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Faregate Manual

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1. Introduction

1.1. Purpose

The purpose of this document is to introduce the information for the configuration of faregate and faregate operation.

1.2. Scope

This document covers generally the physical specification, appearance, configuration and operation manual.

1.3. Abbreviations

ADA	American with Disabilities Act
CPU	Central Processor Unit
DC	Direct Current
ECU	Electronic Control Unit
FA / FAI	Fire Alarm / Fire Alarm Interface
FCS	Faregate Central System
GB	Gigabyte
GCU	Gate Control Unit
GFCI	Ground Fault Circuit Interrupter
IO	Input / Output
IoT	Internet of Things
LAN	Local Area Network
LCD	Liquid Crystal Display
LED	Light Emitting Diode
MCBF	Mean Cycle Between Failure

MTBF	Mean Time Between Failure
NWS	Network Switch
OS	Operating System
OSD	On Screen Display
PPT	Payment Processing Target
PSU	Power Supply Unit
SMPS	Switching Mode Power Supply
SSD	Solid State Drive
ST	Station Terminal
TBD	To Be Determined
USB	Universal Serial Bus
UPS	Uninterruptible Power Supply
VGA	Video Graphics Array
WMATA	Washington Metropolitan Area Transit Authority

[Table 1] Abbreviations

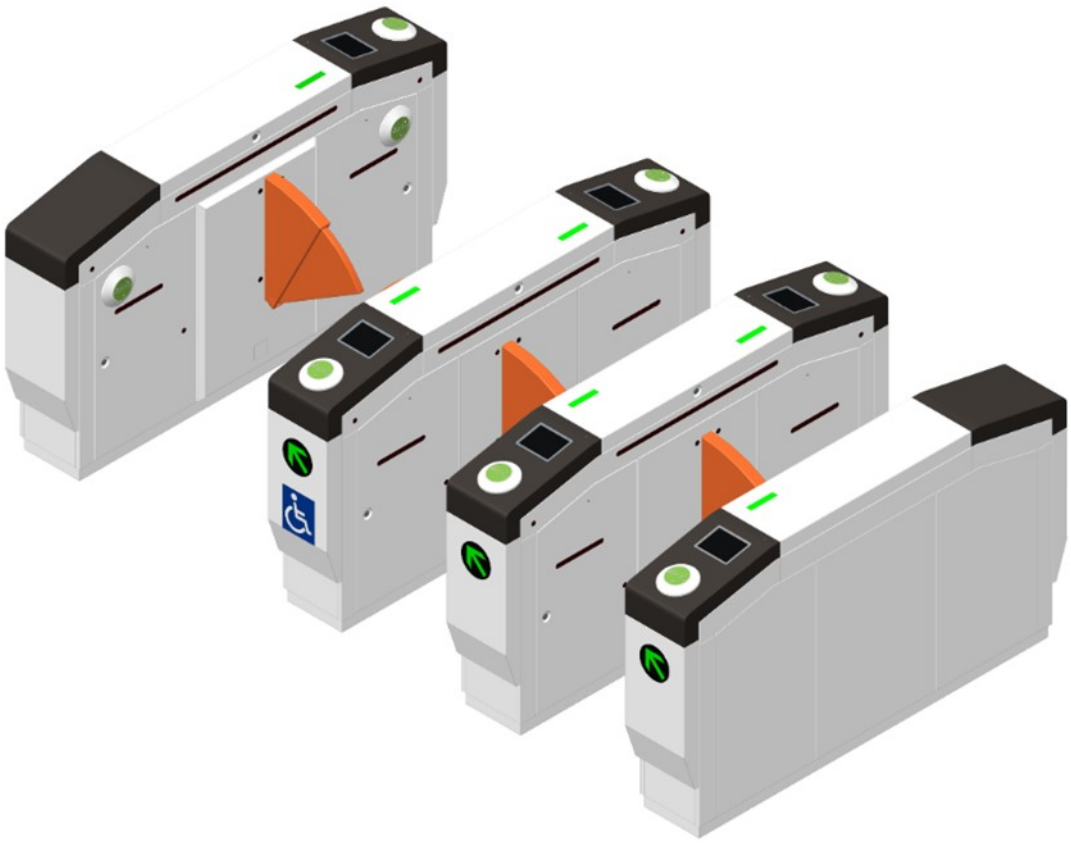
2. Overview

2.1. General Description

The faregate is installed between the free area and the paid area. It enables passengers to pass through the passage between the free area and the paid area with the ticket.

The ADA faregate is designed suitable for the use of visually impaired passengers or those with impaired mobility and PPT is positioned in a manner that is ergonomically appropriate for users in wheelchairs.

Metro Brown color accents are added to end caps to achieve a connection to WMATA's historic architecture aesthetic. These accents which are made of a material that is durable and strong, contrast with the industrial look and functionality of the 316L brushed Number 4 finish of the remainder of the cabinet exterior.

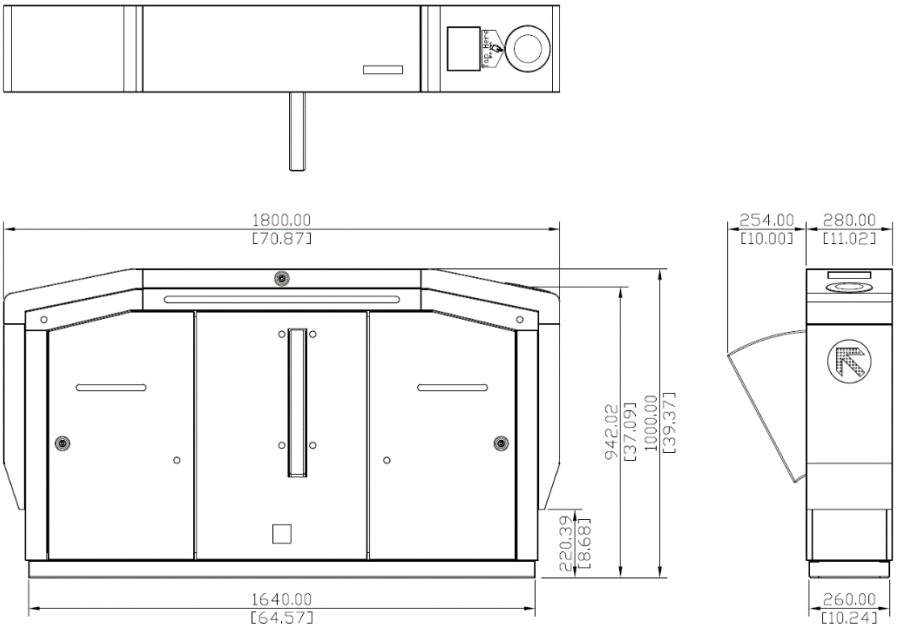


[Figure 1] Faregate Design

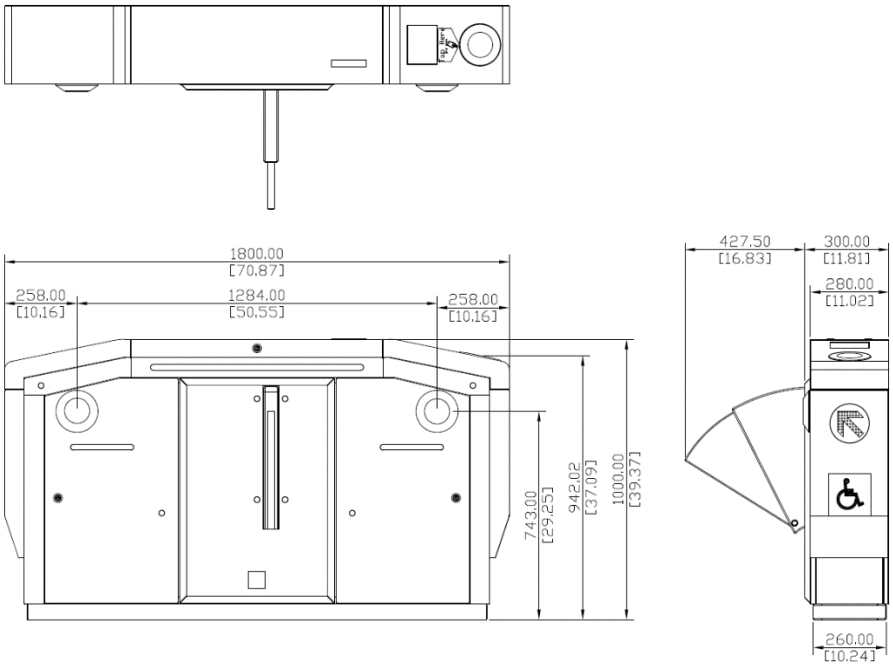
2.2. Configuration of Faregate

The drawing below shows the dimension of standard and ADA faregate.

2.2.1. Outline Layout



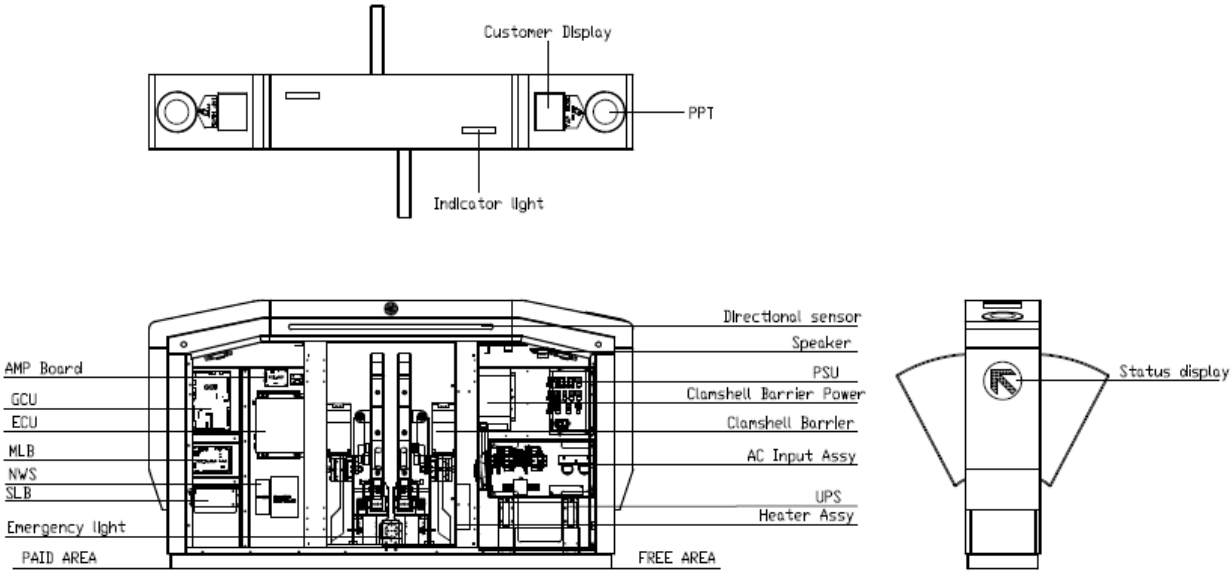
[Figure 2] Outline layout of the stadard faregate



[Figure 3] Outline layout of the ADA faregate

2.2.2. Internal Layout

The figure below shows the internal modular components and layout.



[Figure 4] Faregate Modular components

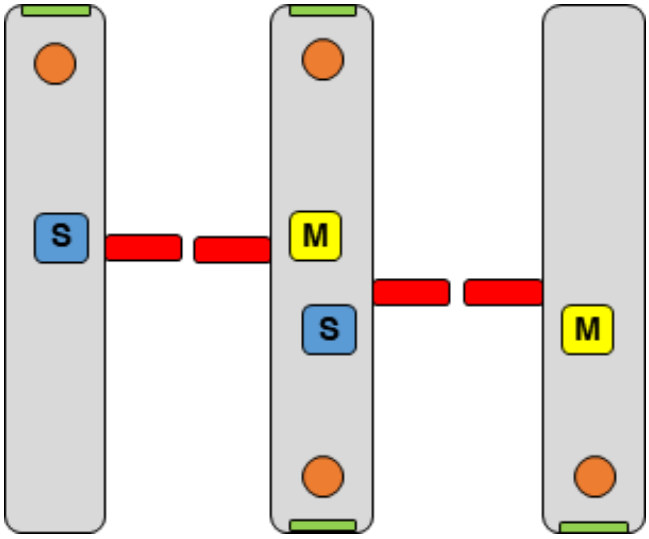
2.3. Faregate type definition

The faregate consists of the ADA aisle and the standard aisle. Faregate cabinets that make up the aisle are classified into ADA end, ADA reversible, standard end and standard reversible types.

2.3.1. Standard Faregate

Standard end cabinets are divided into master and slave. The master cabinet includes the major modules such as ECU, GCU, PSU, UPS and NWS but the slave cabinet does not include the major modules.

Standard reversible cabinets contain all modules of master and slave.

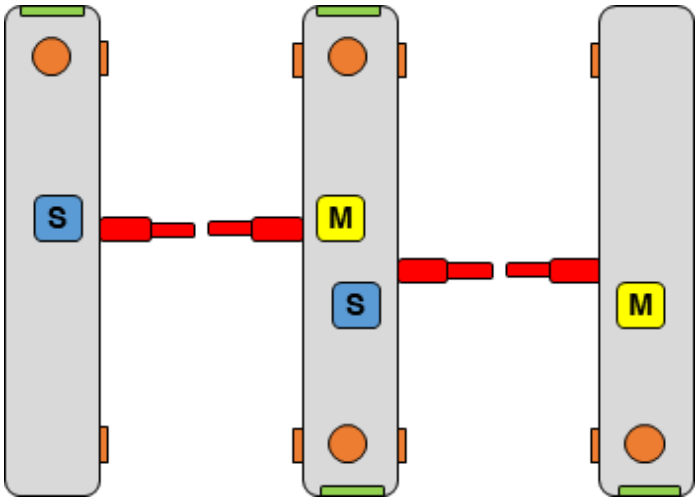


[Figure 5] Standard End and Reversible cabinet

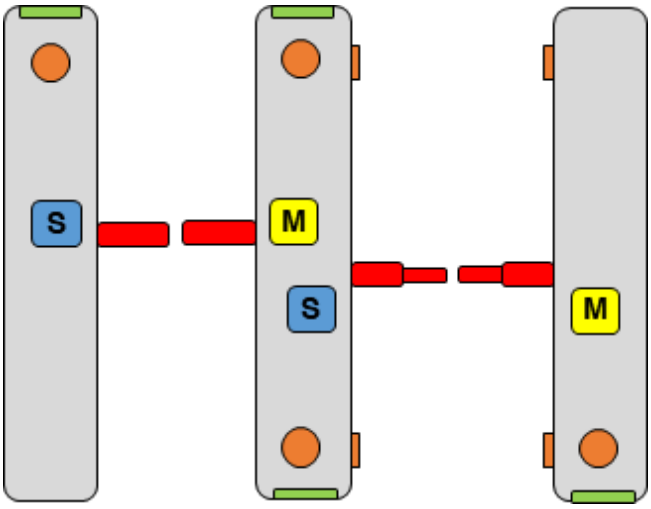
2.3.2. ADA Faregate

ADA end cabinets are divided into master and slave. The master cabinet includes the major modules such as ECU, GCU, PSU, UPS and NWS but the slave cabinet does not include the major modules.

ADA reversible cabinets are divided into two types, one type is located between ADA aisles as shown in [Figure 8] and the other type is located between ADA aisle and standard aisle as shown in [Figure 9].



[Figure 6] ADA End and Reversible cabinet



[Figure 7] Hybrid ADA Reversible cabinet

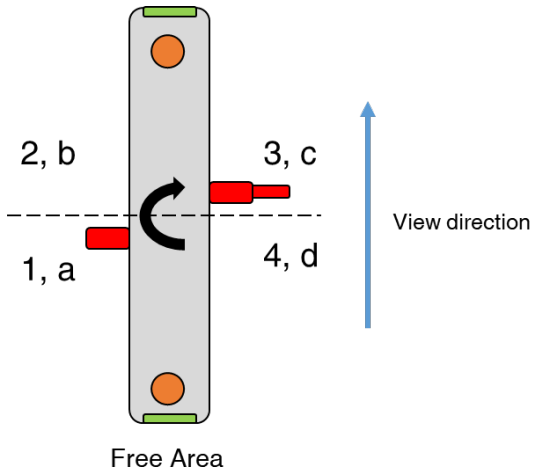
2.4. Faregate nomenclature

2.4.1. Faregate nomenclature for different types

Faregate cabinets are identified by 4 alphanumeric codes (XXXX) as follows

1	2	3	4
S : Standard W : Wide H : Hybrid	B : Base R : Reversible E : End	1 ~ 4 : Standard barrier position a ~ d : Wide barrier position 0 : Not attached	

The definition of barrier position (digit 3, 4) is as below



[Figure 8] Code definitions according to barrier position

View direction is from the free area to the paid area.

The numeric code is the position of a standard barrier and the alphabet code is the position of a wide barrier.

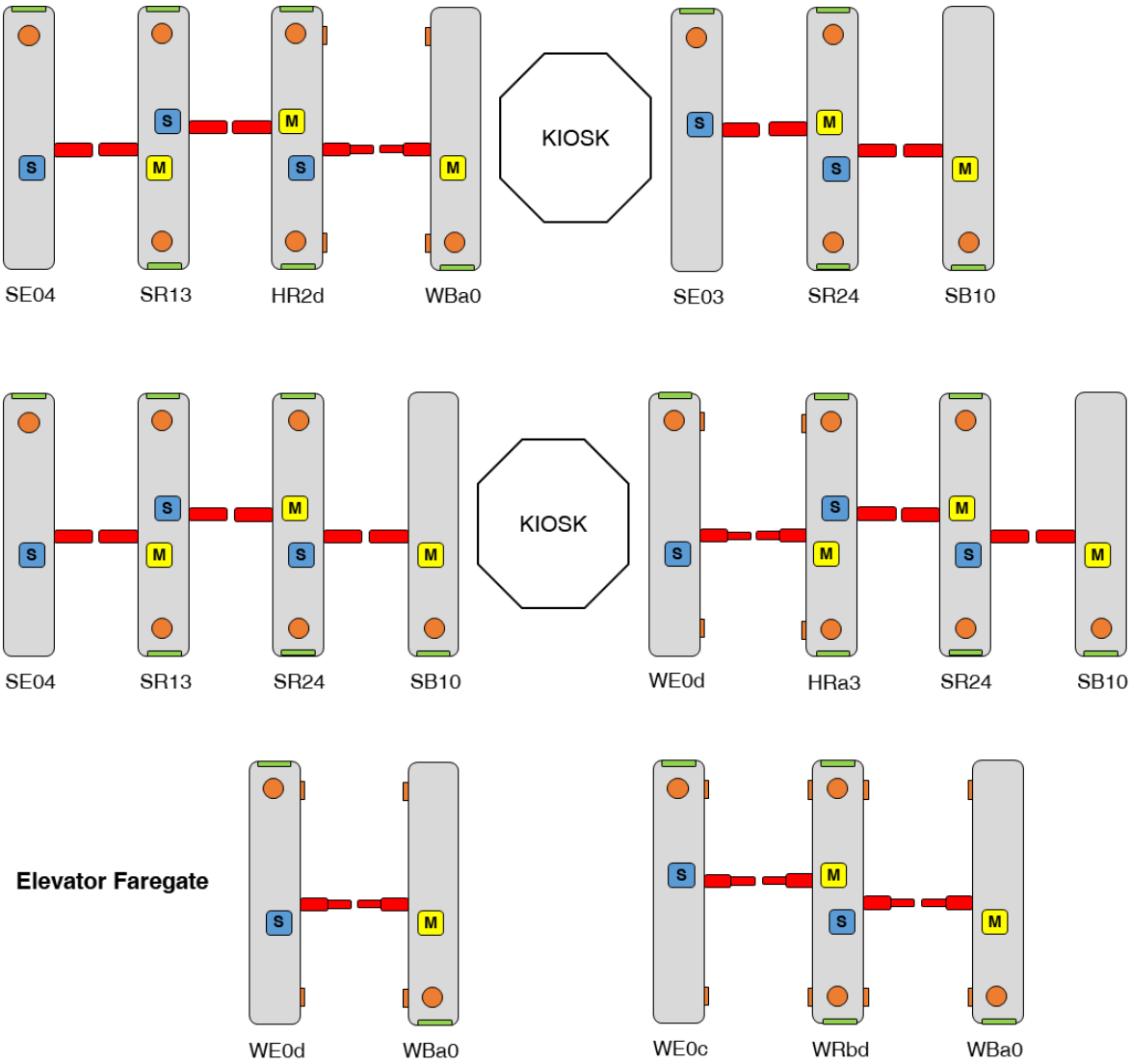
The detailed description of barrier type is as follows;

- Odd number is standard barrier – Right type
- Even number is standard barrier – Left type
- Alphabet ‘a’, ‘c’ is wide barrier – Right type
- Alphabet ‘b’, ‘d’ is wide barrier – Left type

2.4.2. The rules of Faregate layout

- Viewing cabinets from free area to paid area
- Placement of cabinet from right side
- Base cabinets place at rightmost (SB10, WBa0)

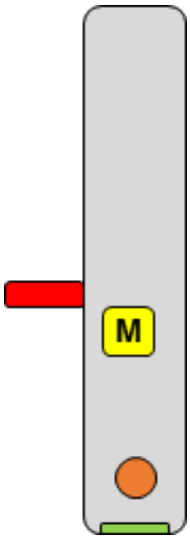
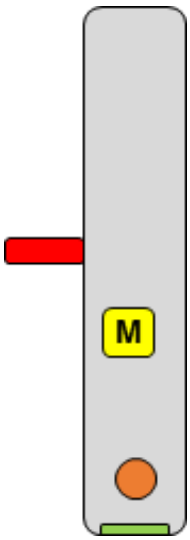
2.4.3. Faregate type and typical array layout

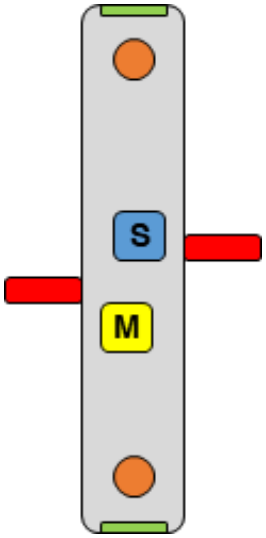
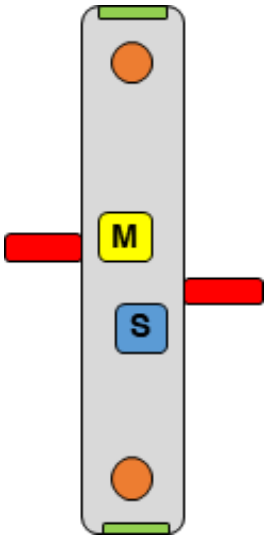


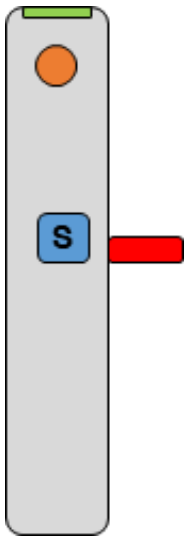
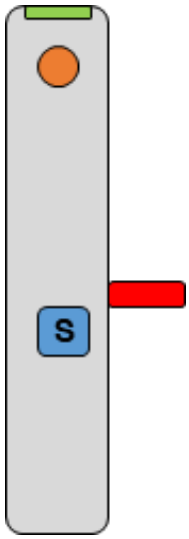
[Figure 9] Typical array layout of faregate

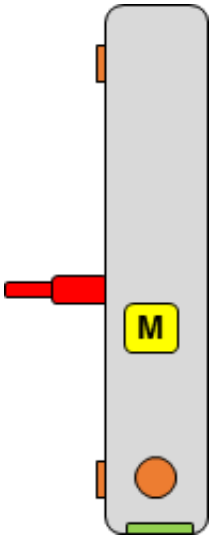
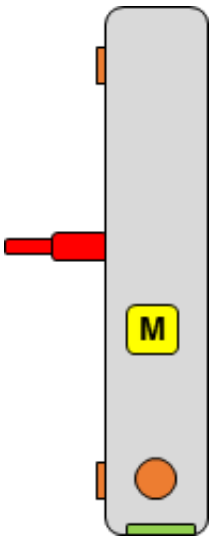
2.4.4. Definition of detailed faregate type

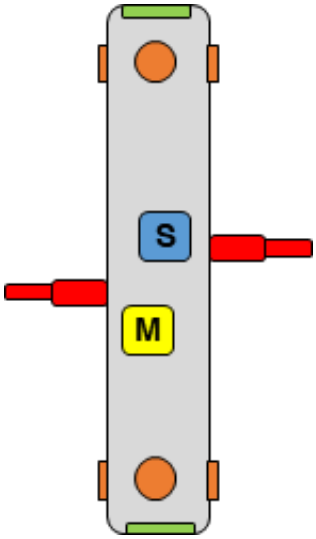
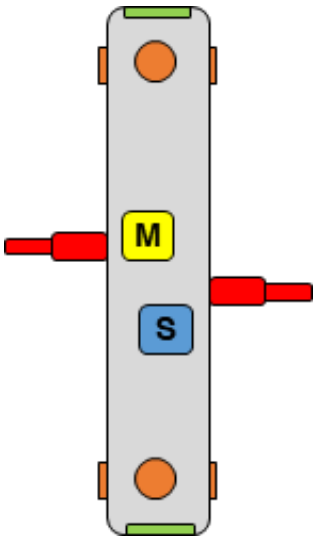
The main components of each type are shown in the following table.

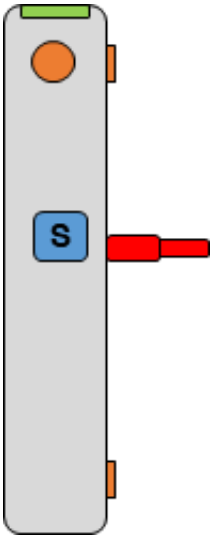
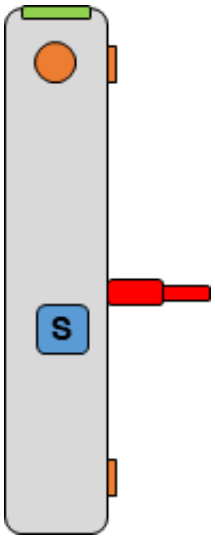
Type		Description
SB10		Type: Standard Base (Right End) – Master ECU : 1 GCU : 1 UPS : 1 PSU : 1 NWS : 1 PPT : 1 Customer Display : 1 Status Display : 1 Indicator Light : 1 Emergency Light : 1 Directional Sensor (Rx) : 18 Directional Sensor (Tx) : 0 Standard Barrier (Right type) : 1
SB20		Type: Standard Base (Right End) – Master ECU : 1 GCU : 1 UPS : 1 PSU : 1 NWS : 1 PPT : 1 Customer Display : 1 Status Display : 1 Indicator Light : 1 Emergency Light : 1 Directional Sensor (Rx) : 18 Directional Sensor (Tx) : 0 Standard Barrier (Left type) : 1

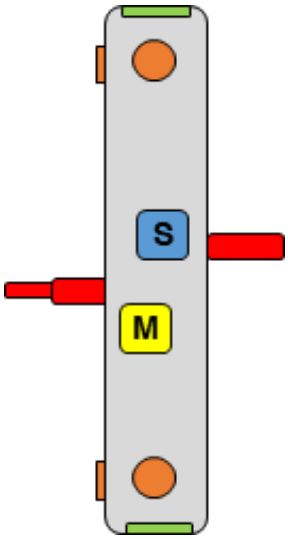
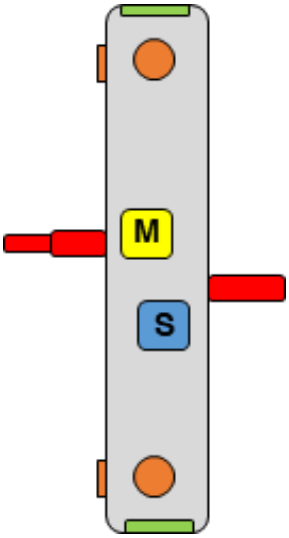
SR13		Type: Standard Reversible ECU : 1 GCU : 1 UPS : 1 PSU : 1 NWS: 1 PPT : 2 Customer Display : 2 Status Display : 2 Indicator Light : 2 Emergency Light : 2 Directional Sensor (Rx) : 18 Directional Sensor (Tx) : 18 Standard Barrier (Right type) : 2
SR24		Type: Standard Reversible ECU : 1 GCU : 1 UPS : 1 PSU : 1 NWS: 1 PPT : 2 Customer Display : 2 Status Display : 2 Indicator Light : 2 Emergency Light : 2 Directional Sensor (Rx) : 18 Directional Sensor (Tx) : 18 Standard Barrier (Left type) : 2

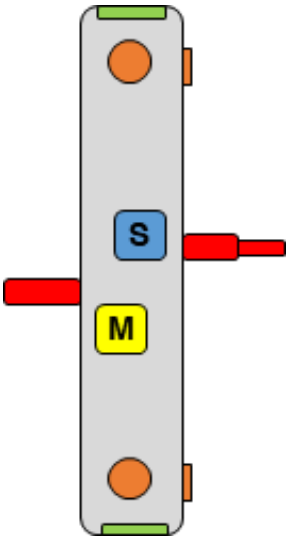
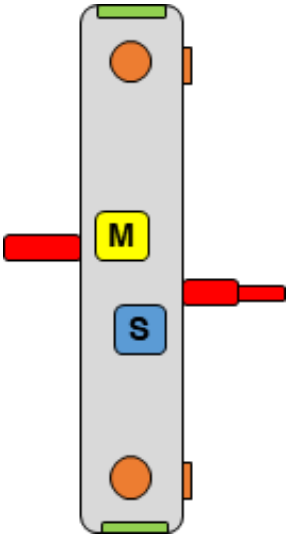
SE03		Type: Standard End (Left End) – Slave PPT : 1 Customer Display : 1 Status Display : 1 Indicator Light : 1 Emergency Light : 1 Directional Sensor (Rx) : 0 Directional Sensor (Tx) : 18 Standard Barrier (Right type) : 1
SE04		Type: Standard End (Left End) – Slave PPT : 1 Customer Display : 1 Status Display : 1 Indicator Light : 1 Emergency Light : 1 Directional Sensor (Rx) : 0 Directional Sensor (Tx) : 18 Standard Barrier (Left type) : 1

WBa0		Type: ADA Base (Right End) – Master ECU : 1 GCU : 1 UPS : 1 PSU : 1 NWS: 1 PPT : 3 Customer Display : 1 Status Display : 1 Indicator Light : 1 Emergency Light : 1 Directional Sensor (Rx) : 18 Directional Sensor (Tx) : 0 ADA Barrier (Right type) : 1
WBb0		Type: ADA Base (Right End) – Master ECU : 1 GCU : 1 UPS : 1 PSU : 1 NWS: 1 PPT : 3 Customer Display : 1 Status Display : 1 Indicator Light : 1 Emergency Light : 1 Directional Sensor (Rx) : 18 Directional Sensor (Tx) : 0 ADA Barrier (Left type) : 1

WRac		Type: ADA Reversible ECU : 1 GCU : 1 UPS : 1 PSU : 1 NWS: 1 PPT : 6 Customer Display : 2 Status Display : 2 Indicator Light : 2 Emergency Light : 2 Directional Sensor (Rx) : 18 Directional Sensor (Tx) : 18 ADA Barrier (Right type) : 2
WRbd		Type: ADA Reversible ECU : 1 GCU : 1 UPS : 1 PSU : 1 NWS: 1 PPT : 6 Customer Display : 2 Status Display : 2 Indicator Light : 2 Emergency Light : 2 Directional Sensor (Rx) : 18 Directional Sensor (Tx) : 18 ADA Barrier (Left type) : 2

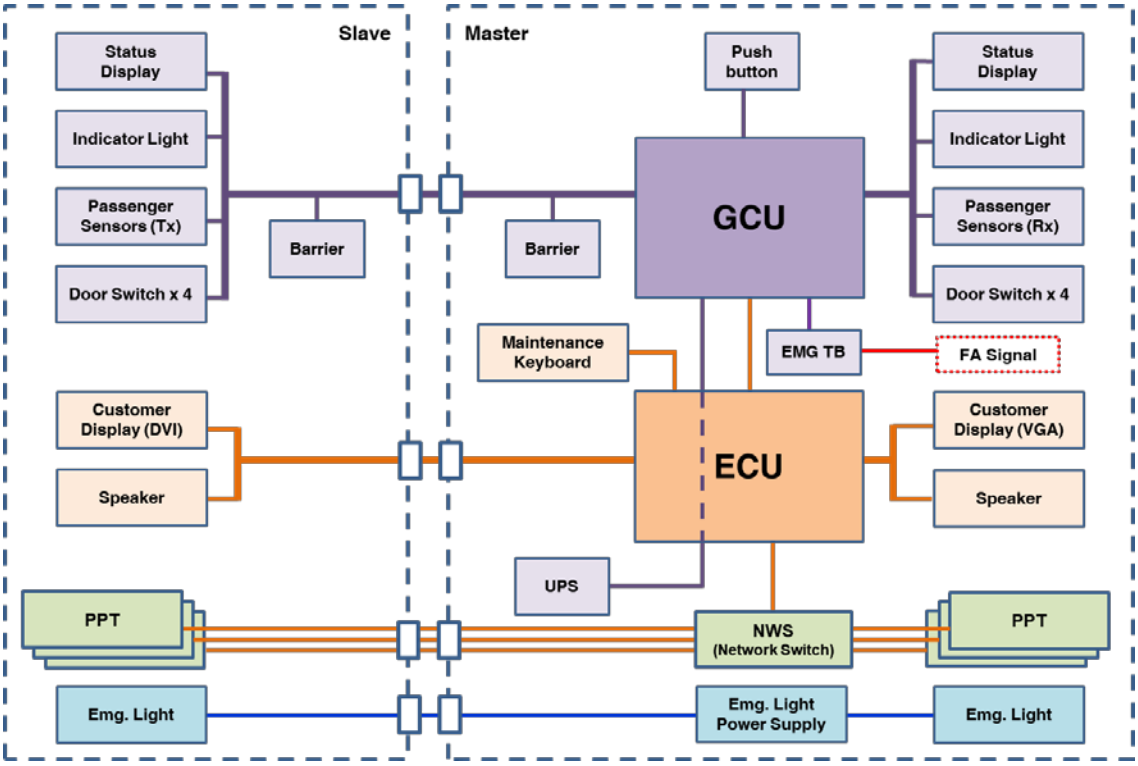
WE0c		Type: ADA End (Left End) – Slave PPT : 3 Customer Display : 1 Status Display : 1 Indicator Light : 1 Emergency Light : 1 Directional Sensor (Rx) : 0 Directional Sensor (Tx) : 18 ADA Barrier (Right type) : 1
WE0d		Type: ADA End (Left End) – Slave PPT : 3 Customer Display : 1 Status Display : 1 Indicator Light : 1 Emergency Light : 1 Directional Sensor (Rx) : 0 Directional Sensor (Tx) : 18 ADA Barrier (Left type) : 1

HRa3		Type: Hybrid Reversible ECU : 1 GCU : 1 UPS : 1 PSU : 1 NWS: 1 PPT : 4 Customer Display : 2 Status Display : 2 Indicator Light : 2 Emergency Light : 2 Directional Sensor (Rx) : 18 Directional Sensor (Tx) : 18 Standard Barrier (Right type) : 1 ADA Barrier (Right type) : 1
HRb4		Type: Hybrid Reversible ECU : 1 GCU : 1 UPS : 1 PSU : 1 NWS: 1 PPT : 4 Customer Display : 2 Status Display : 2 Indicator Light : 2 Emergency Light : 2 Directional Sensor (Rx) : 18 Directional Sensor (Tx) : 18 Standard Barrier (Left type) : 1 ADA Barrier (Left type) : 1

HR1c		Type: Hybrid Reversible ECU : 1 GCU : 1 UPS : 1 PSU : 1 NWS: 1 PPT : 4 Customer Display : 2 Status Display : 2 Indicator Light : 2 Emergency Light : 2 Directional Sensor (Rx) : 18 Directional Sensor (Tx) : 18 Standard Barrier (Right type) : 1 ADA Barrier (Right type) : 1
HR2d		Type: Hybrid Reversible ECU : 1 GCU : 1 UPS : 1 PSU : 1 NWS: 1 PPT : 4 Customer Display : 2 Status Display : 2 Indicator Light : 2 Emergency Light : 2 Directional Sensor (Rx) : 18 Directional Sensor (Tx) : 18 Standard Barrier (Left type) : 1 ADA Barrier (Left type) : 1

2.5. System Configuration

2.5.1. Hardware Logical Architecture



[Figure 10] ADA Faregate Logical Architecture

The faregate consists of master / slave side for passenger service. The major modules such as ECU, GCU, UPS, and NWS are equipped on master side and these modules control all components including slave side.

