SIGNALLING & COMMUNICATION DEPARTMENT

27 February 2019

CENTRALIZED TRAFFIC CONTROL (CTC) & AUTOMATIC TRAIN PROTECTION (ATP)

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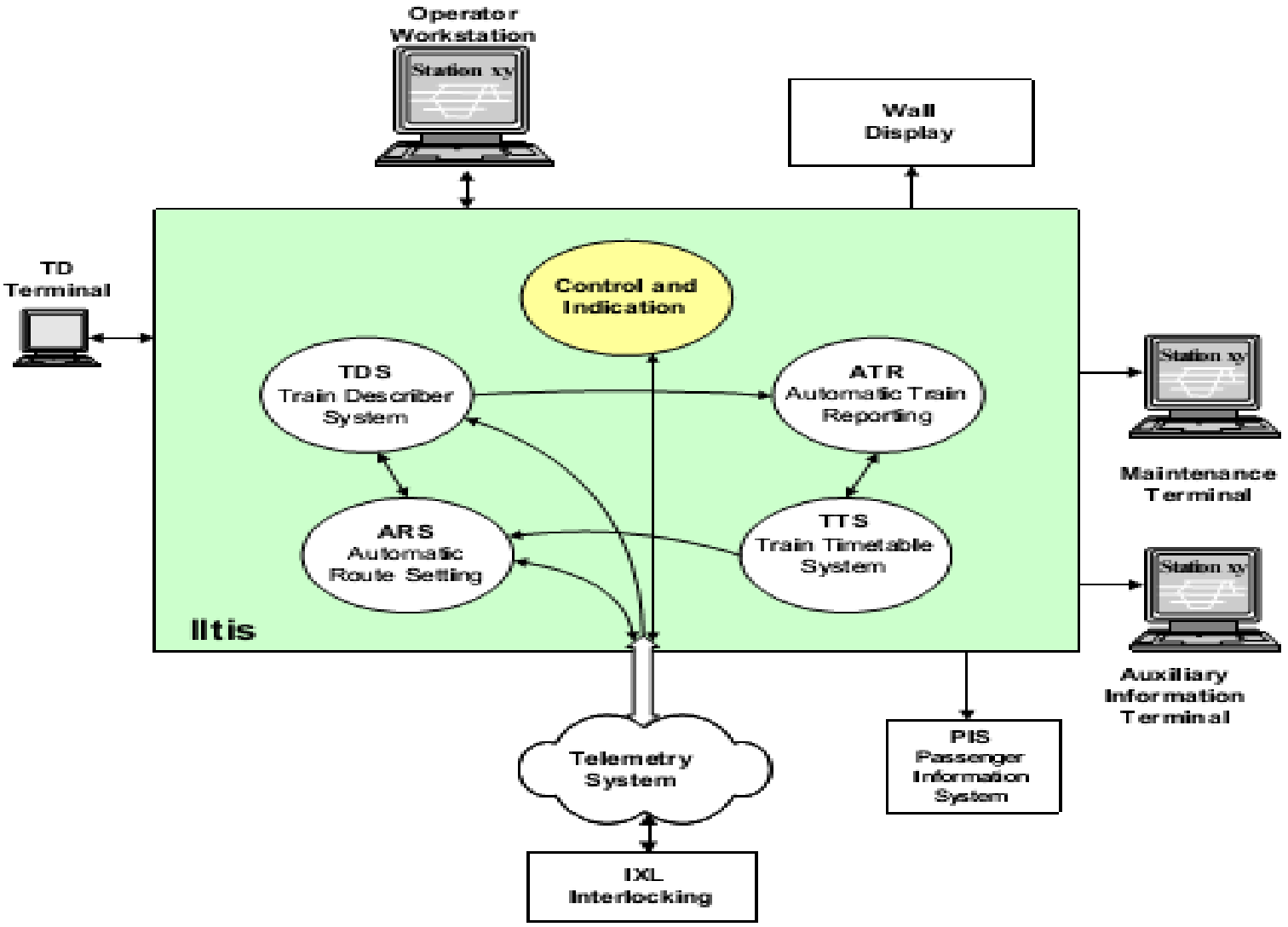
INTRODUCTION

Centralized Traffic Control (CTC)

- Centralized traffic control is a form of railway signaling system
- The CTC incorporates railway routes previously operated by station managers (local signals) or own railway trips
- The system consists of a central railway office to control signalling interlocking and the traffic flow of the trains
- CTC is a control panel with a graphic picture movement of the trains
- This panel can indicate the location of all trains at the station and in all areas

