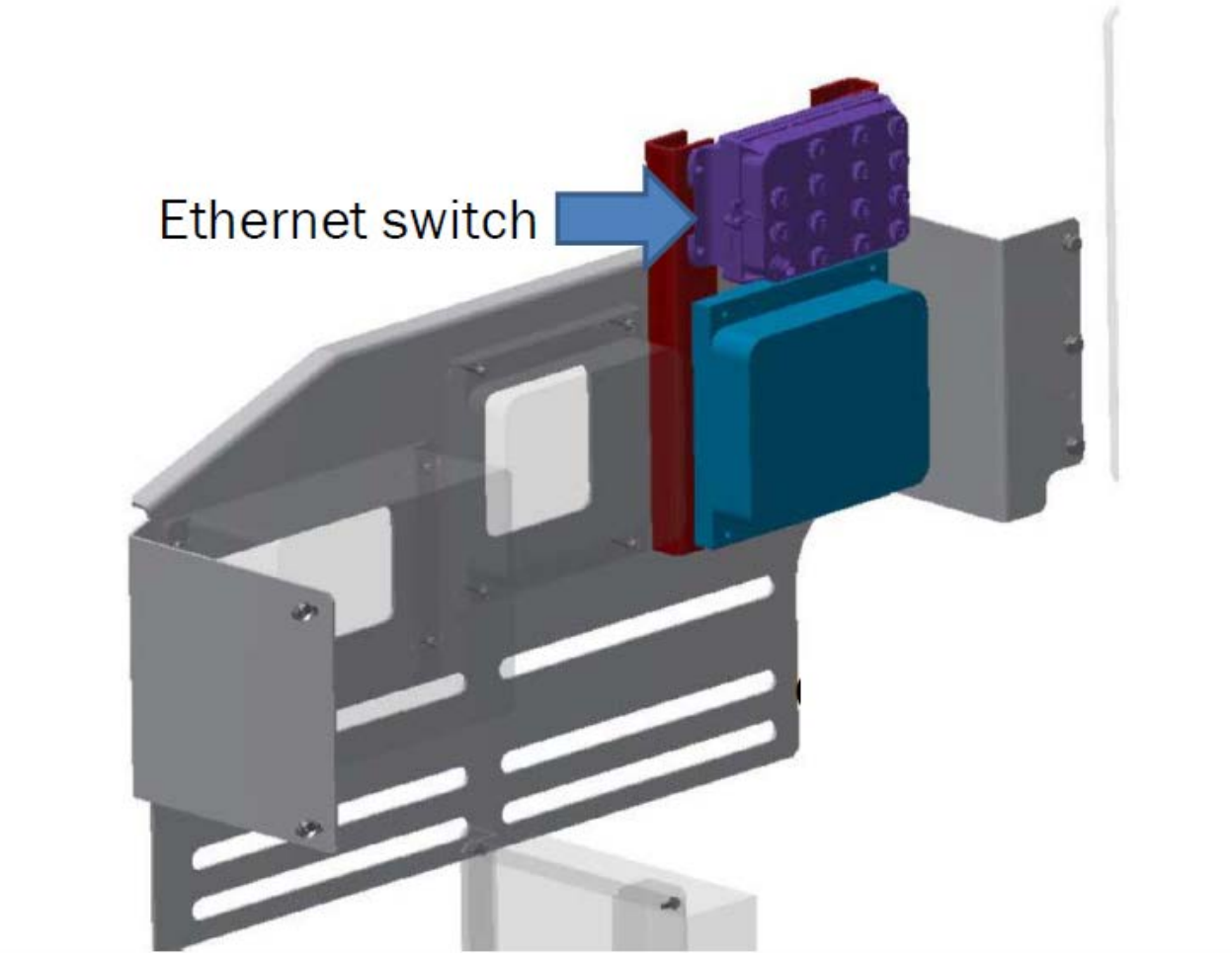

Figure 3-13: Detail location of Ethernet switch installed

3.6.2 Removal

1) To access the Ethernet Switch, unlock the two locks on the cab ceiling panel using a maintenance key, lower the cab ceiling panel, and release the two safety chains to fully open the panel.
2) Disconnect all Ethernet cable connection from the Ethernet Switch.
3) Release four screw with lock/plain washers and remove the Ethernet Switch from the bracket.

3.6.3 Installation

1) Mount the Ethernet Switch to the brackets using four screws with lock/plain washers.
2) Reconnect all Ethernet cable connection to the Ethernet Switch.
3) Hook the two safety chains, close the cab ceiling panel and unlock the two locks on the cab ceiling panel using a maintenance key.

3.6.4 Setup Procedure for Ethernet Switch

When the TOA Ethernet Switch is installed to the new one, the network setting for Ethernet Switch shall be properly implemented. The following procedure described how to set up the Ethernet Switch

3.6.4.1 Preparation

System configuration to setup the Ethernet Switch is shown in the below figure.

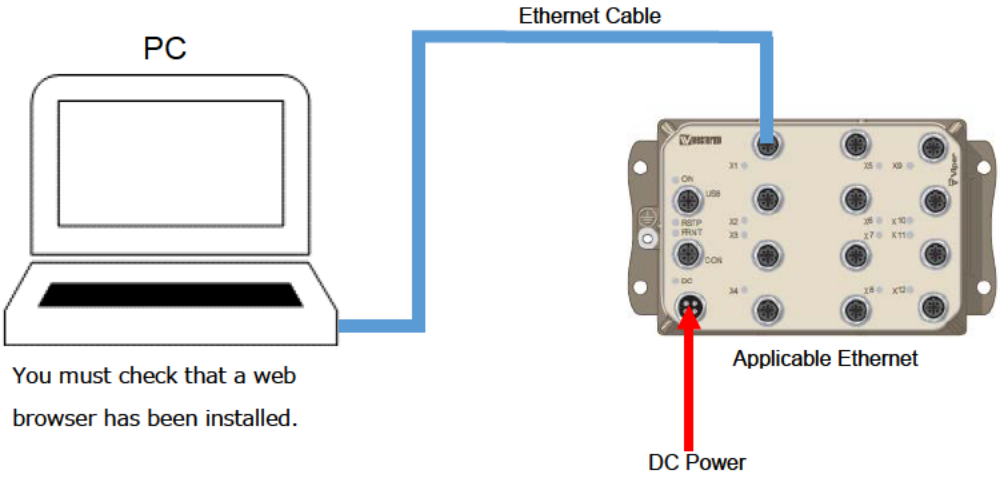

Figure 3-14: System configuration

3.6.4.2 Setup Procedure

a. Turn off the "Communication Control" circuit breaker. If you work on the A car, the circuit breaker location shall be referred to Figure 3-15. If you work on the B car, the breaker location shall be referred to Figure 3-16.

Figure 3-15 "Communication Control" Circuit Breaker location on A car

Figure 3-16 "Communication Control" Circuit Breaker location on B car

b. Remove all Ethernet cables from the Ethernet switch except the one which connect with the Laptop PC. DC power cable shall not be removed as well. (Please refer to Figure 3-14 for Ethernet switch layout.)

c. Turn on the "Communication Control" circuit breaker. If you work on the A car, the circuit breaker location shall be referred to Figure 3-15. If you work on the B car, the breaker location shall be referred to Figure 3-16.

d. Change the network setting is as follows;

IP Address: 192.168.2.1

Sub netmask: 255.255.255.0

Gateway: Disabled

If the Ethernet switch has already been installed to the train, change the network setting is as follows.

IP Address: 10.0.0.99

Sub netmask: 255.0.0.0

Gateway: Disabled

[How to open the network setting?]

1. In the Start menu, search for and select the "ncpa.cpl".

2. Right click on your Ethernet connection adapter and select "Properties" from the drop-down menu.

3. This will open a new window. In the "Networking" tab, select "Internet Protocol Version 4 (TCP/IPv4)" and click the "Properties" button.

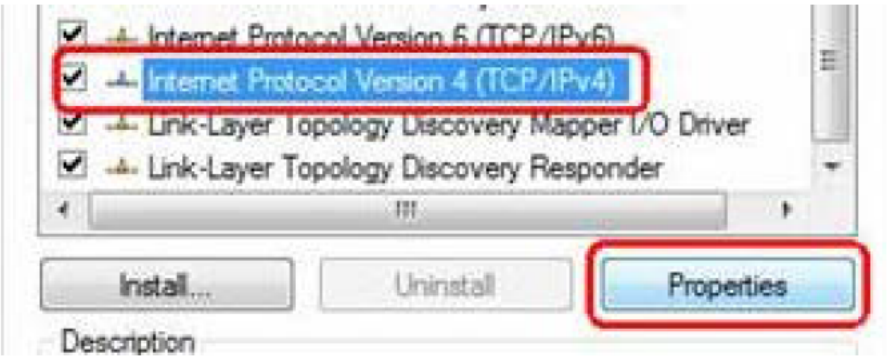

Figure 3-17 Window screen for Network Setting

4. Click the radio button by "Use the following IP address" and put the above IP address and Sub netmask. Click the radio button by "Obtain DNS server address automatically". Click "OK" to finish and close.

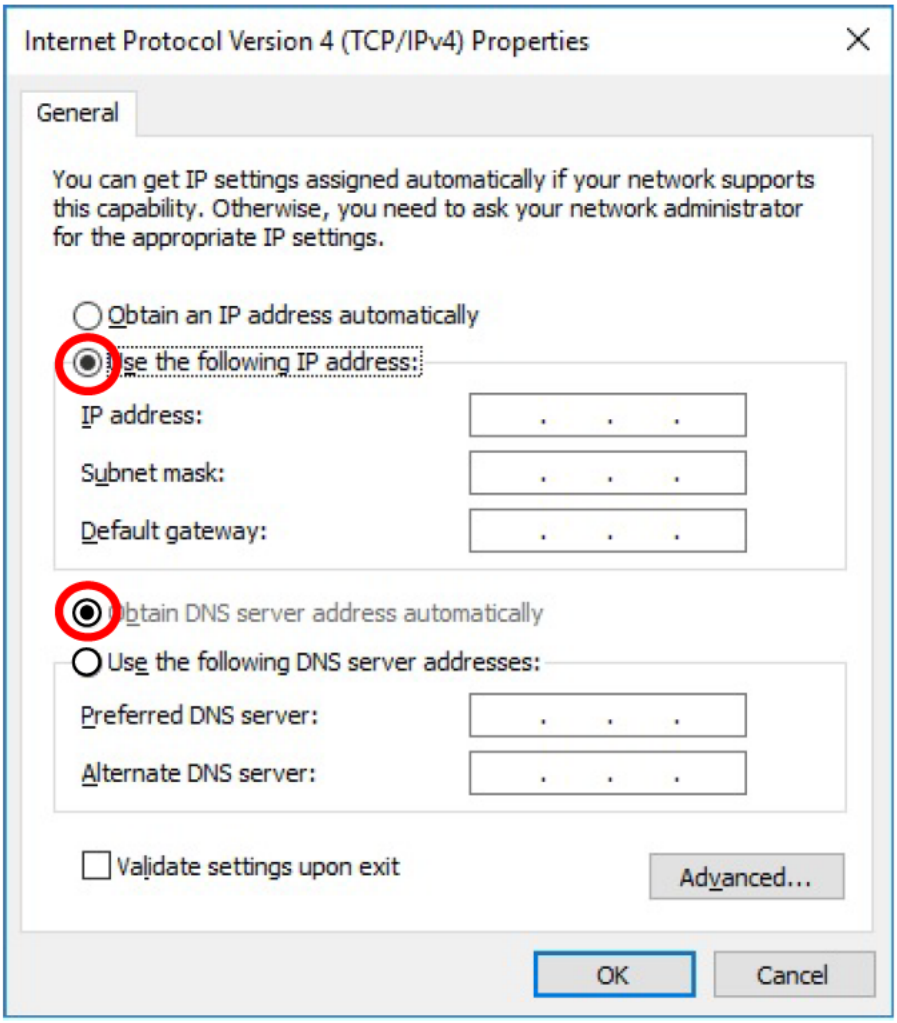

Figure 3-18 Window screen for Internet Protocol Version 4 (TCP/IPv4) Setting

e. Access to the Ethernet Switch by the following web browser

http://192.168.2.200

When the Ethernet switch has already been installed to the train, access to the Ethernet Switch by a web browser as follows.

http://10.0.xxx.28 (for switch on A car) or http://10.0.xxx.29 (for switch on B car)

Note) xxx is car number - 1000.

f. Log in to the Ethernet Switch by the following username and password.

Login username: admin

Password: westermo

Note) In case of the factory setting

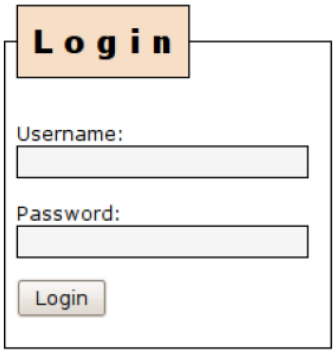

Figure 3-19：WeOS log in

g. Ethernet Switch setting should be set on WeOS.

Load the basic setting file, and update information as necessary, in accordance with the car number and A/B-Unit of the location of the Ethernet Switch.

（Menu path: Maintenance⇒Backup&Restore）

To update the information, click “Apply” Button for each page.

Figure 3-20：WeOS Maintenance > Backup&Restore page

For the IP Address for Car No. 1xxx A-Unit:

1) Load the basic setting file, “TOA Ethernet A end.cfg”

2) Set the IP address Setting

“Menu path: Configuration 〉 Network 〉 Interface”

IP Address = 10.0.xxx.28

Note) If you find that the default primary address is 10.0.xxx.29 in A car, the configuration file which you applied is incorrect. Please select the correct file.

