



System Technical Information

for

**Passenger Information and Coach Computing Unit
(PICCU)**

[Make: A. Paul Instruments Company, Model: Optitech]

**Wi-Fi based entertainment system and Integration of
Public Address System**

Published and Released by:





Following are the acronyms used in this document:

PICCU	PASSENGER INFORMATION AND COACH COMPUTING UNIT
ISP	INTEGRATED SYSTEM PERIPHERALS
LRU	LEAST REPLACEABLE UNIT
PIS	PASSENGER INFORMATION SYSTEM
PAS	PUBLIC ADDRESS SYSTEM
GPS	GLOBAL POSITIONING SYSTEM
GPRS	GENERAL RADIO PACKET SERVICE
DDB	DIGITAL DESTINATION BOARD
ICD	IN-COACH DISPLAY
LCD	LIQUID CRYSTAL DISPLAY
LED	LIGHT EMITTING DIODE
USB	UNIVERSAL SERIAL BUS
MBU	MASTER BOARD UNIT
MPU	MASTER PROCESSING UNIT
AAU	AUDIO AMPLIFIER UNIT
CCTV	CLOSED CIRCUIT TELEVISION
SPK	SPEAKER
WAP	WIRELESS/WI-FI ACCESS POINT
NVR	NETWORK VIDEO RECORDER



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1 System Overview

1.1 Passenger Information and Coach Computing Unit (PICCU/CCU):

A.Paul's Optitech an on-board high-end processing system/platform and an integrated solution for Passenger Information and Display System(PIS), Passenger Address/Announcement System (PAS), CCTV/Camera/Video Analytic System for Surveillance Applications and Wifi Infotainment System. It uses on-board Train-wide/Coach-wide IP Backbone Network and for all Components/LRUs including functional Video modules (e.g. LCD Screens and IP Cameras etc.) and Multi-Drop RS-485 Data-link and Analog Audio Signal lines for high quality train-wide audio distribution. In addition to wired communications, it also supports Wi-Fi/Wireless technology and provides a network for integrating the same components/LRUs wirelessly too.

Hence, the system is a Hybrid and Redundant system to optimize bandwidth and to Prevent failure and fault fall-back conditions, in which these systems and communication media work complementary and redundant to each other to have a fail-safe mode in all conditions. This significantly raises system' availability in the event of a network breakdown on either link.

- It supports TCP/IP and related protocols for all IP communications on the network.
- For Audio Lines, a Balanced Line distributed Amplifier System is integrated.
- For In coach LED display and LED Destination boards a high-reliability multi-drop RS-485 and Wi-Fi/Wireless link is also used for communication media redundancy with communication traffic bandwidth management.

The system is able to work on GPS and manual triggers to generate a wide range of messages relevant to passengers and train operating staff (Displays/Audio-Visual announcements).

2 System Components

PICCU has following modules inbuilt:

2.1 MBU Modules with Software for PIS/PAS Function:

The MBU is a GPS based module for an automated PIS/PAS controlling and functioning , designed to access, operate and update the PAS /PIS, Train data for all display/LRUs in scope including Destination boards. All displays are connected over onboard Wi-Fi/Wireless network as well as with specified cable for redundancy and communication bandwidth



management. It's connected to AAU/Amplifier module within PICCU/CCU enclosure to enable PAS function, which itself is connected to coach speakers as per approved wiring plan. The MBU has a feature to play music content, loaded by railway's authorized personnel through given user interface at PICCU/CCU after due authentication. The train line is also connected to the MBU for assuring a common audio announcement throughout the train. Manual override facility is also provided in the MBU, so that whenever a manual public announcement has to be made, the ongoing music or automated announcement can be paused. Once the manual public announcement is completed, paused music/applicable automated announcement will resume.

