

PENCHALA Road Link Tunnel Kuala Lumpur

Overview

The Penchala Link tunnel, which stretches from Penchala right to the Kerinchi Link is the first “Smart Tunnel” system in Malaysia. Fondly known as the Tunnel Monitoring and Control System (TMCS). The “Smart Tunnel” system controls and monitors the Tunnel system - only from the touch of the mouse. It is part of *Lebuhraya Sprint Traffic Dispersal Scheme Package C*.

Complete design, engineering, testing and commissioning is done by inCONTROL Tech Sdn. Bhd. Malaysia (formerly known as VA TECH SAT Sdn. Bhd.).

It is an 800 m 2 x 3 – lane tunnel for each direction of the traffic. It has three (3) cross passageways that connects both traffic tunnels to each other. Monitoring equipment is stored in the cross passageways.

The TMCS can control the tunnel on an automatic mode. It controls the ventilation, lighting, electrical distribution, emergency telephone, fire

services and traffic signals. All of this is monitored from its two (2) workstations, Tunnel Control Room Workstations (TCRWS) and Damansara Control Centre Workstations (DCCS).

Most of the time, operation off the tunnel will be monitored by the DCCS group. Only in the case when the DCCS group is not available, or the fiber-optic link between Tunnel Control Room and the Damansara Control Centre is out of order, the TCRWS can be used for operation purposes.



Figure-1: Tunnel Portal, 1 Tube



Figure-2: Local TCMS Control Room

TCMS Functions

A) Ventilation System

The purpose of the tunnel ventilation system is to control the jet fans pairs necessary to dilute air pollutants which contains VCO, NO and also improve visibility VI (dust particles) by diluting exhaust smoke generated by diesel powered trucks, buses and taxis.

B) Lighting System

Based on the photometers located at the outside of the tunnel, the amount of lights switched on will be given by the logics in the PLC. The higher the light intensity, the more lights that will be switched on and vice versa. This is to avoid temporary blindness that occurs when a person moves from areas of high difference of lighting luminosity. The lighting system can also be controlled manually.

C) Electrical Distribution System

This is the monitoring system of the electrical distribution. This includes the circuit breakers, the voltage readings, the current readings, active and reactive powers, power factors and protection relay signals.

D) Emergency Telephone

The emergency telephone system is used to monitor and control the calls coming in from the emergency telephones located in the Tunnel. These phones are IP based phones, and communication is established through a server-to-server link. A user may answer, hold, hang up or transfer a call coming in from the field. A user may also call out to a particular phone.

E) Fire Services System

The Fire Services Overview shows all the fire related signals coming in from the fire alarm panel via Modbus protocol. There is also a Fire Incidence overview System that will prompt the operator to choose between these following three fire programs:

- the ventilation program,
- the lighting program,
- the traffic program.

The ventilation program stops all jet fans then restarts it except the one in the fire zone, it also closes all fire dampers in the affected tunnel and starts the pressurization fans to blow the smokes back to into the affected tunnel.

The lighting program switches on all the lights to bring maximum visibility to all the tunnel users.

The traffic program will indicate red crosses in its display at the affected tunnel, thus closing the tunnel to the public.

F) Traffic Signals

Allows the control of the traffic signals in the tunnel by a program. Switching off traffic signals can be done by lane but logic will not allow some of the traffic signals to be executed. Manual switching of the traffic lights can also be done.

The Hardware Used

The heart of the TMCS system is of course, the Terminal Module (TM 1703). There are five (5) of these TMs in the system, which are located at the Eastern Portal Control Room, Eastern Cross Passage, Central Cross Passage, Western Cross Passage and Western Portal Building.

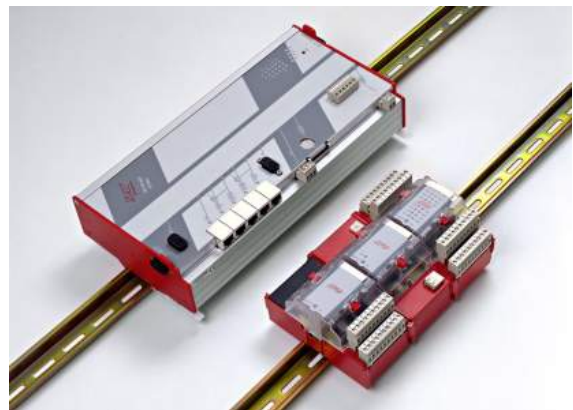


Figure-3: TM 1703

Each of the TM 1703 unit consists of:

A) CP-6003

The master control unit of TM 1703. It handles all communications and processing tasks. This module receives all the relevant monitoring points from the various tunnel sensors and equipment from the peripherals and processes these inputs into the automatic programs that operate tunnel ventilation, tunnel lighting and fire programs. All information from the field is sent to the TMCS via the Ethernet communication channel on the CP-6003. This module also receives all manual commands and set points from the TMCS, processes these request and provides the required output.

B) CM-6830

Functions as the bus interface modules of the peripherals. There are a total of 7 communication channels for 7 I/O racks. The medium of communication from the peripherals to this module is USB electrical connection. The connection speed for each of the channels is 16Mbps. This module is used in a centralized peripheral configuration. That means the peripherals are in the same location as the CM-6830. The maximum distance permitted with this configuration from the CM-6830 to the peripherals is 3m. The CM-6830 is connected to the CP-6003.

C) I/O racks

The racks can hold up to eight peripheral modules, including a power supply unit and also the peripheral controller. A single peripheral controller PE-6400 is used in each I/O racks. The peripheral rack has the same USB connector, to communicate with the CM-6830. Information from the tunnel equipment is received at the peripheral, passed to the PE-6400, from PE-6400 sent to the CM-6830 and finally passed to the CP-6003 for processing. The peripheral used for the I/O rack are:

- DI-6100 – Binary Input 2x8, 24-60VDC
- DO-6212 – Digital Output 8x 24-220VDC/230VAC
- AI-6300 – Analogue Input 2x2 +/- 20mA, +/- 10mA, +/- 10V

The various inputs and outputs are wired directly to the peripheral modules, this will simplify the connections without having the need to add additional isolating and interposing equipment. The arrangement of the peripherals are done so that there is no mixed combinations of inputs, all AI points are together, all DI are together and all DO points are together.

Conclusion

The TMCS or the “Smart Tunnel” system is truly one of its kinds in Malaysia. With its many functions and friendly user interfaces, the TMCS continue to bring great benefits to people in the Klang Valley in many years to come.

The TMCS is another groundbreaking project from **inCONTROL Tech Sdn. Bhd.**