3) Set the DHCP Server Setting as shown in Figure 3-21. Click each pencil icon, then IP address for each port can be modified as shown in Figure 3-22, Figure 3-23 and Figure 3-24.

“Menu path: Configuration 〉 Network 〉 DHCP Server”

Host 1: Port X9 (FDS), IP Address 10.0.xxx.81 (See Static Lease 1 screen in Figure 3-22)

Host 2: Port X10 (SDS), IP Address 10.0.xxx.21 (See Static Lease 2 screen in Figure 3-23)

Host 3: Port X11 (PIDS), IP Address 10.0.xxx.23 (See Static Lease 3 screen in Figure 3-24)

4) Set the Identity as shown inFigure 3-25. Put the name of Viper as “TrainXXXX-A” in Hostname.

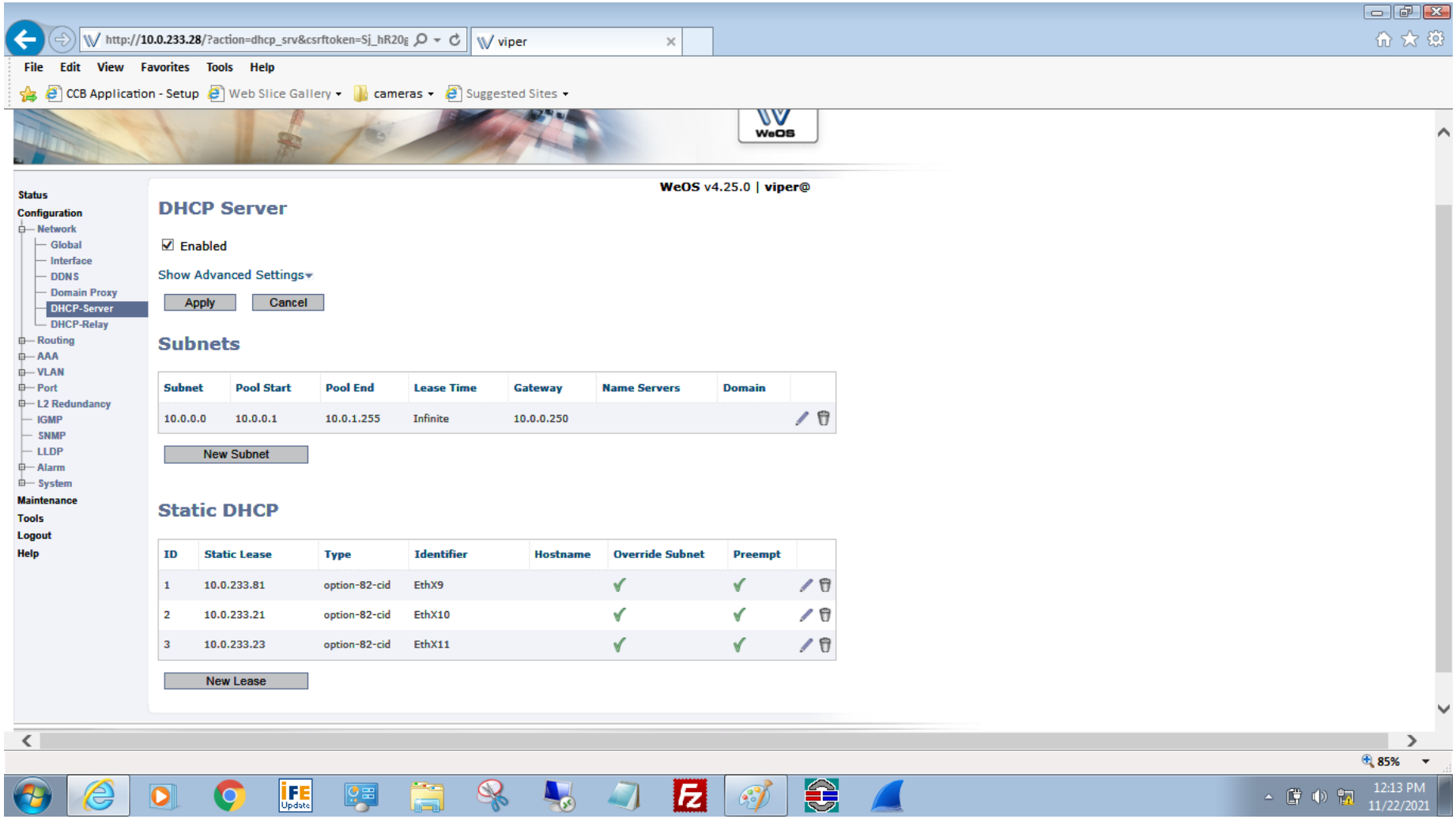

Figure 3-21 DHCP Server Screen

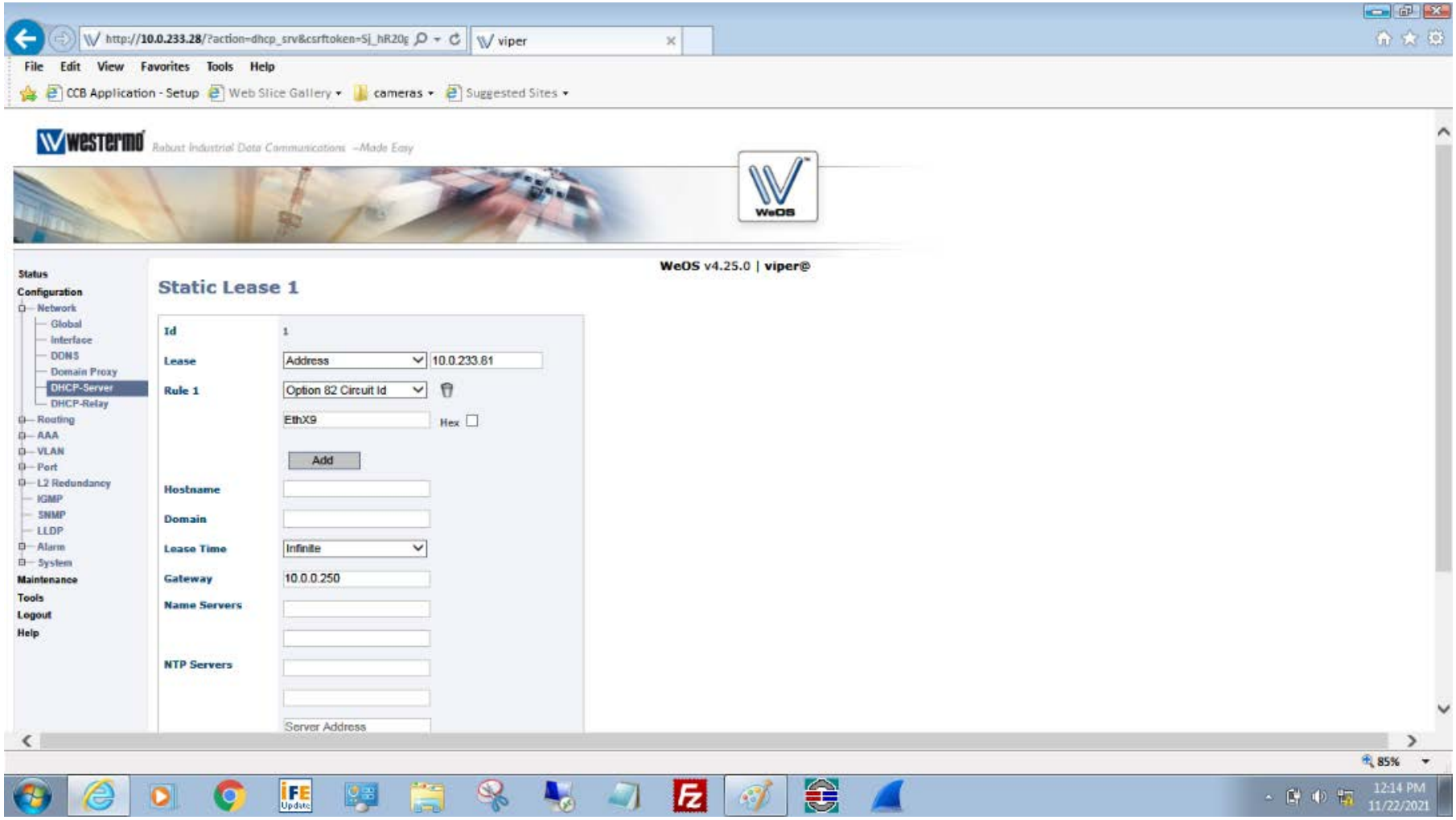

Figure 3-22 Static Lease 1 Screen for each Static ID

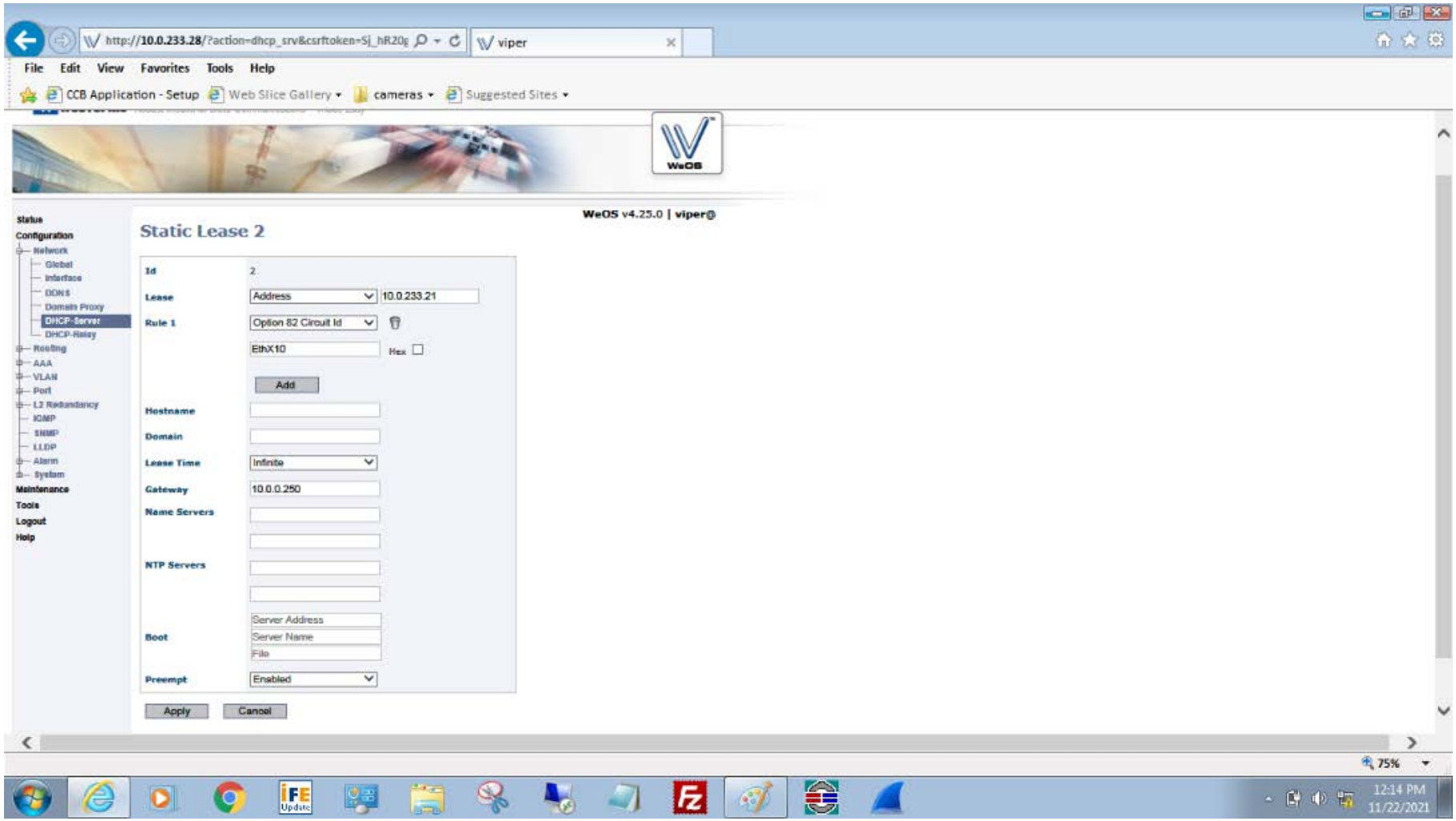

Figure 3-23 Static Lease 2 Screen for each Static ID

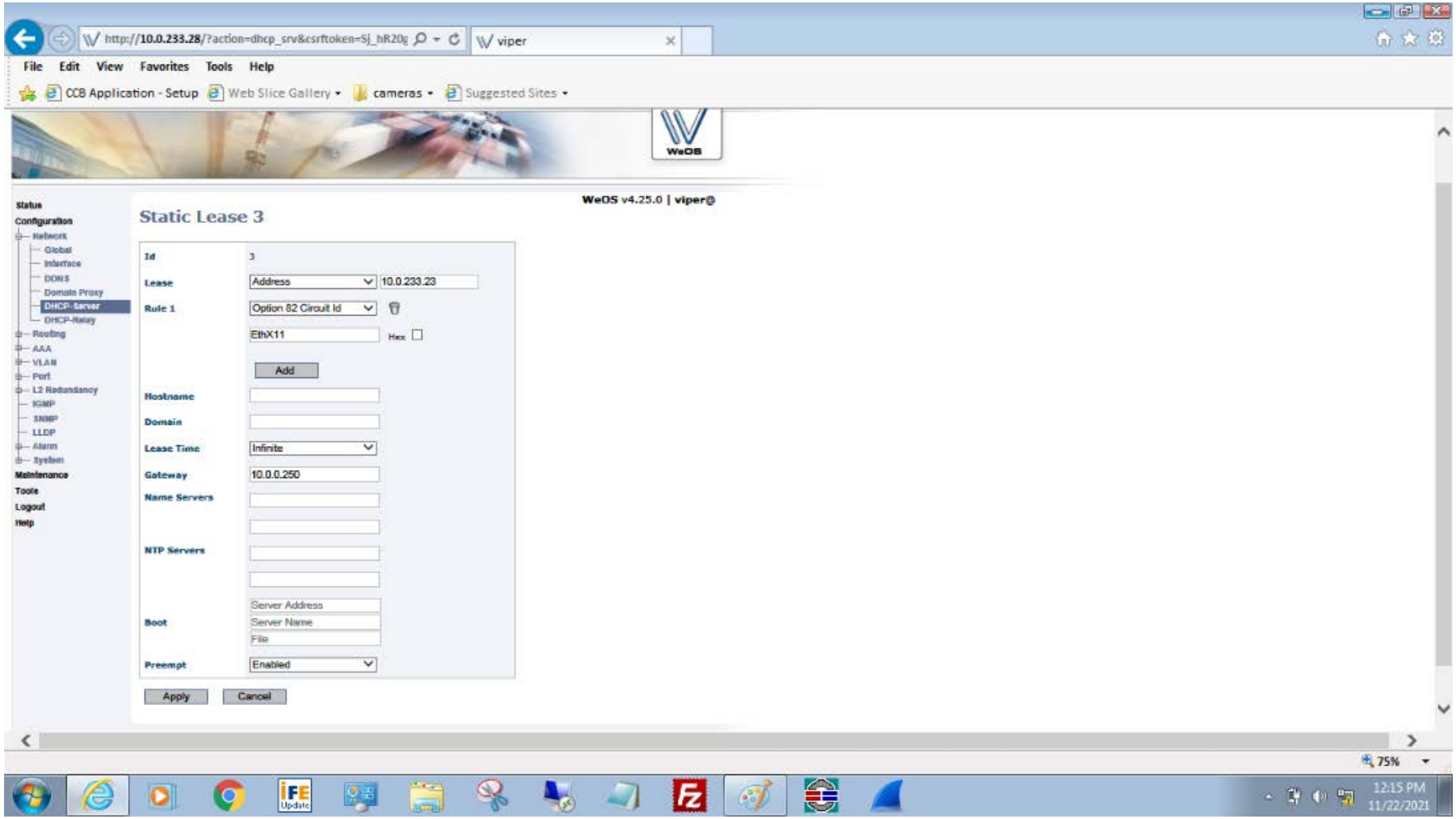

Figure 3-24 Static Lease 3 Screen for each Static ID

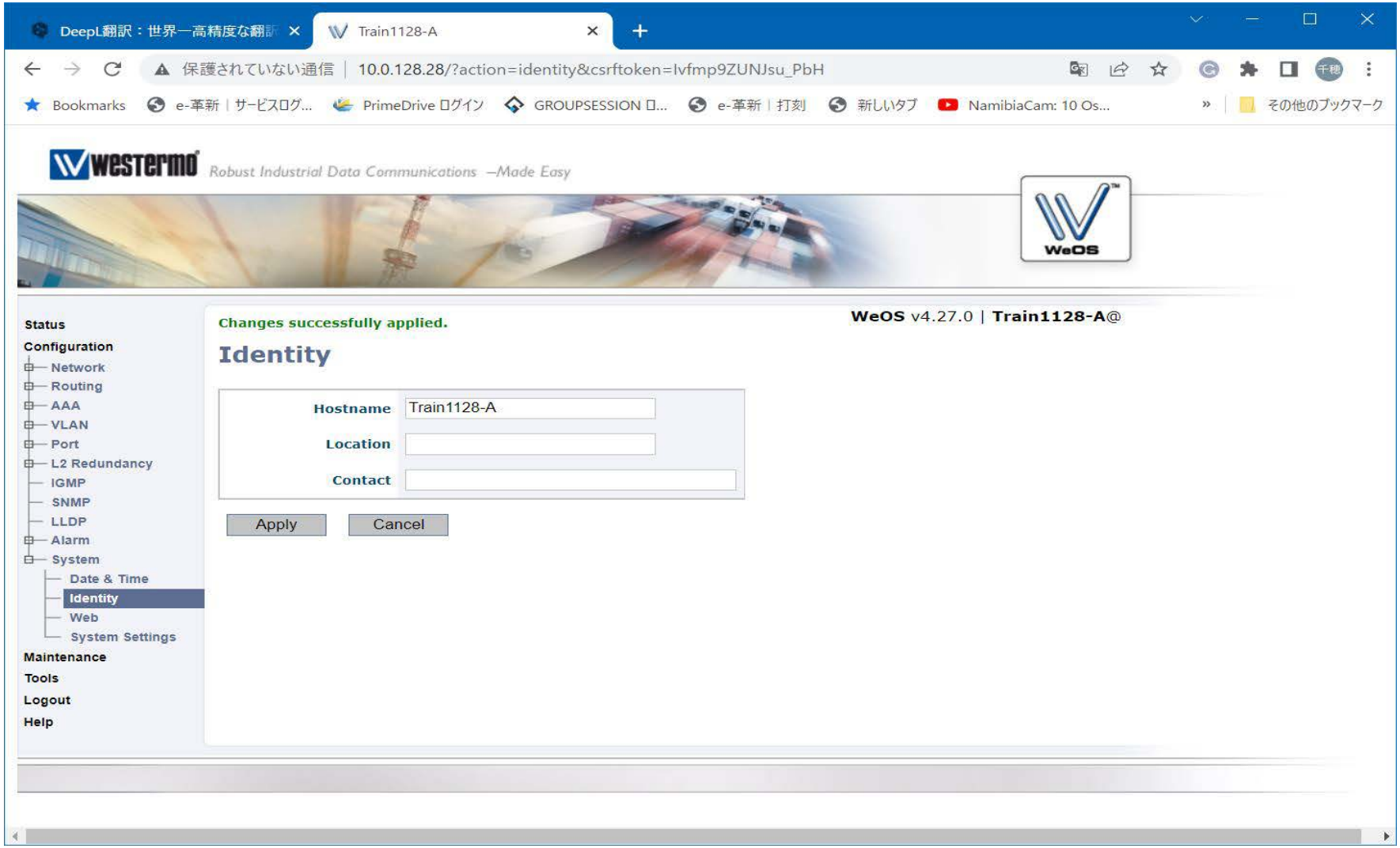

Figure 3-25 Identity Screen

For the IP Address for Car No. 1xxx B-Unit:

1) Load the basic setting file, "TOA Ethernet B end.cfg"

2) Set the IP address Setting

"Menu path: Configuration 〉 Network 〉 Interface"

Primary IP Address = 10.0.xxx.29

Note) If you find that the default primary address is 10.0.xxx.28 in B car, the configuration file which you applied is incorrect. Please select the correct file.

3) Set the DHCP Server Setting as shown in Figure 3-21. Click each pencil icon, then the IP address for each port can be modified as shown in Figure 3-24.

"Menu path: Configuration 〉 Network 〉 DHCP Server"

Host 1: Port X9 (FDS), IP Address 10.0.xxx.82 (See Static Lease 1 screen in Figure 3-24)

Host 2: Port X10 (SDS), IP Address 10.0.xxx.22 (See Static Lease 2 screen in Figure 3-24)

Host 3: Port X11 (PIDS), IP Address 10.0.xxx.24 (See Static Lease 3 screen in Figure 3-24)

4) Set the Identity as shown inFigure 3-25. Put the name of Viper as "TrainXXXX-B" in Hostname.

