



# Domestic Signaling System



# About Us

HISTACO company which is known as the one of the biggest EPC contractors in the fields of telecommunications, signaling, control, etc. in IRAN railway industry. Since 2011, this company has designed, implemented, produced and localized signaling system subsystems, including electronic interlocking system, frequency track circuit system and the other parts of signaling system in keeping with the relevant international standards (CENELEC), which has received official approval from ISLAMIC REPUBLIC OF IRAN Railway Company and tehran Urban Railway Company, and succeeded to sign contracts for the tehran Metro line 1 extension and Shiraz Metro line 2 and some railway projects. the company's products are also under assessment by a European certified assessor company in pursuance of obtaining SIL4 certification.



## Domestic Signaling System

1

HISTACO

**HISTACO interlocking system consists of following main parts:**

**Panel Unit:** It is responsible for receiving commands from the user and displaying the statuses. This unit has the responsibility to connect the user and the interlocking system. It can be local or remote type.

**Main Computer Unit:** Commands and statuses processes and execution of system logic are performed in this unit. Additionally, in the case of achieving the intended reliable result, it sends commands to the relevant areas and equipment. In order to this issue, this unit receives user commands from the panel unit and performs the required logical processing, according to the status of the environmental elements that it has received from the Object Controller units, and sends the desired commands to the Object Controller. This unit also sends the received statuses of the elements to the panel unit to display them to the user.

**Block Unit:** This unit is responsible for communicating

with the adjacent station and carrying out operations to dispatch or accept the trains from adjacent railroad areas.

**Communication Unit:** Consists of a set of switches and gateways that establish communication between different units and parts of the interlocking system.

**Input-Output Unit (IO):** Receiving commands from the central processing unit and applying them to the object controller units and vice versa, i.e., receiving the status of the object controllers and sending them to the central processing unit is the responsibility of this unit.

**Object Controller Unit:** Receiving commands from the input-output unit and applying them to the equipment. It also sends the received statuses of the equipment to the input-output unit.

**Automatic Train Protection Unit:** A set of software and hardware modules responsible for generating safe data code considering various available data (train position, line specifications, speed, operation plan, etc.) finally, these codes are sent to the train onboard through various platforms including frequency track circuit system, loop, balise, etc.

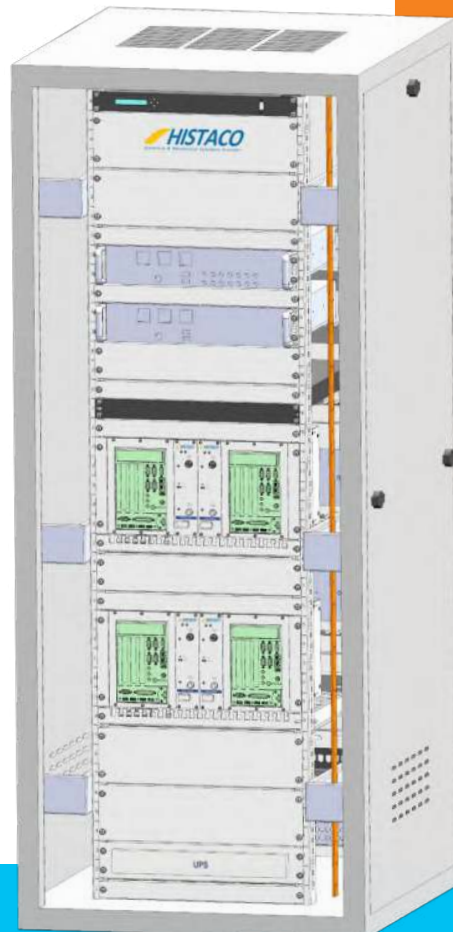
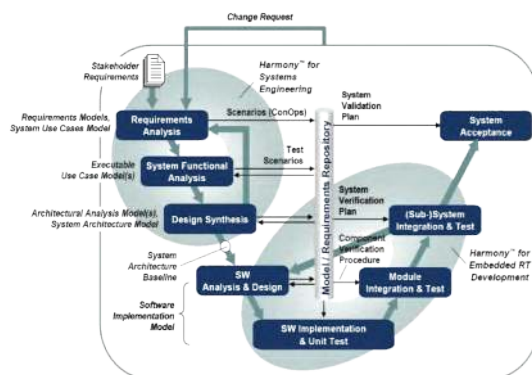
**Diagnose Unit:** It is responsible to collect, record, and display the events related to the all parts of the system and playback them locally or remotely .