※ The only difference between Standard faregate and ADA faregate is the quantity of the PPT.

2.5.2. General specification

The general specification of the faregate is as follows:

Item	Specification
Cabinet	**Dimension (D x W x H)** - Standard : 70.87 x 11.02 x 39.37 inches - ADA : 70.87 x 11.81 x 39.37 inches **Enclosure** - Stainless steel : 2.0mm / 316L - Finish : brushed No.4 **Base** - Stainless steel : 3.0mm / 316L - Finish : brushed No.4 **End Cover** - Material : PC - Thickness : 4.0mm - Color : Metro Brown (Code : AMS-STD-20040) - PPT Cover color : Marshmallow (Pantone 11-4300)
ECU (Electronic Control Unit)	CPU : Intel® Celeron J1900 / 2.0Ghz Memory : Onboard 4GB Dual Display : 1 x VGA, 1 x DVI Storage : 1 x 128GB SSD I/O Interface : 2 x LAN, 6 x USB, 10 x COM
GCU (Gate Control Unit)	CPU : 32bit RISC Memory : 256KB Flash, 64KB SRAM I/O Control : Barrier, Sensor, Status Display, Indicator Light, Door Switch, Emergency Interface, UPS, Etc.
Clamshell Barrier	Motor Type : Brush DC Closing Force: ≤ 250N Brake Force: ≤ 250N Flapper - Type : Polyurethane - Color : Orange (Code : Pantone 144C) MCBF : 1,000,000 cycles
Customer Display	6.5inch TFT-LCD

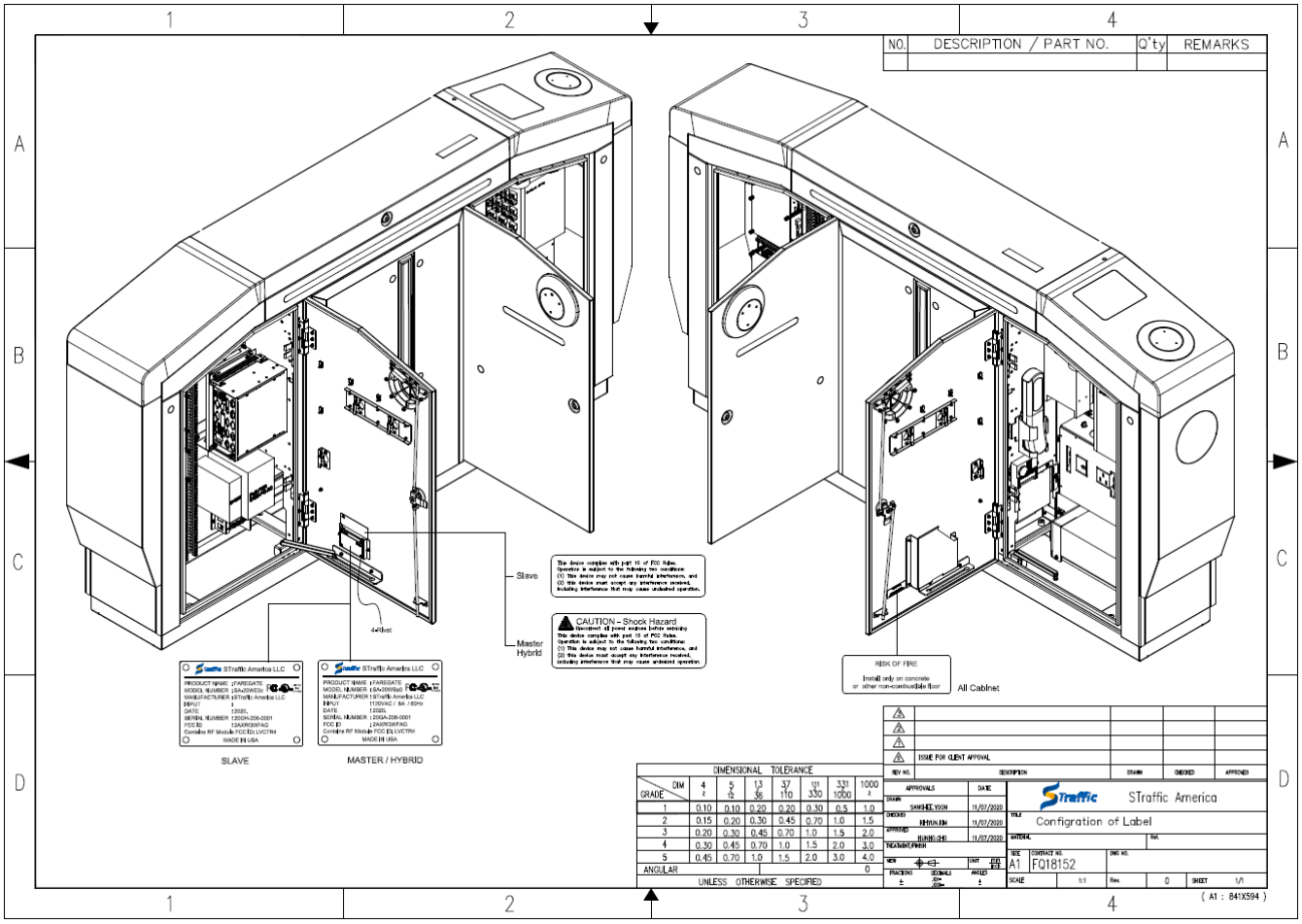
	LED Backlit Resolution : 640 x 480 Interface : DVI, VGA MTBF : 50000 hours
Status Display	Entry : Green Do not enter : Red
Indicator Light	3-Color LED (Red, Green, Yellow)
Directional Sensor	Infra-Red beam (Emitter, Receiver) Quantity : 18 Sets
Audio	18W Amplifier Board 20W, 4ohm Speaker
Emergency Light	**Emergency light power** - 120VAC / 12VDC (24W) **Emergency light** - 1.5W / 12VDC - Color : White
PSU	Input Voltage : 100 ~ 240VAC Output Voltage : +5VDC, +12VDC, +24VDC Rated Capacity : 312W
UPS	500VA (300W)
Heater	Input Voltage : 120VAC Capacity : 310W
Network Switch Power Supply for NWS	IE-1000-8P2S-LM PWR-IE170W-PC- AC
PPT	TR4 Refer to *"CDRL 2-1 Physical Interface Specification" by SI Contractor*

[Table 2] General specifications of faregate

3. Faregate Label

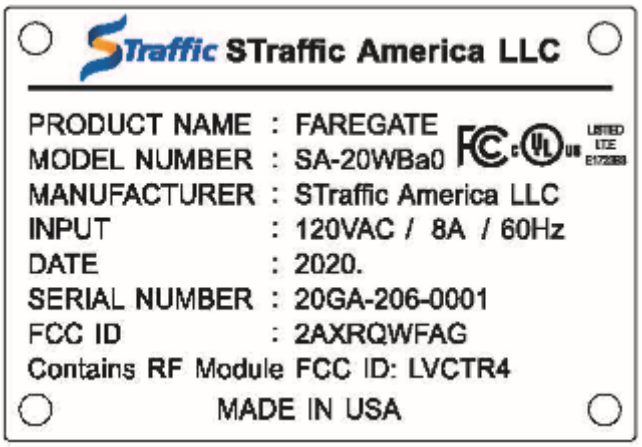
3.1. Nameplate

The faregate nameplate will be placed in the faregate. The user can check the product name and model number on this label with opening the maintenance door with key.

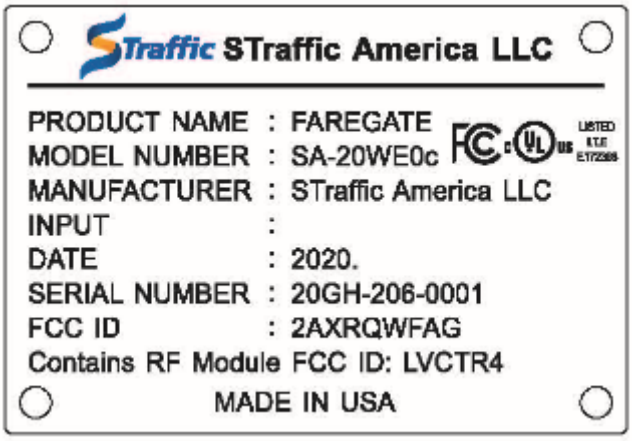


[Figure 11] Nameplate and FCC instruction label position

The nameplate will be divided two types. Because the AC input is only for the master faregate not slave faregate.



[Figure 12] Nameplate for the Master faregate



[Figure 13] Nameplate for the Slave faregate

3.2. FCC Compliance label and instructions

The faregate will have the instruction label for FCC compliance. The upper label is for the slave cabinet and the bottom label is for the master cabinet.

This device complies with part 15 of 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.

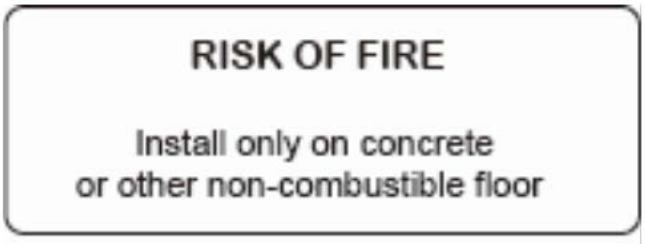
CAUTION - Shock Hazard
Disconnect all power sources before servicing
This device complies with part 15 of FCC Rules.
Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and
(2) this device must accept any interference received,
including interference that may cause undesired operation.

[Figure 14] Label for FCC compliance

Caution: changes or modifications not expressly approved by Straffic America could void your authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 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.

3.3. Risk of Fire



[Figure 15] Label for Risk of Fire

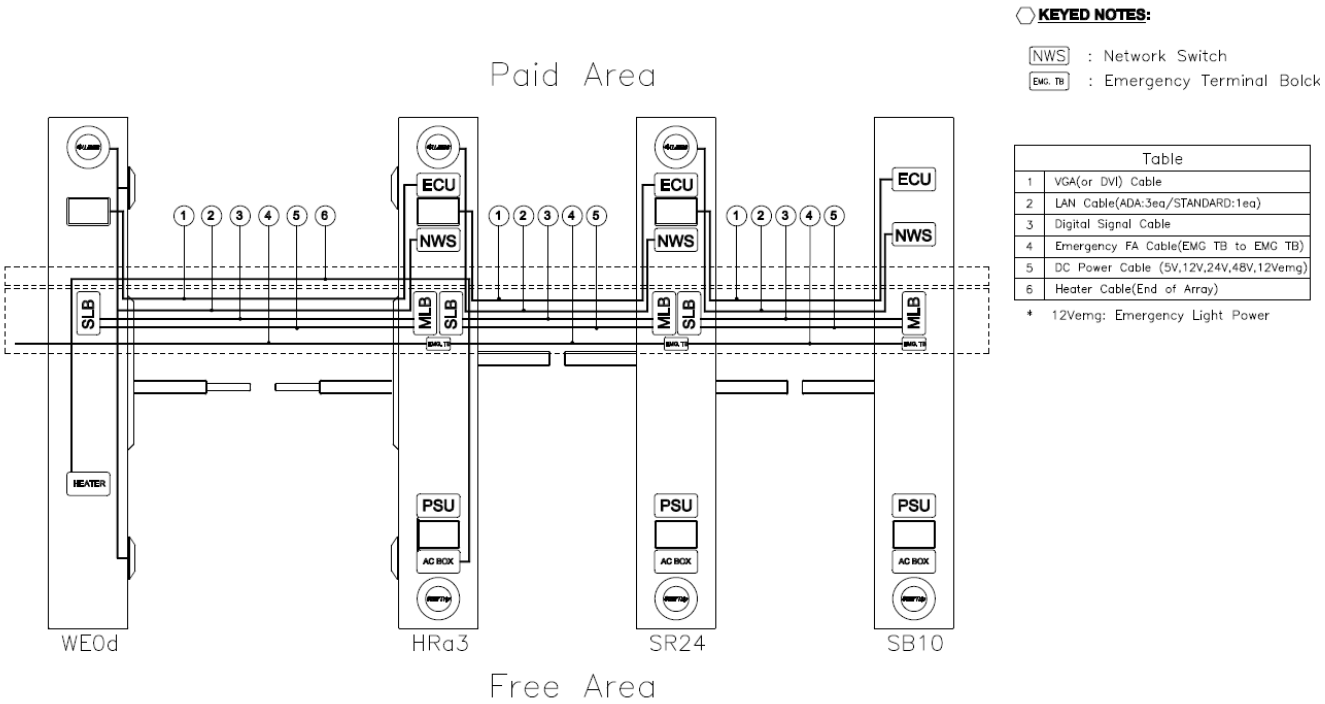
3.4. Contact Information

- Responsible Party: STraffic America, LLC
- Address: Suite 125 1593 Springhill Rd, Vienna, VA 22182
- Contact: Brian Hong (H.P: 703-732-7153)
- Web Site: http://www.straffic.co.kr/en/index.php/company

4. Faregate Connection

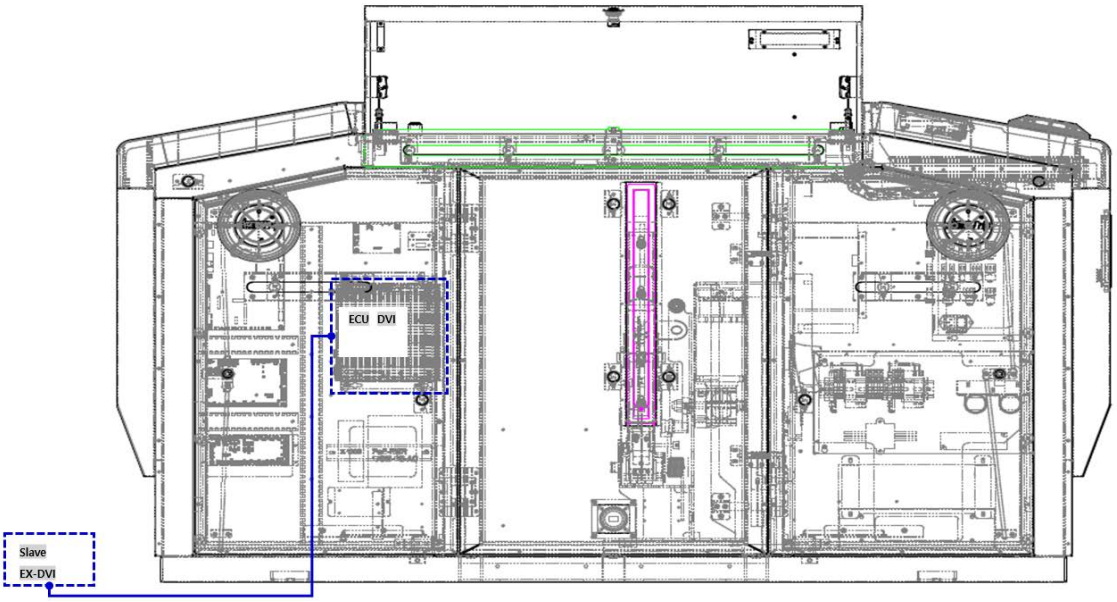
4.1. Interconnect Cable

The faregate aisle consists of 2 types, master and slave. Between the master and slave cabinet, the interconnection cable should be connected. The below figure is a simple diagram between the master and slave cabinet. The emergency FA cable is connected to EMG TB (Emergency Terminal Block) in master cabinet based on the aisle. To power on the faregate, turn the ELCB switch on then, turn the UPS on, and then turn the power supply on.



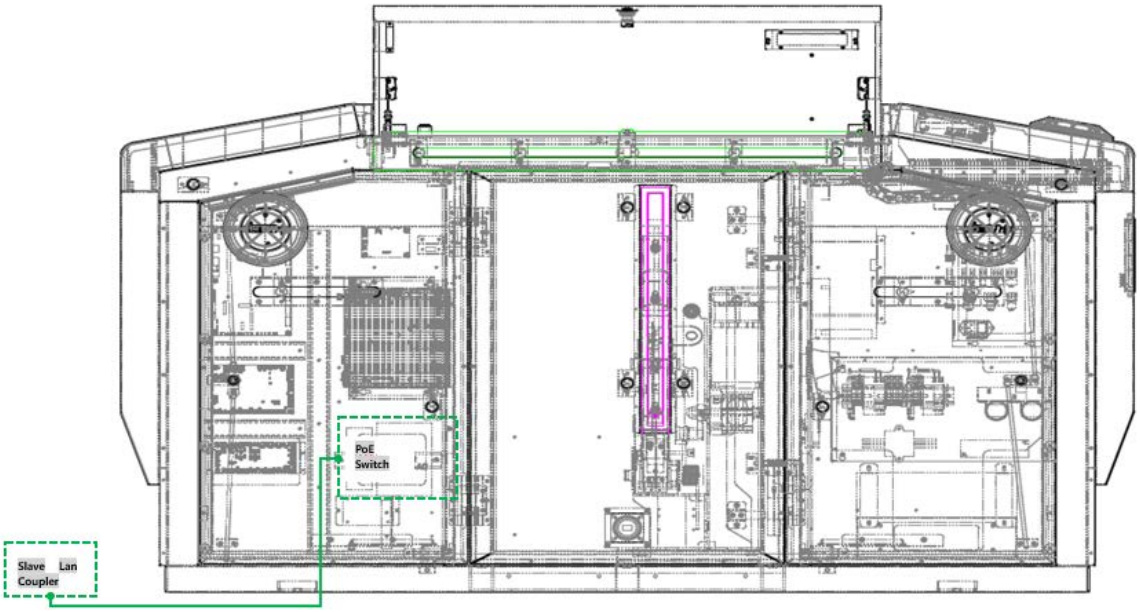
[Figure 16] Faregate Interconnect Cable connection

1. DVI Cable

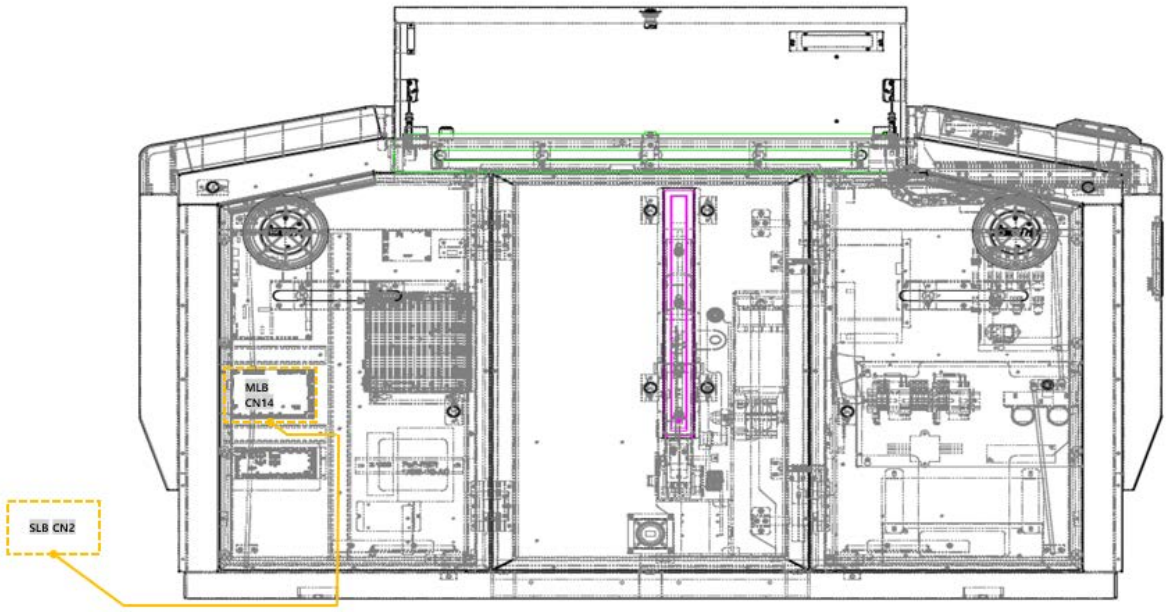


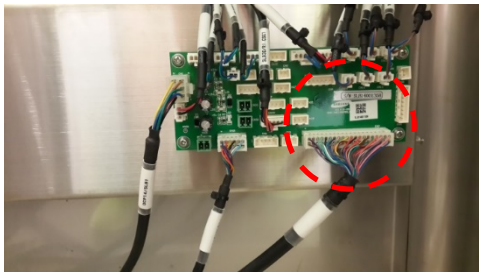
Connect the DVI cable with the DVI extension cable in the secondary cabinet.

2. LAN Cable



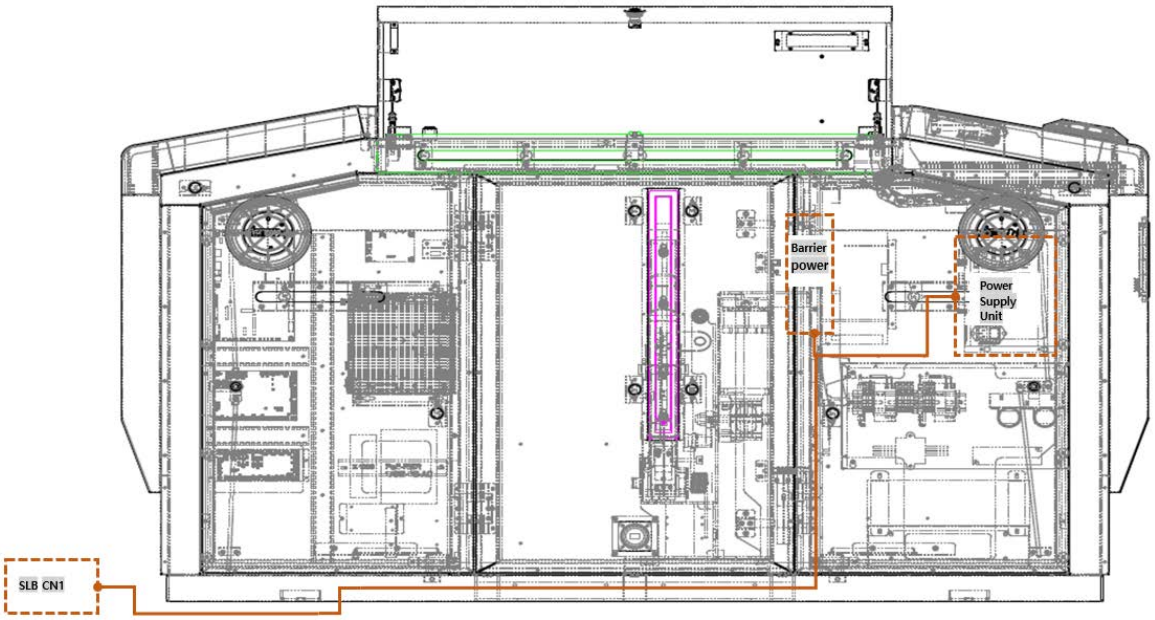
3. Digital Signal Cable

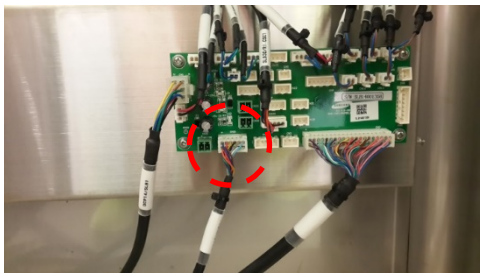




Connect the digital signal cable to the SLB(Secondary Link Board) CN X1/X2.

4. DC Power Cable



	Connect the DC Power Cable to SLB CN 1.

[Figure 17] Faregate Interconnect Cable

4.2. Power Connection

4.2.1.1. Power Plug

Both the main and emergency power will utilize a twist lock plug. This lock will prevent the power cables from disconnecting, reducing the risk of faulty power cable connections. The twist lock power plug also provides a safety environment for the maintenance operator in the future. The main power plug will be a NEMA L5-20P and the emergency power plug will be a NEMA L5-15P.

[Figure 18] Faregate Twist Lock Power Plug

4.2.1.2. Power Receptacle

The power receptacles will be checked prior to the installation to determine if they need to be repositioned. In case a repositioning of the power receptacle is required, a certified electrician will adjust the power receptacles for the new faregate. All the stations will be reviewed to see if the conduit opening needs to be chipped, elongated or if flexible tubing is needed to reposition the power receptacles. The power receptacles will be surveyed during the installation survey and a review to determine if repositioning is required. If the modification to the power receptacle is necessary, we will submit the switch order 4 weeks ahead of the installation date.

[Figure 19] Current Power Receptacle Example

4.3. Data Connection Cable

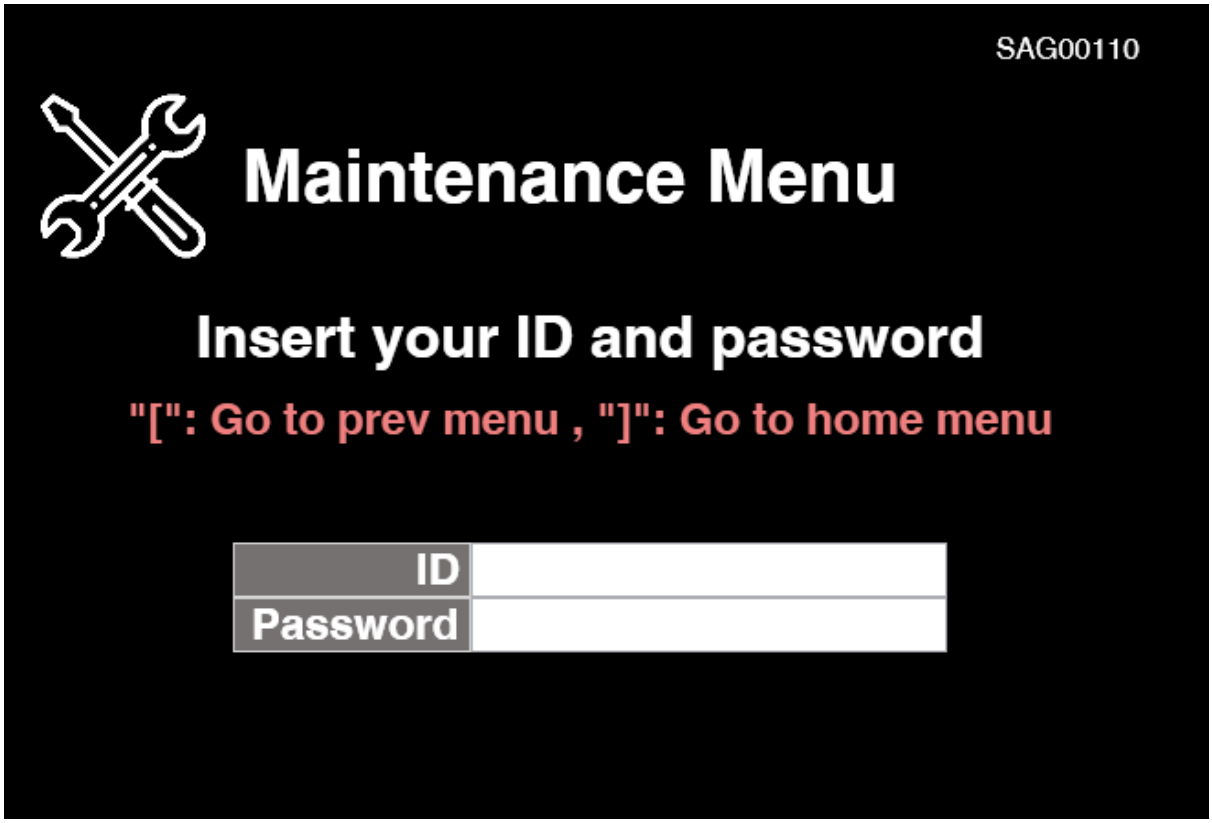
One WMATA approved Ethernet switch per faregate aisle will be installed in the faregate. The switch will connect all TR4s associated with a single aisle as well as the faregate controller to the WMATA LAN/WAN.

The Wan will be utilized to connect the central system level and station level while the LAN will be used to connect equipment in the station level.

The wiring work will start from the cabinet furthest from the Kiosk to reduce multiple cables coming out from the Kiosk.

5. Operation Manual

5.1. Maintenance menu log-in page



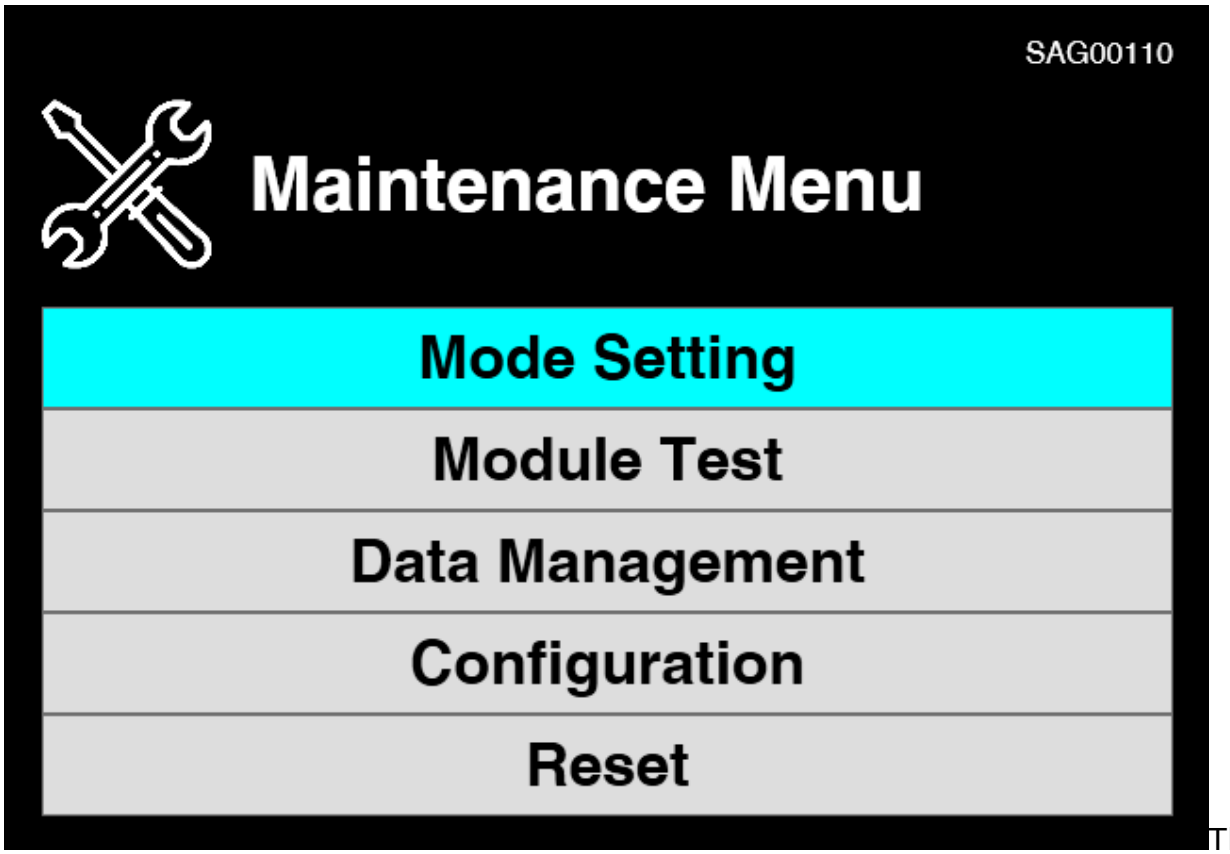
Insert ID/PW in each textbox to login maintenance menu.

(ID: afceng / PW: afc1004)

After login, you can go to prev menu with ‘ [‘ key and go to home menu with ‘] ’ key.

Note. The faregate application limits the use of some key-in such as “arrow ←↑→↓” keys. Please use the mouse-pad on the keyboard.