h. Create the backup setting file

"Menu path: Maintenance 〉 Backup&Restore"

i. Confirmation for setting

The backup setting .cfg file should be compared with the original .cfg file by the file comparison tool. The differences between these files should be checked. These are the locations you have changed.

j. Turn off the "Communication Control" circuit breaker. If you work on the A car, the circuit breaker location shall be referred to Figure 3-15. If you work on B car, the breaker location shall be referred to Figure 3-16.

k. Re-connect all Ethernet cables from the Ethernet switch except the one which connect with the Laptop PC. (Please refer to Figure 3-14 for Ethernet switch layout.)

l. Turn on the "Communication Control" circuit breaker. If you work on the A car, the circuit breaker location shall be referred to Figure 3-15. If you work on the B car, the breaker location shall be referred to Figure 3-16.

m. Key on the LRV and implement Onboard Test as per Section 5.4 to verify PID and SDS/FDS is working correctly.

3.7 Ethernet Interface Module, DDW-002-B1

3.7.1 Location

Ethernet Interface Module is installed in the right side locker in the cab as shown in Figure 3-26 and Figure 3-27. Two are in A car, and another two in B car.

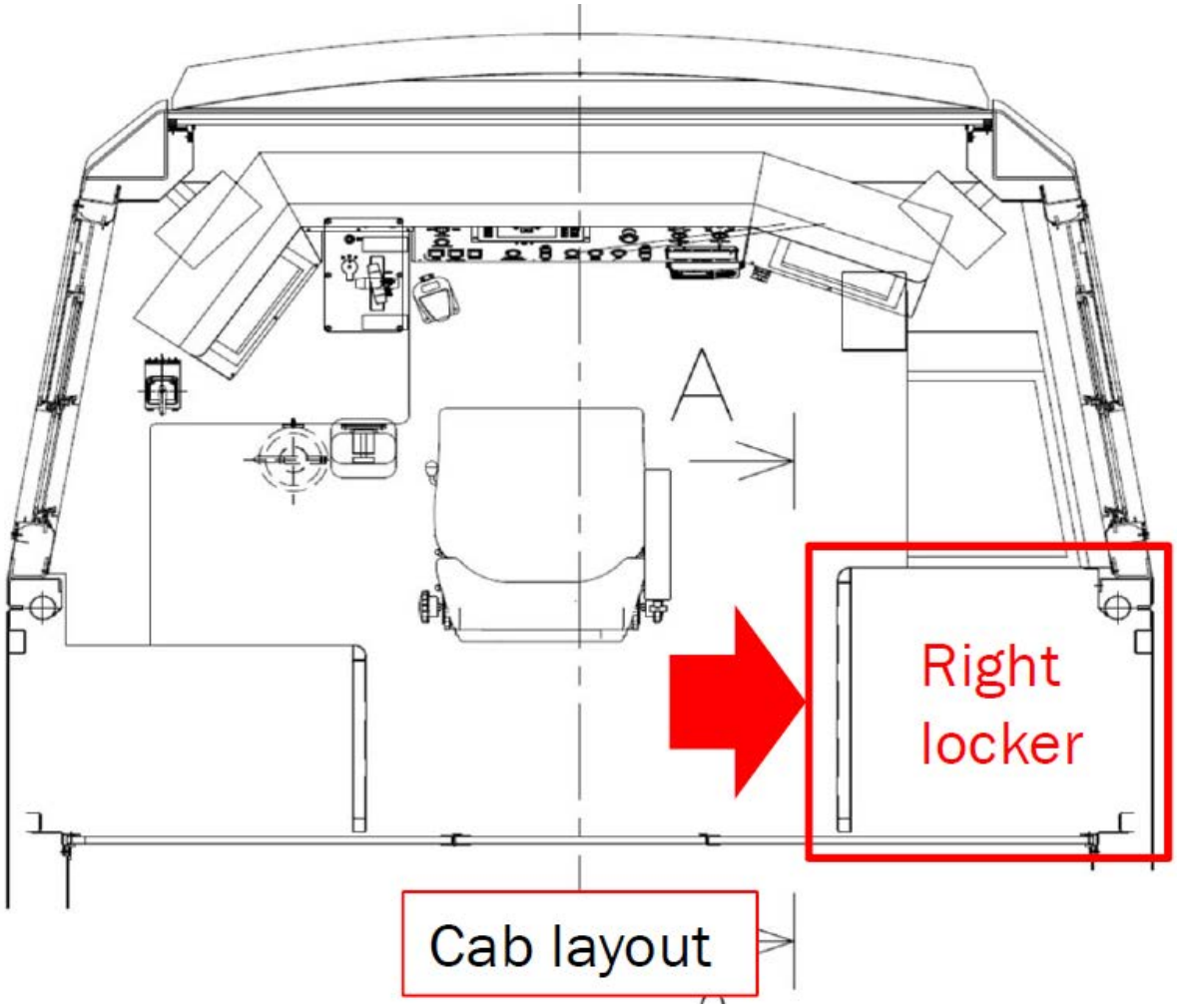

Figure 3-26: Location of Ethernet Interface Module installed

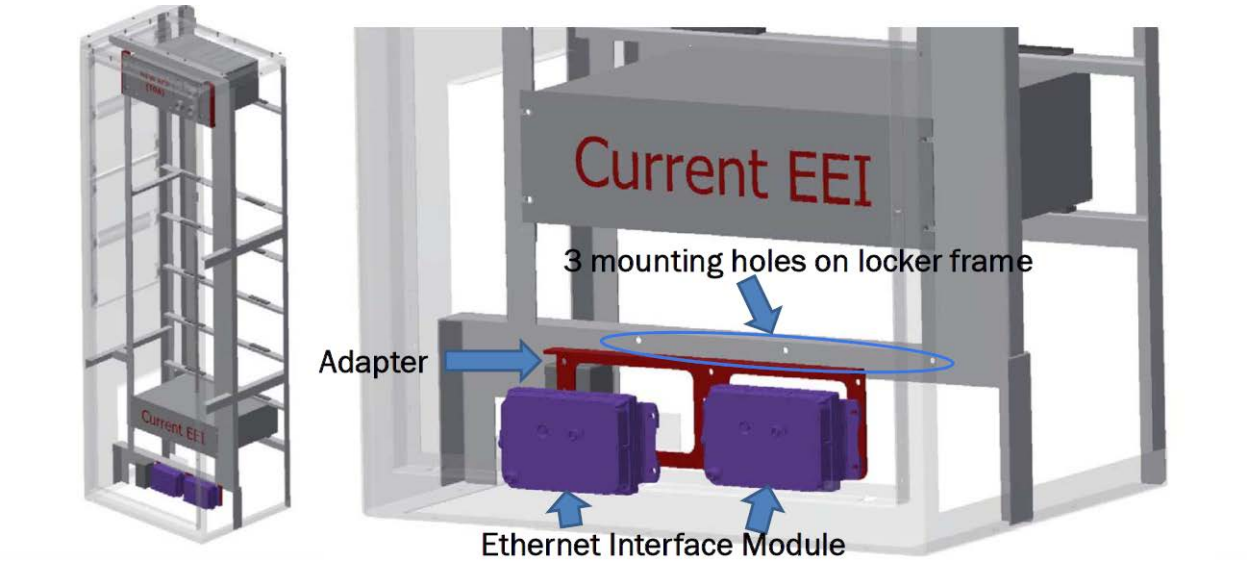

Figure 3-27: Detail Location of Ethernet Interface Module installed

3.7.2 Removal

1) Open the right side cab locker shown in Figure 3-26 by unlocking the three locks using a maintenance key and locate the two Ethernet Interface Modules at the bottom of the rack shown in Figure 3-27.
2) Disconnect all cable connection from the Ethernet Interface Module.
3) Release four each of the M6x20 screws, M6 lock washers, and M6 plain washers per module and remove the Ethernet Interface Modules from the adapter plate.