CENTRALIZED TRAFFIC CONTROL (CTC) AT KLS

CTC SYSTEMS



CTC SYSTEMS

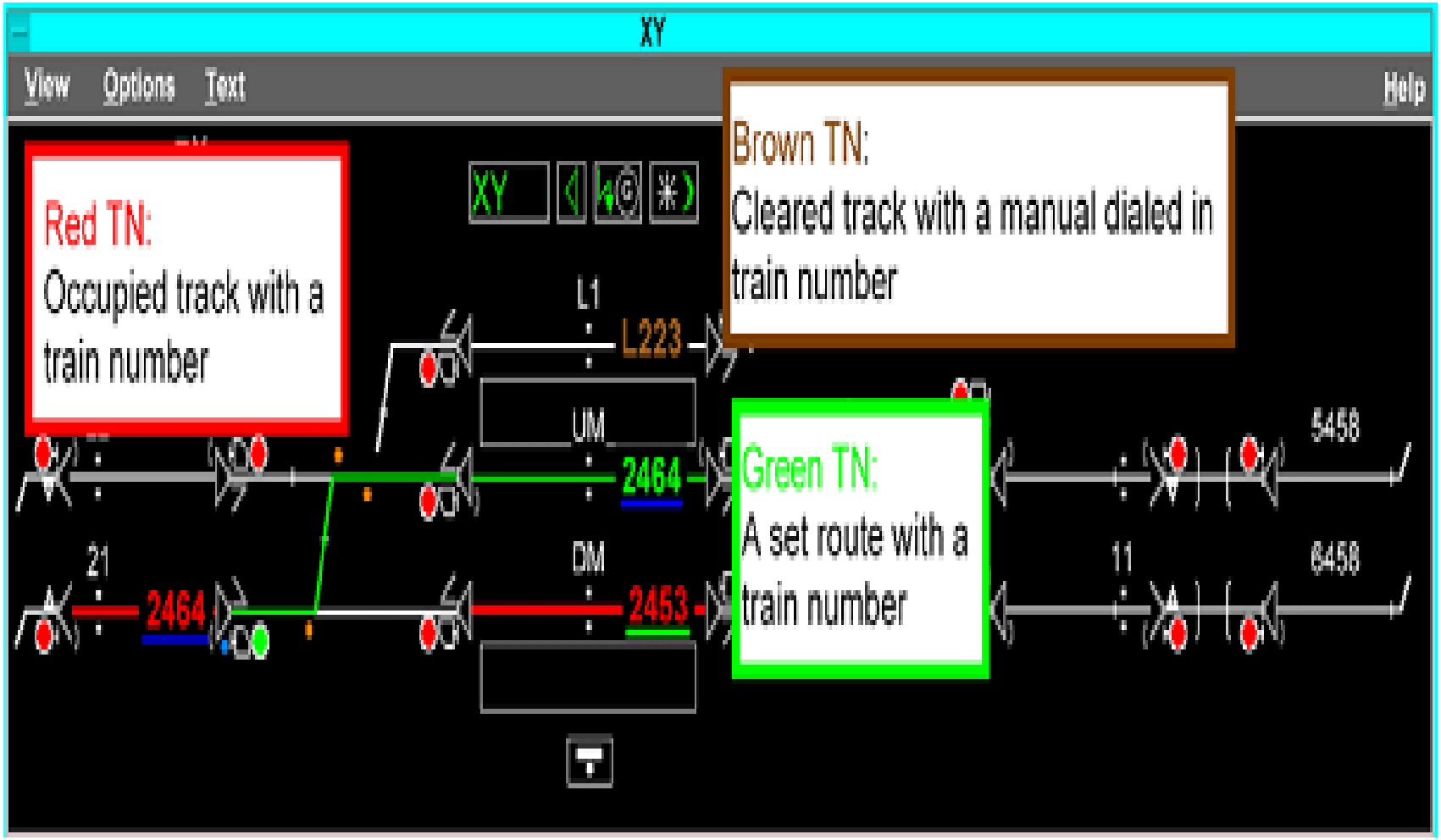
Components

- Train Describer System (TDS)
- Automatic Route Setting (ARS)
- Train Timetable System (TTS)
- Automatic Train Reporting (ATR)

TRAIN DESCRIBER SYSTEM (TDS)

- It indicates which trains occupy the tracks in the views
- It is the basis for the ARS
- It is the basis for communication with other information systems connected to Iltis
- It consists of 4 alphanumeric characters

TRAIN DESCRIBER SYSTEM (TDS)



This view shows the different colours used for train numbers

AUTOMATIC ROUTE SETTING (ARS)

- Planning the train traffic
- Monitoring operations on remote control sections of track
- Ensuring the punctuality of passenger and freight trains
- Rectifying problems reliable and quickly communicating with passengers, relevant services and to staff whenever there is a disruption to scheduled services

AUTOMATIC ROUTE SETTING (ARS)

Train Path

Train Timetable System (TTS)

- Creation and management of up to 10 train timetables. Weekdays, Saturdays, Sundays, public holidays can be handled
- Easy adaptation of the current half day timetable to operational requirements, whenever the need arises
- Scheduling of trains on predefined timings
- Connecting every single train to designated platforms and routes
- Set-up of relations between trains using a wide range of dispatching criteria
- TTS data editing by operators as well as offline-planners

Train Timetable System (TTS)

Date	weekday	Assigned Service-day type	Comment / Reason
01.01.02	Tuesday	Sunday	New Year's Day
28.01.02	Monday	Sunday	Thaipusam
11.02.02	Monday	Friday	Day before Chinese New Year
12.02.02	Tuesday	Sunday	Chinese New Year
13.02.02	Wednesday	Sunday	Chinese New Year
14.02.02	Thursday	Monday	Day after Chinese New Year
23.02.02	Saturday	Sunday	Hari Raya Haji
15.03.02	Friday	Sunday	Awal Muharam
25.04.02	Thursday	Sunday	Installation of the New King
01.05.02	Wednesday	Sunday	Labour Day
25.05.02	Saturday	Sunday	Prophet Muhammed's Birthday
26.05.02	Sunday	Sunday	Wesak Day
01.06.02	Saturday	Sunday	Agong's Birthday
31.08.02	Saturday	Sunday	National Day
04.11.02	Monday	Sunday	Deepavali Day
22.11.02	Friday	Sunday	Nuzul Quaran
06.12.02	Friday	Sunday	Hari Raya Puasa
07.12.02	Saturday	Sunday	Hari Raya Puasa
14.12.02	Saturday	Sunday	Sultan Selangor's Birthday
25.12.02	Wednesday	Sunday	Christmas Day