HISTACO Interlocking System can manage and perform all defined operations and activities in the IRAN railway and subway lines. This system consists of software and hardware components. It covers the Safety, availability, maintainability, and reliability (RAMS) requirement. In addition, it has other features such as fast response and ease of use. The main tasks of this system are:

- Controlling the safe movement of trains at the station and along the line
- Controlling the dispatch or admission of trains from adjacent railroad areas
- Emergency control at the station
- Connecting to the train on-board system by sending data
- Continuous monitoring of station equipment and displaying their status
- Storing the important events and logs and playback them if needed

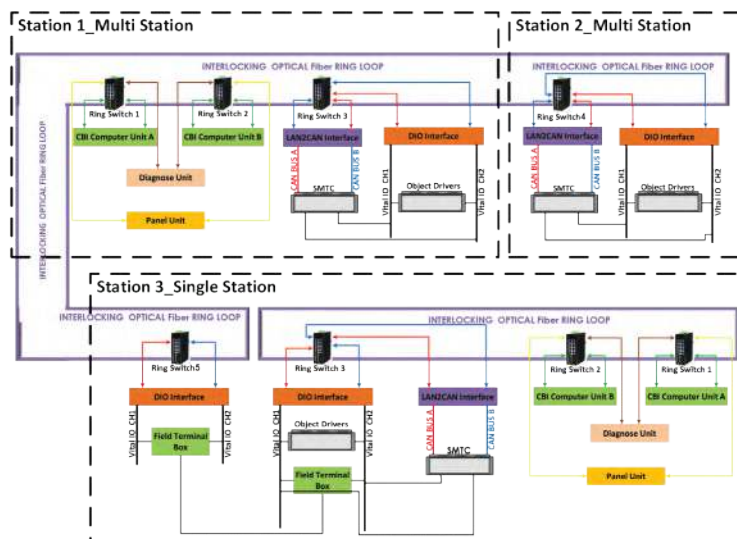
In order to consider and take into account the principle of design and manufacturing, all steps of design, implementation, and testing of HISTACO local interlocking system have been performed based on IBM Harmony methodology. This group's attempt in this process by considering the safety standards in all stages of design, manufacturing, and testing has led to acceptable reliability for the final product and having a safe approach (Fail-Safe) to all station events for the final product.



| Unit              | Capabilities                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| HMI Panel&CTC     | <ul style="list-style-type: none"> <li>• Compliance with IRAN railway and Metro projects Rules</li> <li>• User-friendly graphical user interface (User- Friendly)</li> <li>• Easy to use and training by different users</li> <li>• Modular architecture to adapt and configure to different stations in a short time</li> <li>• Safety in receiving commands by not displaying unauthorized commands at any time</li> <li>• Different access levels for different commands</li> <li>• Ability to define user account, password and personal profile for different users</li> <li>• Redundant communication from two independent paths to the interlocking system</li> <li>• Local, remote and Central Control and Monitoring</li> </ul> |
| Main Computer     | <ul style="list-style-type: none"> <li>• Analyzing and decision making according to the rules of the Railway and metro projects</li> <li>• 2 out of 2 Double architecture for more reliability and availability</li> <li>• Using the VxWorks operating system for safety reasons</li> <li>• Design, development and testing based on IBM Harmony methodology</li> <li>• Ability to adapt and configure to different stations in a short time</li> </ul>                                                                                                                                                                                                                                                                                  |
| Block             | <ul style="list-style-type: none"> <li>• 2 out of 2 Double architecture for more reliability and availability</li> <li>• Ability to perform the processes manually, semi-automatically or fully-automatically according to customer needs</li> <li>• Ability to connect and communicate with the block system of other brands of interlocking system manufacturers</li> <li>• Full coverage of block system logic and all related commands</li> </ul>                                                                                                                                                                                                                                                                                    |
| Communication     | <ul style="list-style-type: none"> <li>• Using standard protocols</li> <li>• Using industrial equipment</li> <li>• Based on Ring Network Topology</li> <li>• Redundancy features</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| IO                | <ul style="list-style-type: none"> <li>• 2 out of 2 architecture for more safety and reliability</li> <li>• Using standard communication protocols</li> <li>• Ability to use and adapt to various electronic and relay based object controllers</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Object Controller | <ul style="list-style-type: none"> <li>• Design and manufacturing of point machine, signal light and balise drivers</li> <li>• Architecture with a safe (Fail-safe) approach when an error occurs</li> <li>• Electronic based version compatible with customer needs</li> <li>• Relay based version compatible with customer needs</li> <li>• Utilizing components and equipment approved by the IRAN railway and metro companies</li> <li>• Modular design for easy installation and maintenance</li> </ul>                                                                                                                                                                                                                             |
| ATP/ATO           | <ul style="list-style-type: none"> <li>• Design and implementation of hardware and software modules with high reliability</li> <li>• Ability to adapt to onboard equipment of different manufacturers and send a complete packet data to them</li> <li>• Full implementation of all system expected functions</li> <li>• Simulation of ATP/ATO and onboard system software and their behavior</li> </ul>                                                                                                                                                                                                                                                                                                                                 |
| Diagnose          | <ul style="list-style-type: none"> <li>• Collecting and recording all events in the station at any time</li> <li>• Automatically recording back up data</li> <li>• Ability to access and display events locally or Remotely</li> <li>• Ability to playback events</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                             |