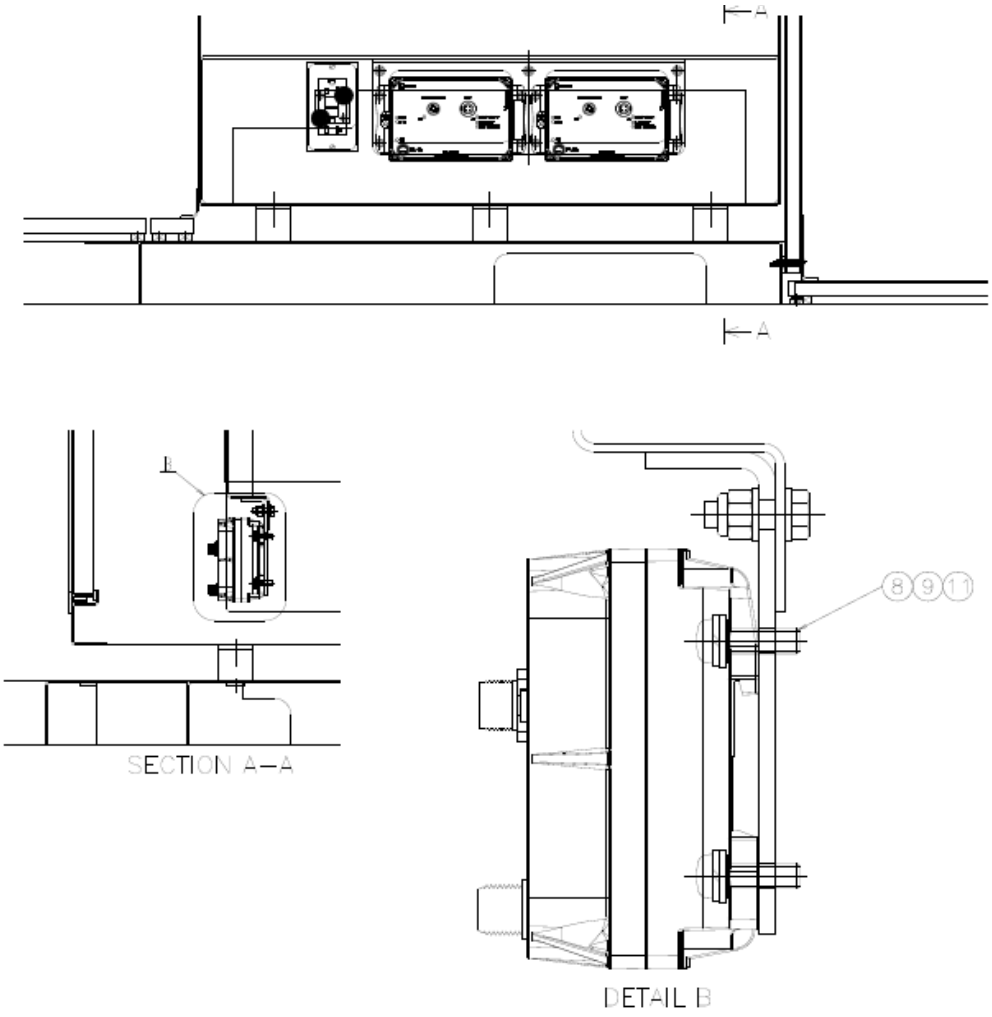

Figure 3-28: Detail view of Ethernet Interface Module installed

3.7.3 Installation

1) Mount the Ethernet Interface Modules to the adapter plate using four M6x20 screws together with lock washers and plain washers per module.
2) Reconnect the cable connection to the Ethernet Interface Module.
3) Close the right-side cab locker by locking the three locks using a maintenance key.

3.7.4 Set up Procedure for Ethernet Interface Module

When the TOA Ethernet Interface Module is replaced by the new one, the network setting for Ethernet Interface Module shall be properly implemented. The following procedure describes how to set up the Ethernet Interface Module.

3.7.4.1 Preparation

The latest WeConfig should be installed in the Laptop PC before setting from the following web browser;

https://www.westermo.com/solutions/weconfig/get-weconfig

Note) WeConfig 1.16.X cannot detect powerline devices (DDW-002). WeConfig 1.15.X should be installed.

When the Ethernet Interface Modules have already been installed to the train, change the network setting of the laptop PC is as follows.

IP Address: 10.0.0.99

Sub netmask: 255.0.0.0

Gateway: Disabled

After Ethernet switches (Viper-112A) are adopted FRNT network setting, WeConfig cannot access via the Ethernet switch.

Connect the laptop PC to the Ethernet Interface Module directly.

Figure 3-29: DDW-002-B1

3.7.4.2 Setup procedure

a. Start WeConfig software.

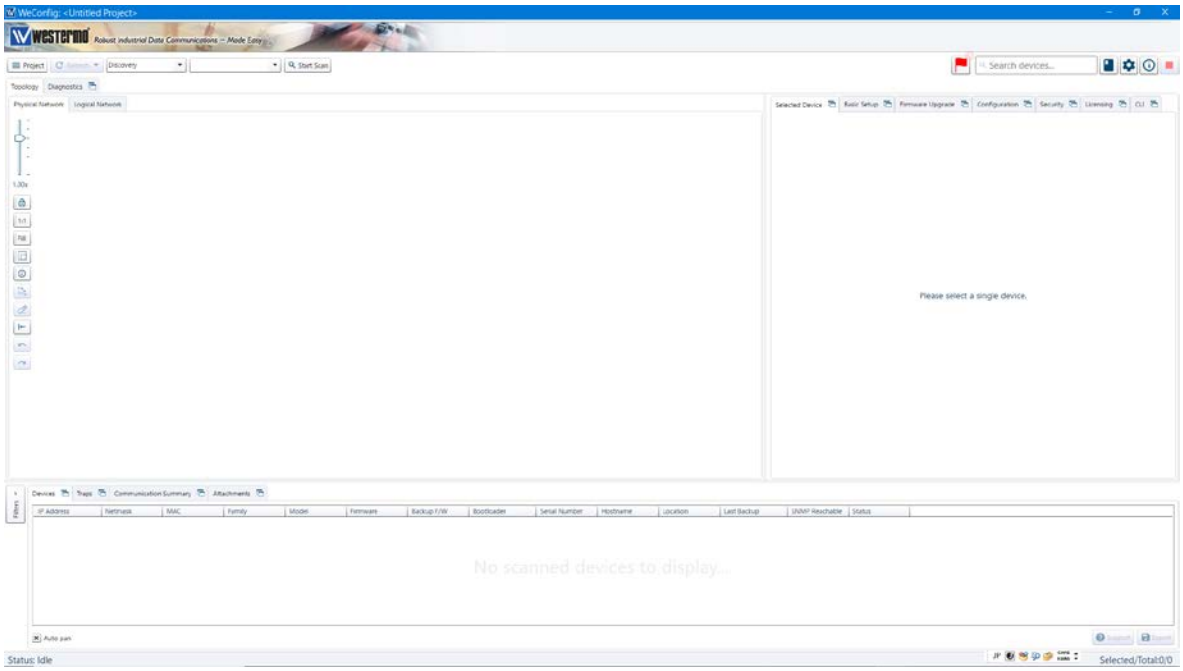

Figure 3-30: WeConfig Main Screen

b. Go to Setting and Make sure that Powerline is selected

c. Start Scan for all the Westermo Device on the network

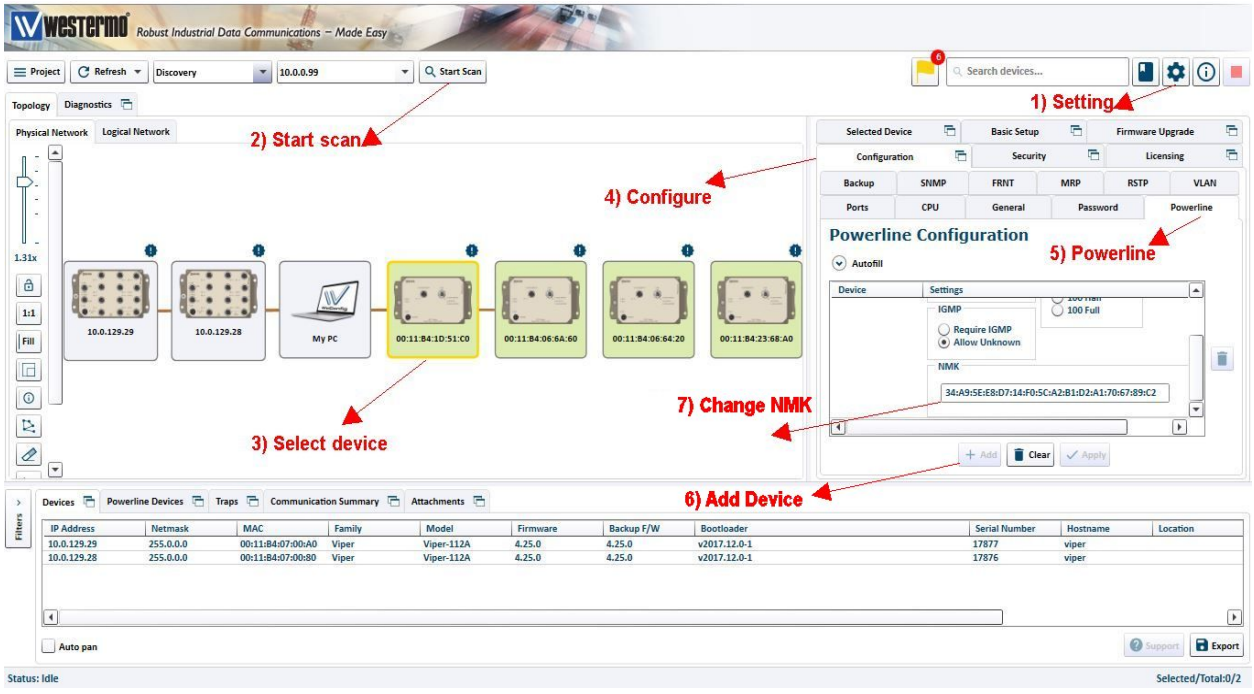

Figure 3-31: WeConfig Screen after scan

d. Select the Ethernet Interface Module for which you need to change the NMK

Note) Make sure only the desired EIM's are connected to the network to avoid any mistakes

e. Select the Configurations to make changes

f. Then Select the Powerline Configuration

g. Add the Device

h. Change the NMK Value

- EIM1= 34:A9:5E:E8:D7:14:F0:5C:A2:B1:D2:A1:70:67:89:CE (Factory default)
- EIM2 = 34:A9:5E:E8:D7:14:F0:5C:A2:B1:D2:A1:70:67:89:C2

Note) EIM1 should be link to port 8 of the Ethernet Switch (Viper-112A) and EIM2 should be link to port 12 of the Ethernet Switch (Viper-112A).

Note) Default of IGMP is "Allow Unknown".
It is able to change IGMP settings from "Require IGMP" to "Allow Unknown" by WeConfig. But the table will not fresh automatically, you need to "clear" and "add" the devices again after you apply the changes, then it will show the updated configurations.

i. Close WeConfig application and disconnect laptop PC from Ethernet switch. Click "Project/new" and "Start Scan".