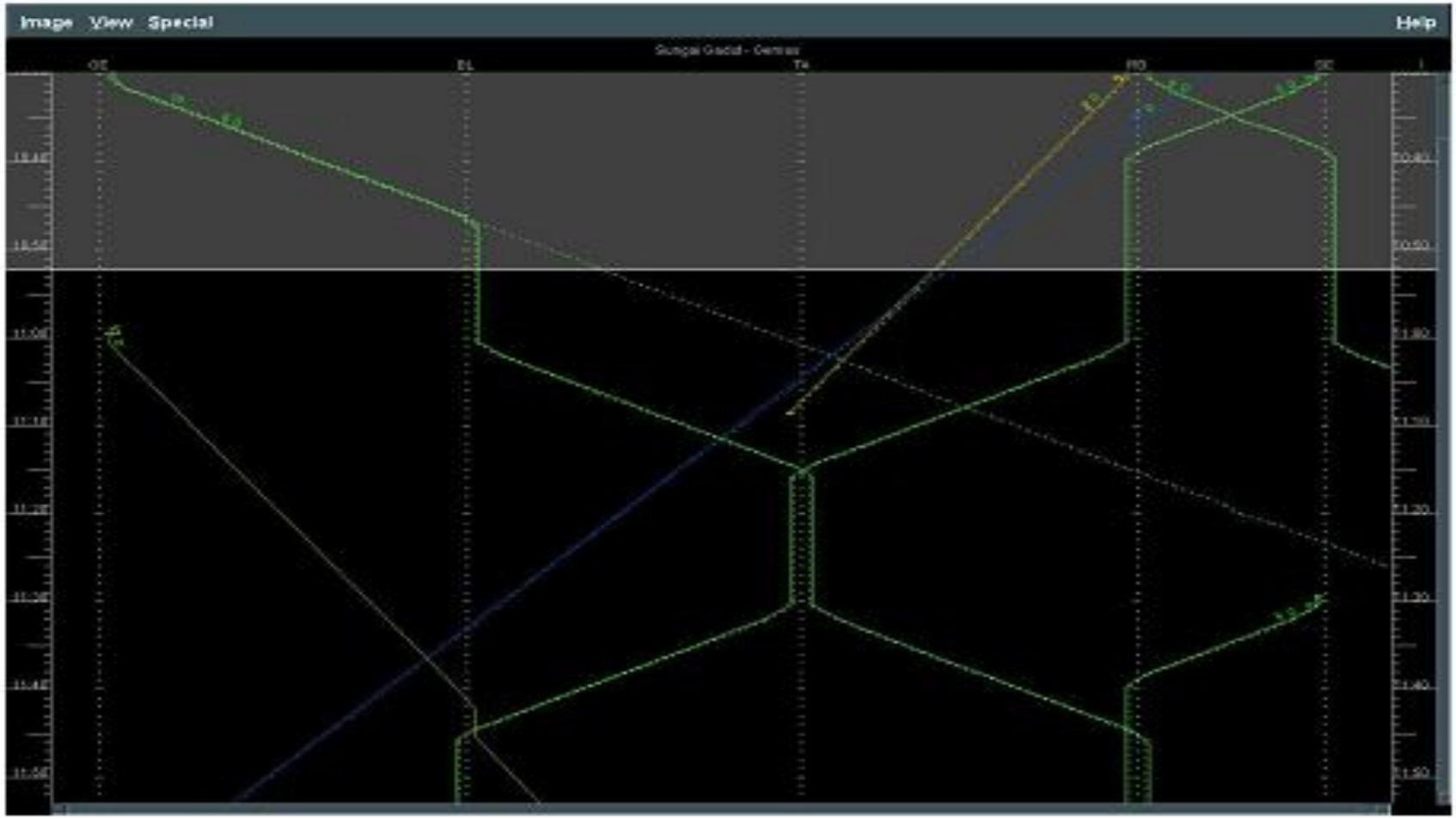
Special Days Schedule

AUTOMATIC TRAIN REPORTING (ATR)

- Monitoring of the current train traffic performance against timetable
- Forecasting the traffic within the next hour
- Prepare and display the information in a concise form, called train graphs
- Store statistical data for later analysis and timetable preparation
- Conflict management and weighted solution scenarios

AUTOMATIC TRAIN REPORTING (ATR)

Sample Train Graph Display



AUTOMATIC TRAIN PROTECTION (ATP)

1. Overview

- The Automatic Train Protection (ATP) system is one of the safety system which are equipped at KTMB trains. It is required to assist a train driver to drive the train safely and efficiently especially when the train has to travel at a high speed and has to complete a long distance journey.

- ATP is functioning by providing a continuously speed supervision while the train is in operation, comparing the actual train speed versus the maximum permissible speed.

- In case of a maximum permissible speed is exceeded or a signal is passed at danger, ATP will protect the train by means of automatic brake application in order to reduce the train speed back to a permitted speed or to command an emergency brake to stop the train when a signal at danger is passed.

- The Automatic Train Protection (ATP) system provides a safe train operation by means of an essential data is transferred from track to train and driver. This is explained by the following:

a. Information regarding the track is communicated to the train

b. The information is stored, process, displayed to the driver and aid is being made to aware of the state of approaching signals and boards.

c. Supervisions of driver actions

d. Any necessary automatic braking of a train

- The KTMB ATP system is consist of two main components:

  a. Onboard system
  b. Wayside system

- They are two types of ATP Onboard system currently used in KTMB:

  a. L10000 - Legacy ATP with Specific Transmission Module (STM)
  b. EBICAB2000 – European Train Control System (ETCS with KTMB STM)

- While as for the infrastructure, only the STM type of Wayside System is currently used at all KTMB double track sector from Padang Besar to Gemas.

2. Component of ATP System

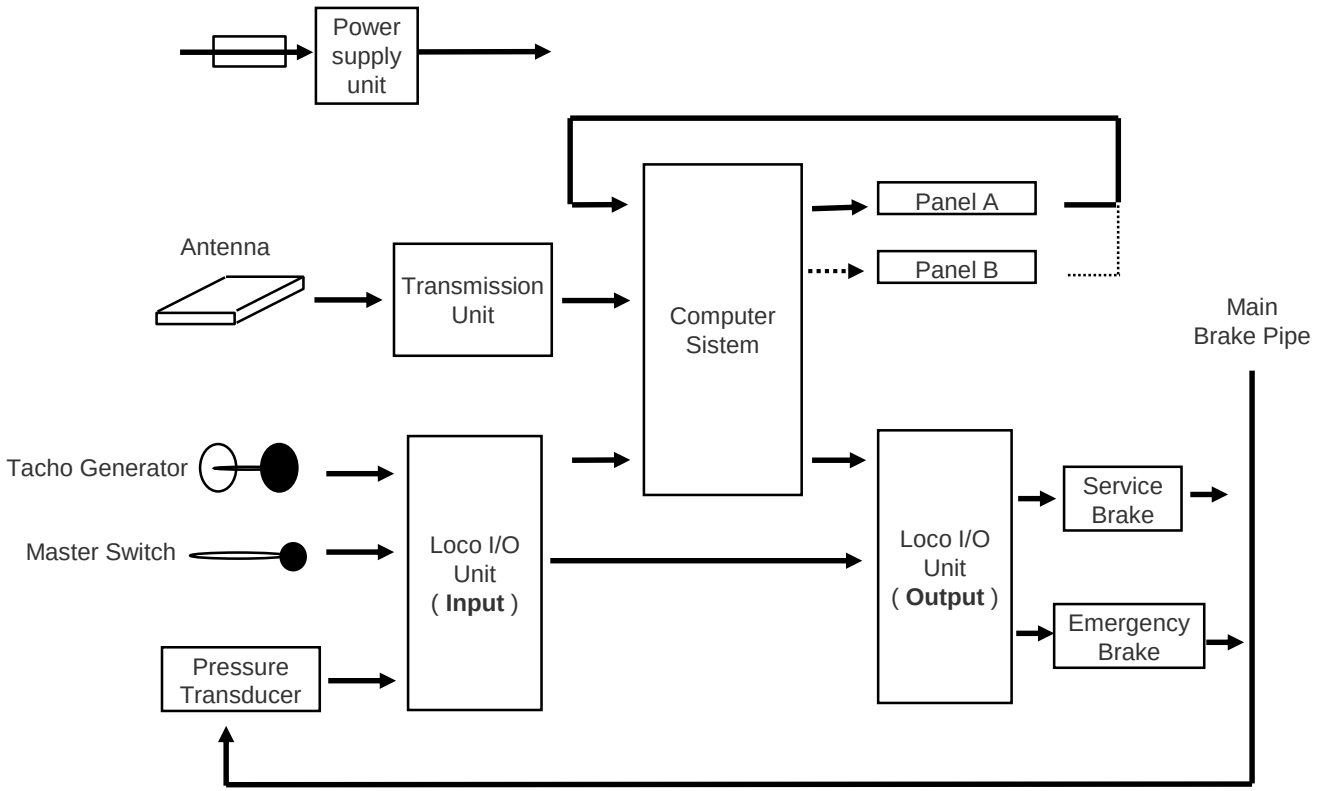
- The ATP system is consist of two main components:

a. Onboard System

b. Wayside System

a. Onboard System

- The ATP onboard system consist of several sub components as illustrated in the diagram below:



- A typical example of the equipment in a onboard ATP System is as follows:

  a. Pressure Transducer providing signals for indicating the status of the pressure in the main brake pipe or pressure in the brake cylinder

  b. Input interface to the train Master Key for Cabin active input signal.

  c. Interface to the electrical control system of the vehicle for cabin active, forward/reverse direction, speed & distance, brake feedback and etc.

  d. Antenna and communication equipment for the reception of track data from Transponder.

  e. Evaluation computer equipment

  f. Driver panels

  g. Output interface to the vehicle brake system.

  h. Recorder unit for event logger.

- Main components of ATP Onboard

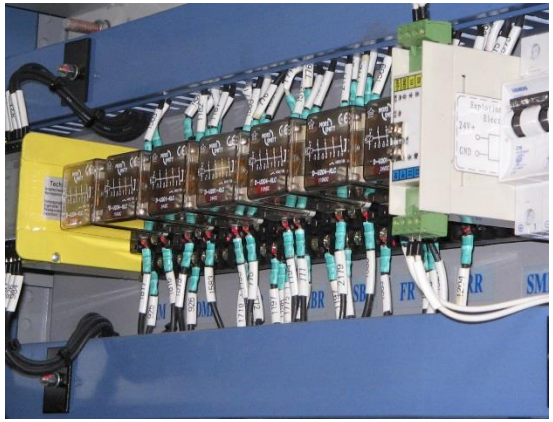
a. Evaluation unit

- CPU unit
- Loco I/O unit
- Comparator unit
- Transmission unit
- Power unit
- Recorder unit

Function:

- To interface with train control system and brake system
- To validate and process wayside data received from Transponder
- To generate a 27Mhz downlink power frequency for Transponder activation.
- To performed a maximum permitted speed supervision versus actual train speed
- To command brake
- Event logger

b. Relay interface between ATP and rolling stock



Function:

- To allow cabin active, forward and reverse input signal received from rolling stock to the ATP.
- Brake command output signal sent out from ATP to the rolling stock brake system.
- Brake Feedback Input Signal received from rolling stock brake system to the ATP.

b. Driver Panels

Display Panel/Data Panel

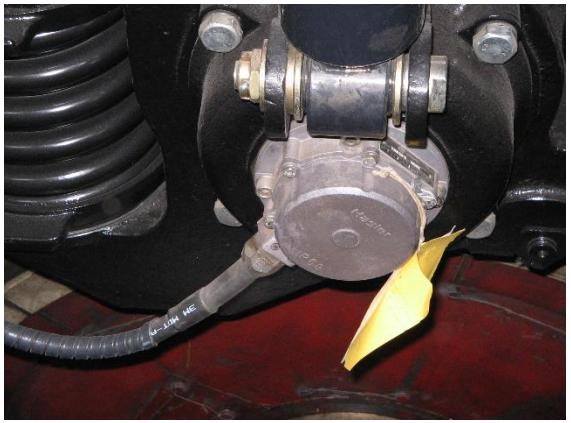
Driver Machine Interface(DMI)

Function:

- To Display information on Maximum Permitted Speed, Target Speed, Target Distance, Actual Train Speed Over speed Audible Alarm and ATP Brake Intervene.

- Train category data input such as Train Length, Deceleration Factor and Maximum Train Speed use for onboard speed supervision.

c. Speed and Distance Unit



- Pulse Generator

Function:

- To provide a speed and distance input data use by the evaluation unit to calculate the actual train speed and travelling distance.

d. Pressure Sensor

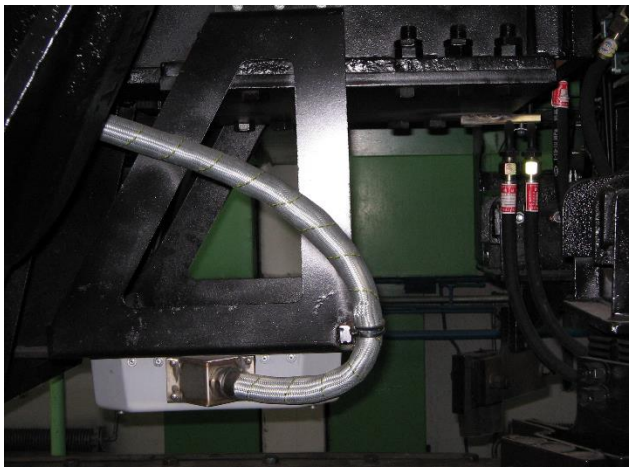
Function:

- To provide a brake feedback information in order to ensure a sufficient brake pressure reduction is achieved upon ATP brake intervention.

- To provide an information on a current status of a Main Brake Pipe or Brake Cylinder pressure in order to ensure a sufficient air pressure is available for the ATP brake application.

- The pressure gauge range is between 350kpa to 550kpa in Main Brake pipe.

e. Antenna Transmission Coil

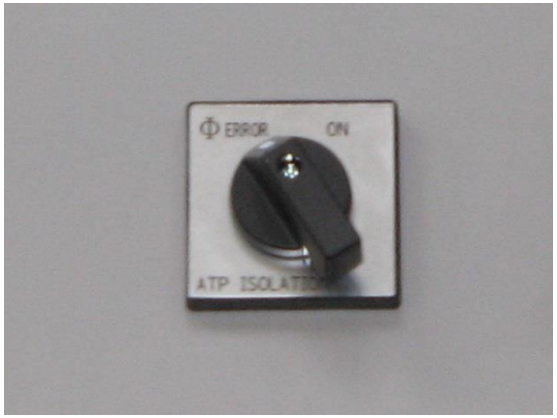


Function:

- To transmit a 27Mhz, 20W downlink Power Frequency for Transponder activation.