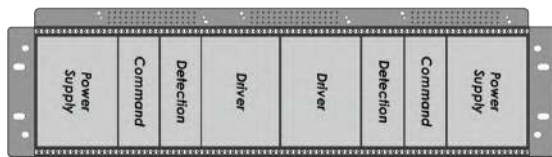
The configuration of HISTACO interlocking system in each line can be Multi-Station or Single-Station. Each station is controlled by an interlocking system in the Single- Station type, only a ring switch and DIO interface are installed in the adjacent station to connect the block communication to the interlocking of the adjacent station. However, in the Multi-Station configuration, several stations are controlled by an interlocking system. As a result, CBI computer units, a panel unit, and a diagnostic unit are located in one station. In the other stations, several Object Controllers of the line side equipment are installed in that station.



## Point Machine Object Controller

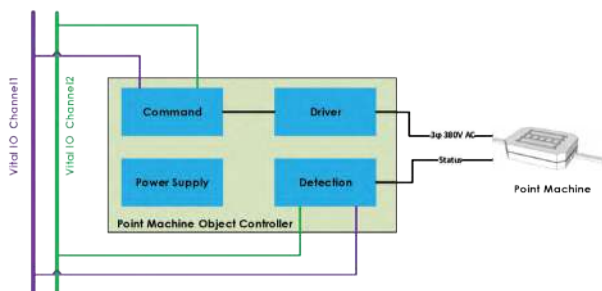
Each point machine controller sub-rack is including two point machine controllers.

Each point machine controller has 4 cards including Command, Supply Power, Detection and Driver.



### Capabilities:

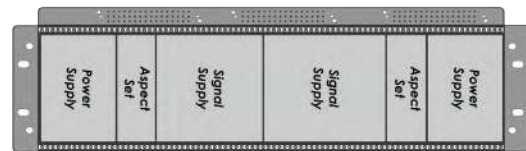
- Ability to move the point machine in both normal and reverse directions
- Ability to detect the point machine status, when it reaches to the end of the course and cut off the motor voltage
- Ability to instantly detect the status of the point machine
- Supplying three-phase 380 VAC power to move and change the position of the point
- Using relay output using relays with EN61810 and EN50205 standards for fail-safe driving and detecting the status of the point machine



## Signal Light Object Controller

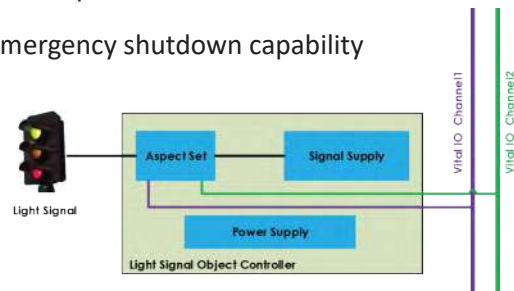
This sub-rack is including two signal light controllers.

Each signal light controller has 3 cards including Aspect Set, Power Supply and Signal Supply.



### Capabilities:

- Turning on the LED signal light lamps
- Changing the view of the signal light to the desired aspect
- Making a flashing aspect
- Correct detection of bright aspect
- Ability to detect aspect health
- Ability to adjust the voltage between the two ends of the lamp in the initial drive
- Emergency shutdown capability



## HISTACO Frequency Track Circuit (SFTC)

The domestic frequency track circuit system of HISTACO company, SFTC, has capability of integrated detection of occupation and vacancy of railway, subway, and other types of urban railway tracks. The separation of the tracks in this type of track circuit is done by electrical separators. The operation of this system is that at the beginning of the track, the rail is powered by an AC power (in the range of audio frequency that reduces the effect of ambient noise) which is received from the transmitter unit. In the end, the receiver unit of this voltage receives and checks the track circuit.