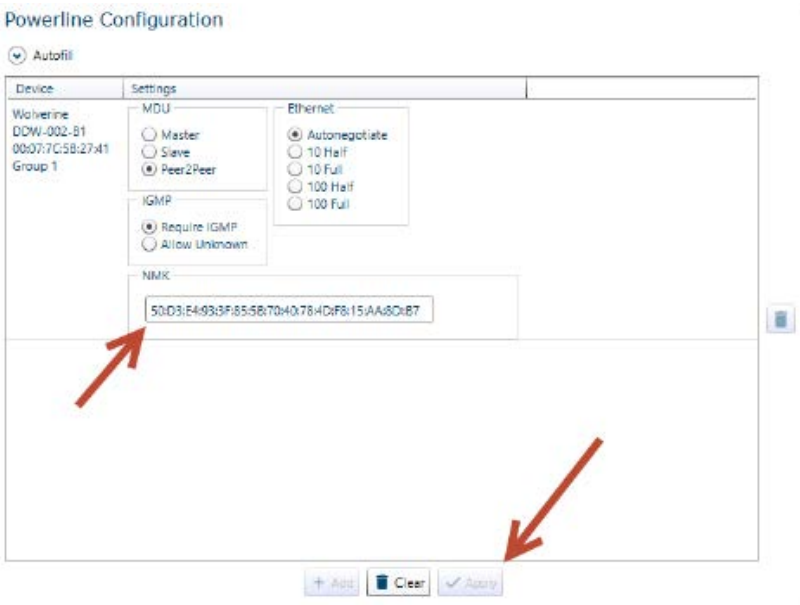

Figure 3-32: WeConfig Powerline Configuration screen

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4.0 SCHEDULED MAINTENANCE TASKS

4.1 Introduction

This chapter provides scheduled maintenance tasks in the form of a quick reference table. A thorough visual inspection should be performed before proceeding. Obvious malfunctions from damage observed during the visual inspection are to be corrected.

4.2 Scheduled Maintenance Index

Table 4-1 is a scheduled maintenance index, which lists maintenance intervals and each maintenance task for the Communications equipment. The reference column indicates the section of this manual that details these maintenance procedures.

Table 4-1: Maintenance tasks

Maintenance Interval	Part Description	Scheduled Maintenance Task	Section 1401 Communications Running Maintenance & Servicing Manual Section Reference
Daily (Before Operation)	Onboard Test	Initiate Onboard Test via TOA CCH to inspect test tones from Interior/Exterior Speakers and test patterns on PID Displays and Destination Signs, and verify no fault on the TOA CCH	5.4
30,000 miles	TOA Ethernet Switch TOA Ethernet Interface Module	Visually inspect LED indicator to confirm the status of network connection	5.3.4 5.3.5
60,000 miles	TOA ACP(A), TOA ACP(B)	Visually inspect for loose components and secure panel mounting hardware	5.3.1
60,000 miles	TOA IFU	Visually inspect for loose components and secure panel mounting hardware	5.3.2
60,000 miles	TOA CCH(A), TOA CCH (B)	Visually inspect for loose components and secure panel mounting hardware	5.3.3
120,000 miles	TOA Ethernet Switch	Verify all M12 connectors are tightened to the proper torque	5.3.4
120,000 miles	TOA Ethernet Interface Module	Verify all M12 connectors are tightened to the proper torque	5.3.5

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5.0 CORRECTIVE MAINTENANCE

5.1 Introduction

This chapter provides maintenance information for the Communications equipment.

The TOA Communication System equipment such as the ACP, IFU, CCH, Ethernet switch, and Ethernet Interface Modules are considered non-repairable under corrective maintenance. Therefore, troubleshooting shall take the form of isolating the faulty component and replacing it with a known good component as per the fault status listed in Table 6-2.

Before deciding that a system/subsystem is malfunctioning, check that all related circuit breakers, switches, control devices are set properly for normal operation. The TOA Communications system is interconnected to other subsystems on the vehicle and draws signal states from them through the Ethernet network. Consideration must be given to these interrelationships while troubleshooting.

5.2 Safety Information

WARNING

BEFORE INSPECTING ANY ELECTRICAL EQUIPMENT IN AN ELECTRICAL SYSTEM, MAKE SURE THAT THE CIRCUIT BREAKER IS SWITCHED TO THE OFF POSITION AND THERE IS NO VOLTAGE PRESENT WHERE WORK IS PERFORMED. SPECIAL ATTENTION SHOULD BE PAID TO REVERSE FEED APPLICATIONS TO ENSURE NO VOLTAGE IS PRESENT. THE VOLTAGES IN ENERGIZED EQUIPMENT CAN CAUSE INJURY OR DEATH.

WARNING

THE USE OF AN AIR JET, WHICH MUST BE LESS THAN 30 PSIG (2.1 BAR), TO BLOW PARTS CLEAN OR TO BLOW THEM DRY AFTER BEING CLEANED WITH A SOLVENT WILL CAUSE PARTICLES OF DIRT AND/OR DROPLETS OF THE CLEANING SOLVENT TO BE AIRBORNE. THESE PARTICLES AND DROPLETS MAY CAUSE SKIN AND/OR EYE IRRITATION. PERSONAL EYE PROTECTION MUST BE WORN TO PROTECT THE EYES FROM POSSIBLE INJURY. WHEN USING AN AIR JET DO NOT DIRECT IT TOWARD ANOTHER PERSON. IMPROPER USE OF AN AIR JET COULD RESULT IN BODILY INJURY.

CAUTION

DO NOT SCRUB WITH ABRASIVES OR USE BRUSHES FOR CLEANING. DO NOT USE GASOLINE. AGGRESSIVE CLEANING PROCEDURES OR AUTOMATED WASHING EQUIPMENT WILL EVENTUALLY RESULT IN VISUAL HAZING, LOSS OF LIGHT TRANSMISSION AND COATING DELAMINATION.

CAUTION

WEAR SAFETY SHOES AND HARD HATS WHEN WORKING WHERE OBJECTS MIGHT FALL.

WARNING

USE PROPER LIFTING EQUIPMENT TO REMOVE AND INSTALL COMPONENTS THAT WEIGH 50 LBS. (23 KG) OR MORE. ENSURE THAT THE COMPONENT IS SECURELY FASTENED TO THE LIFTING DEVICE. FAILURE TO HEED THESE WARNINGS COULD RESULT IN SEVERE INJURY OR DEATH TO PERSONNEL AND DAMAGE TO EQUIPMENT.

WARNING

ALL AIR SUPPLY AND/OR ELECTRIC CURRENT TO THESE DEVICES AND/OR ANY COMPONENT PARTS MUST BE CUT-OFF BEFORE THESE DEVICES AND/OR COMPONENT PART ARE REMOVED FROM THE EQUIPMENT ARRANGEMENT.

WARNING

TO PREVENT RECEIVING ELECTRICAL SHOCK WHEN PERFORMING ELECTRICAL TEST, HANDS MUST BE CLEAR OF ELECTRICAL COMPONENTS, CONTACTS AND HOUSING AND THERE MUST BE NO BODILY CONTACT WITH THE WORK BENCH. FAILURE TO HEED THIS WARNING COULD RESULT IN SEVERE INJURY OR DEATH.

WARNING

SHUT OFF POWER TO THE CAR BEFORE ATTEMPTING TO SERVICE ANY ROOF MOUNTED EQUIPMENT.

WARNING

MUCH OF THE EQUIPMENT ON THESE CARS OPERATES AT VOLTAGE AND CURRENT LEVELS THAT ARE HAZARDOUS AND LIFE THREATENING. PROPER PRECAUTIONS SHOULD BE TAKEN AND METRO SAFETY RULES, PRACTICES AND PROCEDURES CLOSELY OBSERVED.

WARNING

INSULATED GLOVES MUST BE WORN AND EXTREME CARE TAKEN TO PREVENT BURNS WHEN HANDLING HEATED PARTS.

CAUTION

THE EQUIPMENT OPERATING PROCEDURES DESCRIBED BELOW SHOULD BE FOLLOWED AS GIVEN TO AVOID THE POSSIBILITY OF DAMAGE TO EQUIPMENT AND/OR BODILY INJURY.

CAUTION

WEAR PROPER PPE EQUIPMENT WHEN WORKING UNDER THE CAR.

The importance of safe operation and maintenance cannot be over stressed. The following safety protocols and procedures are critical for maintenance personnel to observe:

1. Wear an insulated hard hat when working on the vehicle roof or any of the roof-mounted components.
2. Wear safety shoes and hard hats when working where objects might fall.
3. Never work on equipment while electrical power is applied unless it is necessary as part of the maintenance program. Verify that power is removed by checking with reliable equipment.
4. Attach a tag with the name of the person who removed the power from the equipment. That person knows why the power was removed and when it will be safe to restore it. Only the individual whose name appears on the tag or a person who has his approval should remove the tag and restore power.
5. Use proper lifting equipment to remove and replace heavy components. Make sure the components are securely fastened to the lifting device.
6. Never attempt to perform a two-person operation alone. Know and follow emergency procedures.
7. Never take any short cuts that are not clearly defined and approved.

5.3 Corrective Maintenance Procedures

5.3.1 TOA ACP

Visually inspect for loose components and secure panel mounting hardware every 60,000 miles. See Figure 2-3, Figure 3-3, Figure 3-4, Figure 3-5 and Figure 3-6.

5.3.2 TOA IFU

Visually inspect for loose components and secure panel mounting hardware every 60,000 miles. See Figure 2-11, Figure 3-7, Figure 3-8 and Figure 3-9.

5.3.3 TOA CCH

Visually inspect for loose components and secure panel mounting hardware every 60,000 miles. See Figure 2-7, Figure 3-10 and Figure 3-11.

5.3.4 Ethernet Switches

Perform visual inspection of LED indicator status of the following items every 30,000 miles and verify that network condition stays normal condition.

1) “RSTP” indicated as green
2) “X1” or “X2” indicated as green. (Another will indicate as yellow. It means green color port is working as “master” connection between TOA Ethernet Switches and yellow color port is working as “slave” connection between them.)

Figure 5-1 shows the explanation of LED indication for Ethernet Switch.

LED	Status	Description
ON	OFF	Unit has no power.
	GREEN	All OK, no alarm condition.
	RED	Alarm condition, or until unit has started up. (Alarm conditions are configurable, see "WeOS Management Guide").
	BLINK	Location indicator ("Here I am!"). Activated when connected to IPConfig Tool, or when configuring the unit via Web or CLI.
DC	OFF	Unit has no power.
	GREEN	Power OK on DC1 and DC1.
	RED	Power failure on DC1 or DC2.
FRNT	OFF	FRNT disabled.
	GREEN	FRNT OK.
	RED	FRNT Error.
	BLINK	Unit configured as FRNT Focal Point.
RSTP	OFF	RSTP disabled.
	GREEN	RSTP enabled.
	BLINK	Unit elected as RSTP/STP root switch.
X1 to X12	OFF	No Link.
	GREEN	Link established.
	GREEN FLASH	Data traffic indication.
	YELLOW	Port alarm and no link. Or if FRNT or RSTP mode, port is blocked.

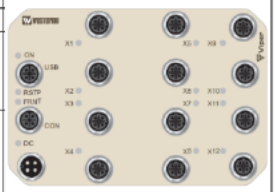


Figure 5-1: LED indicators for Ethernet Switch, Viper-112A

Perform visual inspection of hardware every 120,000 miles and verify that all M12 connectors are tightened to the proper torque. See Table 2-6, Figure 2-12, Figure 3-12 and Figure 3-13.

5.3.5 Ethernet Interface Module

Perform visual inspection of LED indicator status of the following items every 30,000 miles and verify that network condition stays normal condition.

1) “LINK STATUS” and “LINK MASTER” indicator is ON for the one of Ethernet Interface Module in each cab locker. (ON means the applicable Ethernet Interface Modules are working as “master” connection. OFF means “slave” connection”)
2) “X1” indicator is green or green flash for the one of Ethernet Interface Module in each cab locker. (Green or green flash means the applicable Ethernet Interface Modules are working as “master” connection. OFF means “slave” connection”)

Figure 5-2 shows the explanation of LED indication for Ethernet Interface Module.

LED	Status	Description
ON	OFF	Unit has no power
	GREEN	All OK, no alarm condition
DC1	OFF	Unit has no power
	GREEN	Power OK on DC1
	RED	Power failure on DC1
DC2	OFF	Unit has no power
	GREEN	Power OK on DC2
	RED	Power failure on DC2
X1	OFF	No Link
	GREEN	Link established
	GREEN FLASH	Data traffic indication
LINK STATUS	OFF	No PLC link established
	ON	PLC link established
ACTIVITY	OFF	No traffic on PLC link
	GREEN	PLC traffic on PLC link
LINK MASTER	OFF	Device is not link master (if PLC link established)
	ON	Device is link master in the established PLC network

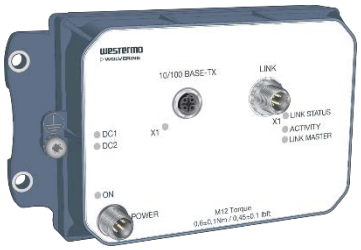


Figure 5-2: LED indicators for Ethernet Interface Module, DDW-002-B1

Perform visual inspection of hardware every 120,000 miles and verify that all M12 connectors are tightened to the proper torque. See Figure 2-13, Figure 3-26, Figure 3-27 and Figure 3-28.

5.4 Onboard Test

The following Onboard test should be run to determine the proper functionality of the TOA Communications system. This testing should be run as part of the diagnostic function to determine which areas to concentrate fault isolation efforts and after the system has been repaired to confirm proper operation prior to releasing a LRV for service.

The Onboard test function performs as a local diagnostic test.