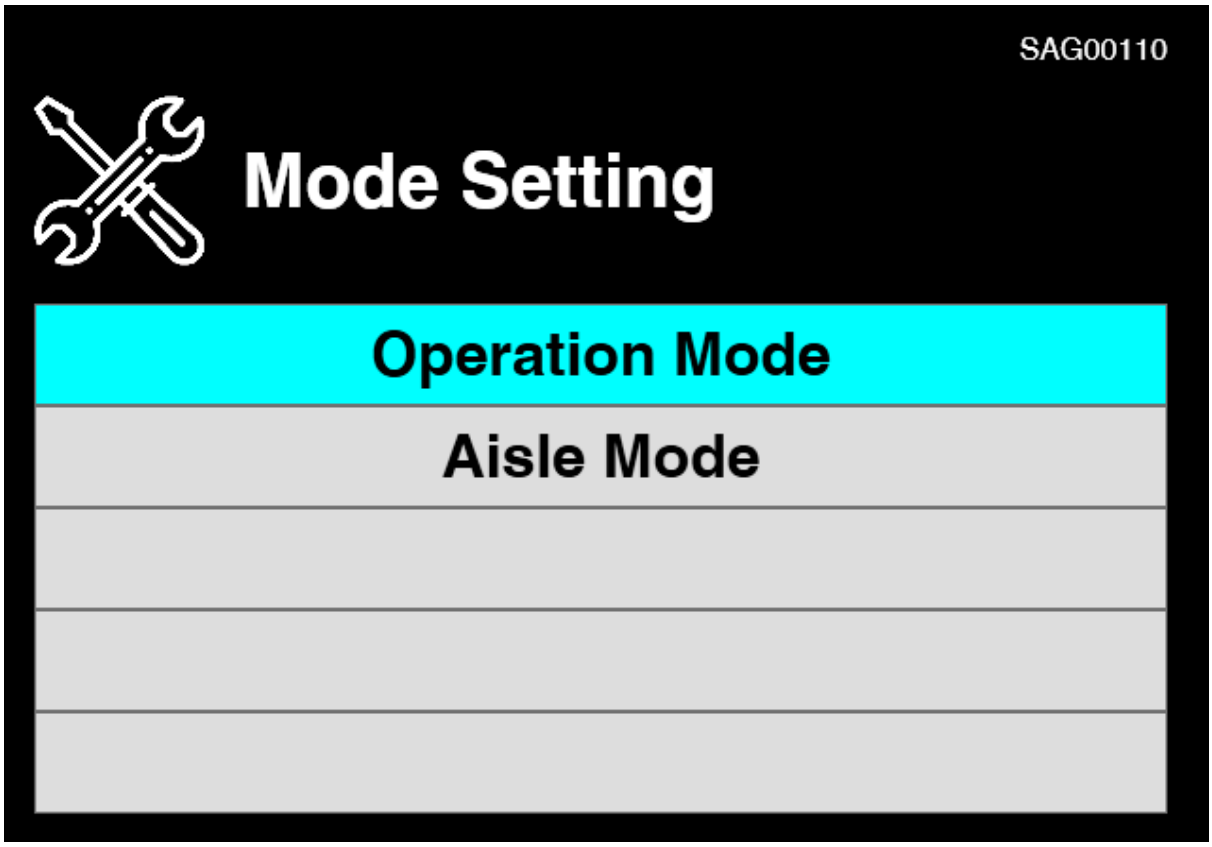
5.2. Top level Maintenance menu.



This page is top level maintenance menu.

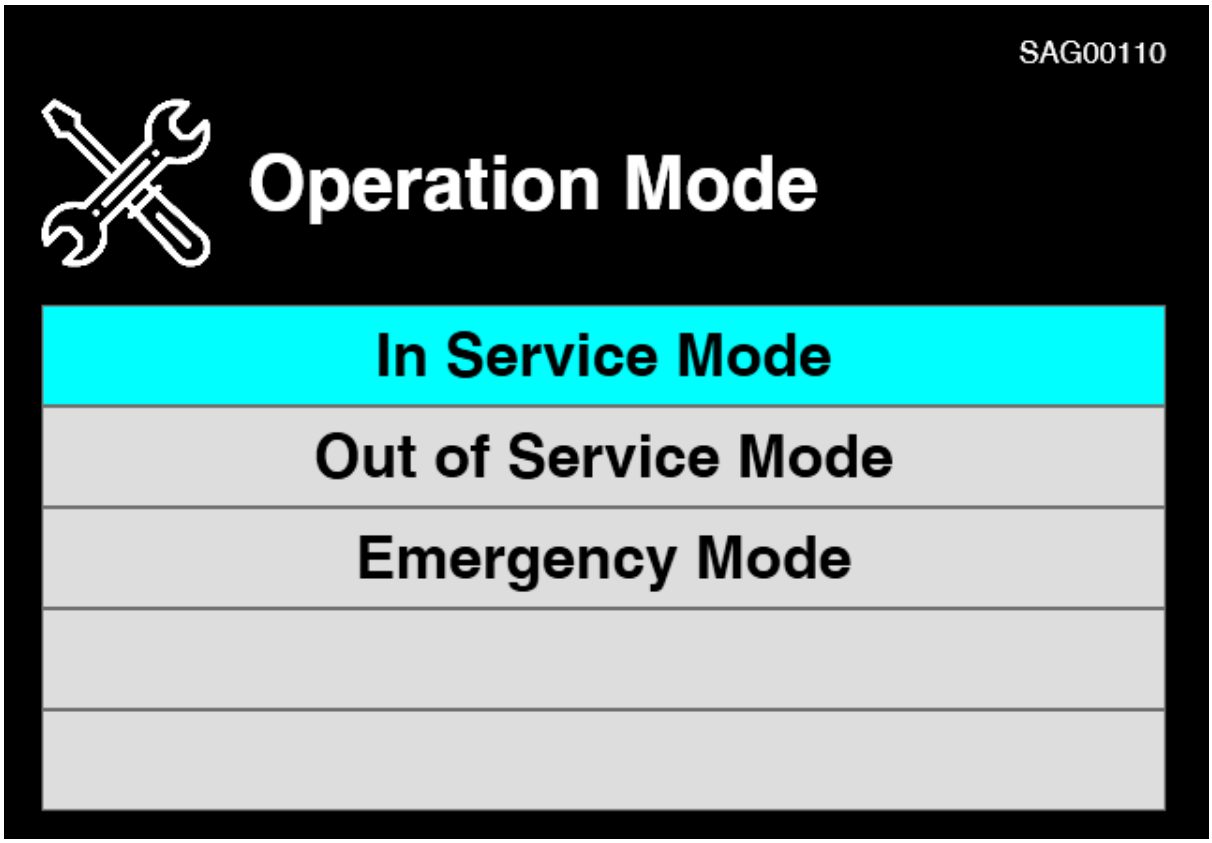
1. Mode Setting – You can change Faregate Operation mode and Faregate Aisle mode in this menu.
2. Module Test – You can test Faregate barrier, Each PPT, Faregate Passenger sensor/Door switch, Faregate Indicator light/Status display and Faregate speaker in this menu.
3. Data management – You can check Faregate Transaction data, Faregate audit register data, Faregate access/event history data and Faregate parameter/software version in this menu.
4. Configuration – You can configure Faregate information, Faregate configuration value, IP setting and module component ID setting in this menu.
5. Reset – You can reset GCU, PPT and delete faregate database data. Also you can close faregate main application or Shutdown Faregate in this menu.

5.3. Mode setting page



You can choose a menu for Faregate operation mode, Aisle mode on this page.

5.4. Mode setting – Operation mode page

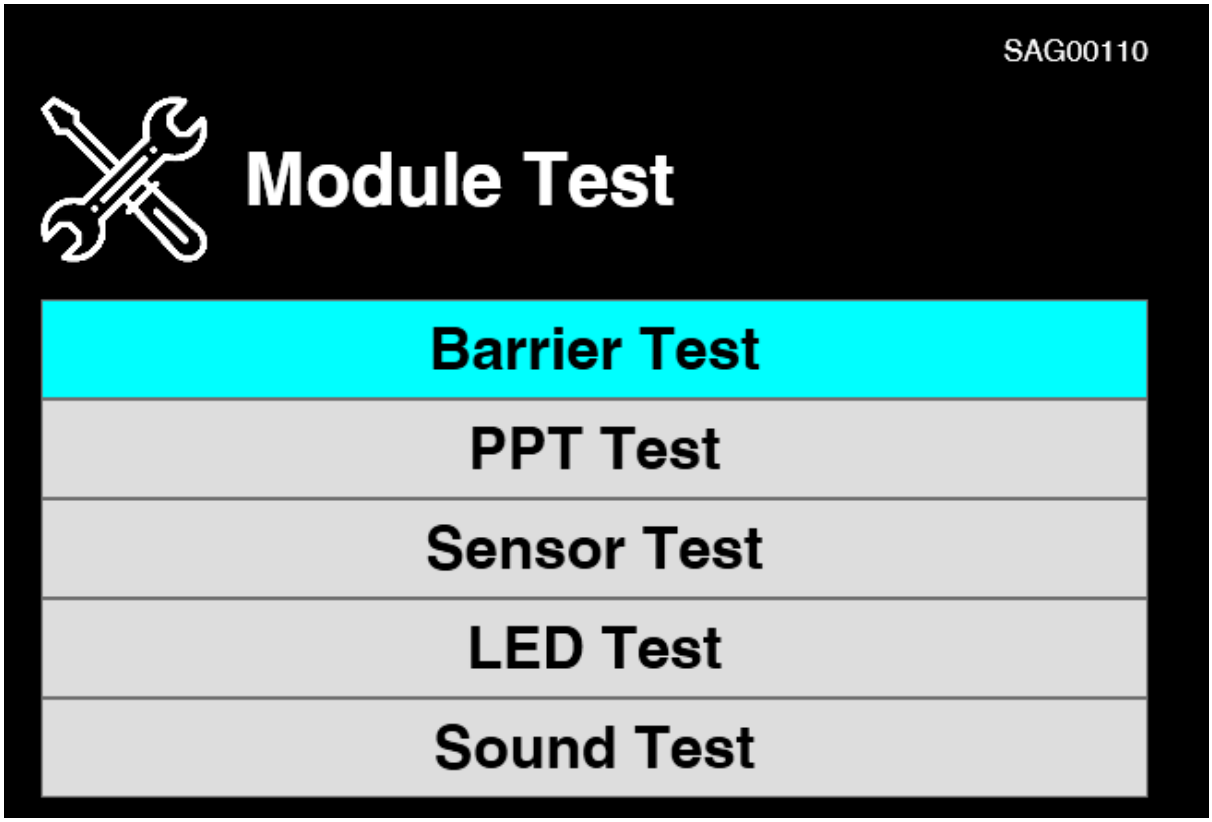


You can choose a button for in service mode, out of service mode and emergency mode on this page.
(After getting out of the maintenance menu, the faregate operation mode will be applied.)

5.5. Mode setting – Aisle mode page

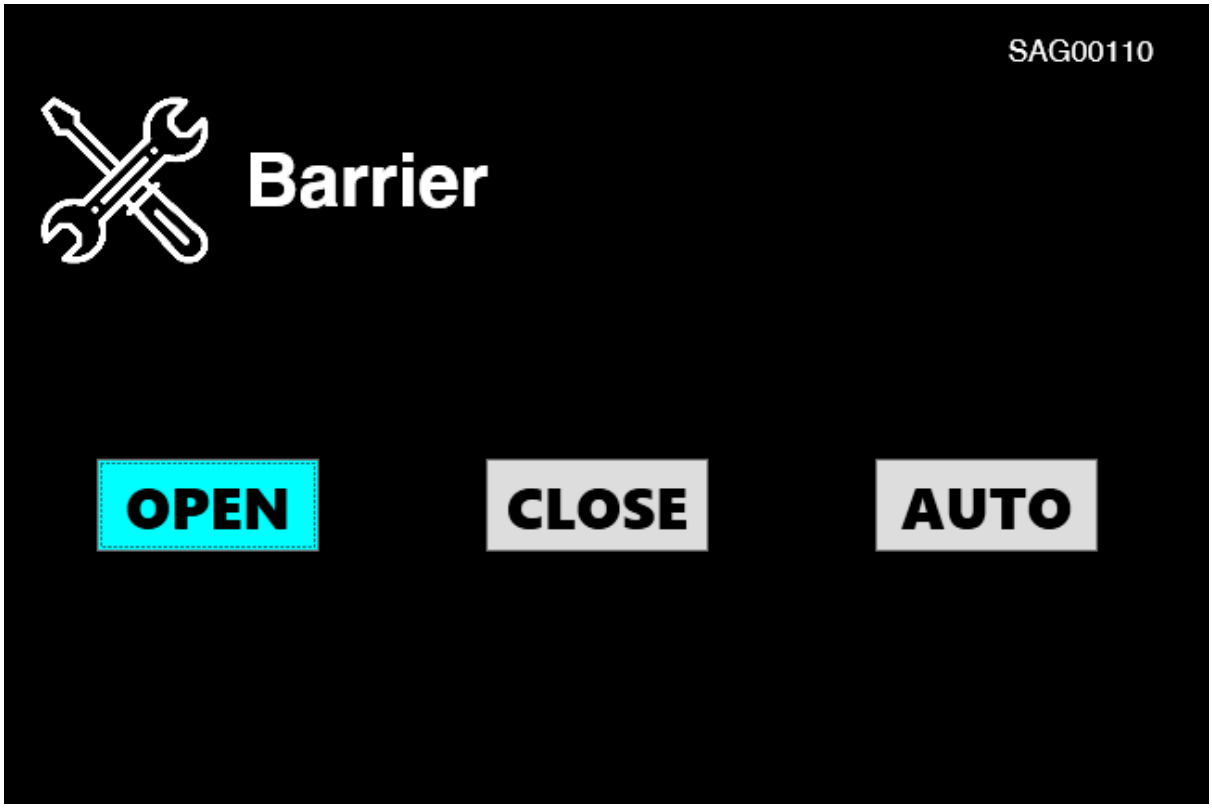
You can choose a button for entry mode, exit mode and bi-directional mode on this page. (After getting out of the maintenance menu, the faregate aisle mode will be applied.)

5.6. Module Test page



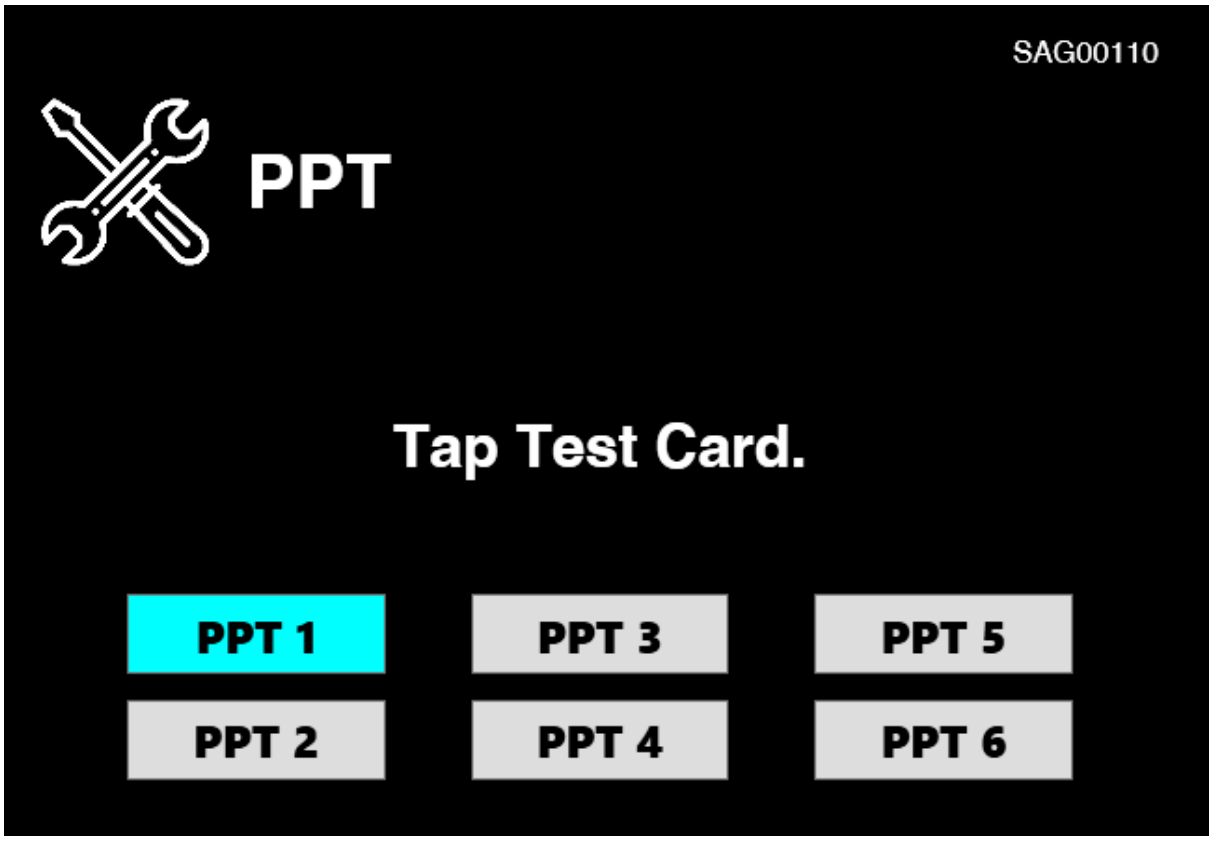
You can choose menu for barrier test, PPT test, sensor test, LED test, sound test on this page.

5.7. Module test – Barrier test page



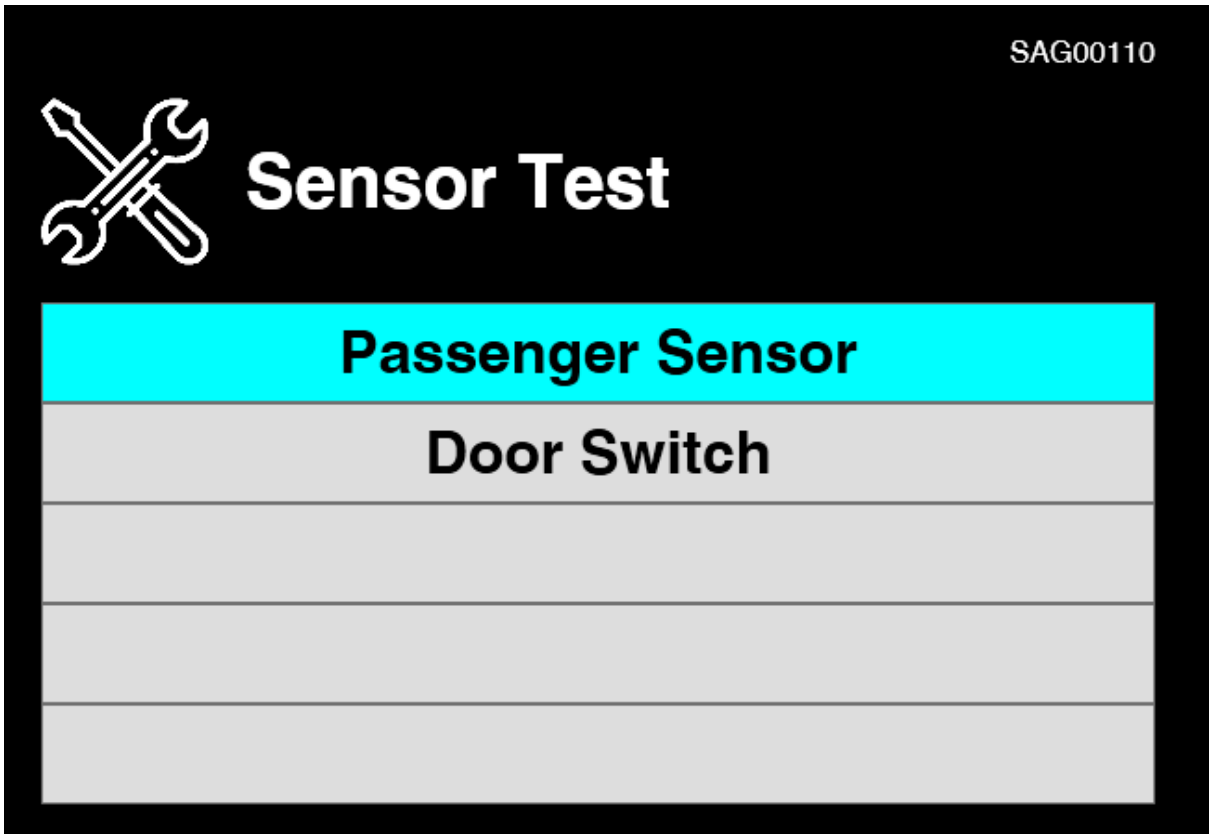
You can open or close the faregate barrier by clicking the “OPEN” and “CLOSE” button. And the faregate barrier can open and close automatically with the “AUTO” button.

5.8. Module test – PPT test page



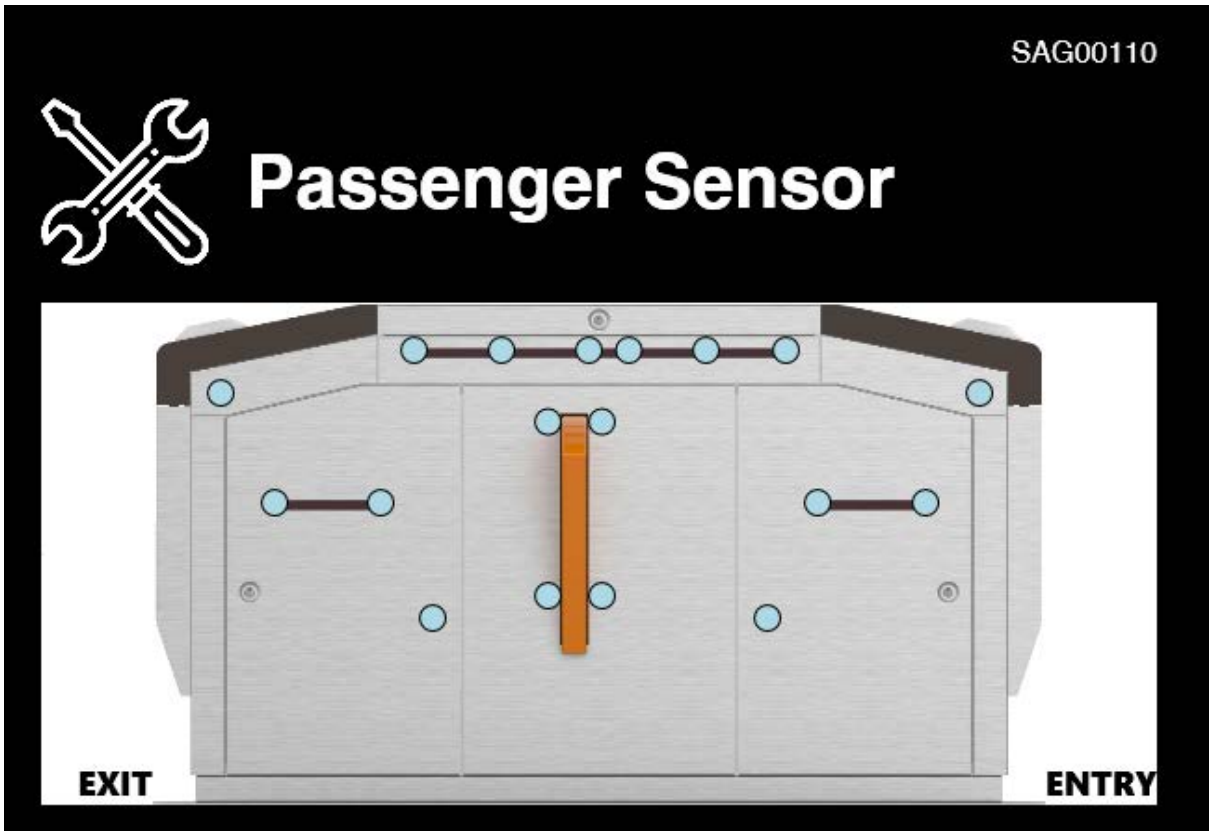
You can test the PPT on this page.
After clicking each button of the PPT to be tested, when the "Tap Test Card" comment appears, you can perform the PPT test by tagging the test card.
(Upper screen is status after click PPT 1 button.)

5.9. Module test – Sensor test page



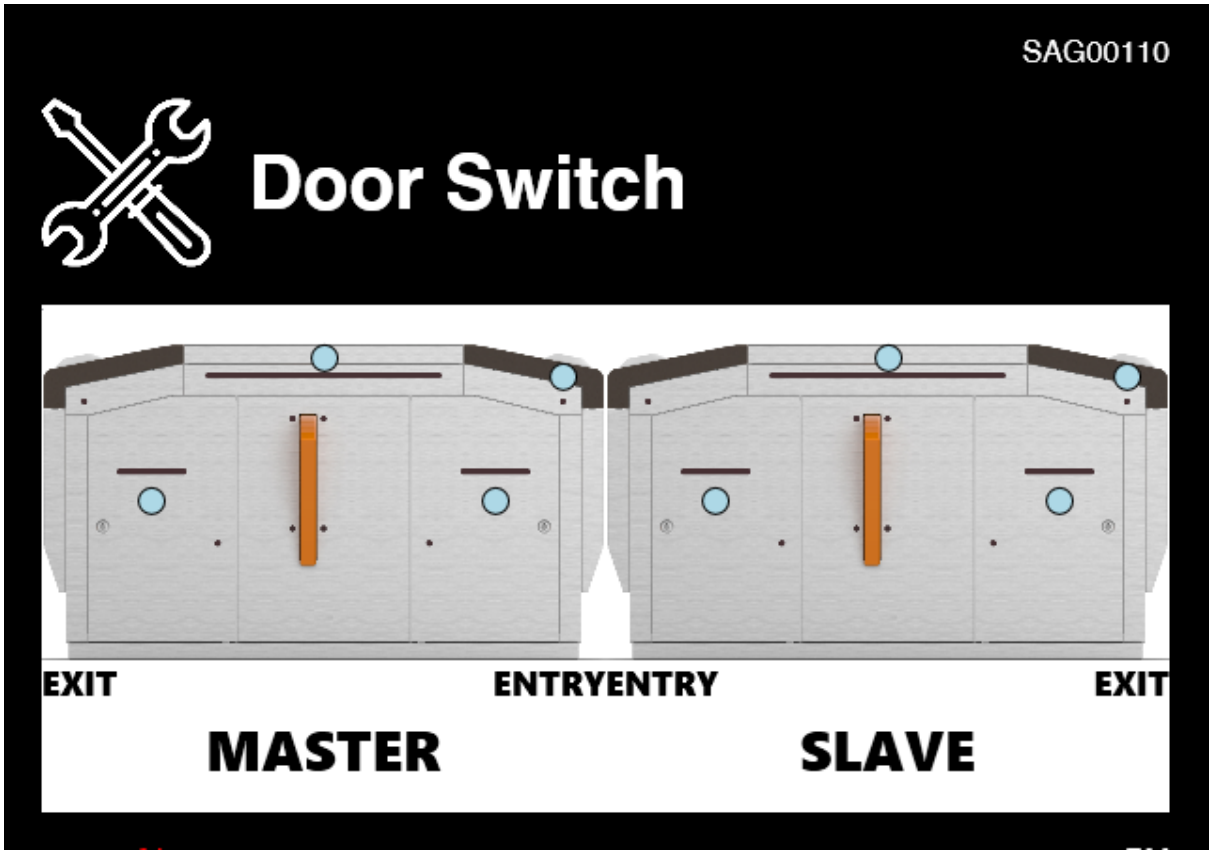
You can choose the test for passenger sensor or door switch on this page.

5.10. Module test – Sensor test – Passenger sensor test page



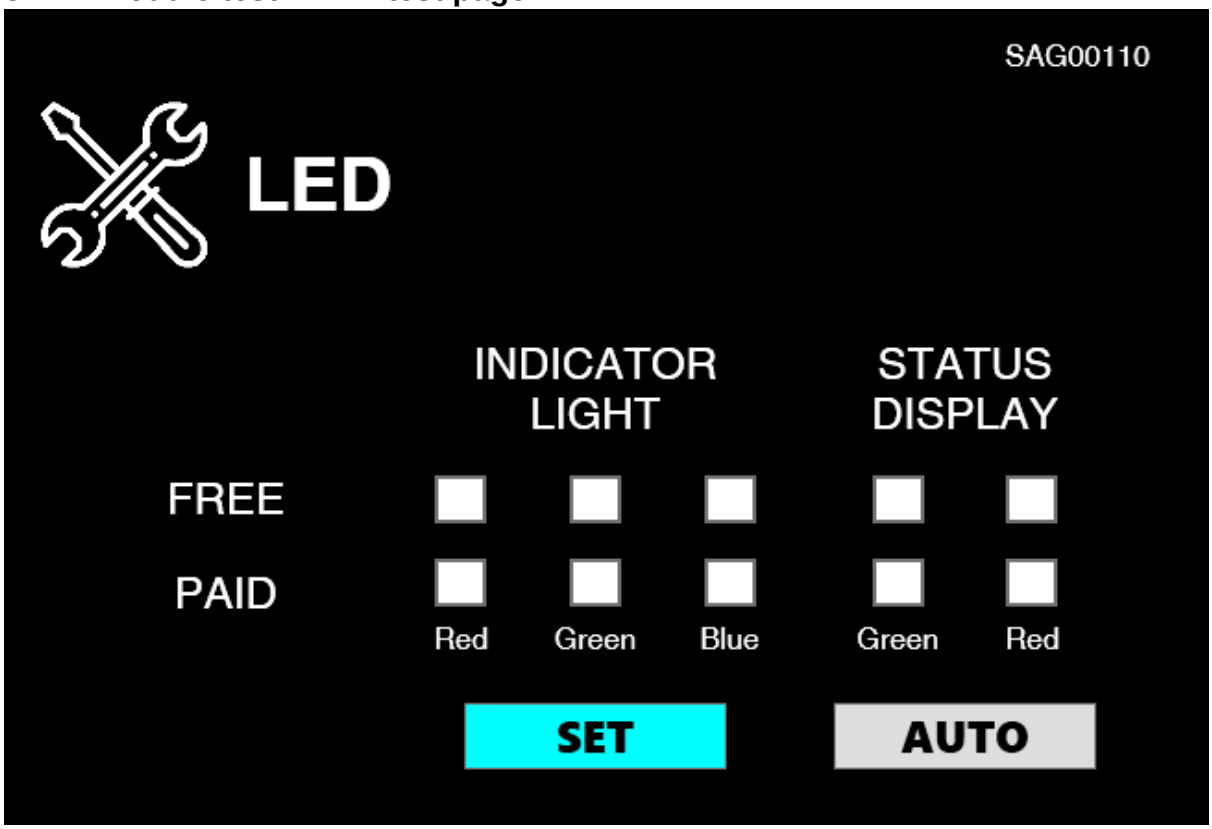
You can test the passenger sensor on this page.
By going through the aisle or by covering the passenger sensor on this faregate.

5.11. Module test – Sensor test – Door switch



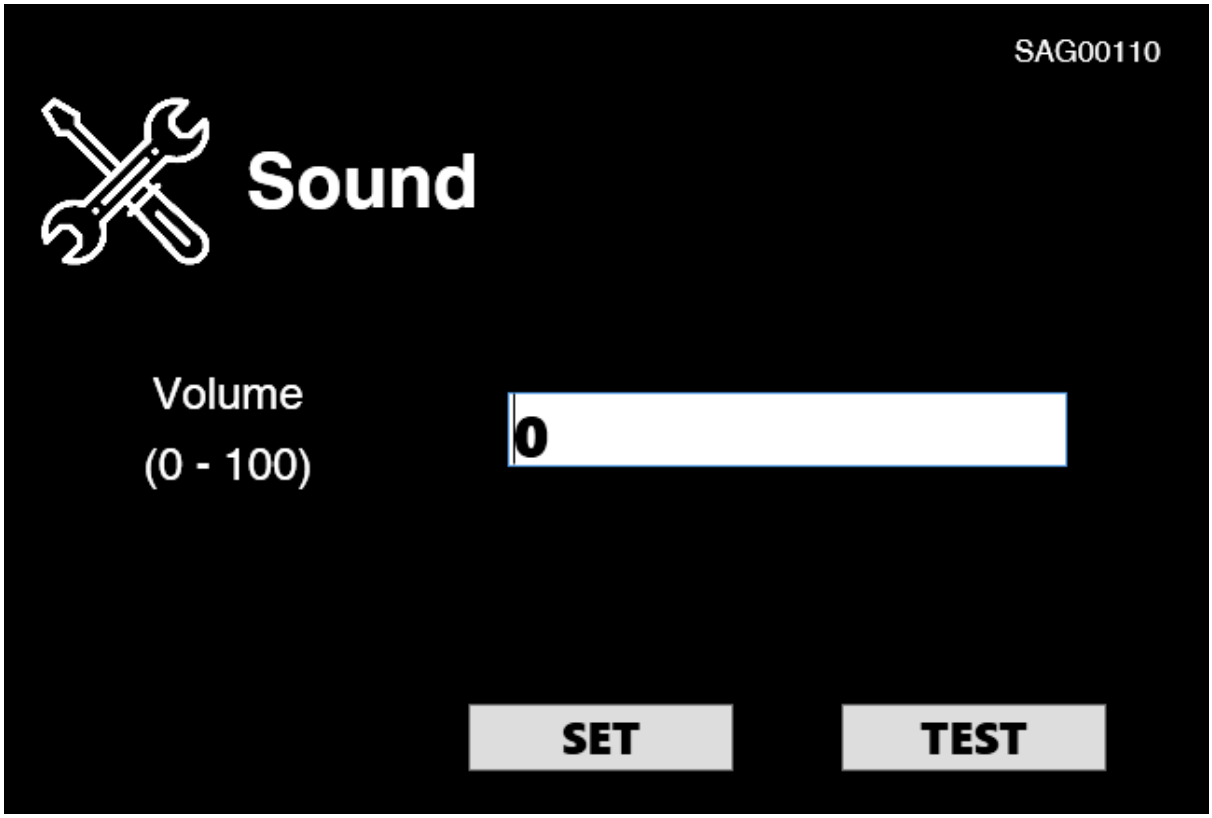
You can test the Door switch on this page.