- To receive a Transponder data via uplink 4.5Mhz Modulation Frequency when a Transponder is passed.

f. Isolation Switch



Function:

- To isolate the ATP system supervision and brake commands after a major failure of the ATP Onboard system.

- Both Emergency and Service Brake shall be in released state while the ATP onboard system is isolated.

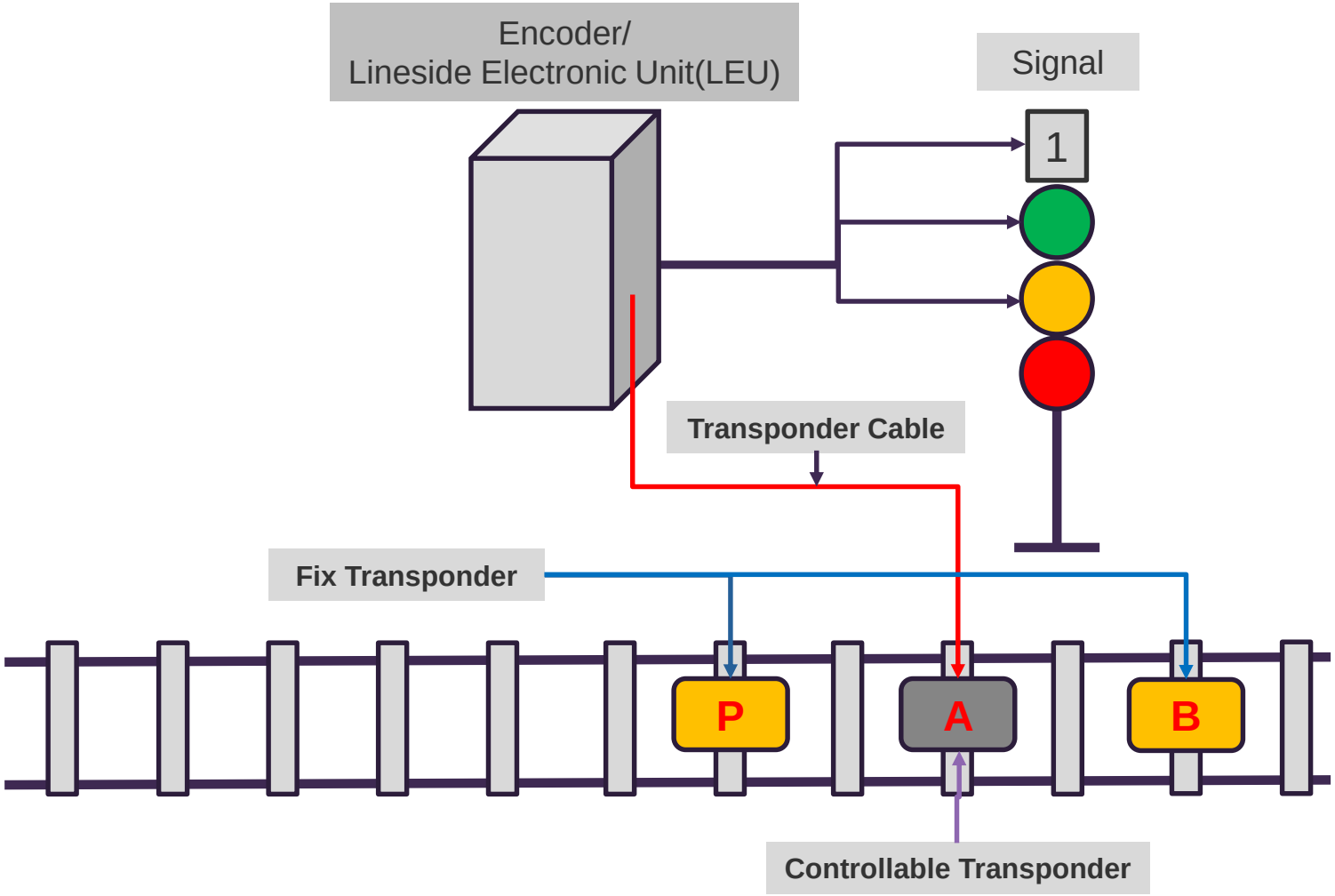
b. Wayside System

- The ATP Wayside system consist of sub components as below:

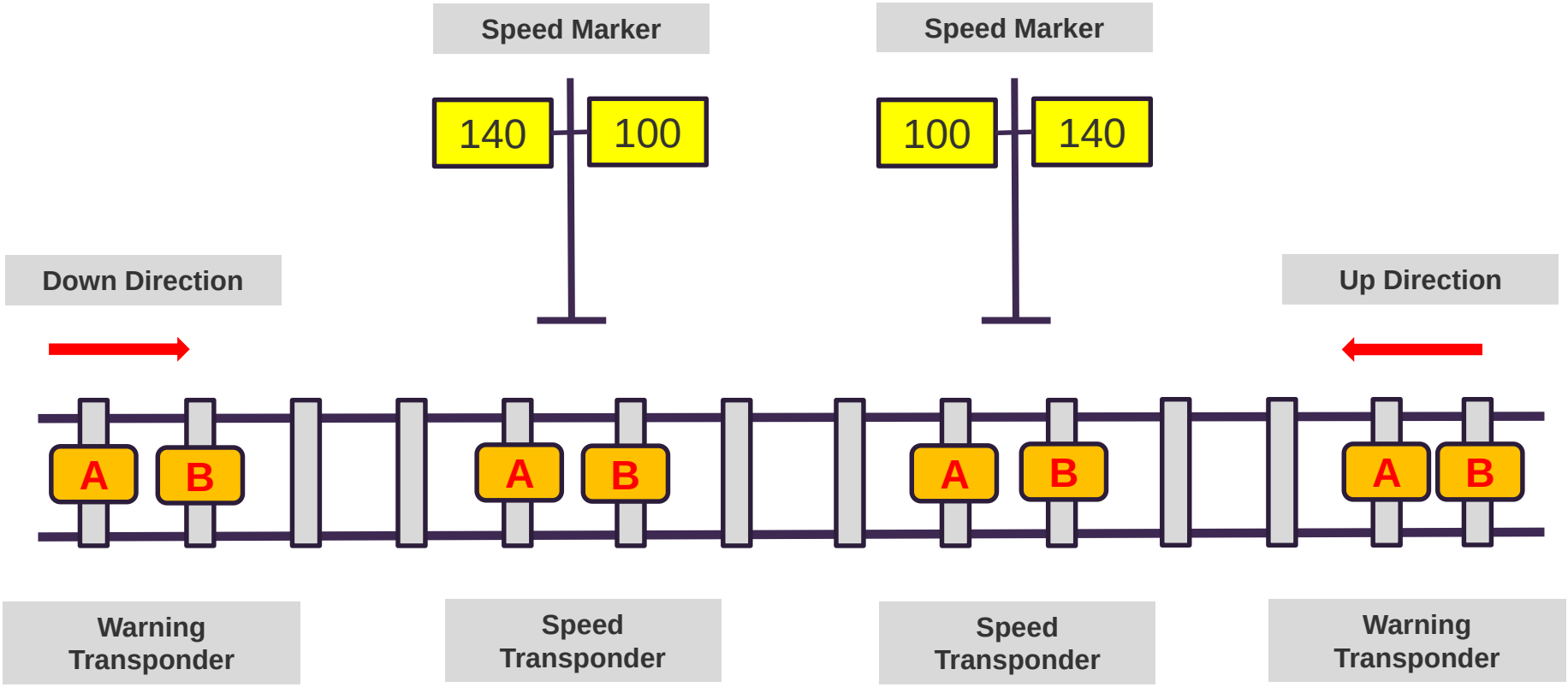
    a. Lineside Electronic Unit (LEU)