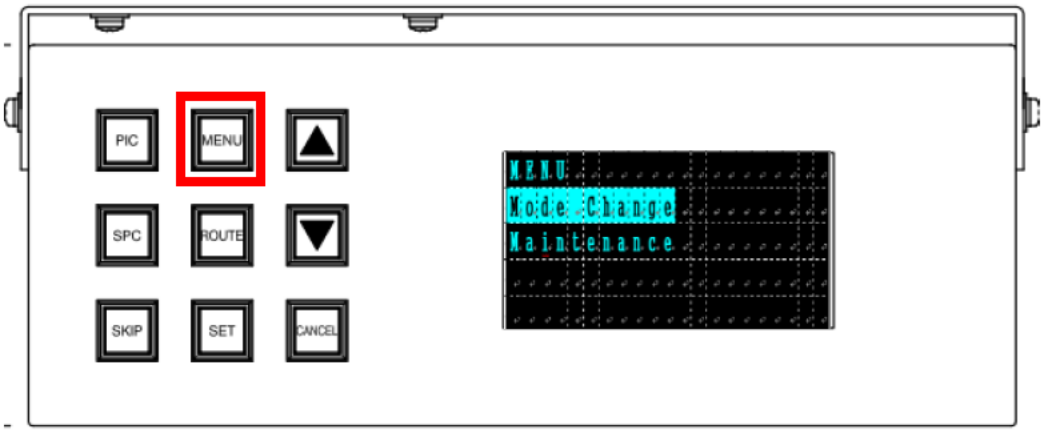
The CCH provides the activation button for the Onboard test and the Operator/Maintenance personnel can activate the test function from the CCH.

The Onboard Test procedure should be performed as follows;

a) In A or B Cab, places the Transfer Switch to the “ON” position.

b) Using the TOA Communication Control Head (CCH) start the Onboard test.

- Select ‘Menu’ on CCH



- Use the ‘Up’, ‘Down’, and ‘Set’ buttons to select ‘Maintenance’

- Select ‘Onboard Test’, ‘Set’

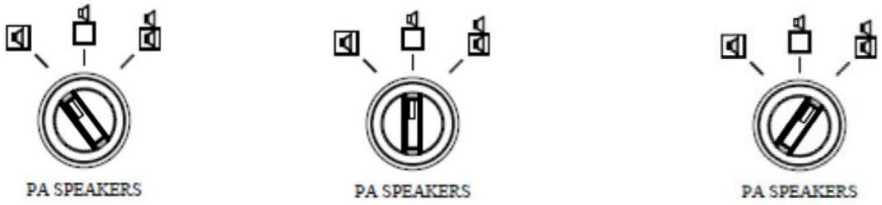
- Select ‘Start’, ‘Set’

c) After the Onboard Test is started, the following test patterns will be announced or displayed on the Audio (Interior/Exterior speakers), Signs (FDS/SDS) and PID LCDs;

- Audio (Interior/Exterior Speakers)

  Speaker output check is available by the Onboard test function. While speaker outputs the test announcements, maintenance personnel can verify the output audio from speakers.
  Test audio announcement and test tone;
  “This is a test message. One, two, three, four, five, six, seven, eight, nine, ten” and test tone
  During the Onboard Test, the PA speaker selection switch located on the cab console can be changed to “Interior only”, “Exterior only” and “both Interior and Exterior” by the maintenance personnel and test audio announcement can be changed as per the selection.

Interior Only Exterior Only Both Interior and Exterior



- Sign (FDS, SDS)
  Factory test of LED display is available by the Onboard test function.
  - Test for the text area (Repeats continuously until Onboard Test is stop): blank (all Lights off) >> checker box pattern >> checker box pattern (reverse) >> checker box pattern >> checker box pattern (reverse) >> blank (all Lights off) >> scroll up from bottom to top >> >> filled (all Lights on) >> blank (all Lights off)
  - Test for the color block (Repeats continuously until Onboard Test is stop):
    blank (all Lights off) >> repeating filled white/red/green/blue >> increase lighting intensity from low, medium to high by one of color (white/red/green/blue) >> blank (all Lights off)

  Figure 5-3 shows the sample displays during the Onboard Test.

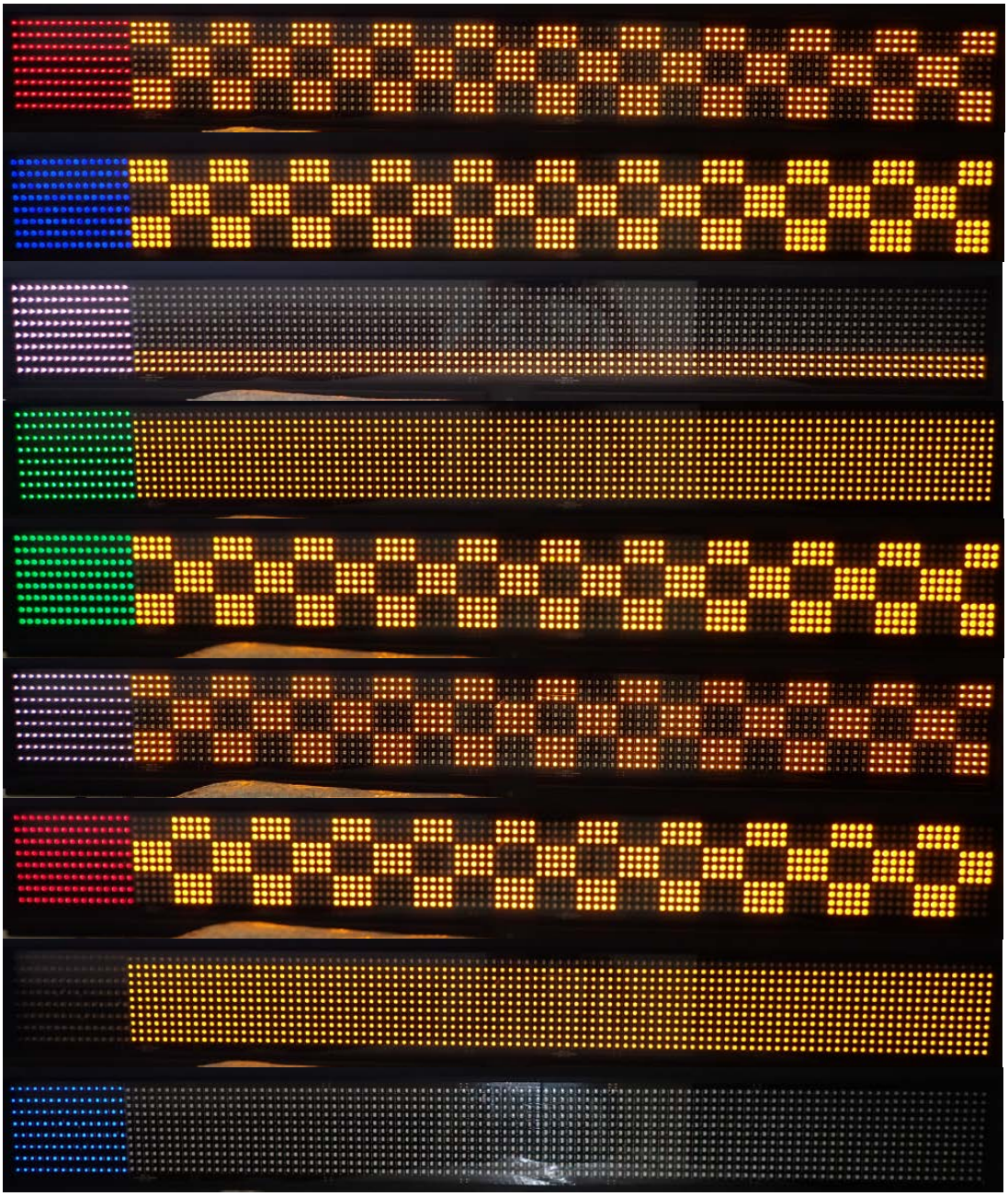


Figure 5-3: Sample LED signs display during Onboard Test

- PID (LCD)
  PID signs will display the automatic test patterns shown in Figure 5-4 cyclically;

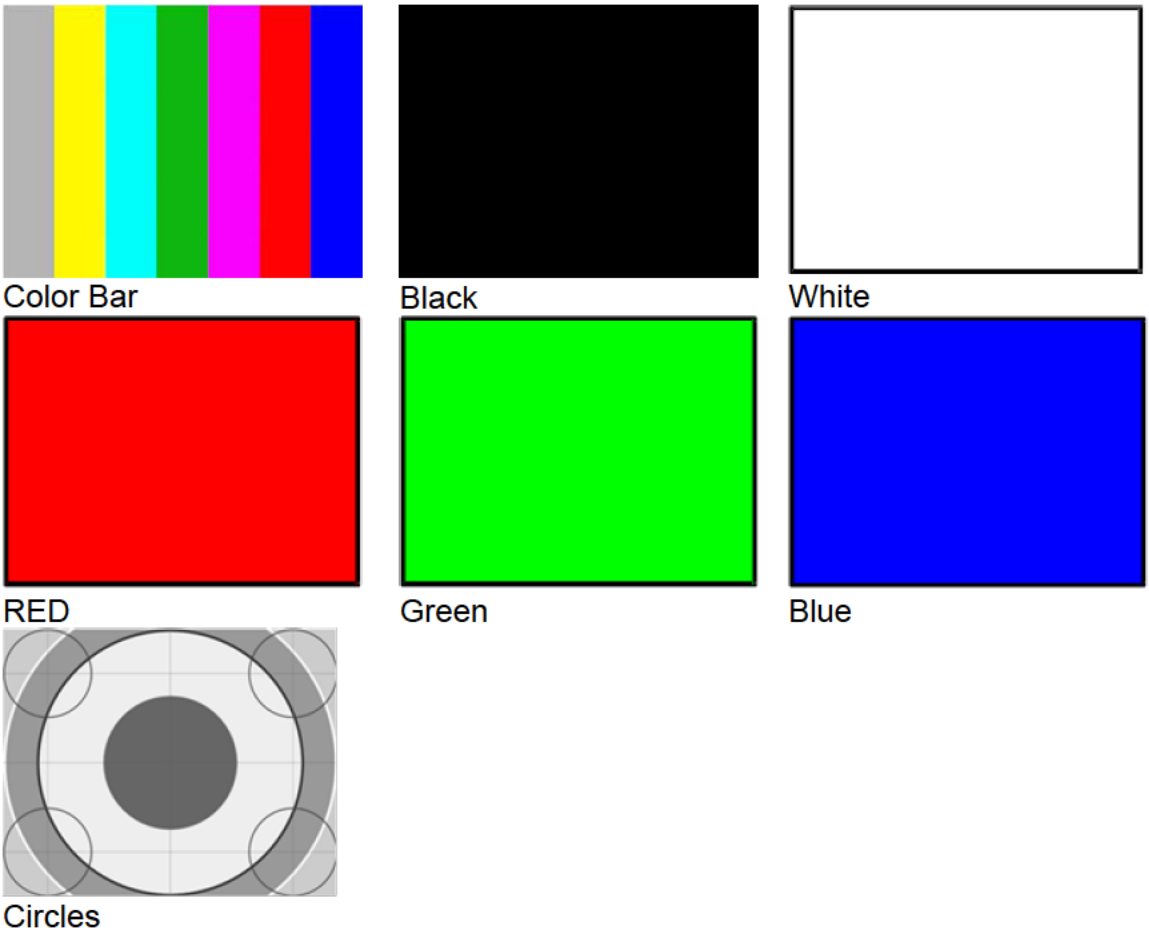


Figure 5-4: Cyclic PID LCD automatic test patterns during Onboard Test

d) Verify all signs are free from any anomalies or defects

e) Select 'Stop' then 'Set' on CCH.

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6.0 TROUBLESHOOTING

6.1 Introduction

This chapter provides troubleshooting procedures for the TOA Communications equipment.

6.2 Troubleshooting

The fault isolation chart lists the symptoms most likely to occur and suggests probable causes and corrective actions.

Table 6-1 contains the troubleshooting procedures for the TOA Communication System equipment. The symptoms listed are the most common malfunctions. The probable cause and remedy are also listed. The troubleshooting table is divided into three columns:

- Column 1, lists the symptoms (indications) of the issue,
- Column 2, indicates Location,
- Column 3, Indicates the Probable Cause,
- Column 4, indicates Probable Fault, and
- Column 5, indicates the Corrective action.

Table 6-1: TOA Communication System Troubleshooting

Symptom	Location	Probable Cause	Probable Fault		Corrective Action
			Shown on TOD	Shown on TOA CCH	
TOA CCH screen does not work	Master Cab	CCH is disconnected from ACP.	ACP(A) CCH Error or ACP(B) CCH Error	N/A	Confirm CCH connector is connected properly.
					Confirm the wiring between CCH and ACP.
		CCH is malfunctioning.			Replace CCH.
		ACP is disconnected from power supply.	ACP(A) Fault or ACP(B) Fault		Confirm ACP CN1 connector is connected properly.
					Check for voltage at the ACP power connection.
		ACP is malfunctioning.			Replace ACP.
	Sub Cabs	No problem. It's the right spec.	N/A	N/A	N/A
TOA CCH buttons do not work	Master Cab	ACP is in the process of booting up.	None	None	Wait about a minute.
		Master key is removed.		N/A	Insert master key
		ACP cannot control CCH.	ACP(A) Fault or ACP(B) Fault		Restart the Train by local off/on switch.
		CCH is malfunctioning.	ACP(A) CCH Error or ACP(B) CCH Error		Replace CCH.
	Sub Cabs	No problem. It's the right spec.	N/A	N/A	N/A
The footswitch, PTT switch, Mode selector switch, Door Close Announcement button, and Speaker selector do not work	Master Cab	RIO cannot respond.	Error with RIO(A) connection or Error with RIO(B) connection	RIOA or RIOB	Wait about a few minutes.
					Restart the Train by local off/on switch.
		RIO is disconnected from Ethernet.			Confirm the connection between RIO and Ethernet switch.
		RIO is malfunctioning.			Replace RIO.