5.12. Module test – LED test page.



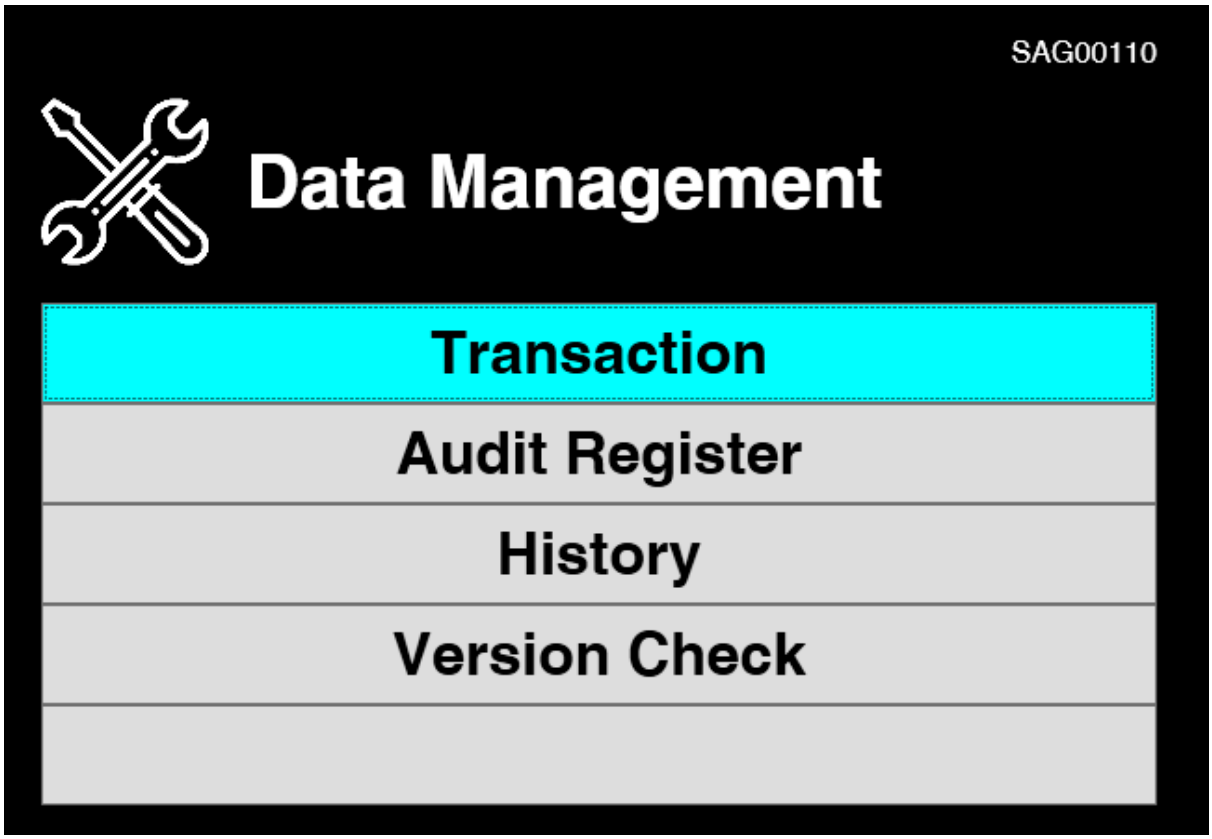
You can test by clicking checkbox and “SET” button on this page.
(After you click checkbox, click “SET” button for Indicator light/Status display test on this page.
And you can test Indicator light/status display automatically with the “AUTO” button.)

5.13. Module test – Sound test page



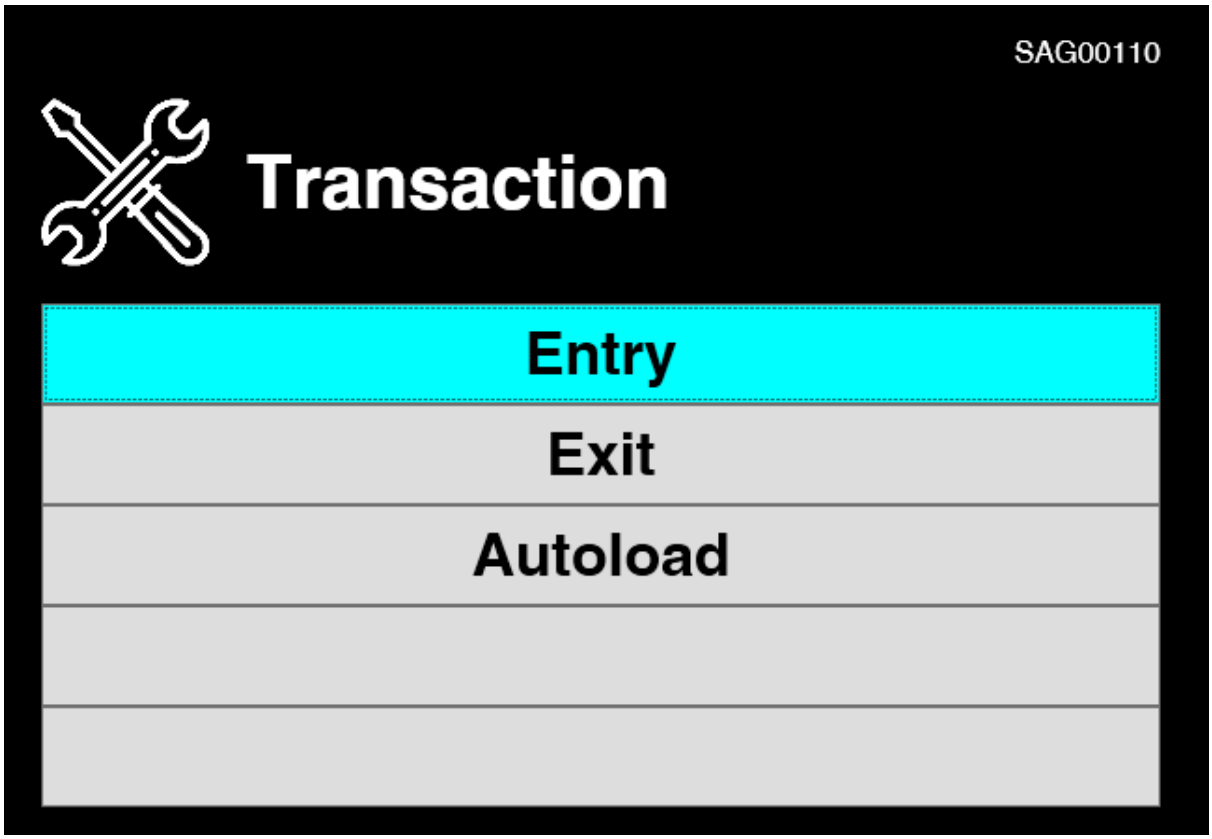
You can test for faregate sound on this page.
(Input a value in the textbox for testing the faregate sound.
Next, click the “SET” button and the “TEST” button for testing.)

5.14. Data management page



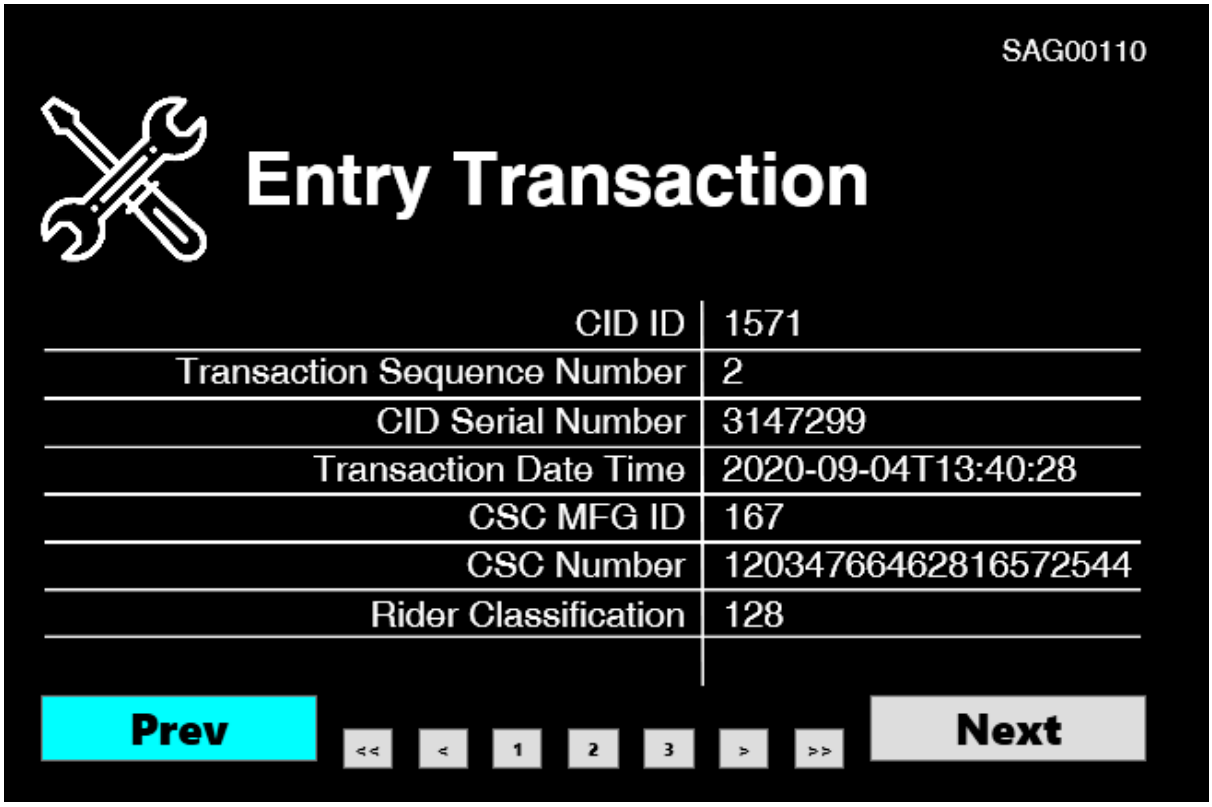
You can choose menu for checking transaction data, audit register, history data and Faregate parameter/software version on this page.

5.15. Data management – Transaction page



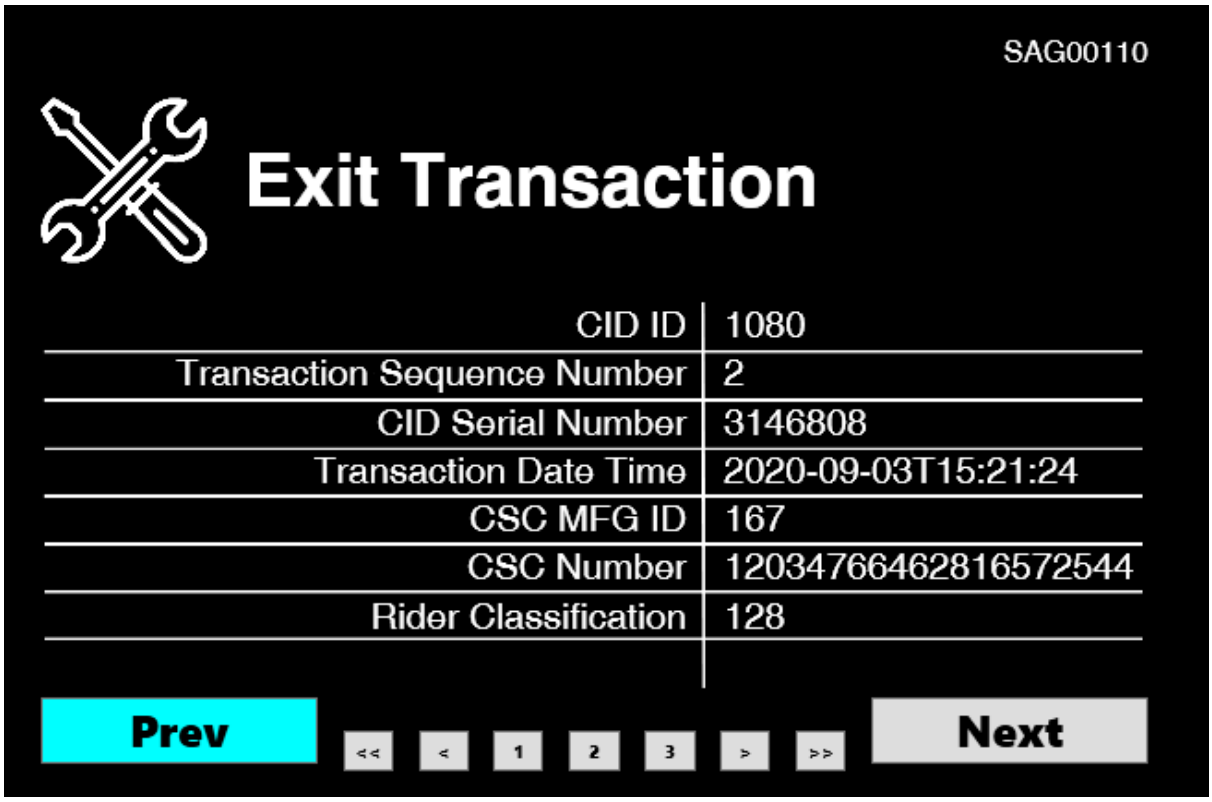
You can choose a menu for checking transaction entry, exit, and autoload data on this page.

5.16. Data management – Transaction – Entry page



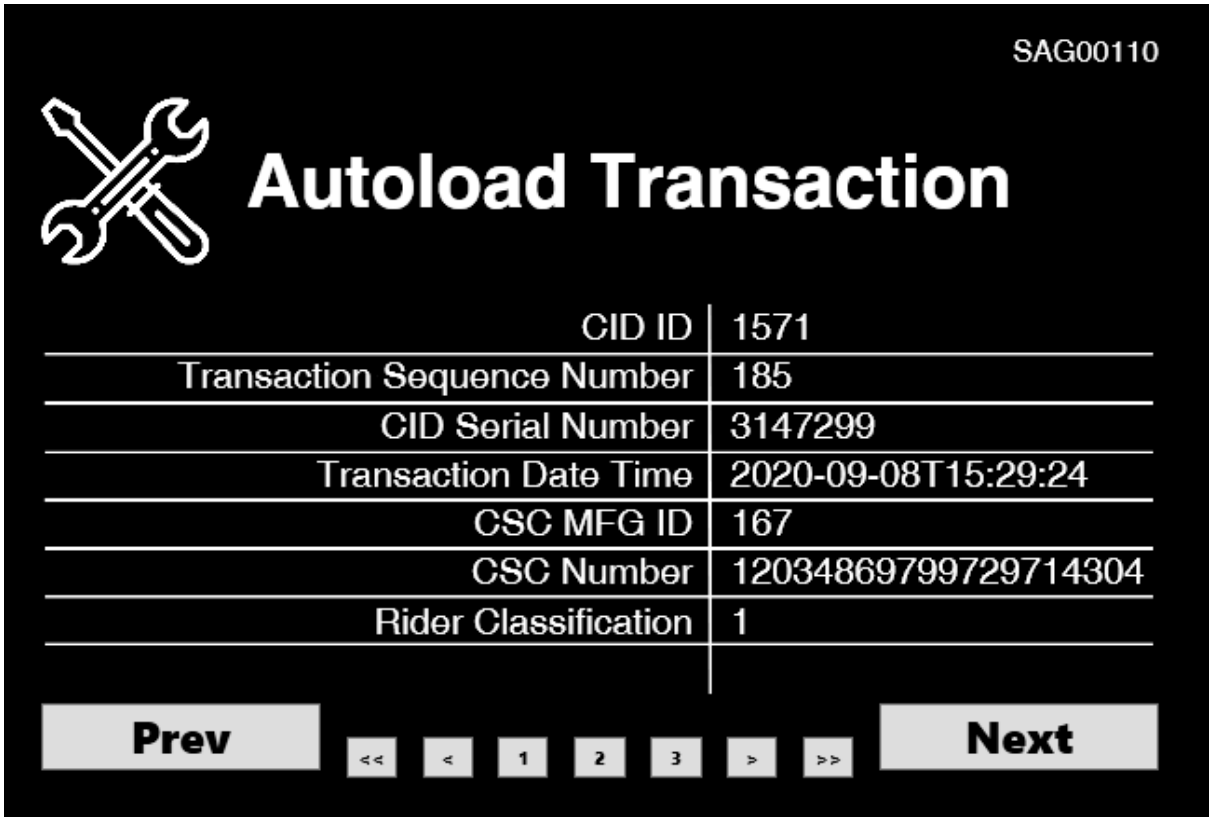
You can check transaction entry data on this page.

5.17. Data management – Transaction – Exit page



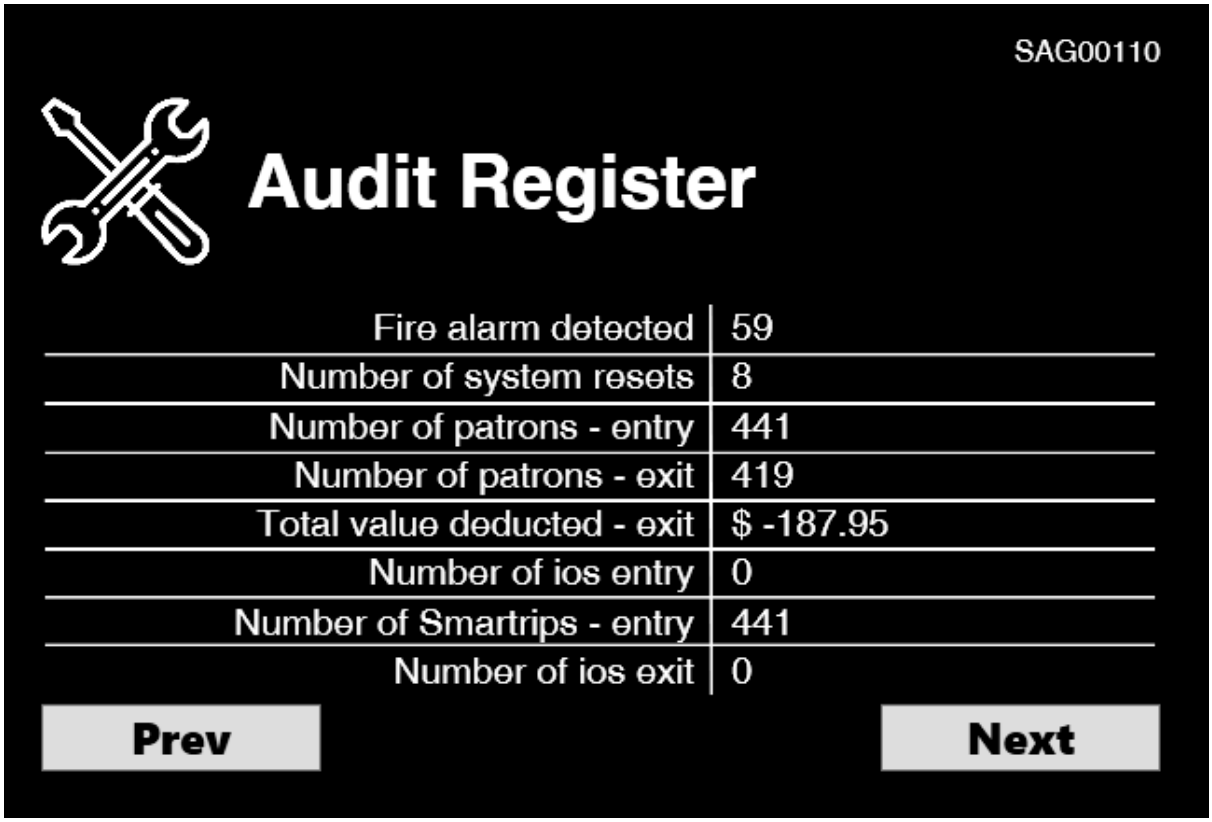
You can check transaction exit data on this page.

5.18. Data management – Transaction – Autoload page



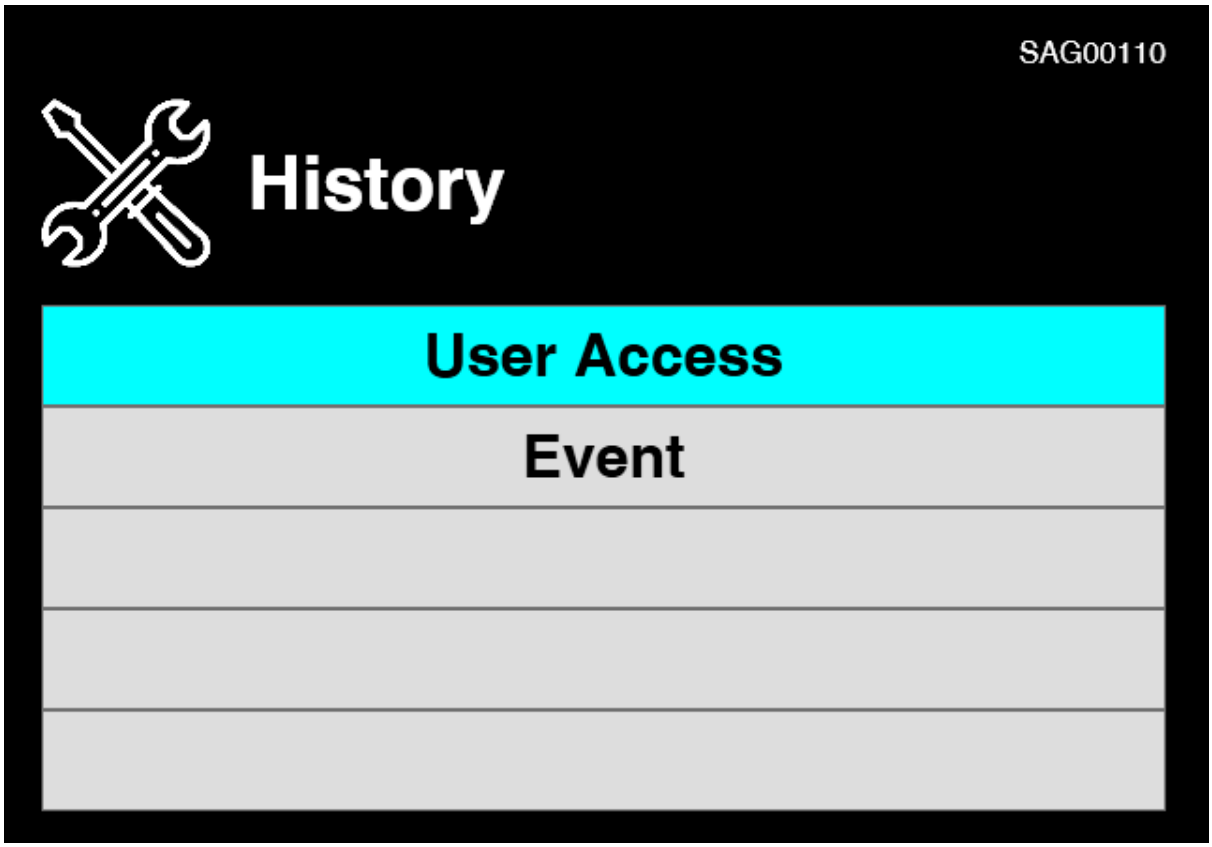
You can check transaction autoload data on this page.

5.19. Data management – Audit register page



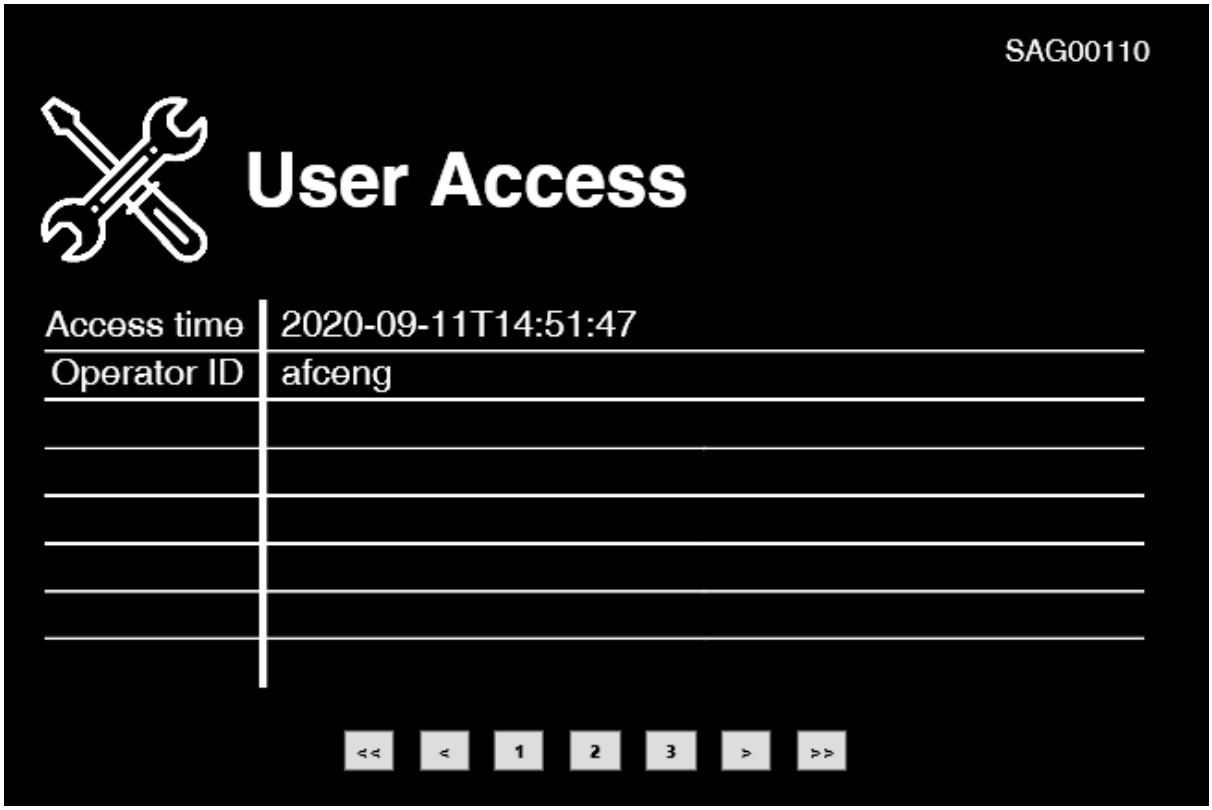
You can check Audit register data on this page.

5.20. Data management – History page



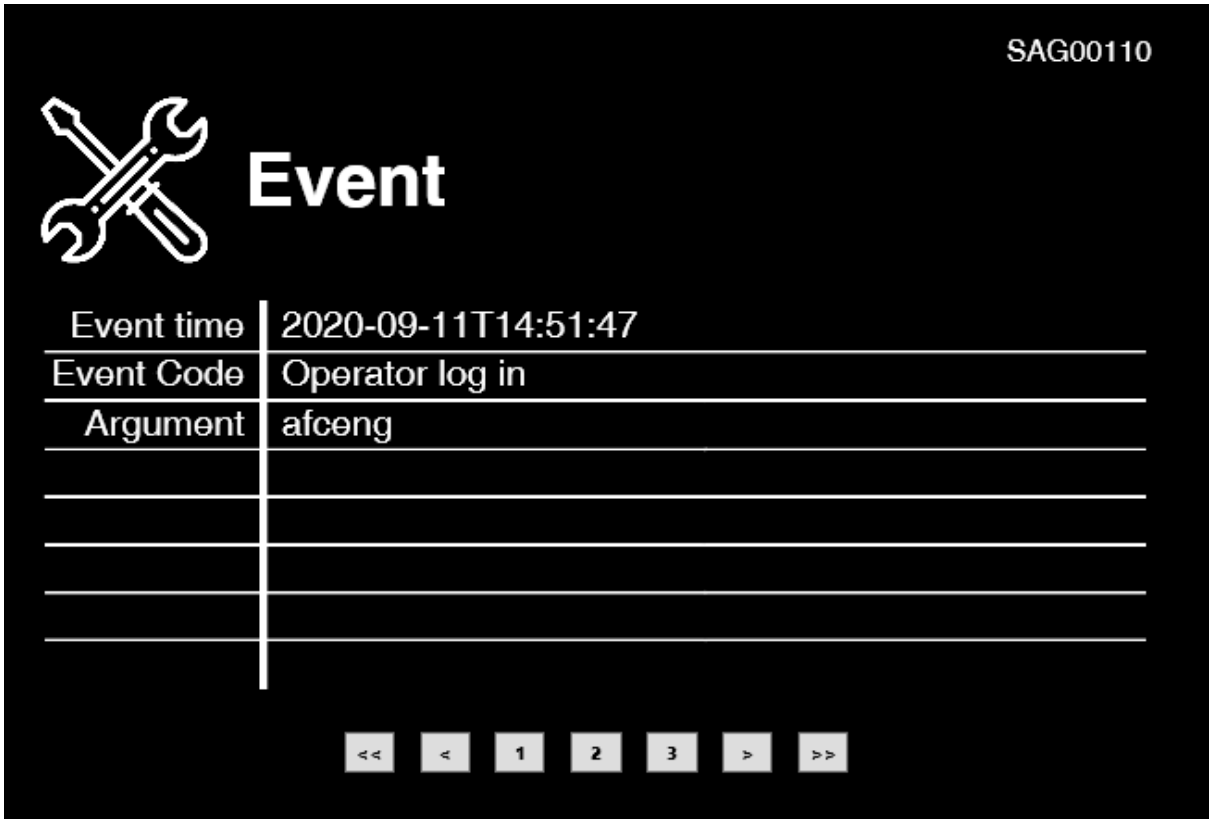
You can choose a menu for checking user access/event history data on this page.

5.21. Data management – History – User access page



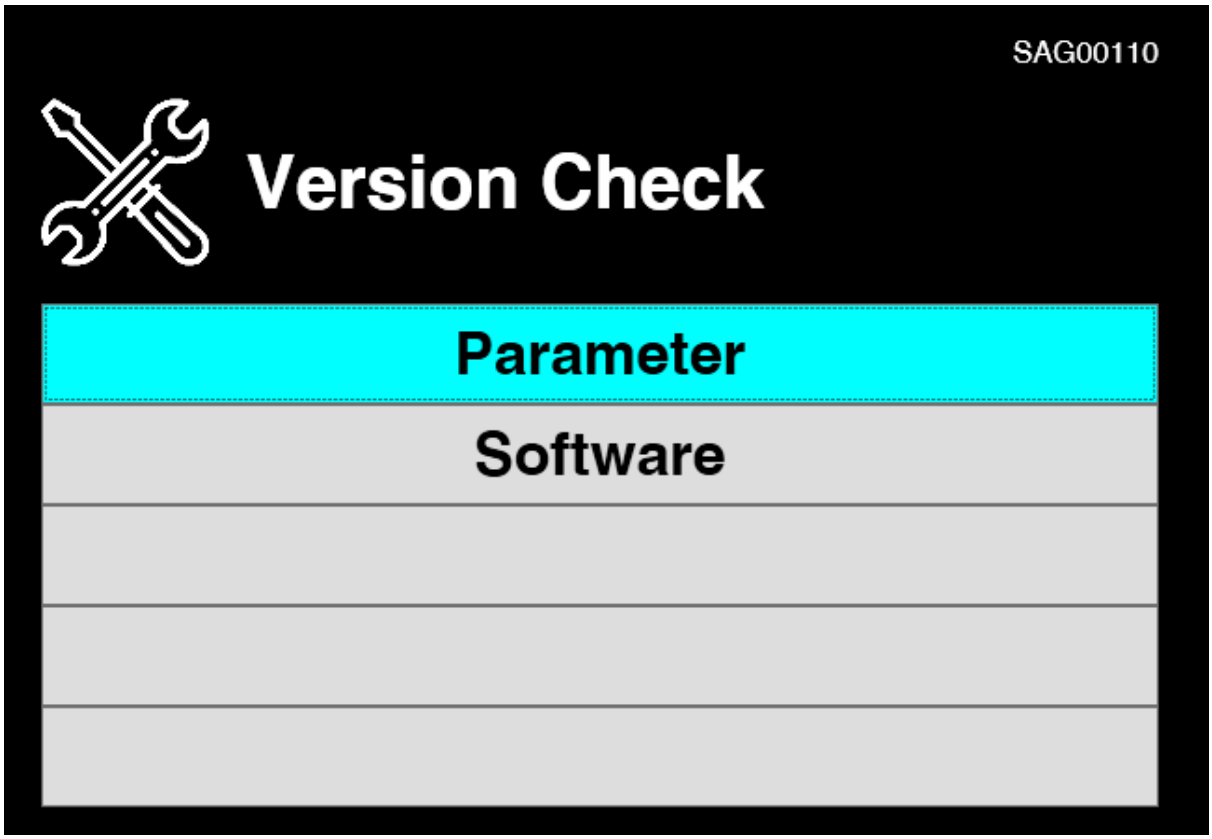
You can check user access history data on this page.

5.22. Data management – History – User access page



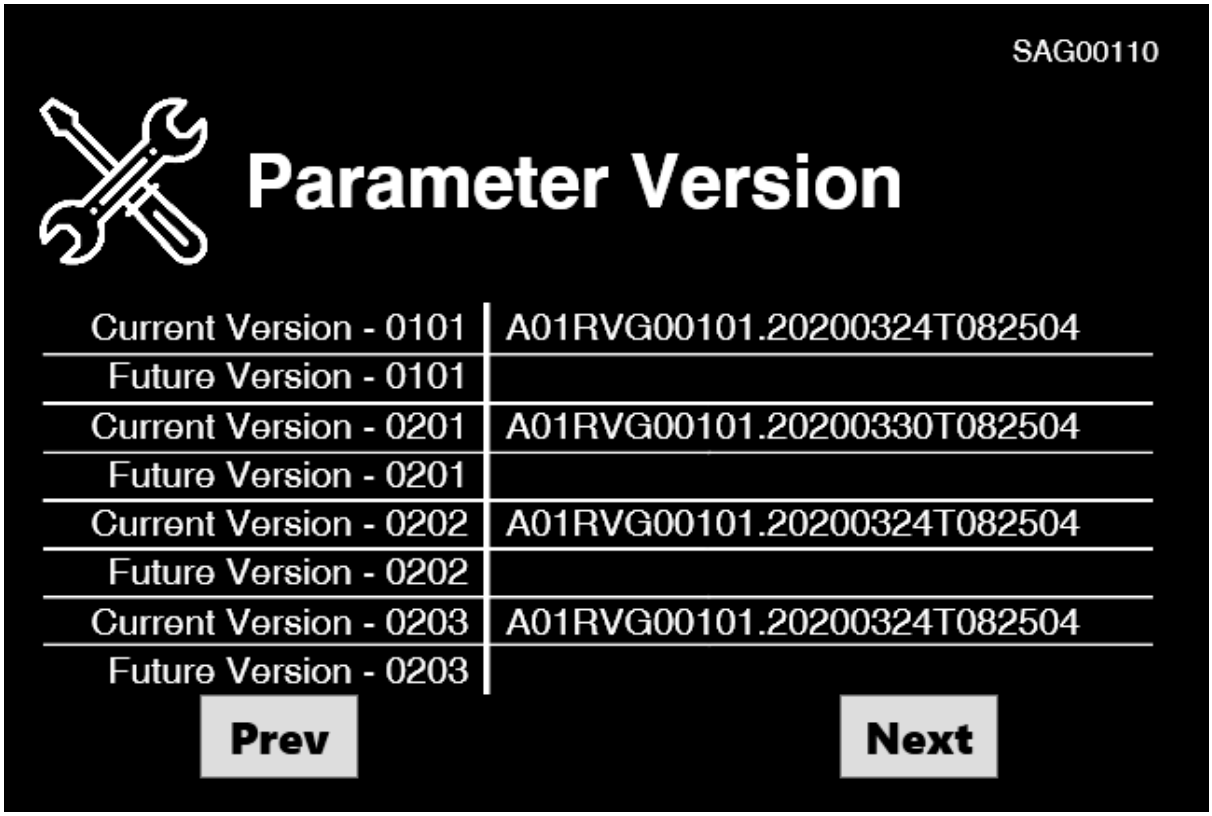
You can check event history data on this page.