    b. Transponder

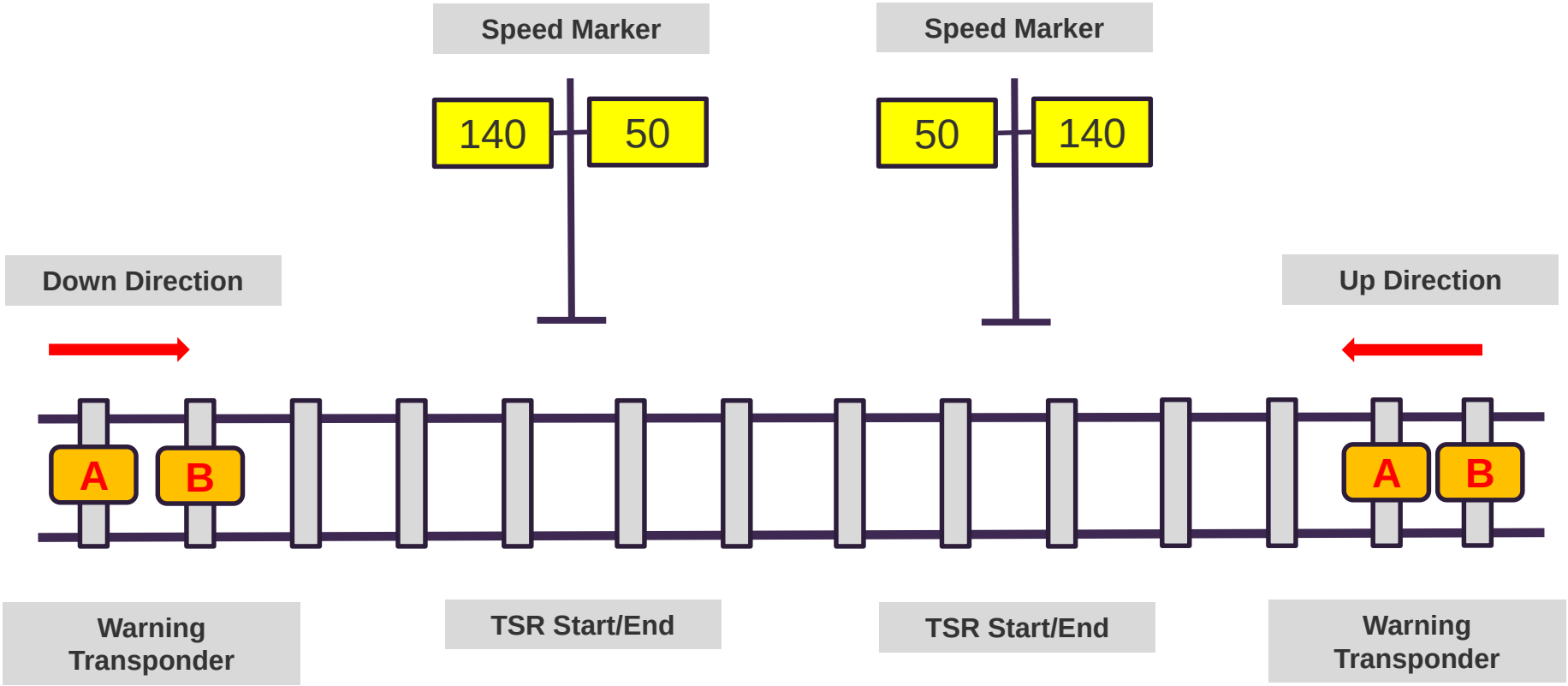
- Typical installation of the ATP wayside equipment at signal.



- Typical installation of the ATP wayside equipment at Permanent Speed Restriction



- Typical installation of the ATP wayside equipment at Temporary Speed Restriction (TSR)



a. Serial Encoder or LEU

Function:

- To sense the status of signal lamp aspect via Lamp Detector Board.
- To encode and trigger the signal lamp aspect information to the controllable transponder via Balise Driver Board and transponder cable.

b. Transponder or Balise

Two types of Transponder

i. Controllable Transponder

ii. Fix Transponder

Function:

- Transponder is a passive device. It is energized by 27Mhz, 20W downlink power frequency transmitted by the onboard antenna when the onboard antenna is passing over the transponder.
- Upon energizes, transponder generates a 4.5Mhz carrier frequency to modulate with transponder data (telegram)
- Controllable transponder received a signal data (telegram) from encoder and transmit the signal aspect information which modulated with a 4.5Mhz carrier frequency to the onboard system.
- Fix transponder is programmed with a fix wayside data such as track speed, target speed, target distance, gradient, signal overlap and etc. while the controllable transponder is programed with a default error telegram.

b. Programming and Testing Equipment (PTE) and Handheld Computer

PTE

Handheld PC

Function:

- To program the encoder module at signal.
- To program wayside data at a fix transponder or to program a default error telegram at controllable transponder.
- To read the data at transponder.