Considering the amplitude (signal level), frequency, and modulated code of the received voltage, one of the two occupied or vacancy states is applied to the interlocking system. The distance between the transmitter and receiver cards (which are installed at the interlocking structure) from the track (rail) can be up to 6.5 km. (the recipient card is up to 2.7 km).

SFTC frequency track circuit is designed, produced, and used in two types SFTC4 and SFTC8. SFTC8 frequency track circuit is used for rails with a maximum length of 950 meters and SFTC4 is used for rails with a maximum length of 1500 meters.

SFTC frequency track circuit is produced and used in the single, double and triple receivers. The double receiver track circuit is used for long tracks and the triple receiver is used to cover the needle area.

The SFTC frequency track circuit system consists of two main parts: indoor equipment and outdoor equipment near to the track. Indoor equipment includes track circuit sub-rack, power supply sub-rack, and compensating resistance module sub-rack. Unit tuning and impedance bond units are also considered as side-track parts of this system.

### Capabilities and Benefits

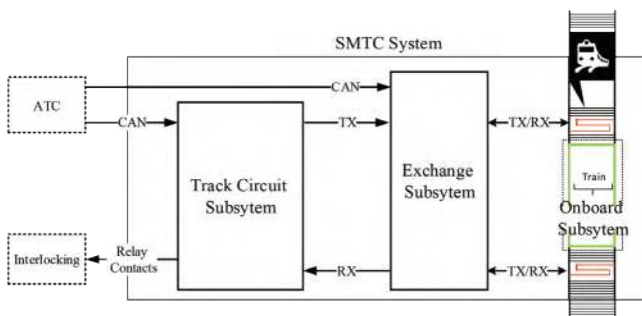
- FSK modulation to send and receive signals
- Using three factors of power, frequency and bit pattern of the signal to increase the accuracy and safety factor
- Continuous monitoring on the track, including in the needle areas
- Remote feeding without using electrical equipment near to the track
- The possibility of reverse current of the electric train passing from the rails
- Ability to direct the reverse current of a train from both rail arms (in case of using a bond)
- Ability to detect fractures in rails
- Safe design, high reliability, low maintenance and repair costs
- Fail-safe track detection system even if the power supply is cut off from the system or a failure
- Compatible with interfering electric currents (even when using magnetic brakes and eddy current brakes)
- No need for mechanical insulation and rail cutting due to the use of resonance circuits for separation



## HISTACO Frequency Track Circuit (SMTC)

The audio frequency track circuit with data transmission capabilities is called SMTC, which is a complete design of the SFTC frequency track circuit that is equipped with a train transmission system. In this kind of track circuit, an audio frequency signal is injected into the rail, and at certain intervals (30 to 1500 meters), one (or more) receiver/s receives the signal. If a train is on the track between the transmitter and receiver, shunting this high-frequency signal will prevent the receiver from receiving this signal, which means there is a train on the rail. Moreover, due to the modulation used in the audio frequency track circuit, these systems are capable of modulating and sending data to the train using a magnetic coupling between the rail and the train.

This track circuit includes indoor equipment and line side part. The SMI9 interlocking system is connected to the indoor parts of the SMTC equipment.



### The components of this system are as follows:

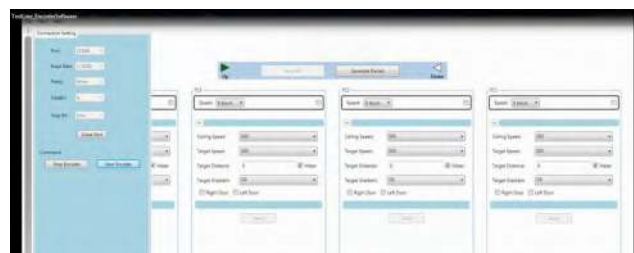
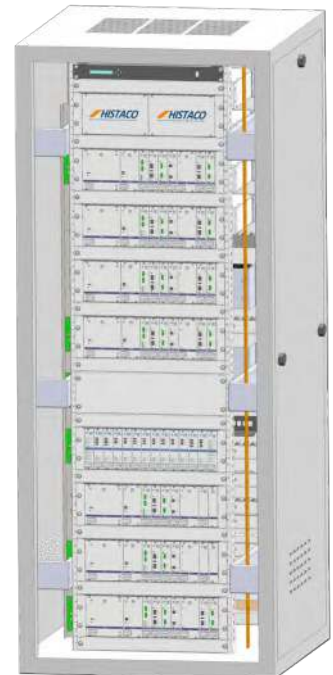
- Track Circuit subsystem
- Exchange subsystem
- Train onboard receiver subsystem

The track subsystem acts as the heart of the system, performing all the functions from detecting the presence of a train to sending data received from the ATC to the rail. In other words, it performs all bit pattern modulation operations, amplifying them and sending them to the rail, also amplifying the signal received from the rail, demodulation, comparing the

sent and received bit pattern, and finally sends the status of track occupancy/ vacancy to the interlocking system. The exchange subsystem receives the change command between transmitter and receiver from the ATC then changes the transmitter and receiver wire heads on both sides of the track. Finally, the train onboard receiver subsystem that receives the data sent from the track circuit on the train cabin.