5.23. Data management – Version check page



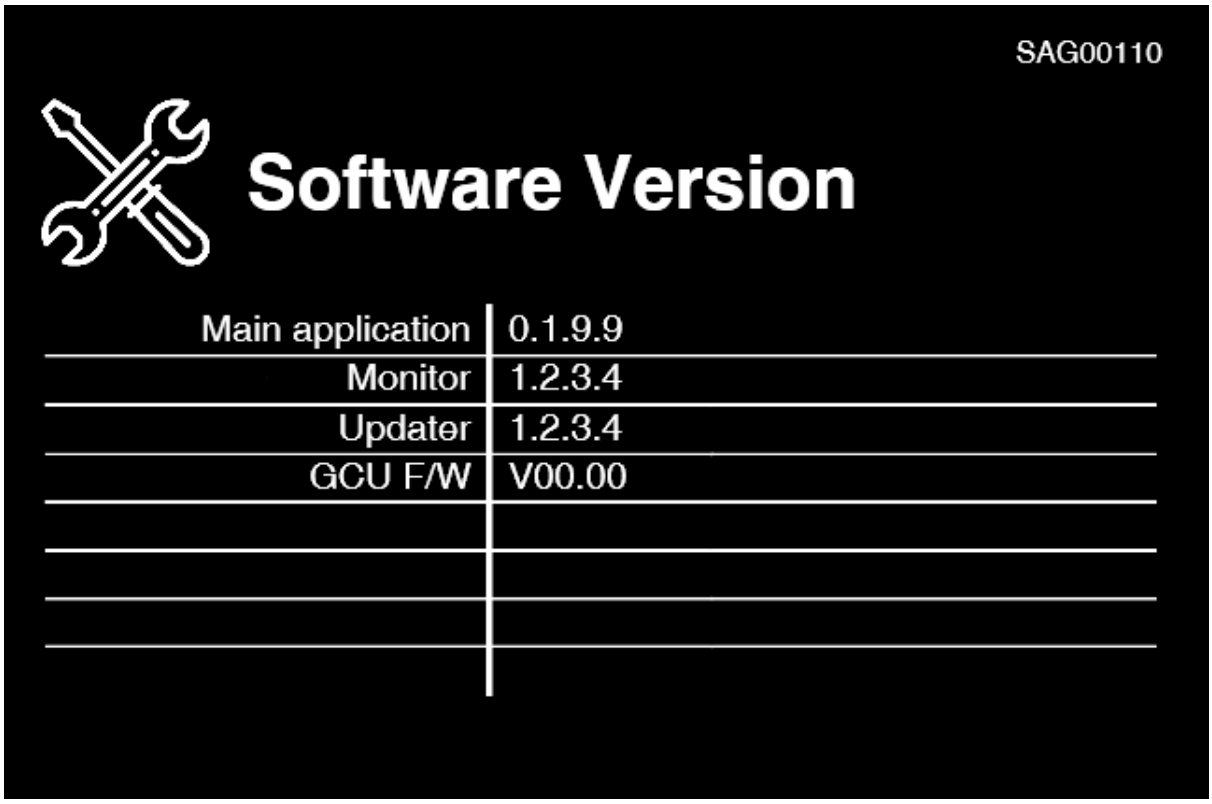
You can choose a menu for checking parameter/software version on this page.

5.24. Data management – Version check – Parameter page



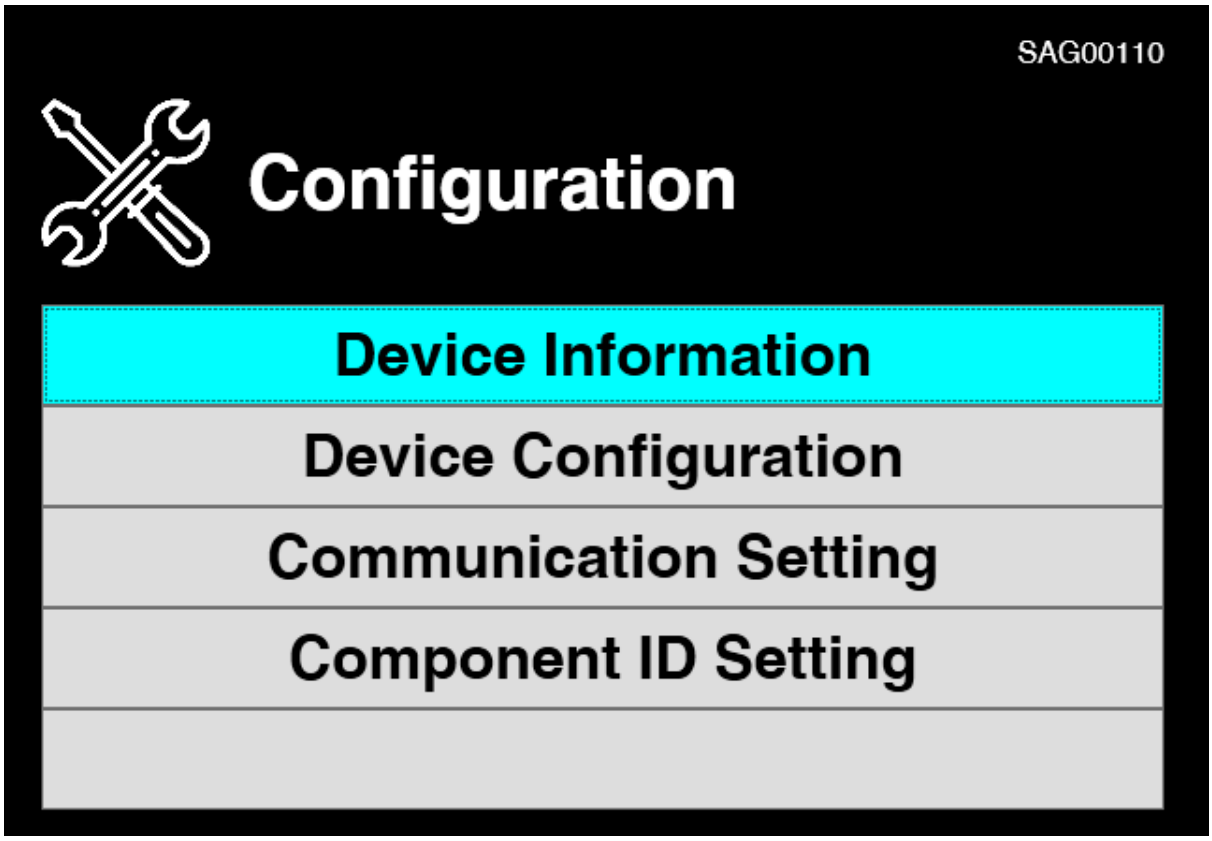
You can check parameter version on this page.

5.25. Data management – Version check – Software page



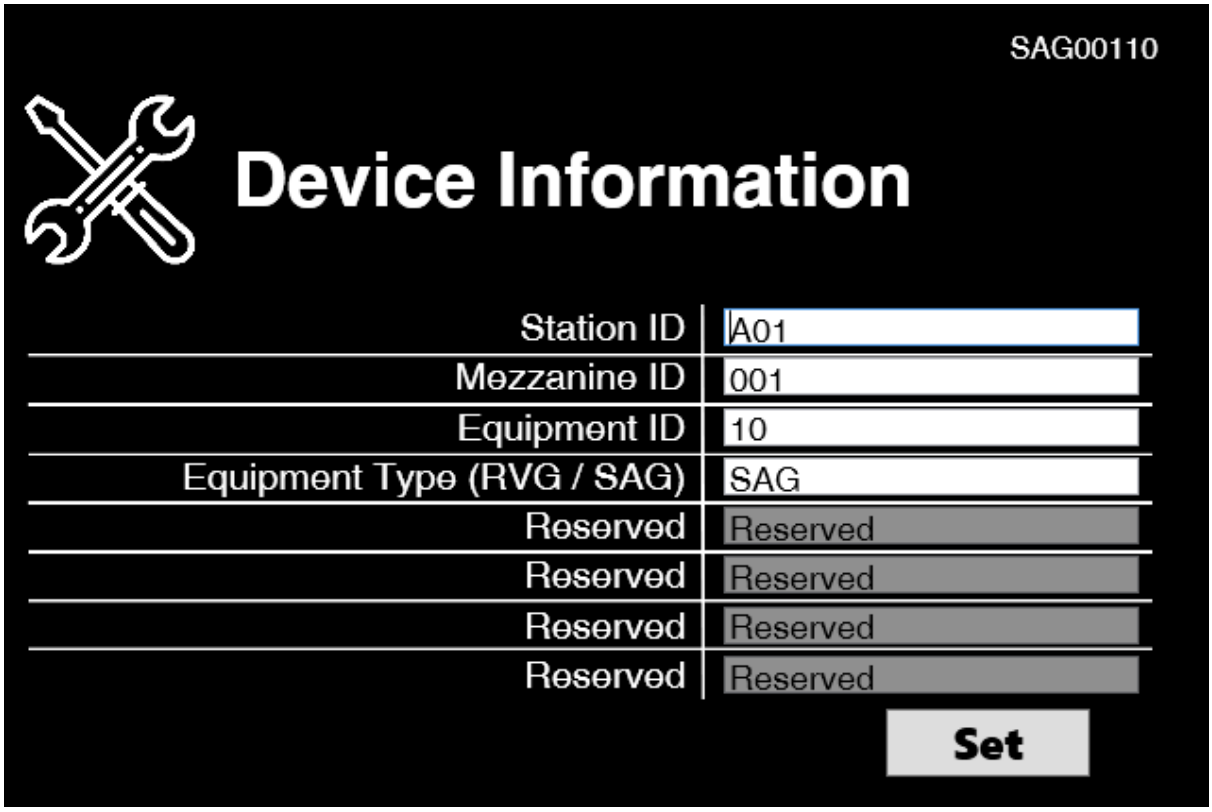
You can check software version on this page.

5.26. Configuration page



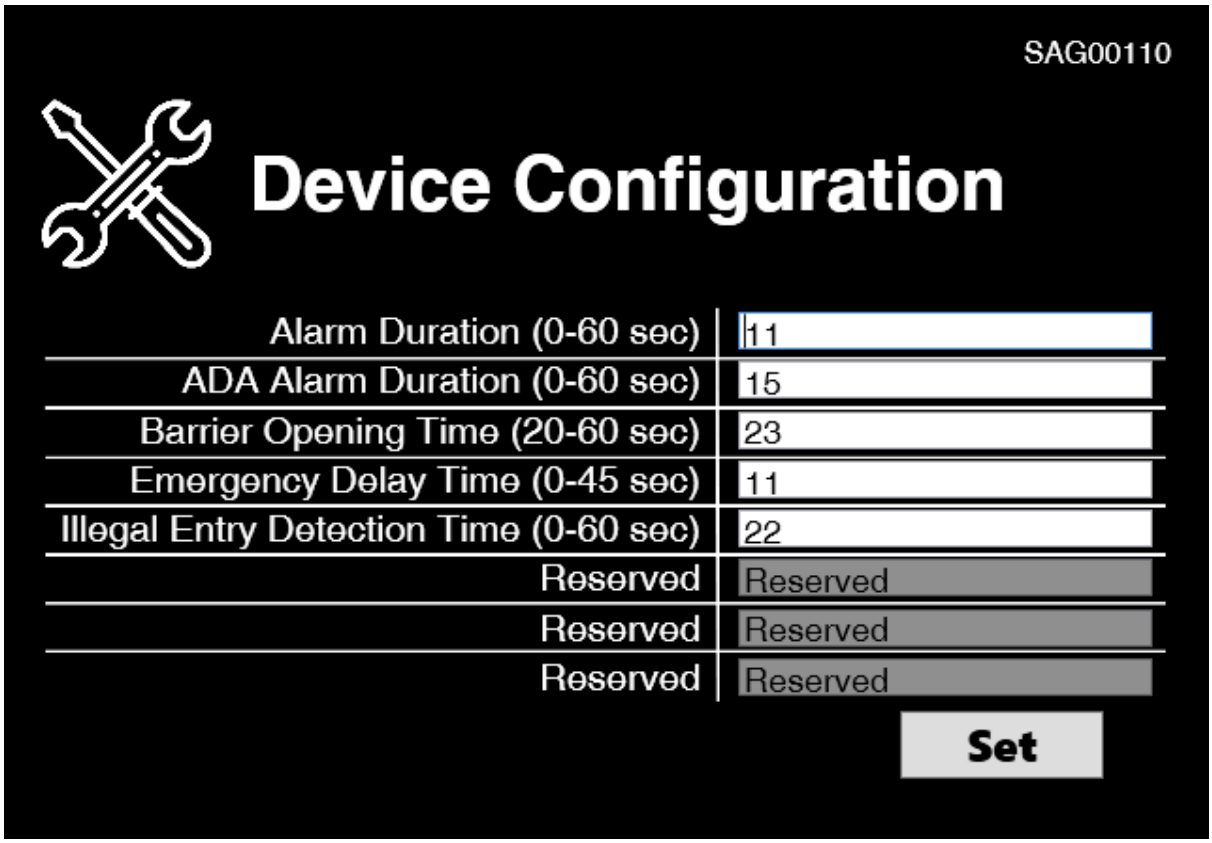
You can choose a configuration menu for device information, device configuration communication setting and component ID on this page.

5.27. Configuration – Device information page



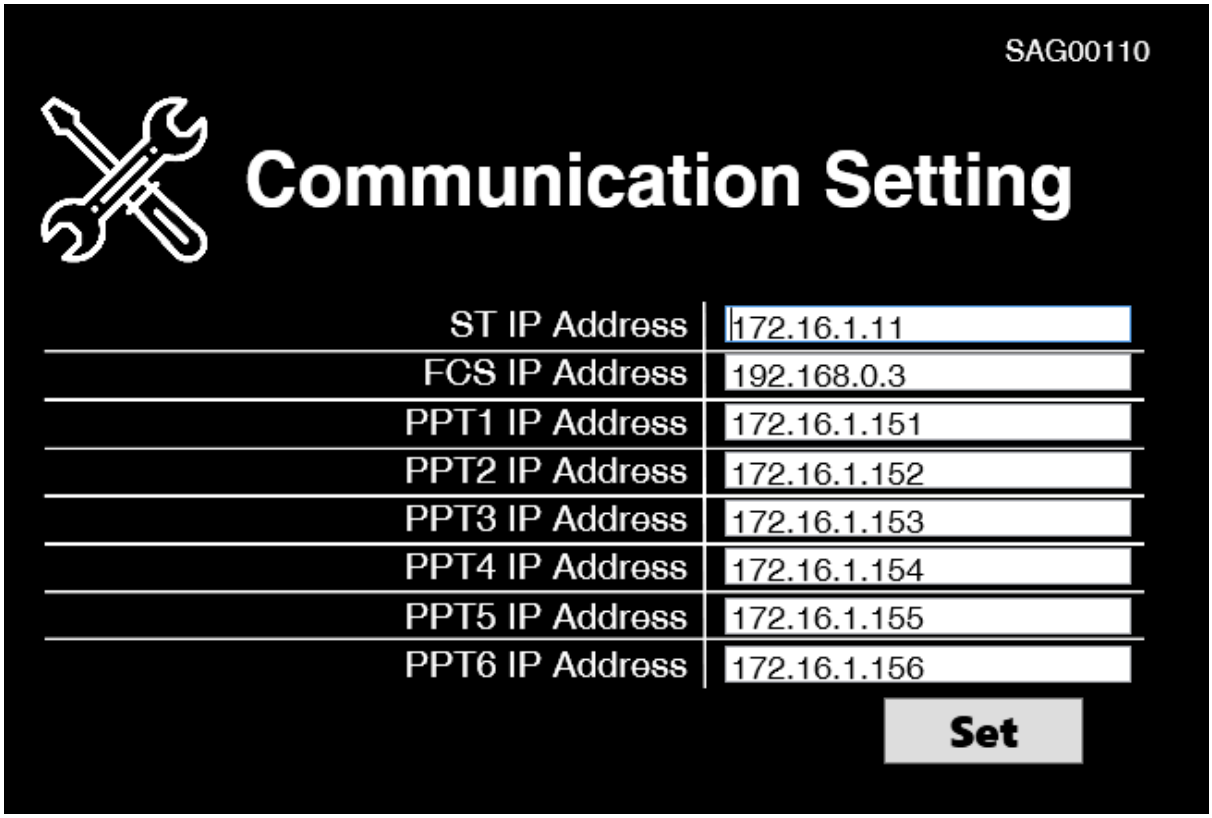
You can set the faregate information on this page.

5.28. Configuration – Device information page



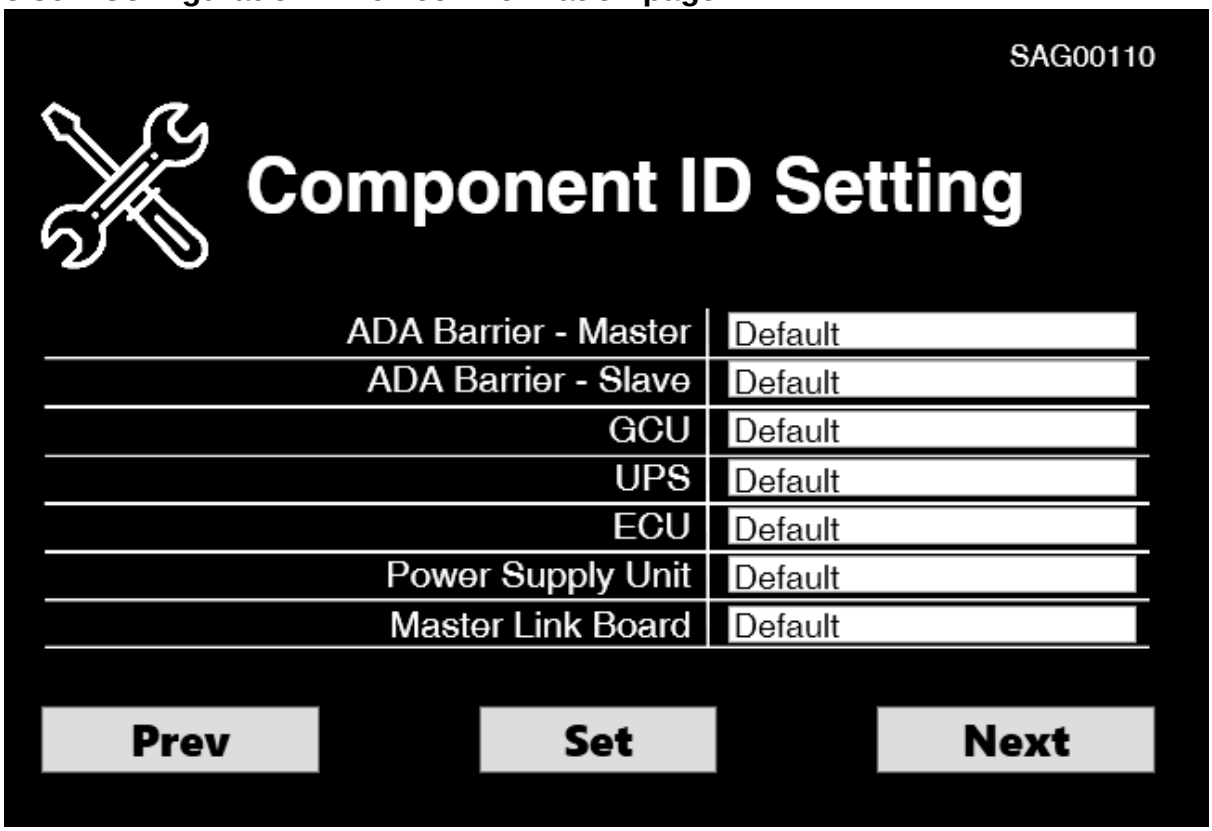
You can set the faregate configuration value on this page.

5.29. Configuration – Device information page



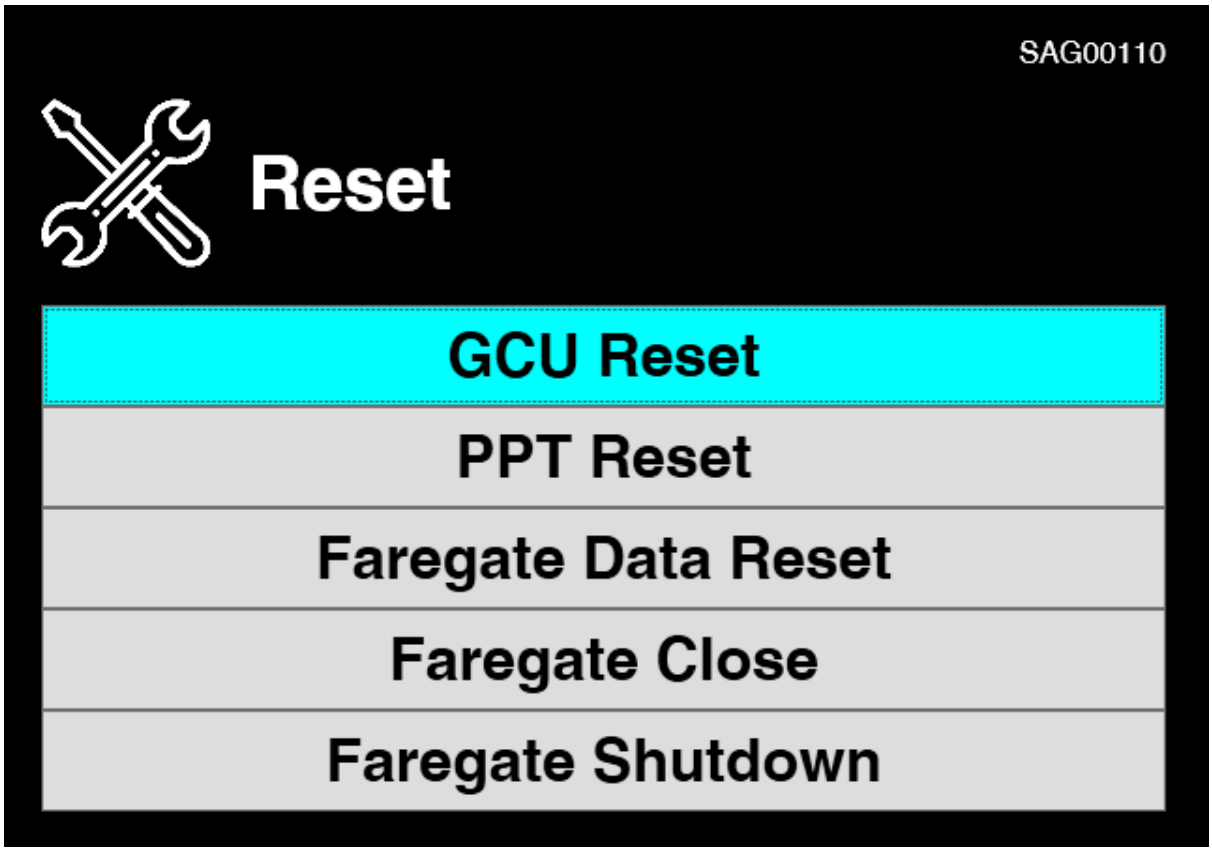
You can set the target IP address to be connected on this page.

5.30. Configuration – Device information page



You can set the faregate component ID on this page.

5.31. Reset page

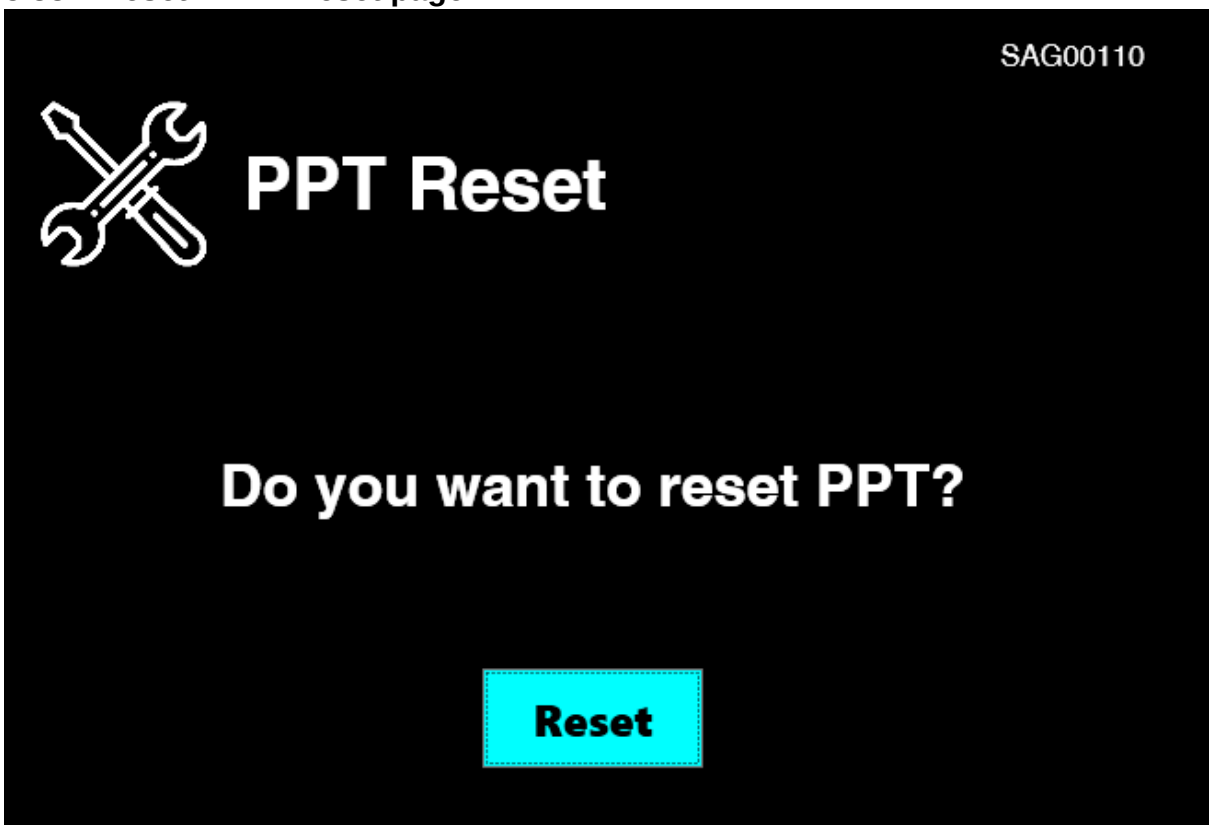


You can choose a menu for GCU reset, PPT reset, faregate data reset, faregate close and faregate shutdown on this page.

5.32. Reset – GCU Reset page

You can reset GCU on this page.

5.33. Reset – PPT Reset page

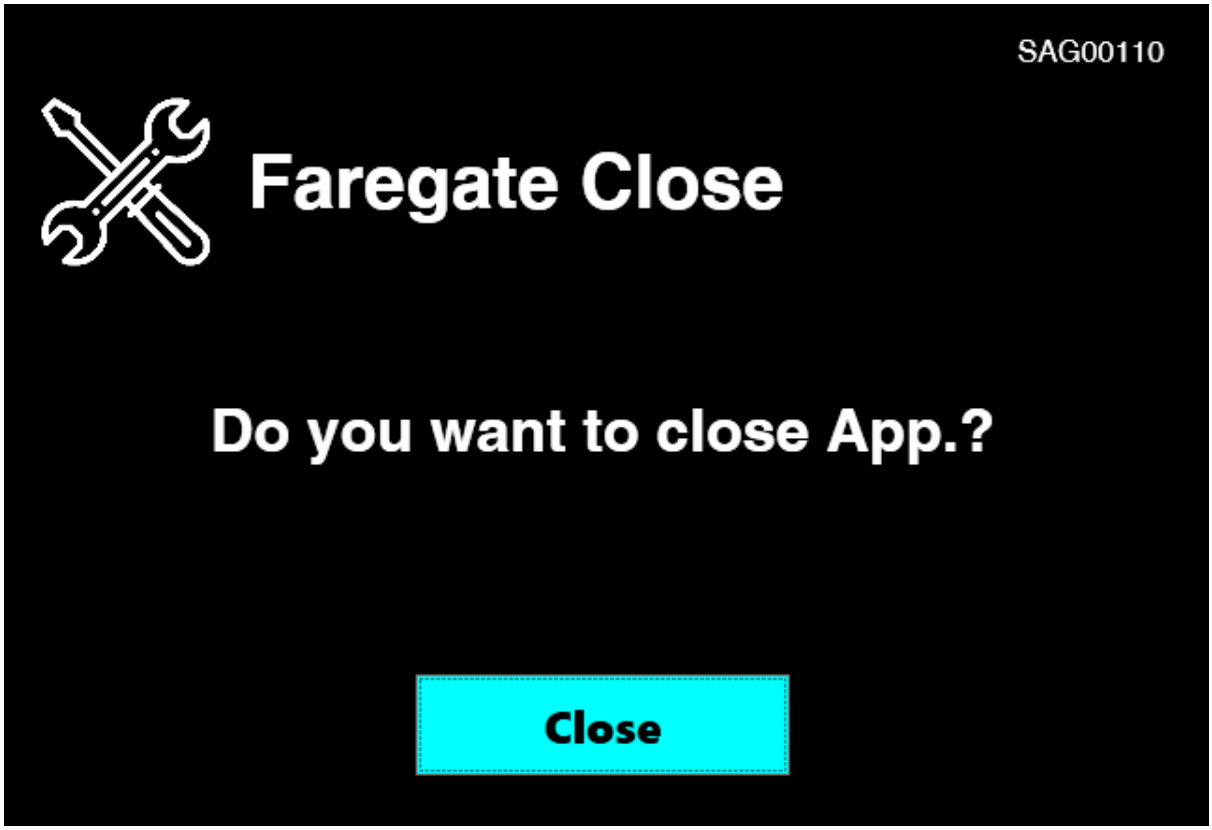


You can reset all PPT on this page.

5.34. Reset – Faregate data Reset page

You can reset all of faregate data on this page.
(Transaction data, Audit register data and History data will be reset.)

5.35. Reset – Faregate close page



You can close faregate main application on this page.

5.36. Reset – Faregate shutdown page

You can shutdown the faregate ECU on this page.

6. Module Configuration

The configuration of faregate is as follows;

- Electronic Control Unit (ECU)
- Gate Control Unit (GCU)
- Barrier (Standard, ADA type)
- Customer Display
- Status Display
- Indicator Light
- Emergency Light
- Directional Sensors
- Payment Processing Target (PPT)
- Network Switch (NWS)
- Audible Tones
- PSU
- UPS
- Master / Slave Link Board
- ES / RS Link Board
- Maintenance Keypad
- Interior Light

7. Electronic Control Unit (ECU)

The Electronic Control Unit (ECU) controls all the sub-modules and processes all the data in the faregate. The ECU uses industrial standard single board computer for its reliability. An ECU is installed in each faregate aisle and controls only faregate aisle where it is installed. Therefore, the failure of ECU in any faregate aisle will not affect the other faregate aisles and their control.

[Figure 20] Electronic Control Unit

7.1. Specification

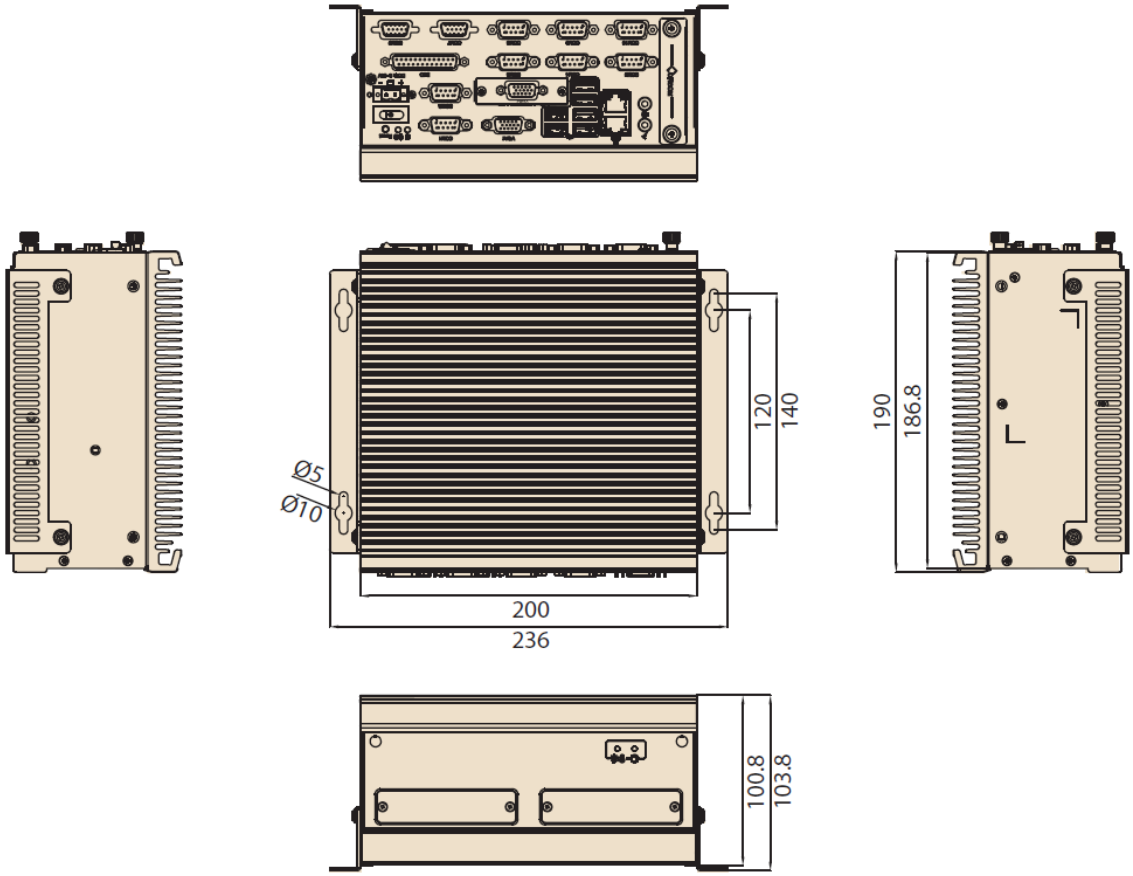
The ECU is a fan-less compact industrial compute chassis with Celeron quad core processor and wide voltage input range, which is specially designed for intelligent transportation.