The MBU has an inbuilt GSM SIM slot permit remote configuration of the Train journey data in PIS/PAS system, Displays including Destination boards from a centralized server located at Railway Control room. It also enables the control room to track the running Trains in real-time and give any required instruction to the Train Driver and Guard in between the journey. This feature of GSM connectivity supports predictive maintenance of the coaches as MBU pushes all the fault data of the system to the control server on the air in real-time. Hence, minimizes the downtime and maintenance time at sheds.

2.2 Audio Amplifier Unit (AAU)/Amplifier Module for PAS/Announcement

Function:

AAU/Amplifier module inbuilt in PICCU along with speakers fitted inside the coach for PA for local as well as common Audio announcement/Music content in the formation. All speakers from Amplifier will be interconnected in cascaded looping. The amplifier will get input feed from MBU module. Audio module consists of two 40W amplifiers with input signal 1.8V +/-0.2V. The system can be viewed as two amplifiers and power supply within the same enclosure which ensures a very high degree of redundancy. 50% of the speakers in a coach are driven by one sub-module and cascaded-branch and the other 50% are driven by the other sub-module. Two 100V audio lines from alternate amplifier sub modules drive the speakers in each coach. Since there are two independently powered amplifier sub modules in the unit, any speaker line failure will cause only 50% of the speakers to be lost. PAS amplifier is able to switch automatically to take input from a central public announcement source from train line provided



by railways. All the speakers maintain a uniform decibel output when the speakers are interconnected in cascade looping with the amplifier. The common announcement for PAS made from Buffet coach in the formation through couplers provided by Railways.

2.3 Network Video Recorder (NVR)/MPU Module:

It is a integrated with High-end Master Processing Unit (MPU) for CCTV Camera Monitoring, Recording, Storage, Play and Scheduled Retrievals for analysis. NVR/MPU module deploys a high end processing system with onboard graphics accelerators that make edge video analytics feasible. Configurable frame rates up to 25fps and image resolution up to 2 megapixels ensure that the coverage is sufficient for facial recognition and to meet all possible operational scenarios. 30 days storage for all cameras is now an accepted standard for anti-terrorism purposes. The high volume storage ensures that this is met without compromising image quality. NVR/MPU has two Ethernet ports on board. The Main Processing Unit (MPU)/Network video Recorder (NVR) is a high powered Quad Core 1.9 GHz Intel Atom Processor-based fan less computer with a dual SSD. The MPU hosts multiple servers like Linux OS, Apache Server, MySQL server and PHP server and HTTP streaming server hosted on the said MPU. The Network Video Recorder (NVR), rugged design with high resistance to vibration and impact in a metal enclosure. The NVR has the following parameters:

ITEMS	PARAMETERS
VIDEO	Supports 8 port and compatible with PoE IP cameras
RECORDING/PLAYBACK	supports real-time video recording and playback
STORAGE	<ol style="list-style-type: none"> 1. One 2.5" HDD with a minimum capacity of 2 TB. However, the capacity should be sufficient enough to record maximum resolution videos for 30 days minimum @ 24 hours per day. 2. One SD card interface with 32 GB capacity
INTERFACE	<ol style="list-style-type: none"> 1. GPS antenna 2. Power input 3. Network interface



	<p>4. PoE port with M12 Connector</p> <p>5. USB port</p> <p>6. GPRS/CDMA mobile communication.</p>
GPS	Device is compatible to support GPS for real time location and speed tagging of video stream.

2.4 LCD PIS display:

LCD is connected to the MBU. The PIS-LCDs displays both PA alert messages and as well as PIS message. In the case of priority of the PA alert, PA alert overrides the PIS message in the display the size of the message is suitable to be read out with font size. The system displays the following messages on the LCD's in Hindi, and regional languages.

Default welcome and farewell messages.