Symptom	Location	Probable Cause	Probable Fault		Corrective Action
			Shown on TOD	Shown on TOA CCH	
The footswitch, PTT switch, Mode selector switch, Door Close Announcement button, and Speaker selector do not work (Cont'd)	B-cab of Leading car	IFU is disconnected from power supply.	TOAE Network Error	I/F UNIT	Confirm IFU CN1 connector is connected properly.
					Check for voltage at the ACP power connection.
		IFU cannot respond.			Restart the Train by local off/on switch.
		IFU is malfunctioning.			Replace IFU.
The Mode selector switch does not work	Master Cab	The Mode selector switch has a poor connection to the RIO or RIO DI has failed.	None	None	Check the connection of the Mode selector switch and the RIO.
		The Mode selector switch is malfunctioning.	None	None	Replace the Mode selector switch.
The Door Close Announcement button does not work	Master Cab	The Door Close Announcement button has a poor connection to the RIO or RIO DI has failed.	None	None	Check the connection of the Door Close Announcement button and RIO.
		The Door Close Announcement button is malfunctioning.	None	None	Replace the Door Close Announcement button.
The Speaker selector does not work	Master Cab	The Speaker selector has a poor connection to the RIO or RIO DI has failed.	None	None	Check the connection of the Speaker selector and RIO.
		The Speaker selector is malfunctioning.	None	None	Replace the Speaker selector.
There is no sound	One car	The ACP cannot control Audio function.	None	None	Restart the Train by local off/on.
		The ACP is disconnected from Ethernet.	ACP(A) or ACP(B) Fault	PAIR CPU	Confirm the connection between ACP and Ethernet switch.
		The ACP is malfunctioning.	Ditto	PAIR CPU	Replace ACP.
	Trail cars	ACPs are disconnected from Ethernet.	None	None	Confirm the Ethernet connection between cars.
	All cars	Master ACP cannot control Audio function.	None	None	Restart the Train by local off/on.
		Master ACP is malfunctioning.	ACP(A) or ACP(B) Fault	PAIR CPU	Replace ACP.

Symptom	Location	Probable Cause	Probable Fault		Corrective Action
			Shown on TOD	Shown on TOA CCH	
No audio generated from In-Dash Mic when activated by the footswitch or the PTT switch	Master Cab	The position of the Mode selector switch is not set to “PA”.	None	None	Change Mode selector switch position to “PA”.
		The footswitch has a poor connection to the RIO or RIO DI has failed.			Check the connection of the footswitch at footswitch and the RIO.
		The PTT switch has a poor connection to the RIO or RIO DI has failed.			Check the connection of the PTT switch at the PTT switch and the RIO.
		The footswitch is malfunctioning.			Replace the footswitch.
		The PTT switch is malfunctioning.			Replace the PTT switch.
		ACP cannot input audio from the In-Dash Microphone.			Confirm the Mic and wiring between the Mic and ACP. Replace In-Dash Microphone.
		ACP cannot communicate with the RIO.	Error with RIO(A) connection or Error with RIO(B) connection	RIOA or RIOB	Confirm the RIO and wiring between the RIO and ACP.
		ACP cannot control manual PA.	ACP(A) or ACP(B) Fault or None	PAIR CPU or None	Restart the Train by local off/on.
		ACP is malfunctioning.	ACP(A) or ACP(B) Fault	PAIR CPU	Replace ACP.
No audio generated from RADIO PA when activated	Master Cab	ACP cannot control Radio PA	ACP(A) Fault or ACP(B) Fault	PAIR CPU or None	Restart the Train by local off/on.
		The position of the Mode selector switch is not set to “Radio”	None	None	Change Mode selector switch position to “RADIO”.
		ACP cannot input audio from the Radio	None	None	Confirm the Radio and wiring between the Radio and ACP.

Symptom	Location	Probable Cause	Probable Fault		Corrective Action
			Shown on TOD	Shown on TOA CCH	
No audio generated from RADIO PA when activated (Cont'd)	Master Cab (Cont'd)	ACP cannot input audio from the Radio (Cont'd)	Error with RIO(A) connection or Error with RIO(B) connection	RIOA or RIOB	Confirm the RIO and wiring between the RIO and ACP.
		ACP is malfunctioning	ACP(A) Fault or ACP(B) Fault	PAIR CPU	Replace ACP.
PIC fault indicated on Master CCH after Onboard Test	One or multiple PIC	1. The PIC is malfunctioning 2. The ACP cannot recognize that PIC is activated.	PIC(A#1) Error or PIC(A#2) Error or PIC(B#1) Error or PIC(B#2) Error	PIC #1 or PIC #2 on CCH in Master Cab	Remove and insert the CN2 connector on ACP.
					Check cable connection between ACP (CN2) and PIC.
					Swap the faulty PIC and the healthy PIC to see whether fault report is transferred to the log or not.
					If the fault has been transferred, replace the PIC.
"EMERGENCY CALL" screen does not appear on TOA CCH screen when activated by any of PIC	One PIC	1. The ACP cannot recognize that PIC is activated. 2. The PIC is malfunctioning	PIC(A#1) Error or PIC(A#2) Error or PIC(B#1) Error or PIC(B#2) Error (after Onboard Test)	PIC #1 or PIC #2 on CCH in Master Cab (after Onboard Test)	After revenue service, carry out Onboard Test from CCH in Master Cab
					Do the same step as "PIC fault indicated on Master CCH after Onboard Test"
Automatic announcements occur earlier or later than specified timing	All cars	Wheel diameter not adjusted after wheel truing	None	None	Adjust wheel diameter by PTU per actual diameters.
		The distance between stations in the route file is incorrect, if a new route file is loaded in CF card	None	None	Verify the distance in the route file and revise it and create a new route file by RME

Symptom	Location	Probable Cause	Probable Fault		Corrective Action
			Shown on TOD	Shown on TOA CCH	
Arriving message of automatic announcement does not occur	All cars	Wheel diameter not adjusted after wheel truing	None	None	Adjust wheel diameter by PTU per actual diameters.
		The distance between stations in the route file is incorrect, if a new route file is loaded in CF card	None	None	Verify the distance in the route file and revise it and create a new route file by RME
One or more FDS/SDS do not power-up.	One car	No power to the FDS/SDS	FDS(#1) Error or FDS(#2) Error or SDS(#1) Error or SDS(#2) Error	FDS #1 or FDS #2 or SDS #1 or SDS #2	Check for voltage at the FDS/SDS power connection.
		Tripped circuit breaker (DSLCB)	FDS(#1) Error SDS(#1) Error and/or FDS(#2) Error SDS(#2) Error	FDS #1 SDS #1 and/or FDS #2 SDS #2	Reset circuit breaker by placing in the OFF position then the ON position.
		FDS/SDS power supply PCB is defective.	FDS(#1) Error or FDS(#2) Error or SDS(#1) Error or SDS(#2) Error	FDS #1 or FDS #2 or SDS #1 or SDS #2	If LED1 on FDS/SDS is not illuminated, replace power supply PCB of FDS/SDS.
		Failed control PCB			If LED4 is not blinking, replace control PCB of FDS/SDS.
					Replace control PCB of FDS/SDS.
One or more FDS/SDS do not display data.	One car	The FDS or SDS cannot communicate with ACP	FDS(#1) Error or FDS(#2) Error or SDS(#1) Error or SDS(#2) Error	FDS #1 or FDS #2 or SDS #1 or SDS #2	Check wiring between the FDS or SDS and ACP, Ethernet switch and its ports are set DHCP correctly.
					Repair connection.
					If LED3 on FDS/SDS is not illuminated, repair broken network link.
					Restart the system.
		Defective display LED(s)	None	None	Replace LED display matrix PCB in FDS/SDS.

Symptom	Location	Probable Cause	Probable Fault		Corrective Action
			Shown on TOD	Shown on TOA CCH	
One or more FDS/SDS displays do not adjust brightness when ambient light changes.	One car	Optical sensor is blocked	None	None	Remove blockage.
		Defective optical sensor	None	None	Replace optical sensor PCB.
FDS/SDS on one LRV section in a coupled trainset do not display	Trail cars	The LRV is disconnected	None	None	Confirm coupling the LRV. Confirm Ethernet Interface Modules are activated and set correctly.
PID displays abnormal color or tint	One car	Bad VGA cable to display monitor or VGA extender module	None	None	Check VGA cable or VGA module, replace if necessary.
One PID on a LRV section does not display	One car	The PIDS monitor is malfunctioning	None	None	Replace the PIDS monitor.
		The PIDS monitor is not input video signal	None	None	Check VGA cable and its connection.
					Check Gigabit Ethernet cable and its connection.
					Replace VGA extender.
PID A-End or PID B-End inoperative	One car	PIDs are independent; troubleshoot each end separately	PIDS Controller (#1) Error or PIDS Controller (#2) Error	PIDS #1 or PIDS #2	Refer to Section 9.6 of Section 1400 Communication Running Maintenance and Service Manual.
Both PIDs on one LRV section do not display	All cars	PIDs have common point at transmitter and controller. Possible defective transmitter or PIDs controller.	PIDS Controller (#1) Error PIDS Controller (#2) Error	PIDS #1 PIDS #2	Confirm connectivity from controller to transmitter.
					Confirm PIDs controller operation.
					Confirm transmitter operation
PID Displays incorrect time.	All cars	GPS Error	None	None	Wait for 10 minutes whether time is updated on PID Displays or not.
					Check GPS functionality using TOD. Replace GPS receiver as required.
	One car	PIDS is set as wrong date and daylight-saving time function.	None	None	Confirm date and daylight-saving time function is off on PIDS controller.

6.3 Passenger Information Displays (PIDS) Troubleshooting

There is one PIDS controller in the A-cab ceiling that controls the PIDs on the A-end. There is another PIDS controller in the B-cab ceiling that controls the PIDs on the B-end. The controllers provide the video output to the VGA extenders that are used to drive the two displays in each end of the LRV.

The PIDs controllers are independent. The displays on one end of the LRV can be functional and the displays on the other end can be non-functional.

The PIDs system is comprised of the controller that transmit video through a VGA extender (transmitter / receiver set) to provide video to two displays. The controller operates on a Windows embedded operating system.

The equipment is non-repairable, so troubleshooting takes the form of isolating the faulty component and replacing it with a known good component. The components include the VGA displays, VGA cables, VGA transmitter(s), VGA receiver(s) and the controllers.

Video distortion or abnormal video color is usually due to a faulty VGA cable. If the cable is connected properly and not faulty, then the VGA transmitter or receiver may be faulty.

If the equipment / hardware has been checked and verified, then the software on the controller may be corrupt. Confirm the software is correct by reloading and restarting the system.

6.4 Fault List

The Fault List shown in Table 6-2, identifies possible faults, causes, and corrective actions for the TOA Communication System equipment.

Table 6-2: Fault List

Fault/Status Name			Description of the Fault/Status	Cause of the Fault (If a Fault)	Corrective Action	Notes
Shown on TOD	**Shown on TOA CCH**	**Shown on TOA ACP internal log[*1]**				
ACP(B) Fault	PAIR CPU	FAULT UP (Pair CPU comm)	ACP(B) does not respond to the request from ACP(A)	ACP(A) cannot communicate with ACP(B). ACP(B) doesn't respond to the request from ACP(A).	1. Switch MCB ON/OFF to reset the system to see whether system can be recovered. 2. Remove and insert the CN1 and CN4 connector on ACP(B). (To check the network condition between two ACP(A) and (B).) If the fault remains, replace ACP(B).	Error to be detected and logged by ACP(A) for each car and to be indicated on TOD and CCH in Master Cab.
ACP(A) CF Card Content Error	CF DATA	FAULT UP (CF card data)	Missing file of ACP(A) CF setting	Data in the CF card is not correct.	1. Remove and insert the CF card. (Refer to Appendix B in RME manual) 2. Reload the data inside CF card. If the fault remains, replace the ACP(A).	Error to be detected and logged by ACP(A) for each car and to be indicated on TOD and CCH in Master Cab.
ACP(A) IO Error	IO	FAULT UP (PIO unit comm)	Communication Error between CPU board and PIO board inside ACP(A)	The 485 communication between PCBs inside ACP(A) fails.	Replace ACP(A).	Error to be detected and logged by ACP(A) for each car and to be indicated on TOD and CCH in Master Cab.

Fault/Status Name			Description of the Fault/Status	Cause of the Fault (If a Fault)	Corrective Action	Notes
Shown on TOD	**Shown on TOA CCH**	**Shown on TOA ACP internal log*1**				
ACP(A) CCH Error	ACP-CCH	FAULT UP (CCH unit comm)	CCH(A) does not respond to the request from ACP(A)	ACP(A) cannot communicate with CCH(A).	1. Switch MCB ON/OFF to reset the system to see whether system can be recovered. 2. Remove and insert the CN3 connector on ACP(A). (To check the network condition between ACP(A) and CCH(A). If the fault remains, replace CCH(A).	Error to be detected and logged by ACP(A) for each car and to be indicated on TOD and CCH in Master Cab.
PIC(A#1) Error	PIC #1	FAULT UP (PIC #1)	PIC(A#1) Error (ONBOARD TEST is needed)	ACP(A) cannot receive the normal sounds where it's input from inside Mic of PIC(A#1), correctly.	1. Remove and insert the CN2 connector on ACP(A). 2. Check cable connection between ACP (CN2) and PIC. 3. Swap the faulty PIC and the healthy PIC to see whether fault report is transferred to the log or not. 4. If the fault has been transferred, replace the PIC. 5. If the failure is not resolved even if you replace the PIC with a good one, ACP failure is suspected. Replace ACP(A)	Error to be detected and logged by ACP(A) for each car and to be indicated on TOD and CCH in Master Cab.
PIC(A#2) Error	PIC #2	FAULT UP (PIC #2)	PIC(A#2) Error (ONBOARD TEST is needed)	ACP(A) cannot receive the normal sounds where it's input from inside Mic of PIC(A#2), correctly.		Error to be detected and logged by ACP(A) for each car and to be indicated on TOD and CCH in Master Cab.
ACP(A) Fault	PAIR CPU	FAULT UP (Pair CPU comm)	ACP(A) does not respond to the request from ACP(B)	ACP(B) cannot communicate with ACP(A). ACP(A) doesn't respond to the request from ACP(B).	1. Switch MCB ON/OFF to reset the system to see whether system can be recovered. 2. Remove and insert the CN1 and CN4 connector on ACP(A). (To check the network condition between two ACP(A) and (B).) If the fault remains, replace ACP(A).	Error to be detected and logged by ACP(B) for each car and to be indicated on TOD and CCH in Master Cab.