Item	Specification
Model No / Vendor	ITA-1711-00A1E / ADVANTECH
Processor System	Fan less, Intel Celeron J1900, 2.0GHz Quad Core BIOS : AMI SPI 64Mb
OS	Window 10 IoT Enterprise 64bit LTSC 2019
Memory	Dual channel DDR3 1333 On-board 4GB (Option : Up to total 8GB with SODIMM)

Graphics	Embedded Gen 4 + GFX Core Shared system memory up to 256MB SDRAM 1 x VGA, 1 x DVI Single channel max : 2048 x 1536 @ 60Hz Dual channel max : 1920 x 1080 @ 60Hz
Ethernet	2 x 10/100/1000M RJ45 port
Storage	1 x 2.5” SDD : 128 GB (SQF-S25M4-128G-SBE) Partition C : OS (64GB) D : Data Backup (32GB) E : Application (32GB)
USB	5 x USB2.0, 1 x USB3.0
Serial I/O	10 x RS-232/422/485 ports with automatic flow control
Digital I/O	1 x 12-ch GPI, 1 x 12-ch GPO
Audio	1 x Speaker out with 2 x 4W amplifier, 1 Mic input
Power input	9 ~ 36V DC
Weight	3.6 Kg
Dimensions (W x H x D)	200 x 190 x 100 mm
Operating Temperature	- 25 ~ 60 ℃
Storage Temperature	- 40 ~ 85 ℃
Humidity	95% @ 40 ℃, non-condensing
Vibration	With CF card: 2 Grms @ 5 ~ 500 Hz, random, 1 hr/axis With 2.5” HDD: 1 Grms @ 5 ~ 500 Hz, random, 1 hr/axis IEC60068-2-6 Sine 2G @ 5 ~ 500 Hz, 1 hr/axis
Shock	With CF card: 20G, IEC-68-2-27, half sine wave, 11 ms duration With 2.5” HDD: 10G, IEC-68-2-27, half sine wave, 11 ms duration
Safety	UL, CCC, CE, FCC, CB and BSMI compliant

[Table 3] Specification of ECU

7.2. Dimension Diagram



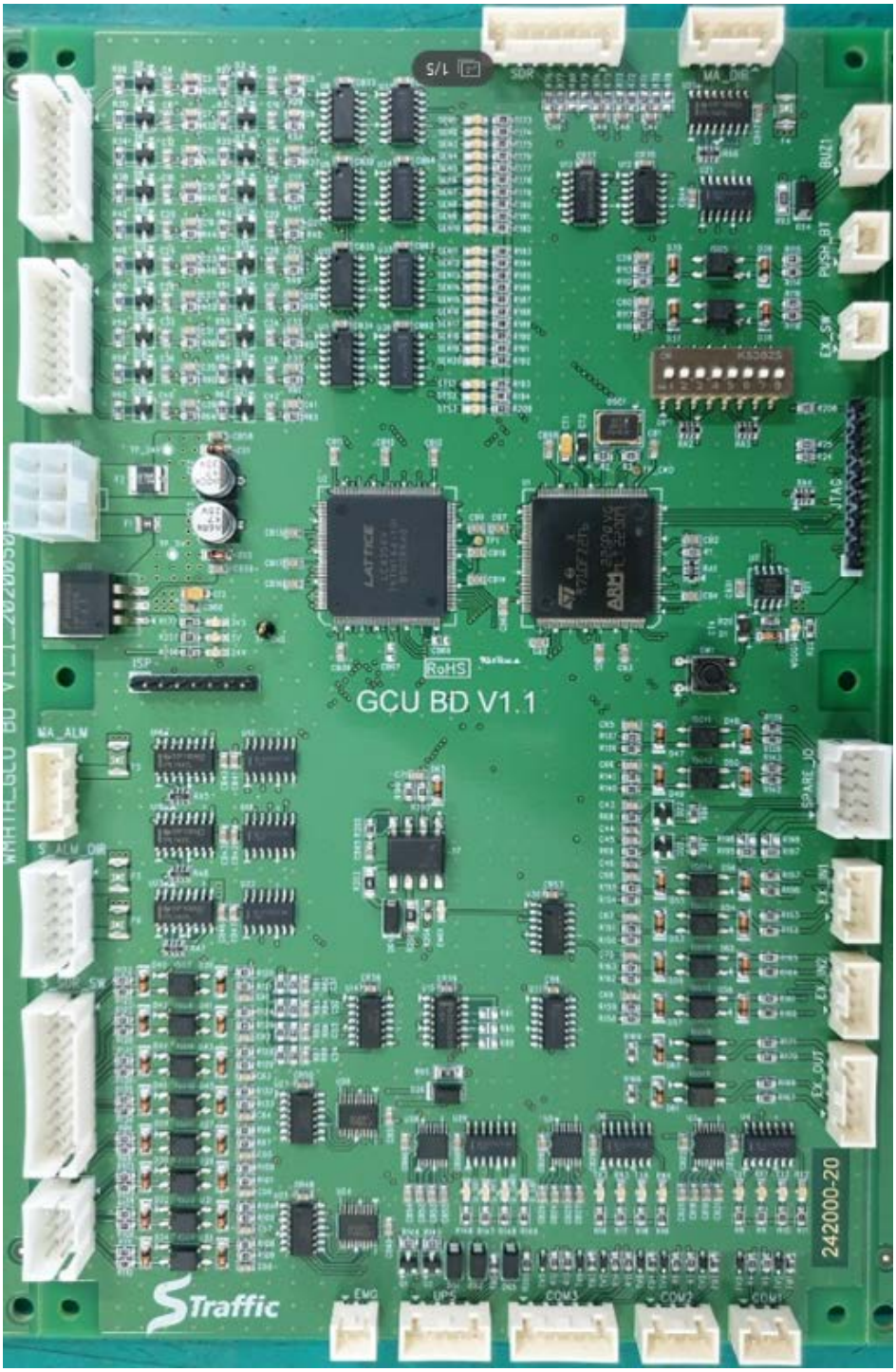
[Figure 21] Dimension of ECU

8. Gate Control Unit (GCU)

Almost of components such as clamshell barrier, directional sensor, status display, indicator light and etc. are connected to the Gate Control Unit (GCU) through digital input/output. These components are controlled by the GCU through the ECU commands.

The GCU is connected to the ECU through RS-232 interface physically. The main functions are as follows;

1) Passage control of passenger
   - Controlling faregate passage with passenger detection algorithm
   - Allowing authorized passenger to pass faregate
   - Detecting illegal entrance, wrong way entrance, and tailgating
   - Inhibiting fare evasion
2) Managing operating mode
   - Entry, exit, reversible
   - Out of service, maintenance, emergency
   - Normal barriers open, normal barriers close
3) Passenger Safety
   - Passenger safety is best priority of faregate function
   - Adopting 4 safety sensors around the range of clamshell barrier
   - When the safety zone sensors detect any object, the faregate doesn't close barriers.
4) On-line / Off-line program update
   - On-line update: program updating using serial interface with the ECU is supported. It can guarantee that the same version of program is running at one site and provides concurrent updates of many faregates
   - Off-line update: program update using debug serial port is supported



[Figure 22] GCU Board

8.1. Specification

Item	Specification
Model No / Vendor	242000-20 / STraffic
Processor	32 bit Processor Internal clock – 44.2368Mhz
Program Memory	256 KB (Internal Flash)
System Memory	64 KB (Internal SRAM)
Serial Interface	1 x RS-232 (Communication with the ECU) 1 x RS-232 for debugging (Debug port for developing)
I/O Interface	18 x Inputs for directional sensor 2 Groups of 3 x Input / Output for Barrier 2 Groups of 2 x Outputs for Status Display 2 Groups of 3 x Outputs for Indicator Light 8 x Inputs for door switch 1 x Input for push-button 1 x Input for emergency
Input Power	5V DC, 24V DC
Dimension (W x H)	220 x 140 mm

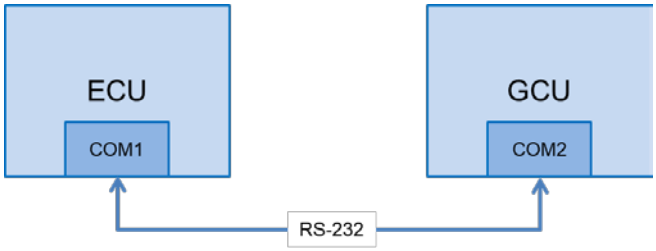
[Table 4] Specifications of GCU

8.2. Interface with ECU

8.2.1. Hardware Interface

GCU is connected to ECU through the RS-232 interface physically.

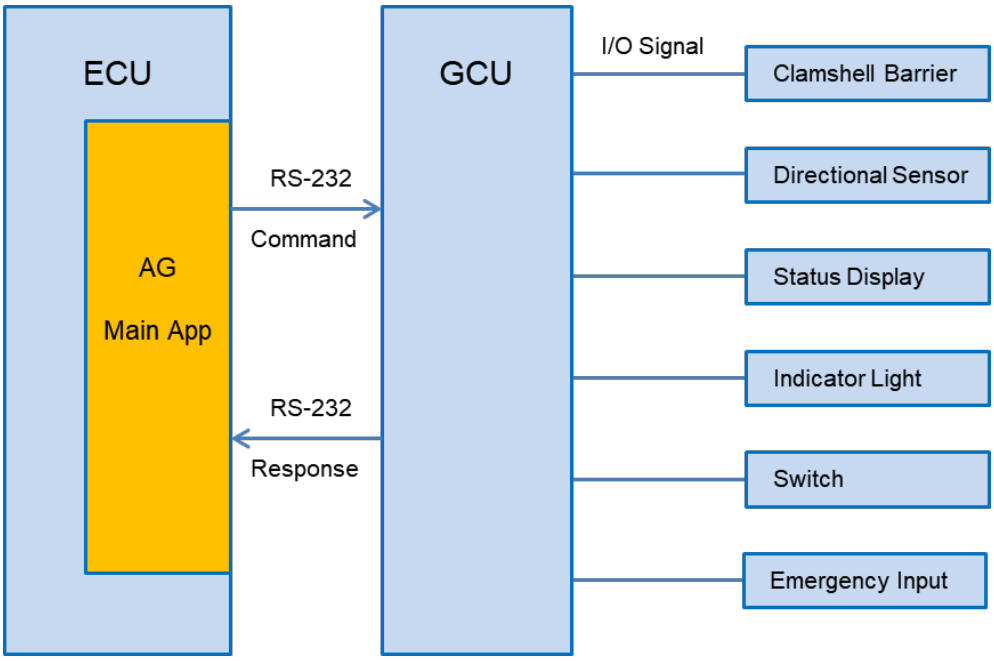
The below is an interface connection diagram between and GCU.



[Figure 23] Communitaction between ECU and GCU

8.2.2. Software Interface

All of the components are connected to GCU through digital input/output such as Clamshell Barrier, Directional Sensor, Status Display, Indicator Light, Switches and so on. And these components are controlled and monitored by GCU through ECU commands.



[Figure 24] Peripheral interface of GCU

9. Clamshell Barrier

The clamshell barrier utilizes bi-parting retractable panel doors. The clamshell barrier is being operated by barrier control board which is getting command signal from the GCU. Command signal consists of open and close command, and it is decided to operate and stop as sensing of internal two magnetic sensors.

The clamshell barrier uses DC motor and worm-gear. It makes easy access to control, softer movement and quiet, therefore, it is efficient to admission control.

9.1. Safety and Convenience

The clamshell barrier consists of followings for stability and convenience for passenger and system.

- Polyurethane material of non-flammable
- Internal reinforcement structure of high elastic material
- The edge of flexible material for the passenger protection and safety
- Structure design for the convenient maintenance and repair

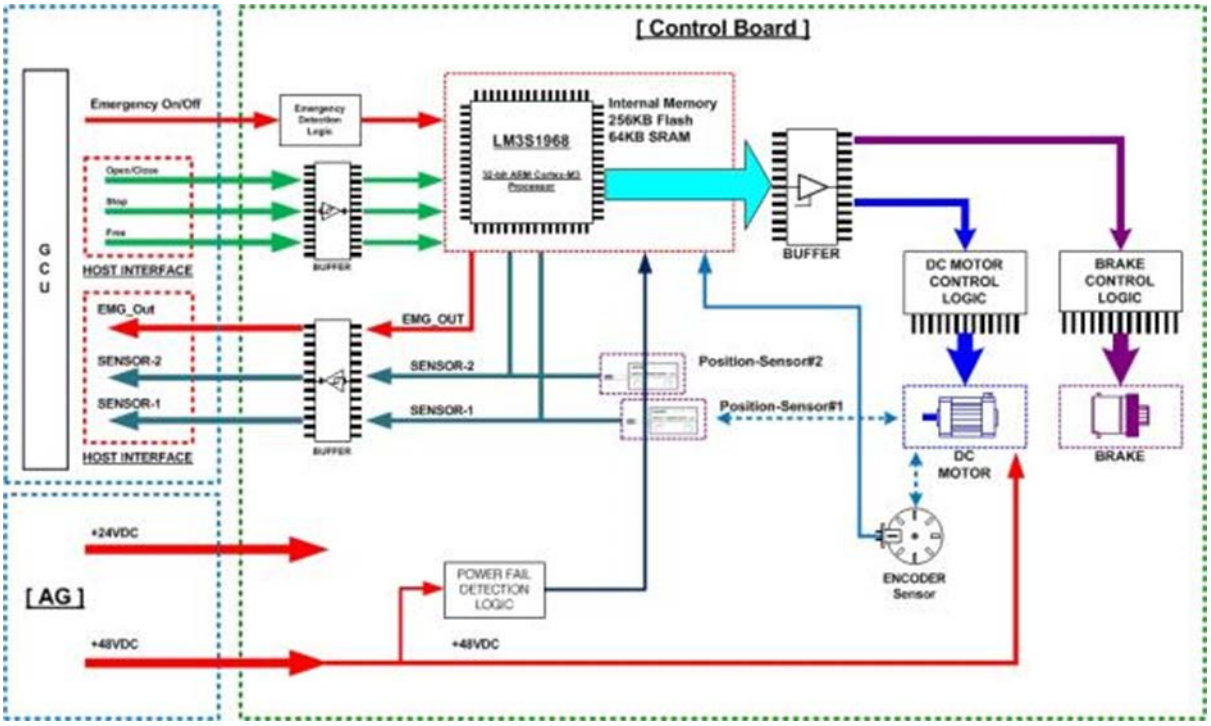
9.2. Description Diagram

The clamshell barrier uses a PWM DC motor for quiet and smooth operation, an encoder and sensors use to detect the rotational speed of the motor.

The clamshell barrier follows the two motion control signals of the GCU such as opening and closing with the I/O interface.

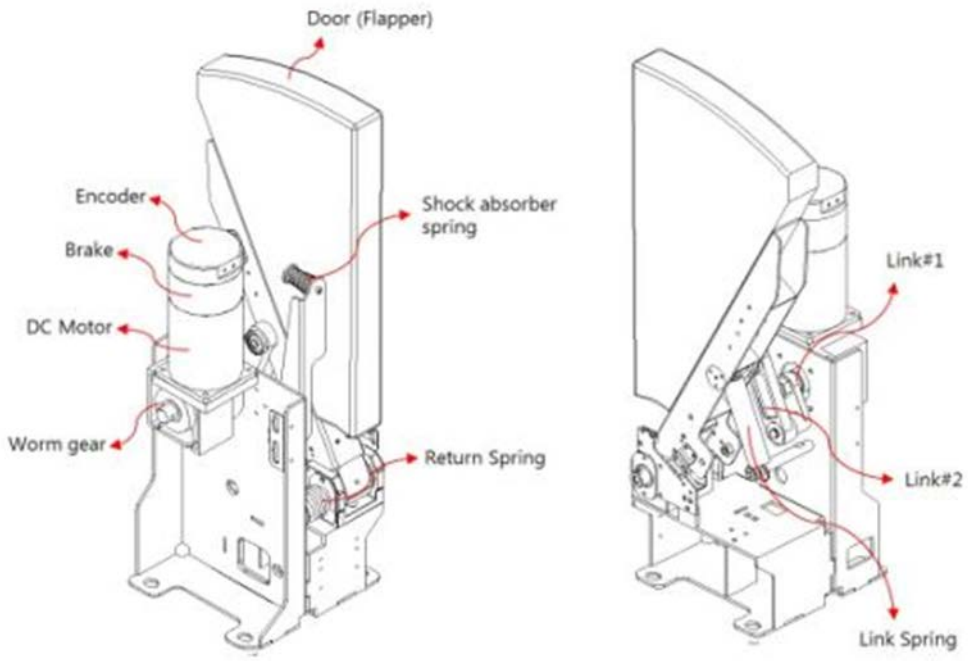
The “OPEN” and “CLOSE” commands from the GCU are used to control the clamshell barrier.

The “OPEN” signal drives the motor to open the barrier electrically, while the “FREE” signal releases the brake without motor driving and opens barriers with a mechanical return spring, and also allows the person to open barriers by hand easily.

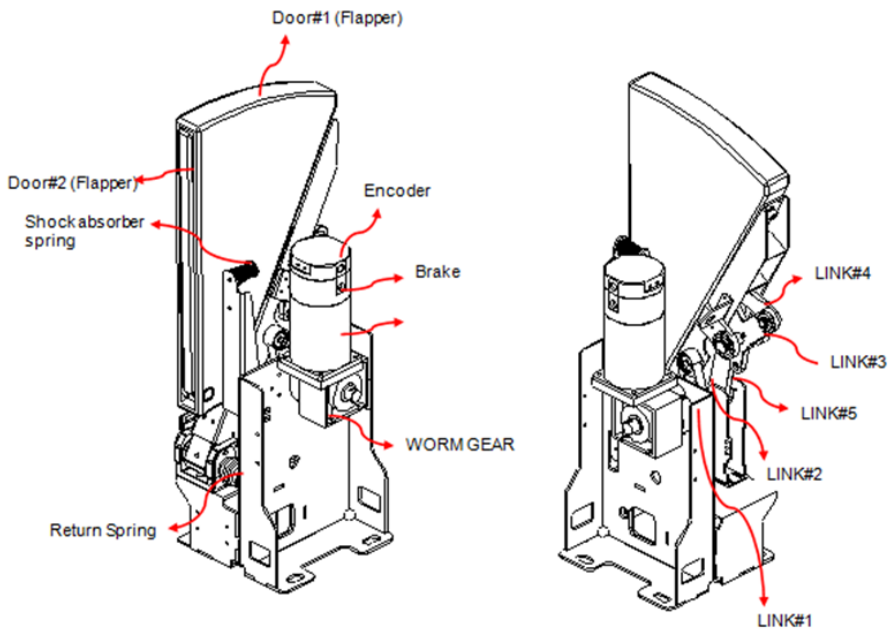


[Figure 25] Block Diagram of Control Board

9.3. Components of barrier



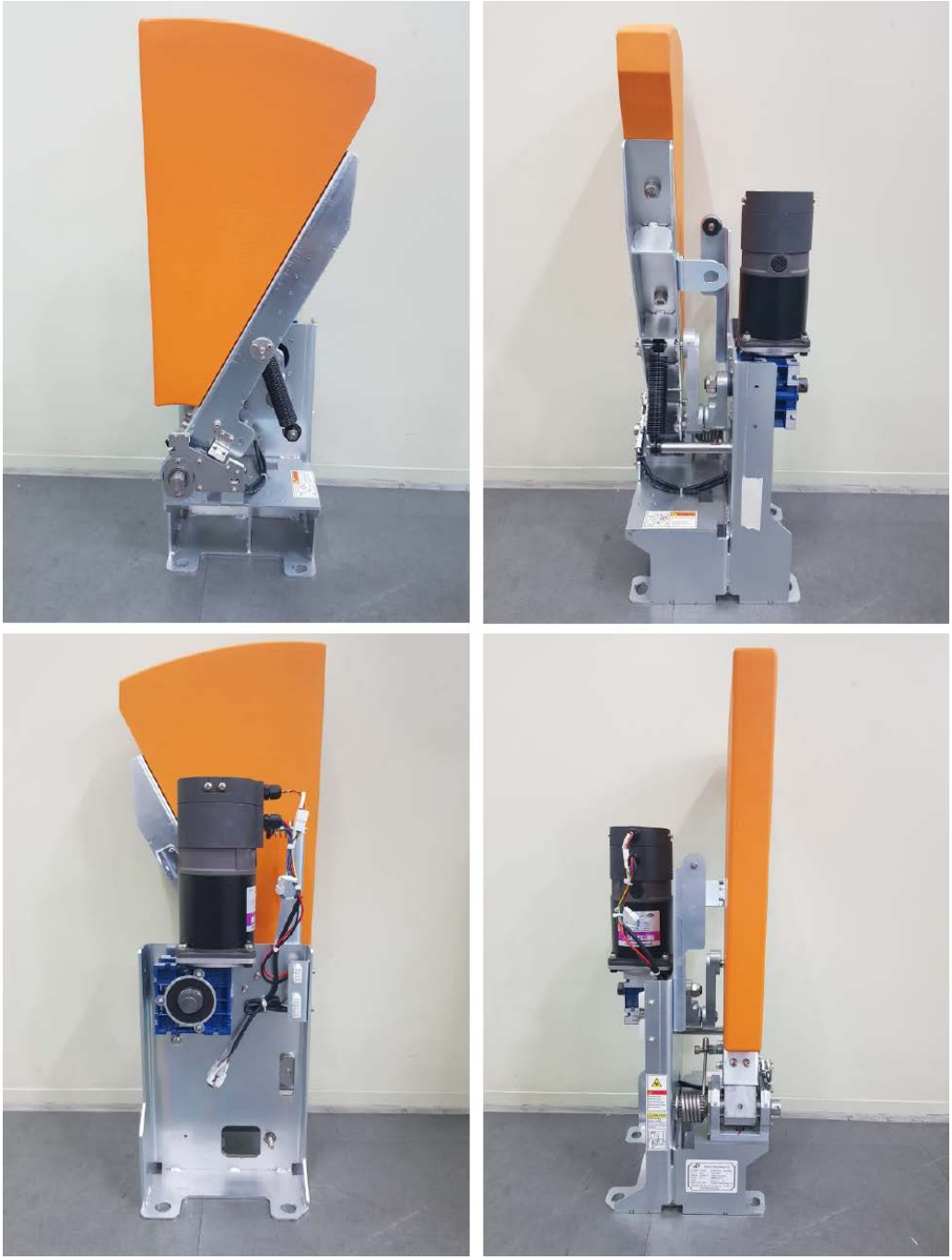
[Figure 26] Components of standard barrier



[Figure 27] Components of ADA barrier

9.4. Standard barrier

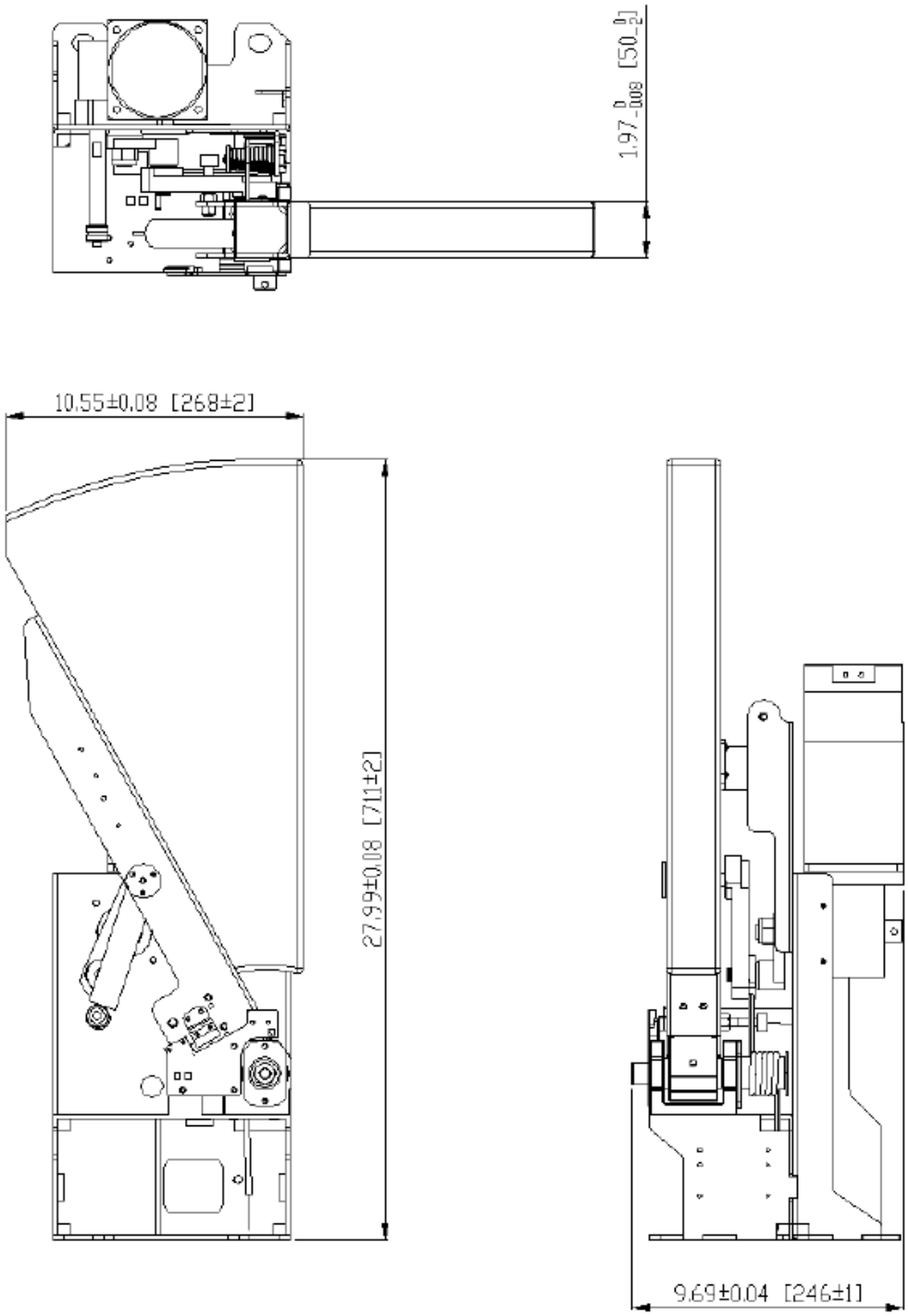
9.4.1. Appearance



[Figure 28] Standard Barrier

9.4.2. Layout – Right type

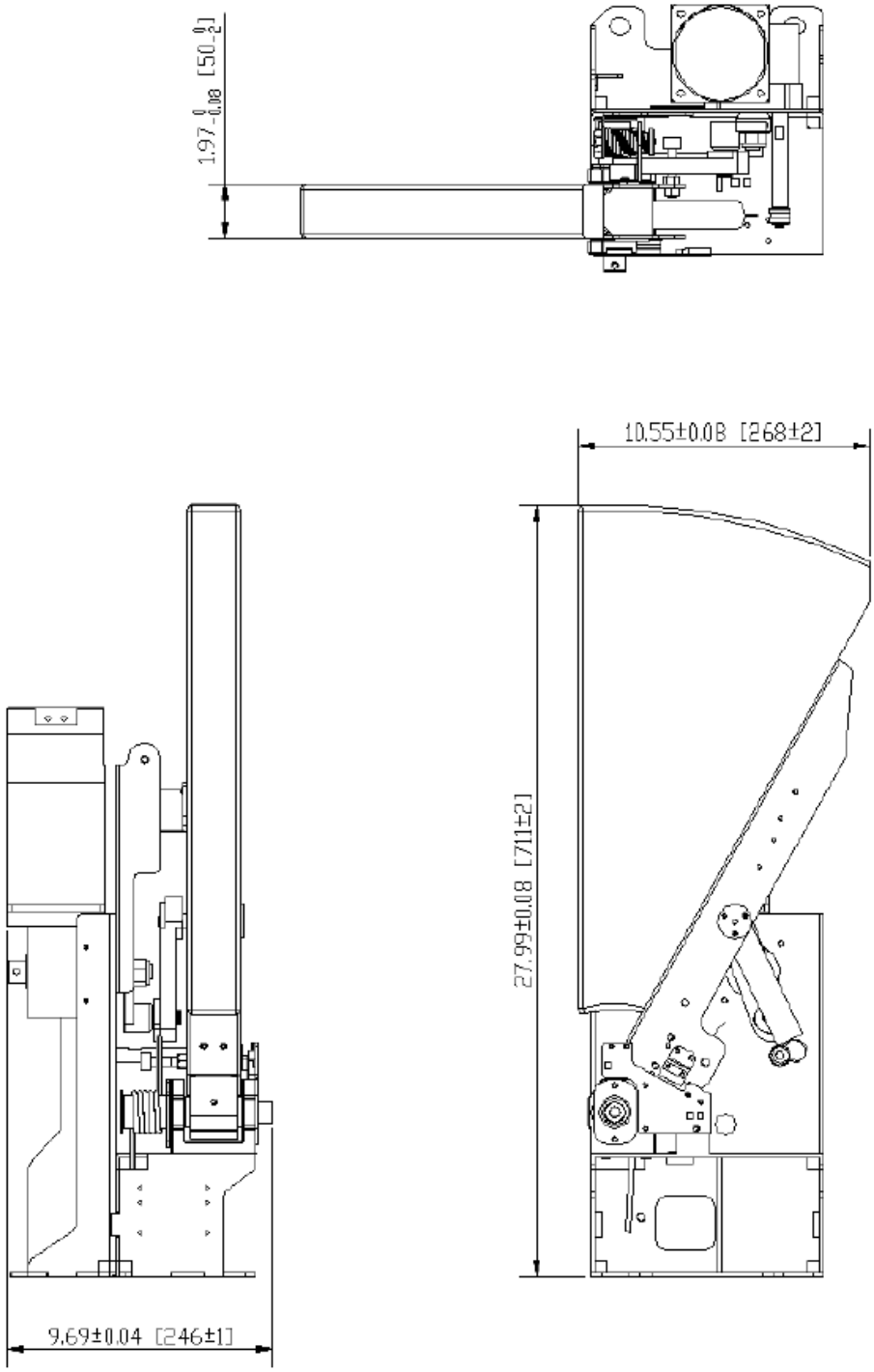
The motor location is on the right inside the faregate enclosure



[Figure 29] Standard Barrier – Right type

9.4.3. Layout – Left type

The motor location is on the left inside the faregate enclosure

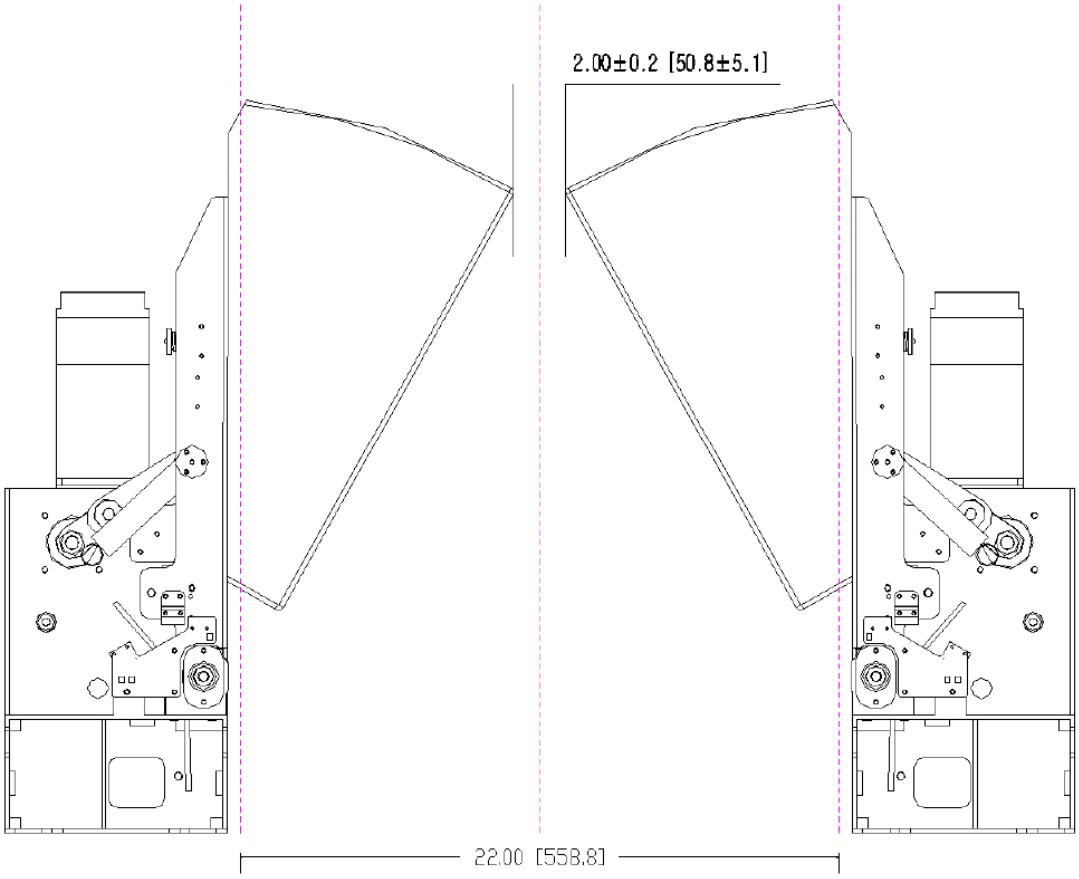


[Figure 30] Standard Barrier – Left type

9.4.4. Gap between the standard barrier

2.0 ± 0.2 inch [50.8 ± 5.1 mm] indicates the gap between standard barriers when it is closed. Passage width between faregate cabinets is 22 inch [558.5 mm]

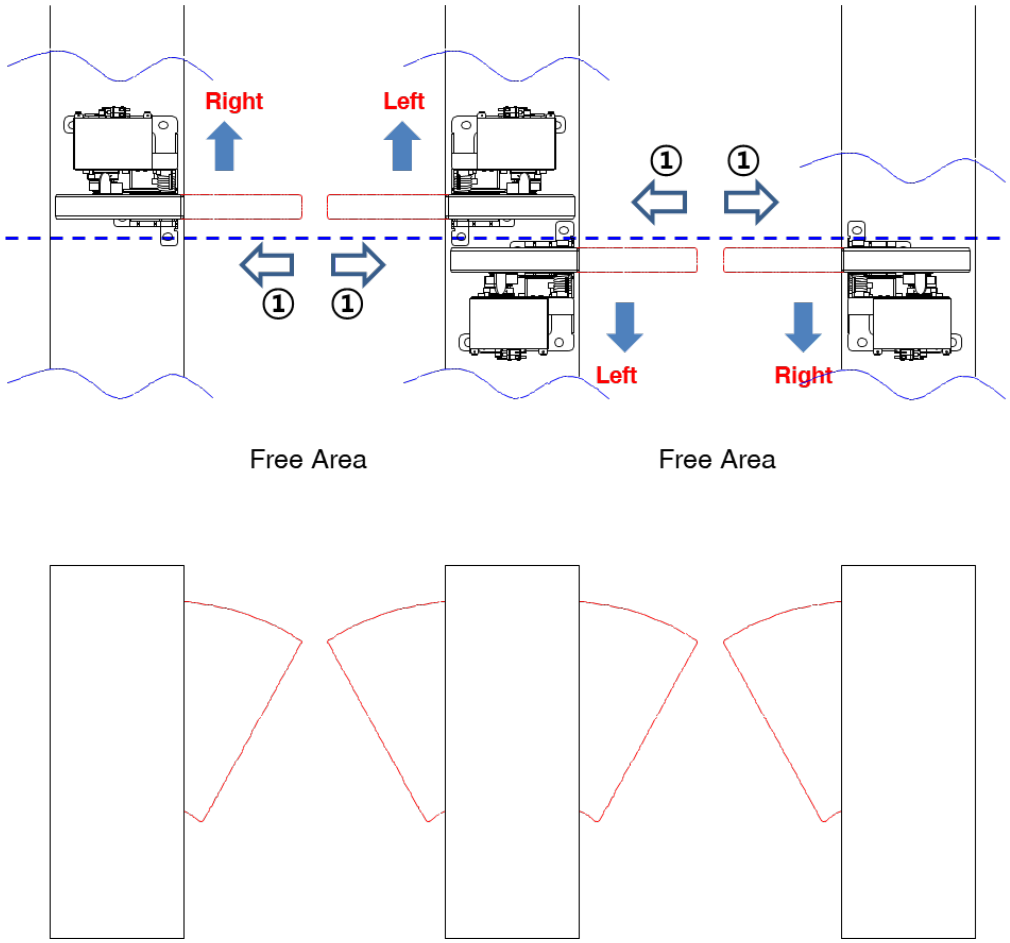
The closed barriers withstand a force at 300 lbs.
(Moving at 3 mph and striking the barrier at the point where both panels meet.)