- Date and time
- Speed
- Current and next station
- Weather at next stoppages station
- Late running status
- Train arrival and departures times with route map
- Safety messages

2.5 MBU :

All displays are connected over Wi-Fi/Wireless network and with specified cable for redundancy and communication bandwidth management. It's connected to AAU/Amplifier module within PICCU/CCU enclosure to enable PAS function which in-turn connected to Speakers in cascaded fashion as per approved design. The MBU has provision to play Music content also which will be loaded by railway's authorized personnel through given user interface at PICCU/CCU after due authentication. The common audio announcement signal from train line is also connected to the MBU to route to AAU/Amplifier module. Override facility is available in the MBU so that whenever a public announcement is made, music or applicable automated announcement is paused. Once the public announcement is completed, paused music/applicable automated announcement is resumed. The MBU has provision for Internet and Wi-Fi feature to permit remote configuration of the PIS/PAS system, Displays including Destination boards from a centralized location.

2.6 System Power Supplies based on Standard DC to DC Convertors:

(Input: 110 VDC and Output: 24 VDC)



ONE 100W DC Power Supply Module for MPU/NVR, MBU and AAU

ONE 100W DC Power Supply Module for Ethernet Switch (ESW) and Wire Access Point (WAP)

- a. Wireless/Wi-Fi Access Point (Make A. Paul Instruments Co.) for primarily Wireless/Wi-Fi connectivity between PICCU and user's mobile for displaying PIS information and entertainment content on users mobile.
- b. 1.5 sq.mm Power Cable and Speaker Line (Make: Siechem/Leoni) for all power line connectivity to the power feeds to the units from PICCU/CCU power supply modules and speakers connectivity with AAU module at PICCU/CCU
- c. 2C,0.5 Sq.mm Shielded Data Cable (Make: Siechem) for RS-485 data connectivity for ICDs and DDBs with MBU Module at PICCU/CCU Enclosure.
- d. Cat 6 UTP Ethernet Cable (Make: Dlink) for CCTV PoE Camera, WAP connectivity to Ethernet Switch Module/Ports at PICCU/CCU Enclosure.

2.6.1 System Unit/Combination wise maximum power consumption:

S.No.	System Unit Detail	Maximum Power Consumption
1.	MPU/NVR and MBU Modules Combinations	20 W
2.	Hub	12W
3.	Wi-Fi/Wireless Access Point (WAP)	40 W
4.	18.5" LCD	108W
5.	AAU	80W
Total Maximum Power Consumption		260W

2.6.2 System BOM/BOQ (per Coach):

S.No. and Sub-parts	Equipment / System Module	Make/Model/Part Number	Quantity per Coach
1.	Passenger Information and Coach Computing Unit(PICCU or CCU) with following parts in-built and encapsulated:	A. Paul Instruments Co. / Model: Optitech Mark-II	1 Assembled Set (with one each sub-part for each set)
1.a	MBU Module with S/W for PIS Function		
1.b	AAU/Amplifier Module for PAS Function		
1.c	MPU/NVR and Software for CCTV Surveillance Function		
1.d	100 Watt DC Power Supply for above Modules.	Mornsun / URF1D24QB-100W Series	
1.e	100 Watt DC Power Supply Module for Ethernet PoE Switch Module and Wi-Fi/Wireless Access Point (WAP)		
2.	GPS and GSM Combo Antenna	Quectel /	1
2.a	GPS+GSM Combo Module	EC25 and L80 Series	
3.	Wi-Fi/Wireless Access Point (WAP)	A. Paul Instruments Co. / WAP 1200	2
4.	18.5" LCDs Screens	A. Paul Instruments Co.	6
5.	Power Cable and Speaker Line Cable (1.5 Sq.mm)	Siechem / Leoni Siechem part number: 3001301(RED), 3001304(BLACK) Leoni Part number: BETAtrans 3GKW-INX 1.5sq.mm, RED and BLACK	3001301(RED) – 180 Meter Approximately and 3001304(BLACK) – 180 Meter Approximately
6.	Data Cable (2C,0.5 Sq.mm Shielded)	Siechem / 2680602	60 Meters Approximately
7.	Ethernet Cable (Cat 6 UTP)	Dlink / CM 23 AWG CAT .6 UTP	150 Meters



			Approximately
8.	HDMI Cable	Falcon	5,10,15 Meters