Fault/Status Name			Description of the Fault/Status	Cause of the Fault (If a Fault)	Corrective Action	Notes
Shown on TOD	**Shown on TOA CCH**	**Shown on TOA ACP internal log[*1]**				
ACP(B) CF Card Content Error	CF DATA	FAULT UP (CF card data)	Missing file of ACP(B) CF setting	Data in the CF card is not correct.	1. Remove and insert the CF card. (Refer to Appendix B in RME manual) 2. Reload the data inside CF card. If the fault remains, replace ACP(B).	Error to be detected and logged by ACP(B) for each car and to be indicated on TOD and CCH in Master Cab.
ACP(B) IO Error	IO	FAULT UP (PIO unit comm)	Communication Error between CPU board and PIO board inside ACP(B)	The 485 communication between PCBs inside ACP(A) fails.	Replace ACP(B).	Error to be detected and logged by ACP(B) for each car and to be indicated on TOD and CCH in Master Cab.
ACP(B) CCH Error	ACP-CCH	FAULT UP (CCH unit comm)	CCH(B) does not respond to the request from ACP(B)	ACP(A) cannot communicate with CCH(A).	1. Switch MCB ON/OFF to reset the system to see whether system can be recovered. 2. Remove and insert the CN3 connector on ACP(B). (To check the network condition between ACP(B) and CCH(B). If the fault remains, replace CCH(B).	Error to be detected and logged by ACP(B) for each car and to be indicated on TOD and CCH in Master Cab.
PIC(B#1) Error	PIC #1	FAULT UP (PIC #1)	PIC(B#1) Error (ONBOARD TEST is needed)	ACP(B) cannot receive the normal sounds where it's input from inside Mic of PIC(B#1), correctly.	1. Remove and insert the CN2 connector on ACP(B). 2. Check cable connection between ACP(B) (CN2) and PIC. 3. Swap the faulty PIC and the healthy PIC to see whether fault report is transferred to	Error to be detected and logged by ACP(B) for each car and to be indicated on TOD and CCH in Master Cab.

Fault/Status Name			Description of the Fault/Status	Cause of the Fault (If a Fault)	Corrective Action	Notes
Shown on TOD	**Shown on TOA CCH**	**Shown on TOA ACP internal log*1**				
PIC(B#2) Error	PIC #2	FAULT UP (PIC #2)	PIC(B#2) Error (ONBOARD TEST is needed)	ACP(B) cannot receive the normal sounds where it's input from inside Mic of PIC(B#2), correctly.	the log or not. 4. If the fault has been transferred, replace the PIC. 5. If the failure is not resolved even if you replace the PIC with a good one, ACP failure is suspected. Replace ACP(B)	Error to be detected and logged by ACP(B) for each car and to be indicated on TOD and CCH in Master Cab.
FDS(#1) Error	FDS #1	FAULT UP (FDS #1 comm)	FDS(#1) Error (Disconnection or Inside Error)	ACP(A) cannot communicate with FDS(#1).	1. Switch the system ON/OFF. 2. Remove and insert the connector. (To check the network condition.) FDS(#1): Port X9 of TOA Ethernet Switch#1 in A car. SDS(#1): Port X10 of TOA Ethernet Switch#1 in A car. 3. If the fault remains, swap the faulty FDS/SDS with a healthy one to see whether fault report moves on the log or not. 4. If the fault moves, replace the FDS/SDS. 5. If the failure is not, other failures are suspected. The possibilities are as follows. (1) Power cable and communication line are broken; (2) Ethernet Switch or port failure; or (3) ACP failure. In either case, it is necessary to replace the applicable equipment and cable.	Error to be detected and logged by ACP(B) for each car and to be indicated on TOD and CCH in Master Cab.
SDS(#1) Error	SDS #1	FAULT UP (SDS #1 comm)	SDS(#1) Error (Disconnection or Inside Error)	ACP(A) cannot communicate with SDS(#1).		Error to be detected and logged by ACP(B) for each car and to be indicated on TOD and CCH in Master Cab.

Fault/Status Name			Description of the Fault/Status	Cause of the Fault (If a Fault)	Corrective Action	Notes
Shown on TOD	**Shown on TOA CCH**	**Shown on TOA ACP internal log[*1]**				
PIDS Controller (#1) Error	PIDS #1	FAULT UP (PID #1 comm)	PIDS Controller (#1) Error (Disconnection or Inside Error)	ACP(A) cannot communicate with PIDS(#1).	1. Switch the system ON/OFF the. 2. Remove and insert the connector. (To check the network condition.) PIDS Controller (#1): Port X11 of TOA Ethernet Switch#1 in A car. 3. If the fault still remains, swap the faulty PIDS display with a healthy one to see whether fault report is moves on the log or not. 4. If the failure is not, other failures are suspected. The possibilities are as follows. (1) Breakage of VGA cable, power cable, and communication line; (2) VGA EXTENDER, VGA REMOTE UNIT failure; (3) PIDS controller failure; (4) Ethernet Switch failure / port failure; or (5) ACP failure. In either case, it is necessary to replace the applicable equipment and cable.	Error to be detected and logged by ACP(B) for each car and to be indicated on TOD and CCH in Master Cab.

Fault/Status Name			Description of the Fault/Status	Cause of the Fault (If a Fault)	Corrective Action	Notes
Shown on TOD	Shown on TOA CCH	Shown on TOA ACP internal log[*1]				
FDS(#2) Error	FDS #2	FAULT UP (FDS #2 comm)	FDS(#2) Error (Disconnection or Inside Error)	ACP(B) cannot communicate with FDS(#2).	1. Switch the system ON/OFF. 2. Remove and insert the connector. (To check the network condition.) FDS(#2): Port X9 of TOA Ethernet Switch#2 in B car. SDS(#2): Port X10 of TOA Ethernet Switch#2 in B car. 3. If the fault remains, swap the faulty FDS/SDS with a healthy one to see whether fault report moves on the log or not. 4. If the fault moves, replace the FDS/SDS. 5. If the failure is not, other failures are suspected. The possibilities are as follows. (1) Power cable and communication line are broken; (2) Ethernet Switch or port failure; or (3) ACP failure. In either case, it is necessary to replace the applicable equipment and cable.	Error to be detected and logged by ACP(B) for each car and to be indicated on TOD and CCH in Master Cab.
SDS(#2) Error	SDS #2	FAULT UP (SDS #2 comm)	SDS(#2) Error (Disconnection or Inside Error)	ACP(B) cannot communicate with SDS(#2).		Error to be detected and logged by ACP(B) for each car and to be indicated on TOD and CCH in Master Cab.

Fault/Status Name			Description of the Fault/Status	Cause of the Fault (If a Fault)	Corrective Action	Notes
Shown on TOD	**Shown on TOA CCH**	**Shown on TOA ACP internal log[*1]**				
PIDS Controller (#2) Error	PIDS #2	FAULT UP (PID #2 comm)	PIDS Controller(#2) Error (Disconnection or Inside Error)	ACP(B) cannot communicate with PIDS(#2).	1. Switch the system ON/OFF the. 2. Remove and insert the connector. (To check the network condition.) PIDS Controller(#1): Port X11 of TOA Ethernet Switch#1 in A car. 3. If the fault still remains, swap the faulty PIDS display with a healthy one to see whether fault report is moves on the log or not. 4. If the failure is not, other failures are suspected. The possibilities are as follows. (1) Breakage of VGA cable, power cable, and communication line; (2) VGA EXTENDER, VGA REMOTE UNIT failure; (3) PIDS controller failure; (4) Ethernet Switch failure / port failure; or (5) ACP failure. In either case, it is necessary to replace the applicable equipment and cable.	Error to be detected and logged by ACP(B) for each car and to be indicated on TOD and CCH in Master Cab.

Fault/Status Name			Description of the Fault/Status	Cause of the Fault (If a Fault)	Corrective Action	Notes
Shown on TOD	**Shown on TOA CCH**	**Shown on TOA ACP internal log*1**				
TOAE Network Error (TOD will possibly display various equipment errors)	NW SW#1 or NW SW#2 (TOA CCH will possibly display various equipment errors)	FAULT UP (ETHER SW #A) or FAULT UP (ETHER SW #B) (TOA ACP internal log will possibly display various equipment errors)	IFU(B) cannot communicate with ACP(A) or ACP(B)	There is malfunction inside network pass between IFU and ACP(A) or ACP(B). Cause of the fault will be Ethernet switch or cables. IFU change the status of this bit as error to notify the faulty condition inside TOAE network.	1. Check actual fault status on screen of CCH(A) and (B) 2. Follow the instruction of listed fault. 3. Switch ON/OFF the system to see whether system can be recovered. 4. Remove and insert the connectors at the equipment shown in CCH screen If fault remains, replace relevant equipment for TOAE network.	Serious Failure, e.g. Communication Error with current equipment
IFU Error	IFU	FAULT UP (Interface BOX)	Disconnect communication between two CPUs inside IFU	The CPU for RTC network cannot communicate with another one for TOAE network. (Note: This fault will be detected at only RTC network side. And it's sent to MDS)	Replace IFU.	Serious Failure, e.g., Communication Error with current equipment
Error with TCNA connection	TCNA	FAULT UP (TCN comm)	TOAE Network does not receive the MVB0103 and 0151 port status.	IFU(B) cannot communicate with the TCNA. And ACP(A) or (B) cannot receive the status from TCNA for operation.	1. Switch ON/OFF the system to see whether system can be recovered. If the fault remains, follow the troubleshooting for TCN.	Communication Error with the equipment located in Car side Network
Error with TCNB connection	TCNB	FAULT UP (TCN comm)	TOAE Network does not receive the MVB 2441 port status.	IFU(B) cannot communicate with the TCN(B). And ACP(B) cannot receive the status from TCN(B) for operation.	1. Switch ON/OFF the system to see whether system can be recovered. If the fault still remains, follow the troubleshooting for the TCN.	Communication Error with the equipment located in Car side Network

Fault/Status Name			Description of the Fault/Status	Cause of the Fault (If a Fault)	Corrective Action	Notes
Shown on TOD	**Shown on TOA CCH**	**Shown on TOA ACP internal log*1**				
Not shown	MDS	FAULT UP (MDS comm)	IFU (B) cannot communicate with MDS.	IFU(B) cannot communicate with the MDS.	1. Switch ON/OFF the system to see whether system can be recovered. If the fault remains, follow the troubleshooting for MDS.	Communication Error with the equipment located in Car side Network
Error with RIO(A) connection	RIOA	FAULT UP (RIO #A comm)	RIO A SIDE Communication Error	IFU(B) cannot communicate with the RIO(A). And ACP(A) or (B) cannot receive the status from RIO(A) for operation.	1. Switch ON/OFF the system to see whether system can be recovered. If the fault remains, replace the unit.	Communication Error with the equipment located in Car side Network Note *2
Error with RIO(B) connection	RIOB	FAULT UP (RIO #B comm)	RIO B SIDE Communication Error	IFU(B) cannot communicate with the RIO(B). And ACP(A) or (B) cannot receive the status from RIO(B) for operation.	1. Switch ON/OFF the system to see whether system can be recovered. If the fault remains, replace the unit.	Communication Error with the equipment located in Car side Network Note *2
No Route Set	“ROUTE” button blinks	FAULT UP (No Route Set)	The Operator does not set the Route by TOA CCH and the train starts running	The Operator does not set the Route by TOA CCH Display before the train starts running.	1. The Operator sets the Route via TOA CCH at the next station with doors open.	Operation Error
The master ACP cannot determine the order of train IDs	N/A	FAULT UP (Train ID)	Incorrect combination pattern of TAIL Relay Information	When the train consists of 3 cars and Master Key is ON, there is no car that Tail End Relay is active or there are multiple cars that Tail End Relay are actives.	1. Confirm each TCN and Head or Tail Relay condition.	Incorrect Information of TAIL Relay Note *3

Note *1: If a fault is reset, the ACP internal log records “FAULT RECOVER (xxxx)”.

Note *2: The RIOB and RIOA Faults may occur occasionally in operation, single RIO Fault that clears itself within 2 seconds does not require any further investigation or corrective action and is not treated as a real fault . If there is continues Set and reset more than 3 times then it needs to be treated as a real fault and further investigation is required.

Note *3: For the TrainID fault, when 2 car consist is coupled with a single car to Make a 3 car, TrainID fault will be seen occassionally. When the Active cab(due to coupling is not lead cab) becomes the Lead car the fault will clear.

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APPENDIX A DRAWINGS

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