3. ATP Supervision

- They are two types ATP supervision:

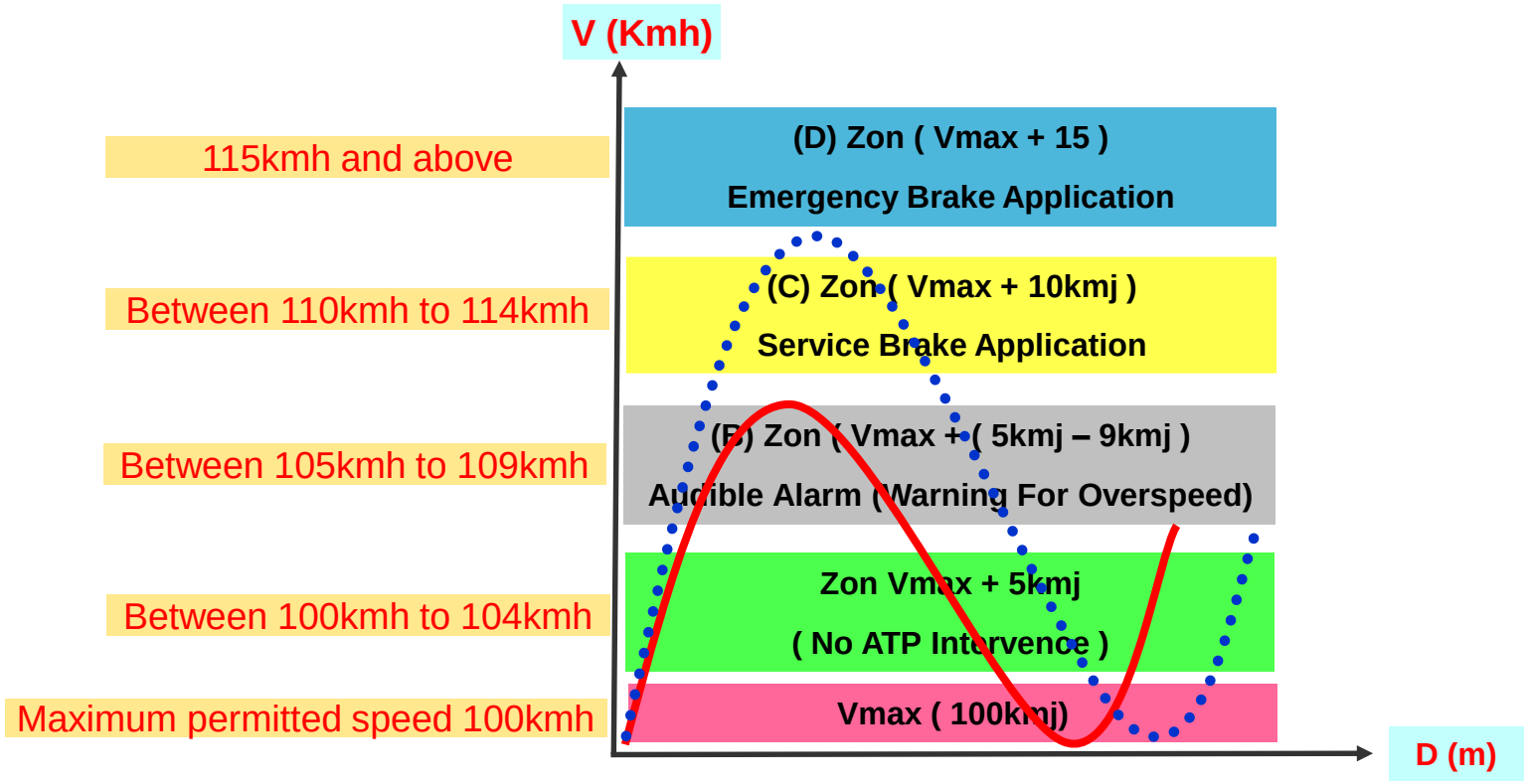
a. Maximum Speed Supervision

b. Target Speed Supervision

a. Maximum Speed Supervision

- Maximum speed supervision is refer to the Maximum Line Permitted Speed supervision which is the lowest speed between:
  i. Train speed
  ii. Signal Speed
  iii. Track Speed
- ATP system will continuously supervise the maximum permitted speed against the actual train speed at all time while train in operation.
- Audible alarm will be triggered and displayed at ATP panel to alert a train driver while over speeding.
- In case of maximum permitted speed is exceeded, ATP will commands Full Service brake or Emergency brake in order to reduce the train speed.
- The ATP brake then has to be manually release by a driver when the train speed has been reduced to the maximum permitted speed.

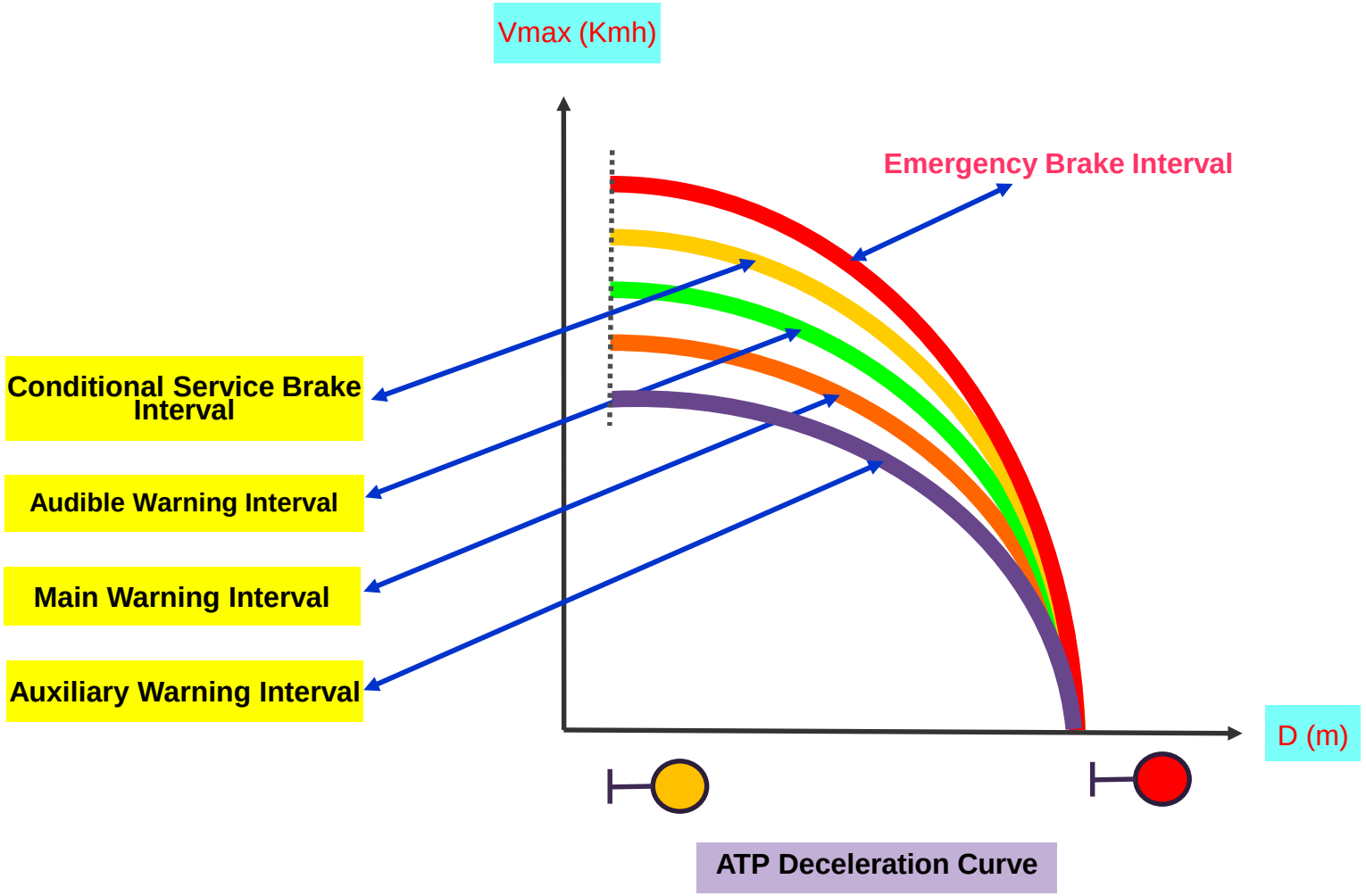
- The diagram below illustrated how the ATP system perform the maximum speed supervision:



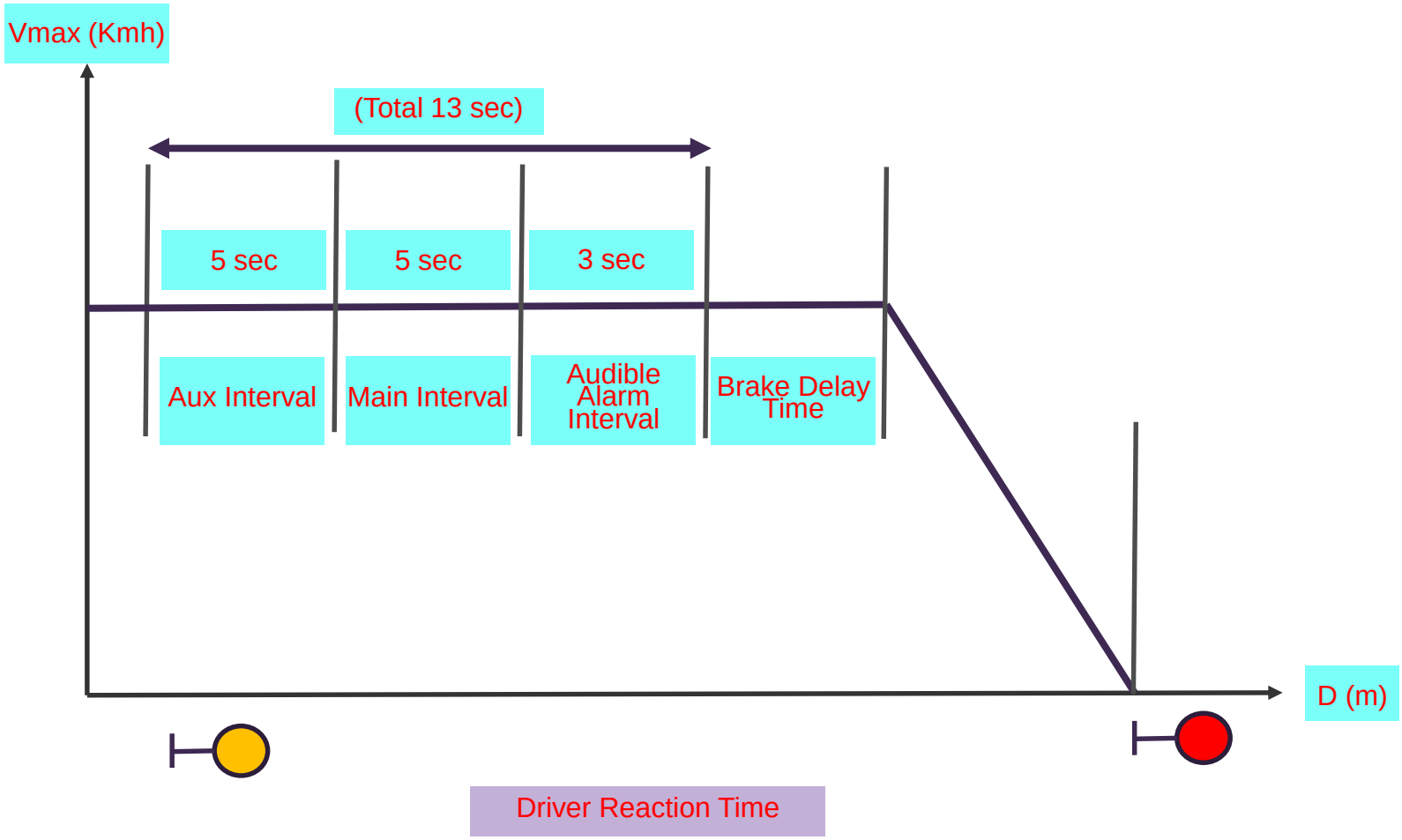
b. Target Speed Supervision

- They are two types of ATP target speed supervision
  i. Target Stop supervision at danger signal
  ii. Target Speed supervision at speed restriction area
- The ATP onboard system will calculates a Safety Braking Distance Curve upon receiving a target stop or target speed information from track site.
- The train driver is given with a 13 seconds warning period before the ATP brake is commanded while approaching a target signal or starting of speed restriction area.
- In case of the train speed is above the safety braking curve, ATP will commands a Full Service Brake or Emergency Brake in order to reduce the train speed.
- The ATP brake then has to be manually release by a driver when the train speed has been reduced to the permitted speed.

- The diagram below illustrated how the ATP system perform the target stop supervision:



- The diagram below illustrated a total driver reaction time while the Target Stop or Target Speed Supervision:



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Any Questions

THANK YOU