### SMTC Track Circuit Capabilities Include:

- Detects the train on the track and reports its status to the interlocking system.
- Receives ATP data from the interlocking system and send it to the track if the related track is occupied.
- Automatically stops sending ATP data to the track if disconnected from the interlocking system.
- Ability to change the location of the transmitter and receivers of the track circuit by the received command from the interlocking system in single-receiver and dual-receiver modes.
- Ability to send data in line with a maximum length of 300 meters for single receiver mode and 700 meters for dual receiver mode.



| Characteristic                                                     | Value                                                                                                                    | Info.                                                                                                                                                                               |
|--------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| System input voltage                                               | 88 ~ 132VAC or 176 ~ 264VAC or 248 ~ 373VDC                                                                              | Adjustable with switch.                                                                                                                                                             |
| Frequency of operation                                             | 6.1 KHz, 7.7 KHz 6.3 KHz, 8.5 KHz<br>5.7 KHz, 7.3 KHz, 6.5 KHz, 8.1 KHz                                                  | Audio frequency range                                                                                                                                                               |
| Modulation type                                                    | Frequency shift modulation                                                                                               | 100Hz± with FSK                                                                                                                                                                     |
| Bit Pattern number                                                 | 15                                                                                                                       | -                                                                                                                                                                                   |
| Bit pattern and data transmission rate                             | 197.6bit/s                                                                                                               | -                                                                                                                                                                                   |
| Protection types                                                   | <ul style="list-style-type: none"> <li>• Lightning protection</li> <li>• Transmitter short circuit protection</li> </ul> | -                                                                                                                                                                                   |
| Separation point type                                              | No need for physical isolation                                                                                           | The electrical isolation of band S, long shunt and band terminal. Physical separation is also possible.                                                                             |
| Overlap area length                                                | 14-19 m                                                                                                                  | Depends on the type of separation of the two track circuits.                                                                                                                        |
| Number of channels for each receiver and output to interlocking    | Two separate channels                                                                                                    | Design of two channels of receiver equipment, for error detection according to the different status of the two output relays                                                        |
| Number of outputs to interlocking                                  | NO:2 / NC:2                                                                                                              | All contacts are isolated                                                                                                                                                           |
| Delay in announcing the track being clear                          | 600-1300ms                                                                                                               | adjustable per customer's request                                                                                                                                                   |
| Delay in announcing the track being occupied                       | 170-250ms                                                                                                                | adjustable per customer's request                                                                                                                                                   |
| Maximum delay in entering data mode after the track being occupied | 2ms                                                                                                                      | -                                                                                                                                                                                   |
| Delay to status detection mode after the track being clear         | 1300ms                                                                                                                   | If the track is clear and the ATC does not issue a command to enter the status detection mode, the SMTC will automatically enter the status detection mode after 1300 milliseconds. |
| Delay switch to track detection mode if no data signal is received | 5s                                                                                                                       | If the data signal does not have an edge for 5 seconds, the SMTC automatically enters the train presence or absence detection mode.                                                 |

## Domestic signaling system

### The main features:

- Design, implementation, manufacturing, supply, installation and commissioning according to the life cycle (V-model)
- High Reliability and Availability
- ATP/ATO functions
- Communication with other signaling system manufacturers
- Compatibility with all kind of line side equipment
- Full implementation of railway and subway signaling functions in the interlocking software
- Fixed Block and Distance to Go design
- Full redundant
- Modularity, scalability, flexibility and decentralized architecture
- Design and manufacturing of point machine, signal light and balise drivers
- Ability to decode and complete access to the onboard equipment code
- Design and development of different hardware testers and software simulators





### CONTACT US:

 Number 75, Hayamanesh street, Shahid kaboli street,  
Seyedkhandan, Tehran, Iran

 +9821-88463868

 +9821-88466474

 [info@histaco.com](mailto:info@histaco.com)

 [www.histaco.com](http://www.histaco.com)