[Figure 31] The gap between the standard barriers

9.4.5. Standard barrier layout and type in the cabinet

The standard barrier layout in the cabinet is as follows.



[Figure 32] Standard barrier layout and type in the cabinet

The barrier type can be easily identified by the following procedure.

1) Look at the barrier in the aisle like arrow ①.

2) Check the flapper is on the right or left side of the center of the cabinet

3) If the flapper is on the right side, the barrier is right type; otherwise left type.

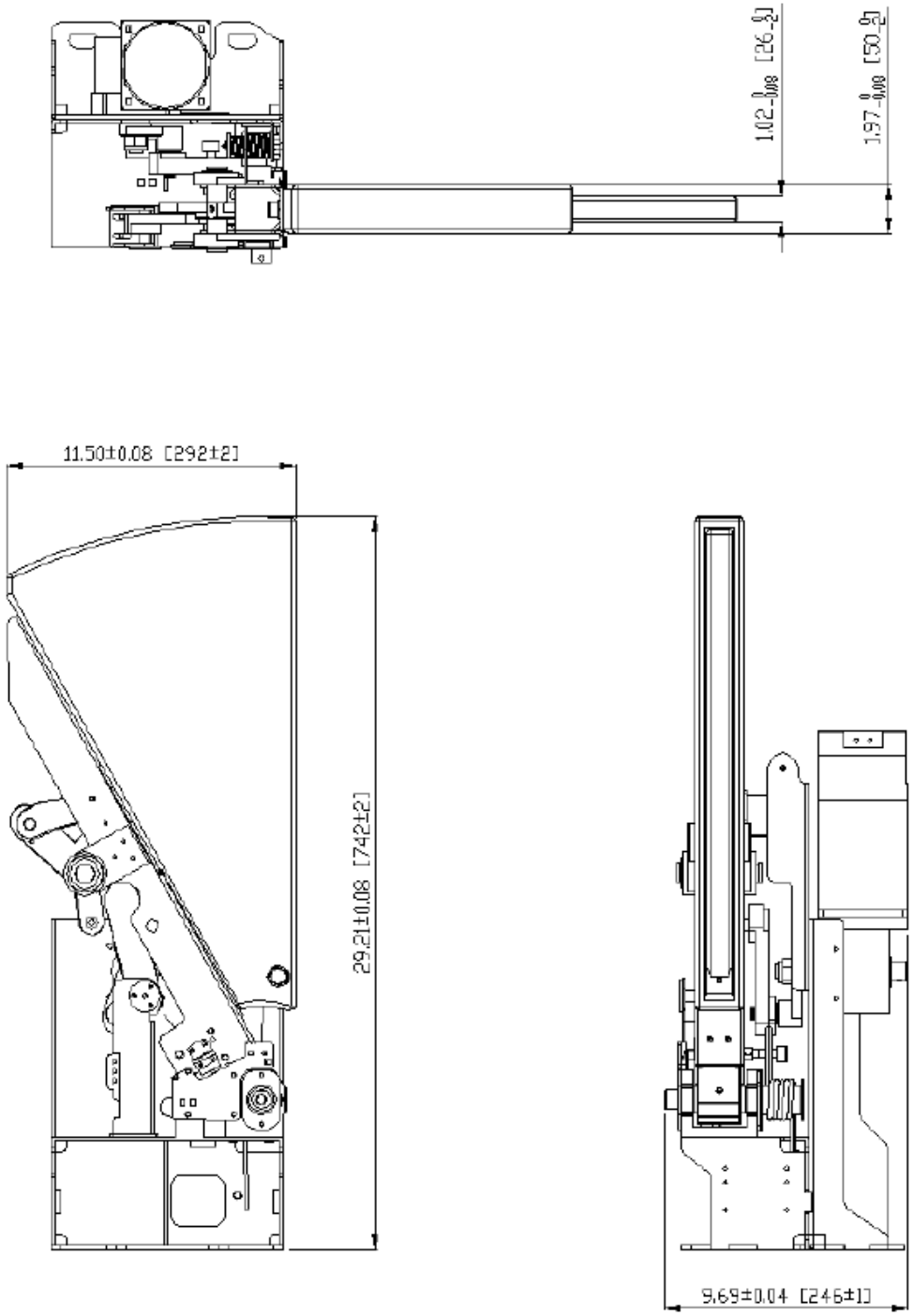
9.5. ADA barrier

9.5.1. Appearance

[Figure 33] ADA Barrier

9.5.2. Layout – Right type

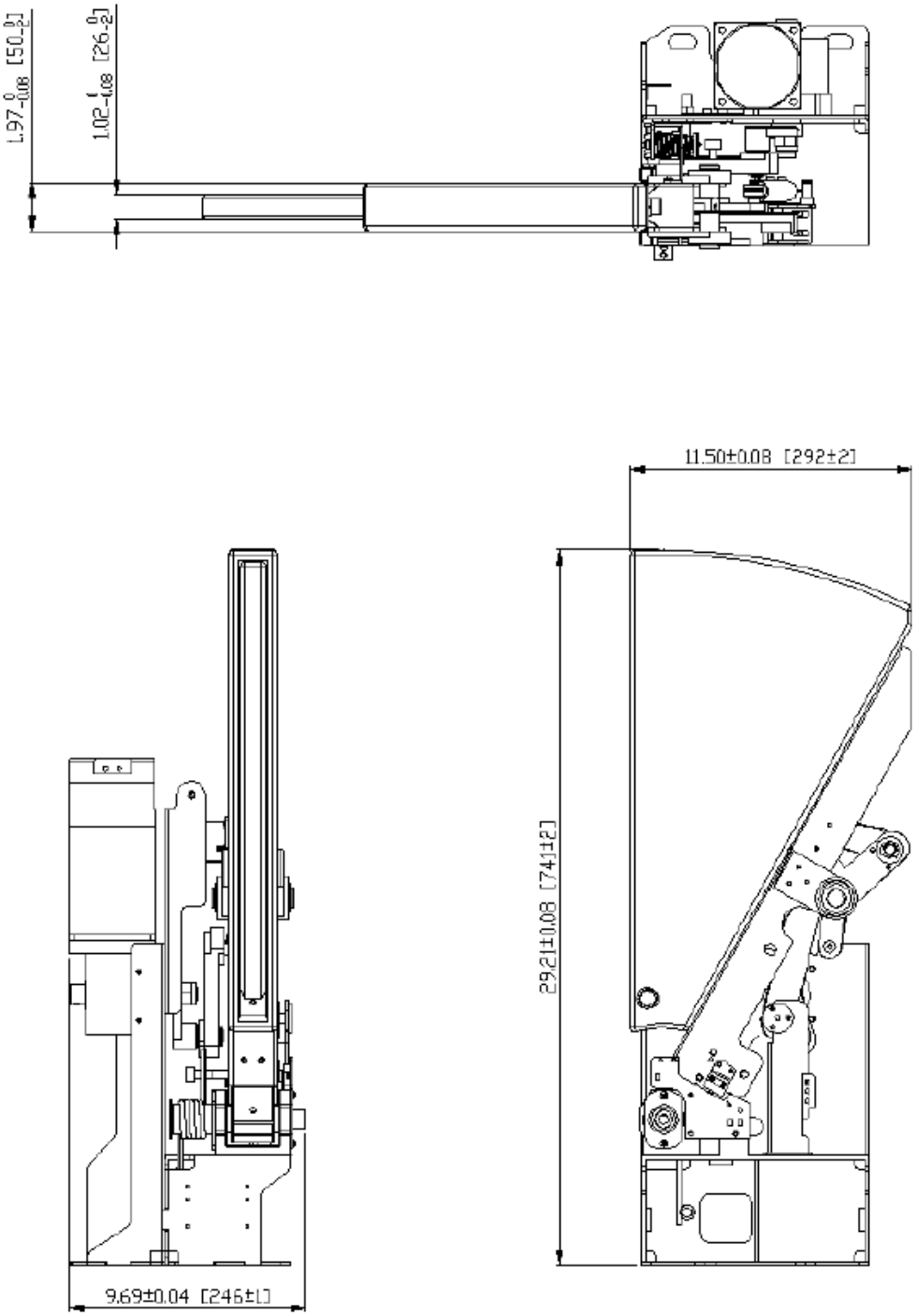
The motor location is on the right inside the ADA faregate enclosure



[Figure 34] ADA Barrier – Right type

9.5.3. Layout – Left type

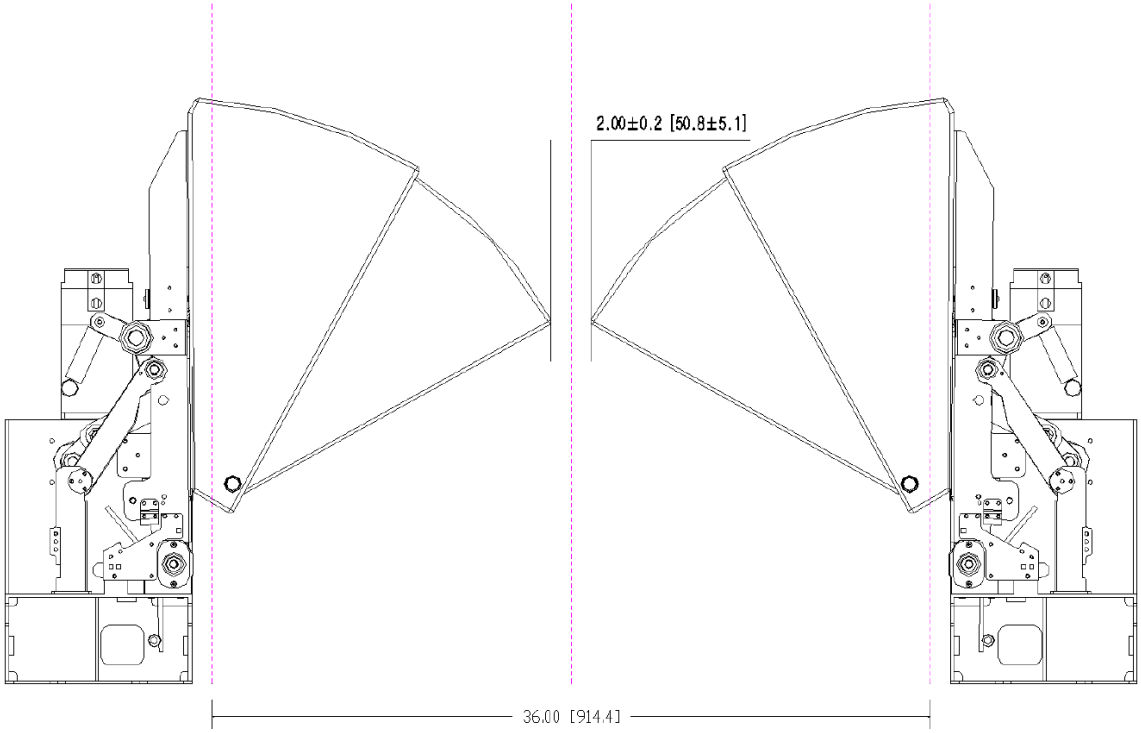
The location is on the left inside the ADA faregate enclosure



[Figure 35] ADA Barrier – Left type

9.5.4. Gap between the ADA barrier

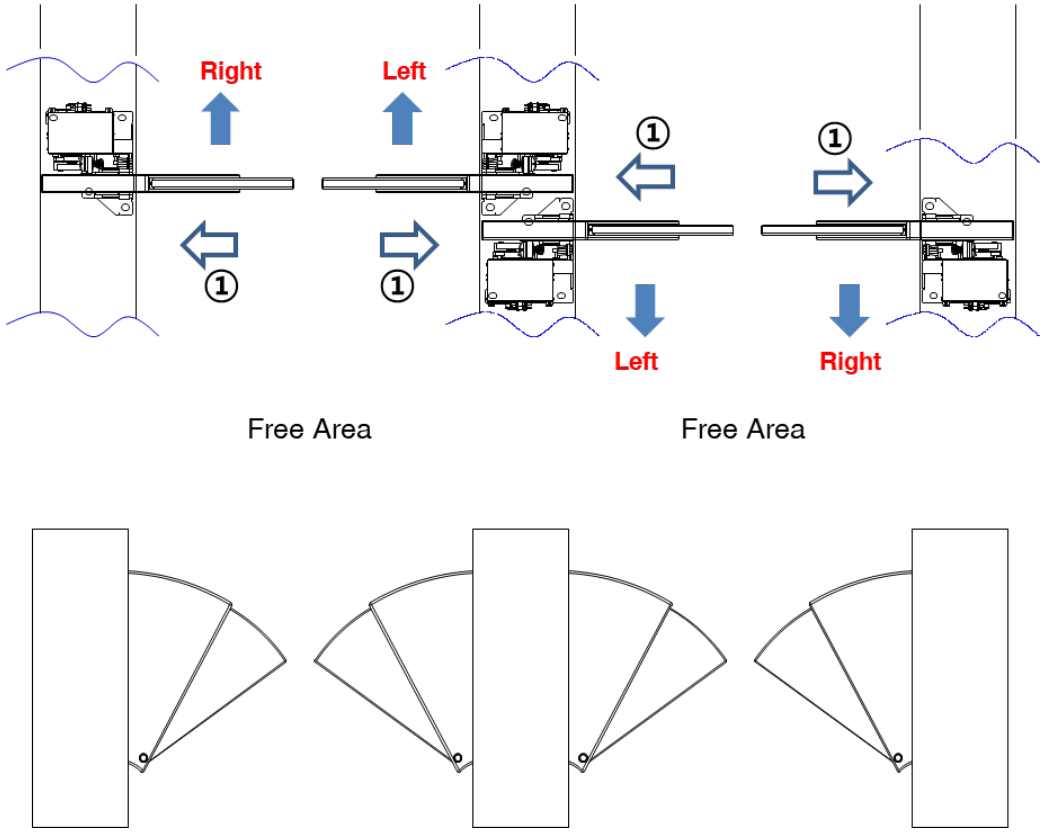
2.0 ± 0.2 inch [50.8 ± 5.1 mm] indicates the gap between ADA barriers when it is closed. Passage width between faregate cabinets is 36 inch [914.4 mm]



[Figure 36] The gap between the ADA barriers

9.5.5. ADA barrier layout and type in the cabinet

The ADA barrier layout in the cabinet is as follows.



[Figure 37] ADA barrier layout and type in the cabinet

The barrier type can be easily identified by the following procedure.

1) Look at the barrier in the aisle like arrow ①.

2) Check the flapper is on the right or left side of the center of the cabinet

3) If the flapper is on the right side, the barrier is right type; otherwise left type.

9.6. Specification

Item	Specification
Model No / Vendor	Standard Right / Left : SSDM-1000D-SR / SSDM-1000D-SL ADA Right / Left : SSDM-1000D-WR / SSDM-1000D-WL Vendor : Puloon Technology
Drive Unit	DC-Motor and DC-Brake
Driving type	Link, Crank, Worm gear mechanism
Command I/O	Signal of TTL - level 3 x control signal 2 x magnetic sensor status 1 x Emergency signal
Position control method	2 Magnetic sensors
Serial Interface	1 x RS-232
Motor Drive	DC Motor Full bridge drive (PWM) / Brush type
Flapper type	Material : Polyurethane Color : Orange (PANTONE 144C)
Operation speed	Standard barrier : about 0.6sec (Factory default) ADA barrier : about 0.8sec (Factory default)
Brake Force	≤350N
Closing Force	≤250N
Noise	Typical 47dB (Ref. Max : 50dB at 1m distance)
Weight	Standard barrier: ≤ 19.5 Kg ADA barrier: ≤ 26.5 Kg
Dimension (W x H x D)	Standard barrier: 10.55 ± 0.08 x 27.99 ± 0.08 x 9.69 ± 0.04 inch
	ADA barrier 11.50 ± 0.08 x 29.21 ± 0.08 x 9.69 ± 0.04 inch
MCBF / MTTR	1,000,000 cycles / 0.5 hour

[Table 5] Specification of Barrier

※ Operating speed is basically the time duration since the barrier gets the moving command from GCU to till take the final position.

9.7. Specification of Motor

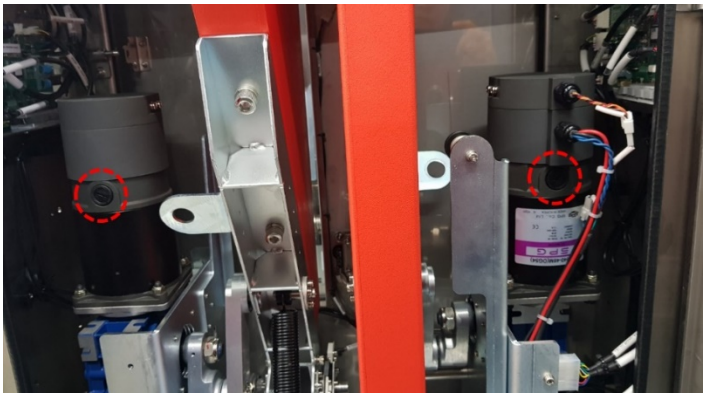
[Figure 38] Barrier Motor

Item	Specification
Model No / Vendor	S9D40-48M(OG54) / SPG
Type	Permanent magnetic DC motor (Brush type)
Model Size	ϕ90 mm
Rated Voltage	+48VDC
Operating Voltage	+38.4VDC ~ +57.6VDC
Direction of Rotation	CW / CCW
Operating Position	Horizontal
Insulation Level	Class A
Rated Torque	3.88 kgf.cm / 0.384 N.m
Rated Current	0.88 ± 20% (A)
Rated Revolution	1000 ± 10% (rpm)
Rated Output	40W
Durability	Min. 2000 hours (Continuous operating)
Weight	About 1.8 Kg (Motor only)

[Table 6] Motor specification

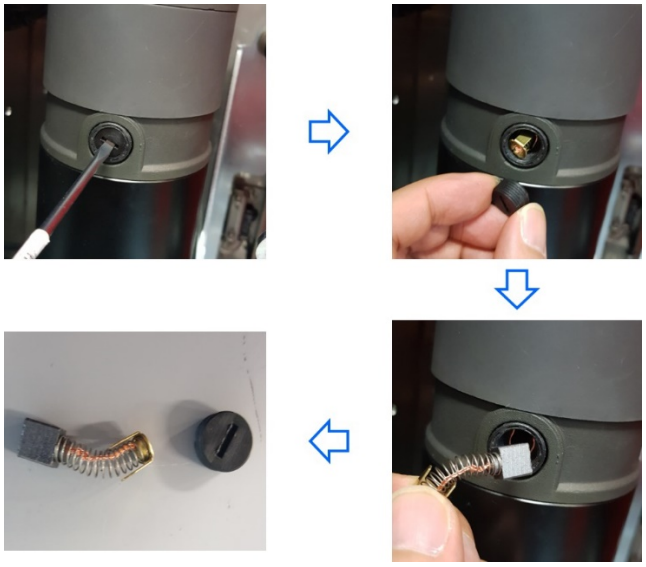
9.7.1. Brush replacement

The motor has two brushes on the front and back as shown below.



[Figure 39] DC Motor brush

The motor brush replacement procedure is as follows.



[Figure 40] Brush Replacement

1) Open the protective cap using a flat head screwdriver.

2) Remove the brush in the motor.

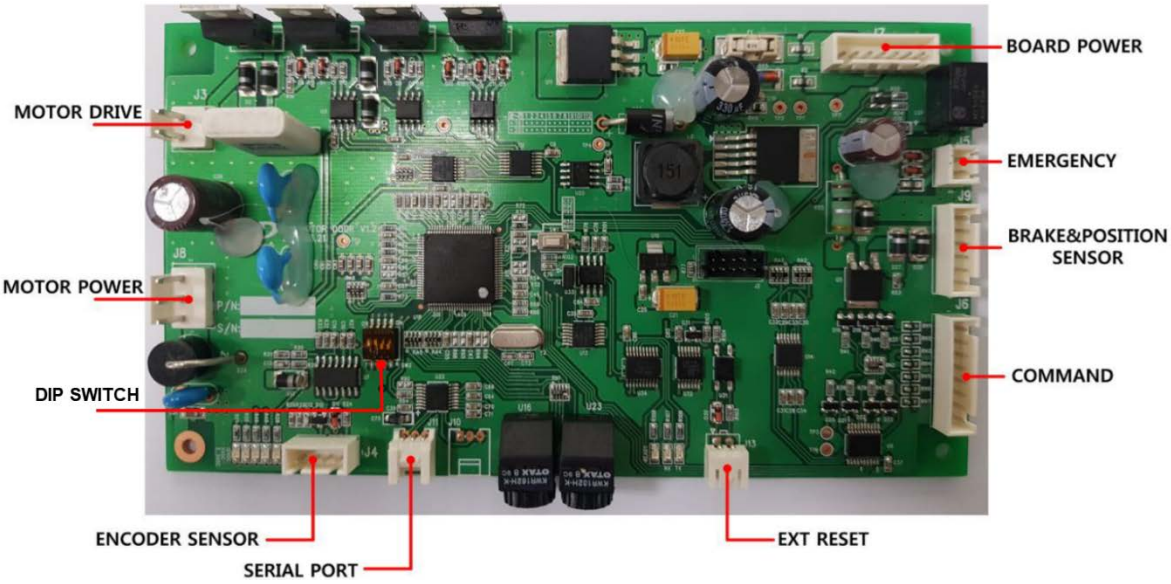
3) Replace with a new brush, then assemble in reverse order.

※ The brush does not need to be replaced due to wear over the life of the motor. If the brush wears out, the motor's commutator will be damaged and the motor will need to be replaced.

9.8. Control Board of Clamshell Barrier

9.8.1. Appearance

The figure below shows the clamshell barrier control board.



[Figure 41] Barrier Control Board

9.8.2. Specification

Item	Specification
Model No / Vendor	RPA100059E / Puloon Technology
MCU	ARM Cortex M3 (32-Bit Microprocessor)
Memory	256 KB Flash (Internal) 64 KB SRAM (Internal) 16 KB Serial EEPROM (External)
Command I/O	Signal of TTL - level 3 x control signal 2 x magnetic sensor status 1 x Emergency signal
Serial Interface	1 x RS-232
Motor Drive	DC Motor Full bridge drive (PWM)
Brake Drive	On and Off

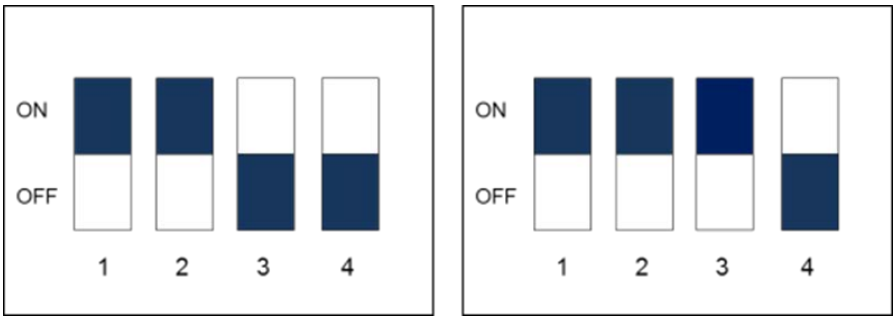
Motor Drive Power	+48VDC
Control Board Power	+24VDC
Dimension (W x D)	160 x 90mm

[Table 7] Barrier control board specification

9.8.3. Functional Description : DIP Switch

The control board of standard clamshell barrier and ADA clamshell barrier is the same. The type (Standard / ADA) of clamshell barrier is identified by the configuration of DIP switch #3.

The DIP switch configuration of clamshell barrier is as follows.



[Figure 42] DIP switch configuration of barrier type (Left : Standard, Right : ADA)

※ After setting the switch, press the reset button to activate the configuration mode.

1) DIP Switch #1 (Only for factory test)

Status	Description
ON	Automatic compensation of the operating speed is disabled.
OFF	Automatic compensation of the operating speed is enabled.

2) DIP Switch #2 (Automatic calibration)

Status	Description
ON	Normal operating mode
OFF	Activated in automatic calibration mode

3) DIP Switch #3 (Barrier type selection)

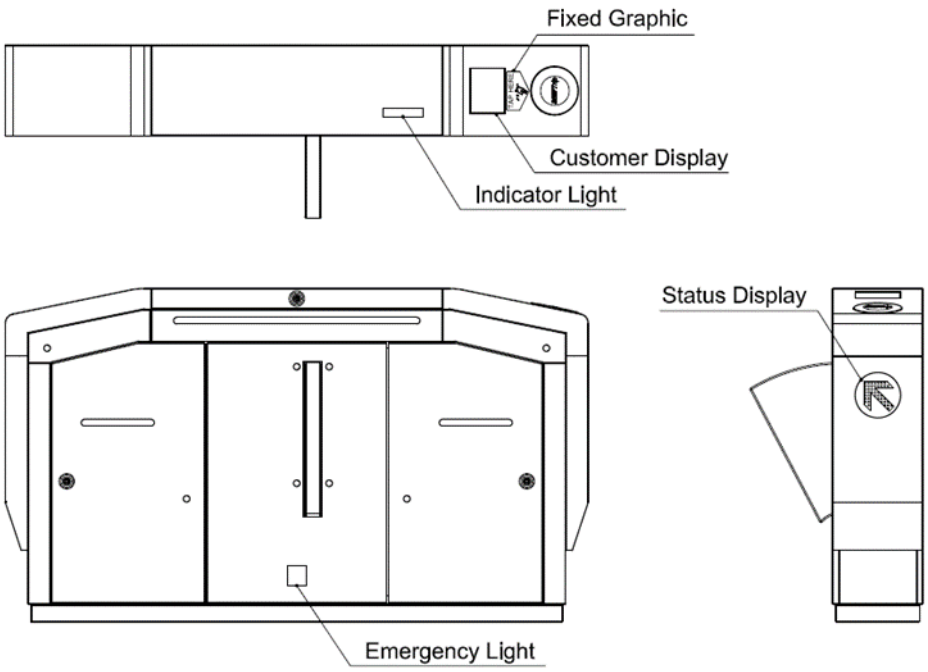
Status	Description
ON	ADA clamshell barrier operating mode
OFF	Standard clamshell barrier operating mode

4) DIP Switch #4 (Factory setting)

Status	Description
ON	Initialization of the EEPROM with the initial factory settings.
OFF	Normal status

10. Customer Interface

The faregate has fixed graphics, emergency lights, indicator lights, customer displays, and status displays. These customer interfaces are designed and strategically placed to maximize their effectiveness and coincide with ergonomics of fare payment.



[Figure 43] Customer Interfaces

10.1. Fixed Graphics

The figure below is a fixed graphics concept design with braille that guides customers to the location and correct use of PPT. The message on the fixed graphics will comply with the Title VI guidelines for customers with limited English proficiency.

[Figure 44] Fixed graphic and Braille

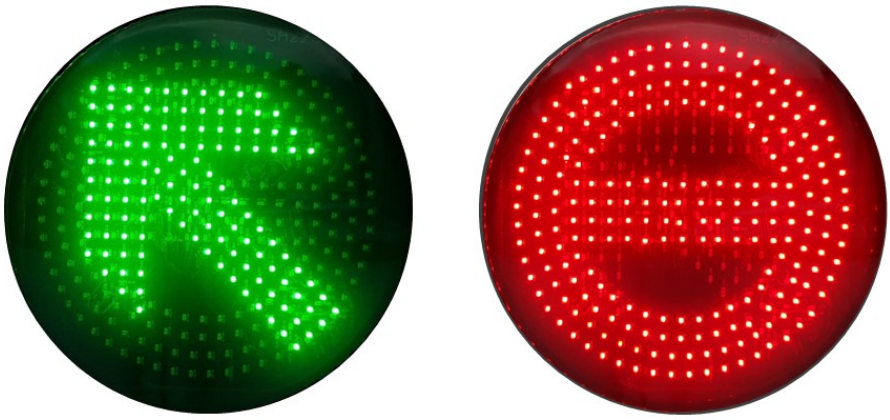
The fixed graphics concept design is attached in front of the ADA faregate to guide customers.

[Figure 45] Fixed graphic for ADA Faregate

10.2. Status Display

The status display provides information identifying the status of the gate and adjacent aisle to the left. The status display could be “Usage OK” with a symbol of green arrow and “Usage Prohibited” with a symbol of the red circle.

The status display is mounted on the vertical panels at both ends of the faregate. It displays the green arrow to indicate the direction of motion for the in-service, or red bar sinister to indicate no entry for the aisle.



[Figure 46] Status Display

10.2.1. Specification

Item	Specification
Model No / Vendor	DIR-LED04 / Shanghai Huaming
Display status	Enter (green arrow), Do not enter (red circle)
Status display mode	Static display
LED colors	Green, Red
Dimension (W x H)	150mm x 150mm
View angle	Horizontal: 120 degrees / Vertical: 100 degrees
Operating voltage	24VDC ± 10%
Power dissipation	6.8watt / green, 6.8watt / red

[Table 8] Status Display specification

10.3. Indicator Light

For fare processing, faregates are equipped with LED indicator lights that can display various colors with Red, Green and Blue LED combinations.

If the processed smart media is valid, either the blue, the yellow or green colors are activated according to the class of fare media presented. And if the media is not valid, the red LED turns on. When the reduced fare media is used at faregate, station personnel is able to easily check the processing status through the indicator light.

[Figure 47] Color types of indicator light

10.3.1. Specification

Item	Specification
Model / Vendor	ALARM-LED04 / Shanghai Huaming
LED Type	3 color high-brightness LED
LED Colors	Red / Green / Blue
Operating Voltage	24VDC ± 10%
Power Dissipation (Max)	1.2W (50mA@24VDC)

[Table 9] Indicator light specification

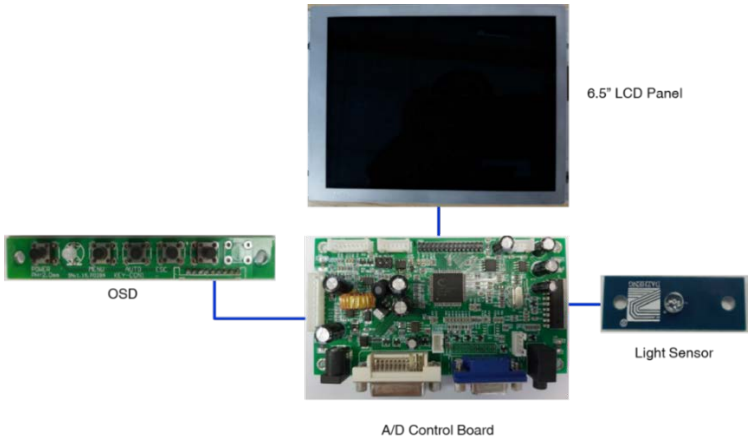
10.4. Customer Display

The customer display is installed on the top of each faregate in each direction of passage and provides information to a customer regarding faregate readiness, faregate aisle usability, transaction success or failure, and fare media status.

The customer display brightness could be adjusted automatically based on ambient light conditions. The illuminance sensor is located nearby customer display so the LCD brightness could be adjusted automatically. When the customer display brightness is adjusted automatically, the customer display brightness is also adjusted manually.

The Customer Display module consists of a 6.5” LCD panel for displaying information, an OSD board for making adjustments to the display menu, a light sensor for detecting ambient brightness, and a control board for controlling LCD panel, OSD board, and light sensor.

[Figure 48] Customer Display Module



[Figure 49] Customer Display Components

10.4.1. Specification

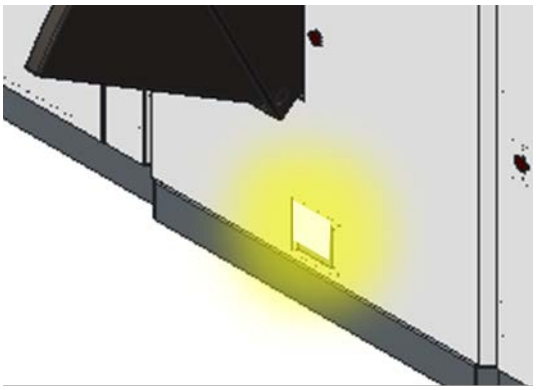
Item	Specification
Model No / Vendor	LC-OF06588 / Anrecson Elec.
Screen Diagonal	6.5 inches
Active Area (mm)	132.48(H) x 99.36(V)
Pixels H x V	640 x 3(RGB) x 480
Pixel Pitch (mm)	0.207 x 0.207
Types of backlight	LED backlight
White Luminance	800 cd/m^2 (typical)
Contrast Ratio	600 (typical)
Response Time	15ms
Viewing Angle	80° / 80° / 70° / 70° (Right / Left / Upper / Lower)
Signal Input	VGA / DVI
Power Input	12VDC
Power Consumption	10W
Operating Temperature	- 20 ~ 70℃
Environmental Humidity	10% ~ 90% without condensation
Life time (hour)	50,000

[Table 10] Customer Display specification

10.5. Emergency Light

The faregate provides emergency lighting that is powered from the emergency power source (AC 120V) to illuminate the faregate aisle.

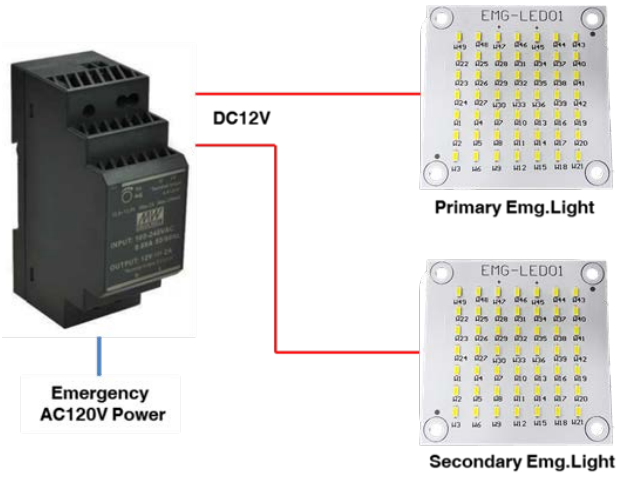
The emergency power to the faregates is connected in a daisy-chain manner to each faregate from a single source (Station UPS Power).



[Figure 50] Emergency Light

Emergency lights keep aisle lighting on through the emergency power (Station UPS Power) and the AC/DC power supply.

The emergency light connection diagram is as follows.



[Figure 51] Connection diagram of Emergency lights

10.5.1. Specification

10.5.1.1. Emergency light power supply

Item	Specification
Model No / Vendor	HDR-30-12 / MEAN WELL
Input Voltage	AC85 ~ 264V / 47 ~ 63Hz
Input Current	0.88A / 115VAC
Output Voltage	DC12V / 2A / 24W
Operating Temperature	- 30 ~ +70℃
Operating Humidity	20% ~ 90% RH non-condensing
Safety Standards	UL62368-1, UL508, TUV EN61558-2-16
Withstand Voltage	I/P – O/P: 4KVAC *(I/P : Input Power, O/P : Output Power)*
Isolation Resistance	I/P – O/P: >100M Ohms / 500VDC / 25℃ / 70% RH
EMC Emission	EN55032 Class B, EN61000-3-2 Class A, EN61000-3-3
EMC Immunity	EN61000-4-2,3,4,5,6,8,11, EN55024, EN55035,EN61000-6-2
MTBF	968.1K hrs min. MIL-HDBK-217F(25℃)
Dimension (W x H x D)	35 x 90 x 54.5mm

[Table 11] Specification of emergency light power supply

10.5.1.2. Emergency light

Item	Specification
Model No / Vendor	EMG-LED01 / Shanghai Huaming
Voltage	12VDC
Power	120mA @12VDC
Operating Temperature	- 20 ~ +60℃
Color	White
MTBF	50,000 hours
Dimension (W x D)	56 x 56mm

[Table 12] Specification of emergency light

10.6. Audible Tone

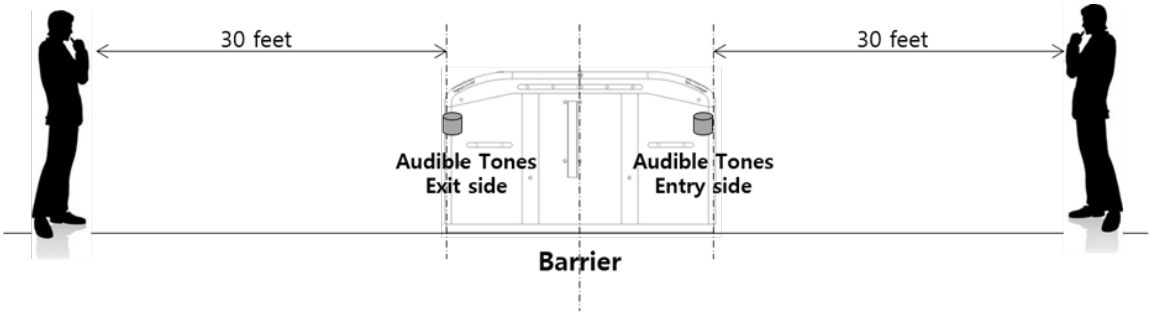
The faregate provides a unique tone for audio feedback to the customer by the audio amplifier board and speakers. The audible tone activation and volume levels can be controlled by a programmable setting for:

- According to fare types
- Emergency mode
- Authorized and unauthorized entry
- Barrier is not closed properly / barrier is opened forcibly

※ There is no manual knob to adjust the volume, and the volume can be adjusted in the ECU windows program.

[Figure 52] Audible tone of the faregate

At a minimum, generated tones will be clearly audible and distinguishable at a distance of not less than thirty (30) feet in an unenclosed environment.



[Figure 53] A distance of audible tones

10.6.1. Specification

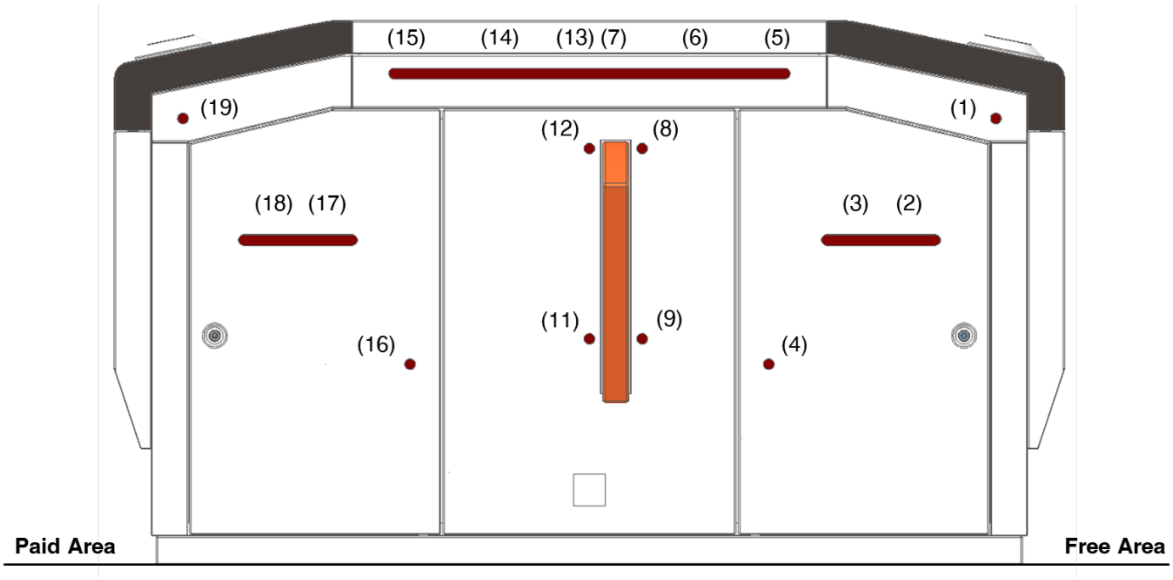
Module	Item	Specification
Audio Amplifier Board	Model No / Vendor	AMP-V3.0 / Shanghai Huaming
	Rated Voltage	+12VDC
	Current	Max. 1A
	Output Power	Max. 18W
	Range of Frequency	20Hz ~ 19KHz
	Operating Temperature	-20 ~ +70℃
Speaker	Model / Vendor	SL87XA – 4 Ohm / VISATON

	Rated Power / Impedance	20W / 4Ω
	Frequency response	350Hz ~ 5800Hz
	Operating Temperature	-40 ~ +70℃

[Table 13] Specification of audio tone components

10.7. Directional Sensors

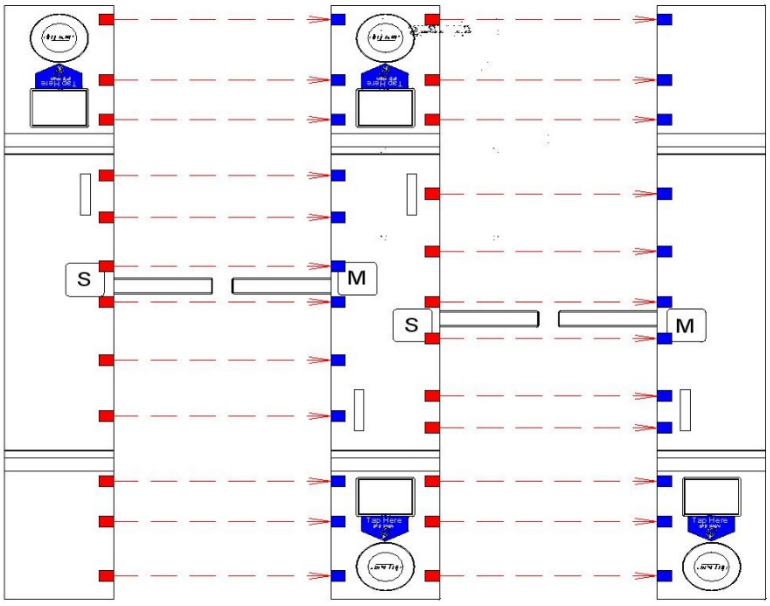
The faregate has 18 sets of sensors in each aisle to detect and determine the movement of all authorized and unauthorized customers between the unpaid and paid areas. When any improper entries are detected, an audible and visual alarm is generated. The audible and visual alarm is programmable and adjustable from within the faregate



[Figure 54] Positioning of Directional Sensors

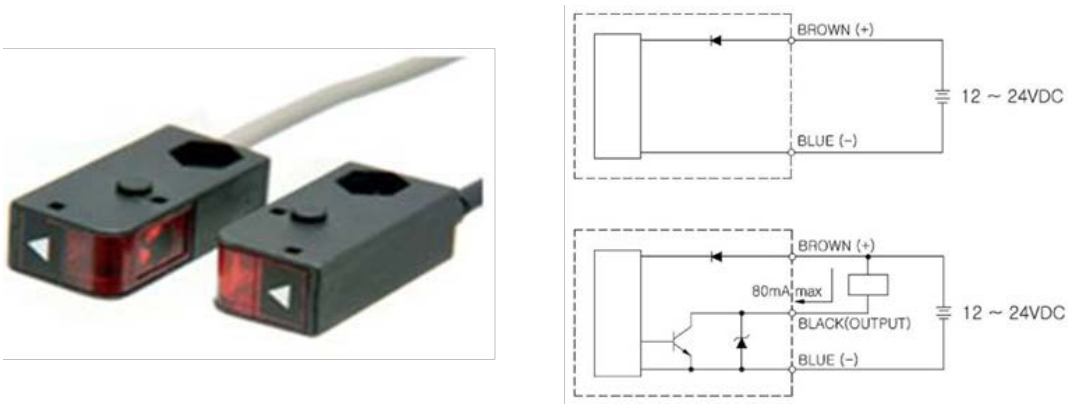
Sensor numbers 1 to 9 are connected to the first RS/ES link board, and sensor numbers 11 to 19 are connected to the second RS/ES link board.

Paired sets of sensors and receivers is attached in the aisle side of the gate, as shown in Figure below. These sensor pairs detect breaks in optical beams between emitter and receivers as customers move through the aisle.



[Figure 55] Paired sensors

The photocells are positioned in such a way that they can distinguish between the passage of one or more passengers.



[Figure 56] Directional sensor and circuit diagram

10.7.1. Specification

Item	Specification
Model No / Vendor	Emitter : KPS-CTV S Receiver : KPS-CTVN S Vendor : KUN HUNG Elec.
Sensing method	Through-beam type
Operating Voltage	12VDC ~ 24VDC (Ripple max 10%)
Current consumption	Max : 25mA (Emitter : Max 10mA, Receiver : Max 15mA)
Sensing distance	≤1.5m
Response time	≤1ms
Operating mode	Dark On
Ambient illumination	Incandescent light : Max 3000Lux, Sunlight : Max 10000 Lux
Operating Temperature	- 20 ~ +60 ℃
Storage Temperature	- 40 ~ +80 ℃

[Table 14] Specification of directional sensor

11. Peripheral Interface

11.1. Servicing Display and Keypad

The faregate provides maintenance functionality to perform maintenance at the faregate using the customer display and the USB keypad. This feature allows maintenance staff to remain standing while doing some maintenance activities.

When the maintenance or other authorized personnel open the maintenance door, the faregate changes mode to maintenance.

[Figure 57] Maintenance Keyboard

11.1.1. Specification

Item	Specification
Model No / Vendor	PERIBOARD-716 III / Perixx
Tracking method	Built-in touchpad with mouse function
Connection type	Wireless 2.4GHz with 33 feet operating range
Number of keys	87 Keys
Key switch technology	X type scissors keys
Dimension (L x W x H)	14.31 x 4.72 x 0.7 inches
Color	Black
Layouts	US

[Table 15] Specification of Maintenance Keyboard

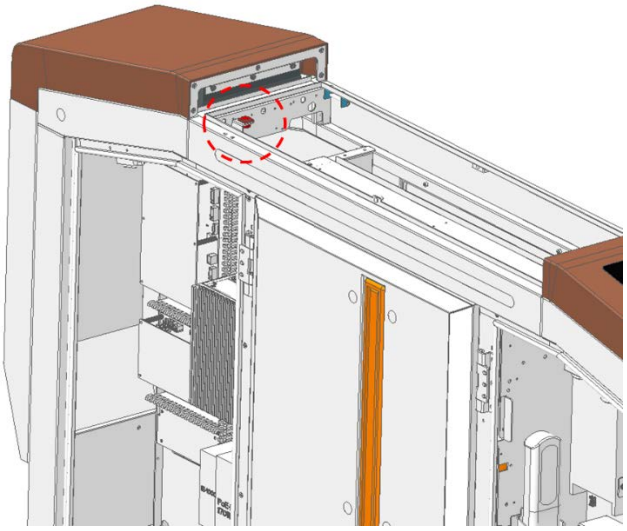
11.2. Push Button

The push button is located on inside of the faregate enclosure, away from the public and accessible by maintenance personnel when the faregate door is opened. This push button simulates an acceptable fare transaction and cycles the faregate one time.

The push button is connected to the GCU and when the push button is activated the barriers are opened and closed in the normal mode of operation.

[Figure 58] Push button

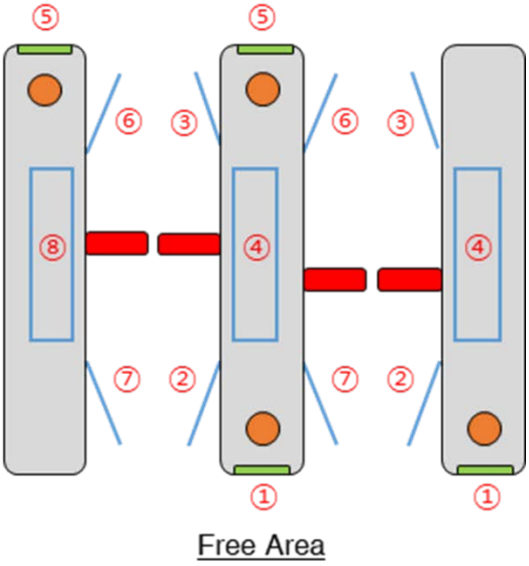
The push-button is located inside the top cover of the paid area (ECU side).



[Figure 59] Push button location

11.3. Door Switch

The faregate is equipped with several magnetic switches for detecting the opening and closing of maintenance doors.



[Figure 60] Magnetic switch and switch number

The switch numbers and locations are as follows:

Switch Number	Location
①	Master / Entry side end cover
②	Master / Entry side maintenance door
③	Master / Exit side maintenance door
④	Master side top cover
⑤	Slave / Exit side end cover
⑥	Slave / Exit side maintenance door
⑦	Slave / Entry side maintenance door
⑧	Slave side top cover

The magnetic switch specification is as follows:

Item	Description
Model No / Vendor	AMS-39 / AMSECO
Contact Type	N.O (Normal Open) without magnet engaged
Contact Rating	10VA
Operating Gap	3/4 inch min.
Color	Ivory
Operating Temperature	32℉ ~ 120℉ (0℃ ~ 49 ℃)

[Table 16] Specification of Magnetic switch

11.4. Interior Light

The faregate has a portable interior light inside the faregate enclosure to facilitate maintenance and repair.

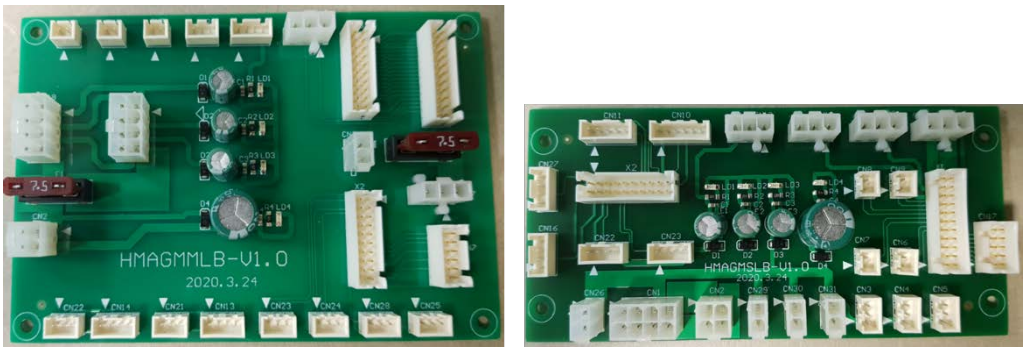
[Figure 61] Interior light

Item	Description
Model No / Vendor	HL-LA0203B / Yuan Mei Elec.
Lamp Type	Super Bright LED
Operating Voltage	+24VDC
Power Dissipation	2W @ 24VDC
Lumens	120 lm
Dimension (W x L x H)	255 x 59 x 40mm
Cable length	3.8m spring cable

[Table 17] Specification of Interior Light

11.5. Master Lind Board (MLB) / Slave Link Board (SLB)

MLB, SLB is the connection board between the master side and the slave side of the faregate. Most parts of slave side connect to power, communication, and I/O signals through MLB and SLB.



[Figure 62] MLB (left) and SLB (Right)

11.6. RS / ES Link Board

11.6.1. RS(Receive Sensor) Link Board

The RS Link Board is connected between the GCU and the receiving sensor to send signals from the sensor to the GCU.

2 number of RS Link Boards are equipped at master side. RS Link Board has the provision to connect up to 10 sensors.

[Figure 63] RS Link Board

11.6.2. ES (Emit Sensor) Link Board

The ES Link Board is connected between the SLB and the emission sensors to power the sensors.

2 number of ES Link Boards are equipped at slave side. ES Link Board has the provision to connect up to 10 sensors.

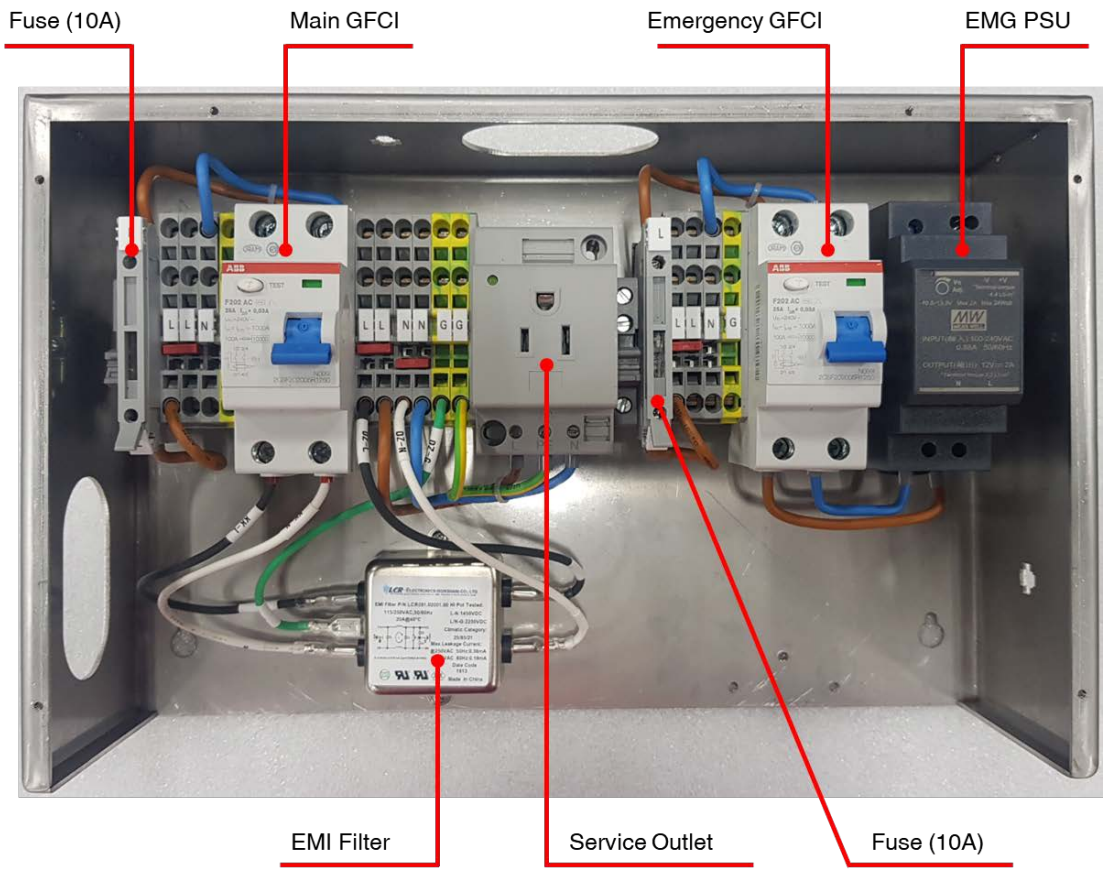
[Figure 64] ES Link Board

12. Power System

12.1. AC Box

The faregate has two terminals in the AC box, one for use to connect to the main power and the second connection to emergency power. The main terminal provides AC 120V to PSU via UPS to supply stable power to the submodules and supplies power to the heater.

The second emergency terminal supplies power to turn on the emergency light always.



[Figure 65] AC Box

12.1.1. GFCI (Ground Fault Circuit Interrupter)

The GFCI circuit breaker assures protection to people and installations against fault current to earth. The GFCI protect circuits by sensing when a ground fault or earth leakage is greater than 30mA and automatically open the circuit.

[Figure 66] GFCI circuit breaker

12.1.1.1. Specification

Item	Description
Model No / Vendor	F202 AC-25_0,03 / ABB
Standard	IEC/EN 61008, UL1053
Operating Characteristic	Instantaneous
Type of Residual Current	AC type
Rated Residual Current 30 mA	30 mA
Rated Current (In)	25 A
Number of Poles	2
Rated Voltage (Ur)	230 / 400 V
Rated Frequency (f)	50 – 60 Hz

Operating Temperature	- 25 – 55 °C
Maximum Operating Voltage UL/CSA	277 V AC
Short-Circuit Current Rating (SCCR)	0.03 mA

[Table 18] RCCB Specification

12.2. UPS

When the ECU receives a power fail signal from the GCU via the UPS due to a loss of main power, all in-process transactions are completed, and barriers are opened by ECU command and then the graceful shutdown proceeds. Upon restoration of power, the faregate returns to its normal operating state without manual intervention. (When the battery is fully discharged, it needs UPS to switch on manually.)

[Figure 67] UPS

12.2.1. Specification

Item	Description
Model No / Vendor	BK500BLK / Schneider
Output Capacity	500 VA / 300 W
Output-on utility	AC120V, 50 or 60 Hz +/- 3 Hz
Output-on battery	115V +/- 8%, 50 or 60 Hz +/- 1Hz
Battery Cartridge	RBC2

Typical Recharge Time	8 hours
Output Connections	6 total NEMA 5-15R: - 3 battery & surge - 3 surge only
Input power	120V, 50 or 60 Hz +/- 3Hz
Input Conn.	6 ft cord with right angle plug (NEMA 5-15P)
Dimension (H x W x D)	6.5” x 3.6” x 11.2”
Weight / Color	13.8 lbs / Black
Certification / Approvals	FCC Part 15 Class B, FCC Part 68, UL1778, Industry Canada

[Table 19] UPS Specification

12.2.2. Switch On the UPS

Press the push-button on the front panel of the UPS.

[Figure 68] UPS power swtich

Observe that the following events occur after pressing and releasing the push-button:

- The green On Line indicator flashes.
- The yellow On Battery indicator lights while the Self-Test is being performed.

- When Self-Test has successfully completed, only green On Line indicator will be lit.
- If the internal battery is not connected, the green On Line indicator and red Replace Battery indicator will light. The UPS will also emit a chirping sound

12.2.3. Status Indicators and Alarms

There are four status indicators on the front panel of the UPS (On Line, On Battery, Overload, and Replace Battery)

[Figure 69] UPS indicator

- On Line (green) – is lit whenever AC power is powering the Battery Backup outlets.
- On Battery (yellow) – is lit whenever the battery of the UPS is powering equipment connected to the Battery Backup outlets.
  - Four Beeps Every 30 Seconds – this alarm is sounded whenever the UPS is running On Battery.
  - Continuous Beeping – this alarm is sounded whenever a low battery condition is reached. Battery run-tine is very low.
- Overload (red) – is lit whenever power demand has exceeded the capacity of the UPS.
  - Continuous Tone – this alarm is sounded whenever the Battery Backup outlets are overload.

- Replace Battery (red) – is lit whenever the battery is near the end of its useful life, or if the battery is not connected (see above). A battery that is near the end of its useful life has insufficient run-time and should be replaced.
  - Chirps for 1 Minute Every 5 Hours – this alarm is sounded whenever the battery has failed the automatic diagnostic test.

12.2.4. UPS Battery

The battery specification of the UPS are as follows.

[Figure 70] UPS Battery

Item	Description
Model No / Vendor	RBC2 / Schneider
Battery type	Maintenance-free sealed Lead-Acid battery with suspended electrolyte : leak-proof
Expected Battery Life (years)	3 ~ 5
Battery Volt-Amp-Hour Capacity	84
Operating Temperature	0 ~ 40 ℃
Operating Relative Humidity	0 ~ 95 %

Dimension (H x W x D)	3.7 x 2.52 x 5.94 inch
Weight	5.5lbs.
Standard Warranty	1 year repair or replace
RoHS	Compliant
REACH	REACH: Contains SVHCs

[Table 20] Battery Specification

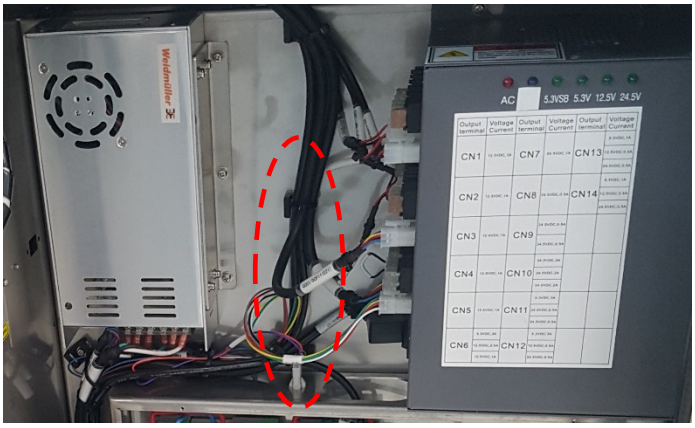
※ Battery replacement: In AFC systems, the battery is typically replaced every two years.

※ Battery life may vary depending on the installation environment, usage environment, and so on.

12.3. Power Supply Unit (PSU)

The PSU operates from the AC120V power source of the UPS and supplies 5VDC, 12VDC and 24VDC to each module through the fuse panel. The AC input cable to PSU is fixed using a cable tie on cable mount to prevent disconnection.

[Figure 71] Power Supply Unit



[Figure 72] Tied cable to prevent disconnection

12.3.1. Specification

12.3.1.1. Specification of Main PSU

Item	Description	
Model No / Vendor	G1323 / Gospell Digital Technology	
Input Rated Voltage	100 ~ 240VAC	
Frequency	47 ~ 63Hz (Typical 50/60Hz)	
Efficiency	85%	
Total Output Power	312W	
Output Voltage & Current	+5.3VSB ± 5%	Max. 3A
	+5.3V ± 5%	Max. 7A
	+12.5V ± 5%	Max. 7A
	+24.5V ± 5%	Max. 7A
Output Ripple & Noise	+5.3VSB	≤ 80mVpp
	+5.3V	≤ 80mVpp
	+12.5V	≤ 120mVpp
	+24.5V	≤ 240mVpp
Over Voltage Protection	+5.3V	≤ 6.5V
	+12.5V	≤ 14.5V
	+24.5V	≤ 30V
Insulation Voltage	Input – Output : 3 kV	
	Input – Earth : 1.8 kV	
	Output – Earth : 0.5 kV	
Standards	EN60950	
EMC Standards	EN55032, EN61000-4-2/3/4/5/6/11	
Operating Temperature	- 25 ~ +60 ℃	
Operating Humidity	5 ~ 95% RH, non-condensing	
Storage Temperature	- 40 ~ +85 ℃	
Operating Life	6,5000hrs (25℃, Fan cooling)	
Noise	≤ 60dB	
Dimension (L x W x H)	248 x 160 x 130mm (tolerance: ± 2mm)	

[Table 21] PSU specification

12.3.1.2. Power Supply of Clamshell barrier

The following is the power supply required for the motor operation of the clamshell barrier. It supplies power to two barriers installed in one aisle.

[Figure 73] Power Supply of Clasmshell barrier

Item	Description
Model No / Vendor	CP E SNT 250W / Weidmueller
DC Output Voltage	+48VDC
Max. DC Output Current	5.2 A
Max. Output Power	250W
Efficiency(Typ)	83 %
Input Range	88 ~ 132VAC / 47~63Hz
Ripple & Noise	≤ 200 mVpp
Voltage Tolerance	±2%
Over Voltage Protection	120 ~ 150%
Operating Temperature Range	-20℃ ~ +70℃
Operating Humidity Range	20 ~ 95%RH (Non condensing)
Storage Temperature Range	-20℃ ~ +85℃
Storage Humidity Range	5 ~ 95%RH (Non condensing)
Cooling Method	Natural Cooling System (FAN & HEATSINK)
Withstand Voltage	Input – Output 3KVAC, Input – F.G : 1.5KVAC, Output – F.G : 0.5KVAC

Insulation Resistance	Input – Output, Input – F.G, Output – F.G : 25℃, 70%RH, 500VDC, 100MΩ

[Table 22] Specification of barrier power supply

12.4. Heater

The heater and thermostat are installed inside so that the faregate can operate at low temperatures. The heater fan can be replaced without replacing the heating element.

[Figure 74] Heater

Item	Description
Model No / Vendor	BSAFH01.1.A120.310 / Shanghai Huaming
Heating element	High performance cartridge
Temperature safety cut-out	To protect against overheating in case of fan failure
Heater body	Die-cast aluminum
Connection	3-pole screw connector 2.5mm^2, clamping torque 0.8N max.
Connection casing	Plastic according to UL94 V-0, Black
Installation position	Vertical
Operating temperature	-45 ~ +70℃
Axial fan, ball bearing	Life time: 50,000hrs at 25℃
Fan connection	2-pole screw connector 2.5mm^2
Input Voltage	120VAC, 50/60Hz
Heating capacity	310W
Airflow (free flow)	108m^3/h
Dimension (W x H x D)	119 x 151 x 57mm

[Table 23] Heater specification

12.5. Thermostat

The thermostat is used to turn the heater on and off. The heater turns on when the set temperature is lower than the ambient temperature and turns off when high.

[Figure 75] Thermostat

Item	Description
Model No / Vendor	NSYCCOTHC / Schneider
Sensor type	Bimetal
Contacts type and composition	NC (Normal Close)
Service life in cycles	>= 100000 cycles
Maximum switch capacity	10A @ 250VAC 15A @ 120VAC
Temperature setting range	0 ~ 60 ℃
Hysteresis	7%
Number of outputs	1 output heating function
Certification	UL
Dimension (W x H x D)	33 x 68 x 44mm

[Table 24] Thermostat specification

13. Network Switch

The master cabinet in each aisle is equipped with a gigabit Ethernet switch, which connects all PPTs associated with an aisle as well as the faregate ECU to the WMATA LAN / WAN.

The PPTs and ECU associated with an aisle are connected to this switch via CAT6 cables.

[Figure 76] Network Switch and Power Supply

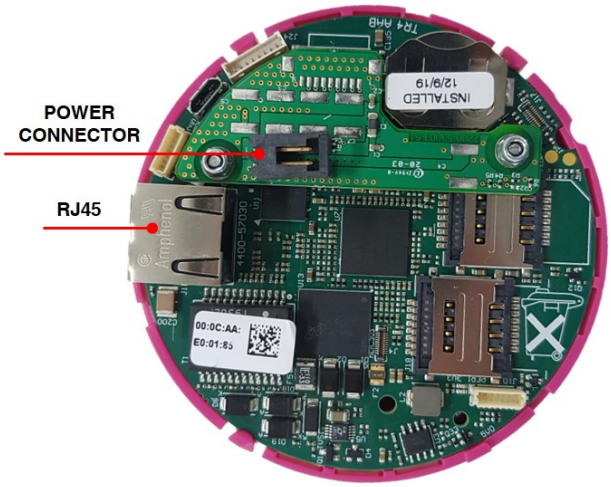
※ *Switch Model:* ***IE-1000-8P2S-LM*** *(Cisco Industrial Ethernet 1000 series)*

※ *Power Supply Model:* ***PWR-IE170W-PC-AC*** *(Cisco Power Supply for IE-1000)*

※ *Network switch and power supply are supplied by WMATA.*

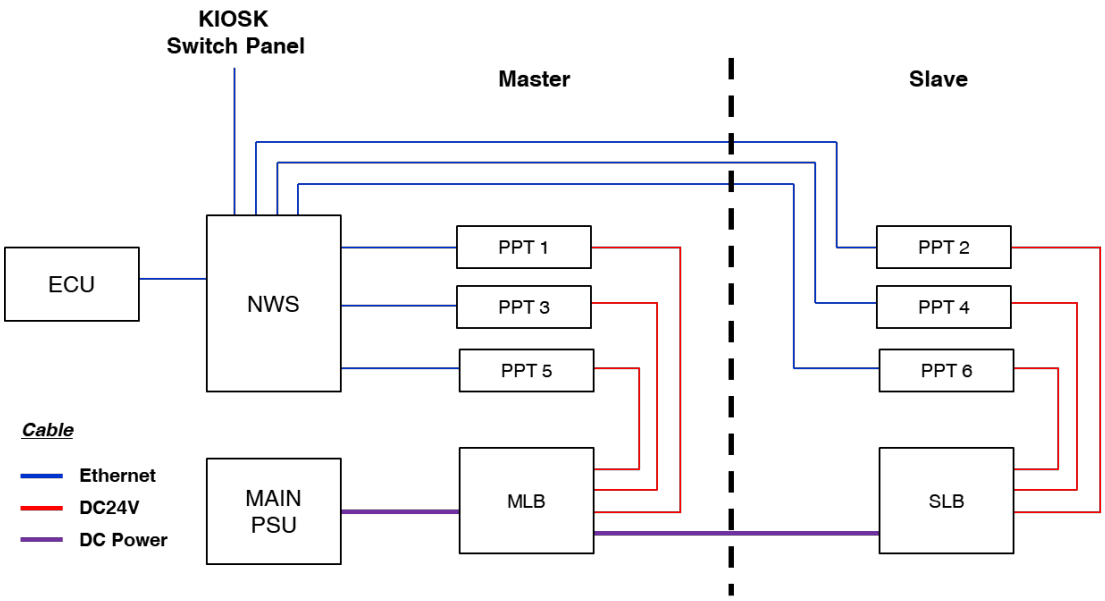
14. PPT (Payment Processing Target)

The PPT connects to the WMATA LAN / WAN via a network switch mounted in the cabinet. And PPT power (24VDC) is supplied to the power board by the main PSU via MLB/SLB.



[Figure 77] PPT

The network and power connection diagram is shown below.



[Figure 78] PPT network and power connection