

TECHNICAL REQUIREMENTS & SPECIFICATIONS (26-Tele-13 CCTV 41 LCs)

105 3 Core flexible copper power cable	
Item	3 Core flexible copper power cable PVC insulated and sheathed 1100V grade conforming As per IS:694 with conductor as per IS:8130 Class-5
Conductor	Electrolytic grade annealed copper, Class-5 stranded as per IS:8130
Insulation	PVC Type-A / Flame Retardant PVC
Outer Sheath	PVC outer sheath suitable for indoor telecom use
Voltage Grade	1100 Volt grade
Temperature Rating	70°C continuous operation
Core Identification	Red, Black, Green (Earth)
Standard	Conforming to IS:694 (latest)
Construction	Multi-strand flexible copper, PVC insulated cores with common PVC sheath
Resistance	Low conductor resistance suitable for UPS and telecom loads
Marking	Manufacturer name, size, voltage grade, IS mark, year of manufacture
Tests	Conductor resistance, HV test, insulation resistance as per IS:694
Application	UPS to rack, PDU to equipment, telecom power wiring
Approved Makes	Polycab / Finolex / Havells / KEI / RR Kabel / Anchor or equivalent
106 STP Cat-6 Cable	
Cable Type	Shielded Twisted Pair (STP), Category 6
Conductor	100% Solid Bare Copper
Conductor Size & Material	23 AWG Annealed Bare Solid Copper
Pairs	4 Pairs (8 Conductors)
Shielding	Overall Aluminum Foil Shield
Compliance Standards	TIA/EIA-568-C.2, ISO/IEC 11801
Color Code	ANSI/TIA-568-B.2 Standard Pair Color Code
Outer Diameter	6.0 – 7.5 mm (typical)
Packing	Tangle-free cable pack in pull-free corrugated box
107 Anti Rodent Cable	
Item Description	Anti-Rodent Armoured CAT6 Outdoor Ethernet Cable
Category	CAT6 UTP
Conductor	23 AWG Solid Bare Copper
Pairs	4 Twisted Pairs
Bandwidth	Minimum 250 MHz
Data Rate	Support 10/100/1000 Mbps Ethernet
Cable Type	Outdoor Armoured Anti-Rodent Cable
Armouring	Steel Tape/Steel Wire Armour
Outer Sheath	UV Resistant PE/HDPE/FRLS
Rodent Protection	Anti-Rodent Protected Construction
Impedance	100 ± 15 Ohms
Standards	ANSI/TIA-568-C.2, ISO/IEC 11801
Application	Railway Telecom, CCTV, Networking and Outdoor Data Connectivity
Marking	Sequential Meter Marking
Warranty	Minimum 1 Year
Suggested Makes	Finolex, Polycab, D-Link
113 PVC Casing 32 mm	
Item Description	PVC Casing, 32 mm Size
Material	High Impact Rigid PVC
Size	32 mm Width
Construction	PVC Casing with Matching Clip-On Cover
Colour	Ivory White / Grey
Flame Retardancy	Self-Extinguishing and Flame Retardant
Mechanical Strength	Suitable for Indoor Telecom and Electrical Wiring Applications
Surface Finish	Smooth Finish. Free from Burrs, Cracks and Defects
Installation	Suitable for Surface Mounting on Walls and Ceilings
UV Resistance	Suitable for Indoor Use
Standards	Conforming to relevant IS standards for PVC casing and capping
Application	Railway Telecom, CCTV, Networking and Electrical Cable Routing
Length	Standard Commercial Length
Warranty	Minimum 1 Year against Manufacturing Defects
Popular Indian Makes	AKG, Precision, Presto Plast or Equivalent

114 Rigid PVC Conduit Pipe 25 mm (1 Inch)	
Colour	White/Grey/Cream
Nominal Diameter	1 Inch
Outer Diameter	25 mm
Inner Diameter	22.5 mm
Standard	IS: 9537 (Part 3)
Pipe Length	3 meters per piece
Wall Thickness	Approx. 1.25 mm
Material Grade	High Impact Resistant PVC
Surface Finish	Smooth inner & outer surface
Accessories	Bend & Eblow as per site requirement
Installation Type	Surface / Concealed
117 Supply, installation and commissioning of 48F straight joint enclosure as per RDSO/SPN/TC/68/2025, Rev. 2.0 or latest	
Joint Enclosure	Dome/inline type SJC suitable for 48 fibres with splice trays, sealing kit, cable glands, strength member fixing arrangement and mounting accessories.
Splicing Requirement	Splicing of two numbers 48F OFC cables (96 fibres) using contractor's fusion splicer including preparation, cleaving, alignment and protection with heat shrink sleeves.
Standards	Work shall conform to ITU-T / TEC guidelines and Railway OFC jointing practices.
Consumables	All consumables such as splice sleeves, cleaning material, sealing tape, clamps, ties to be supplied by contractor.
Testing	Splice loss verification through splicer and OTDR testing after completion of joint.
Acceptance Criteria	Average splice loss ≤ 0.05 dB and individual splice ≤ 0.1 dB for single mode fibre.
Restoration	Proper dressing of fibres in trays, sealing of enclosure, fixation on wall/pole/manhole as required.
Measurement	Rate includes supply of SJC and complete splicing of 2x48F OFC as one unit.
118 8 Port Switch	
TTP Approval	Trusted Telecom Portal (TTP) approval and compliance with other applicable regulatory guidelines, if any, are mandatory
Item Description	08 Port Managed Ethernet Switch
Port Configuration	8 x 10/100 Mbps PoE Ethernet ports and 2 x 1000 Mbps SFP uplink ports
SFP Modules	02 SFP modules to be supplied along with switch
Switching Capacity	Minimum 20 Gbps
Packet Forwarding Rate	Up to 14.88 MPPS (64 byte packets)
VLAN Support	Support for 4K VLAN IDs, minimum 256 static VLANs, Voice VLAN and Video VLAN
PoE Standard & Budget	IEEE 802.3af and IEEE 802.3at compliant with minimum 120 W total PoE power budget
Surge Protection	Surge protection of 2 kV as per IEC/EN 61000-4-5
LLDP	IEEE 802.1AB LLDP and/or LLDP-MED support
Port Mirroring	One-to-one and many-to-one port mirroring
Security Features	Broadcast/Multicast/Unicast storm control, traffic segmentation, TLS, DoS attack prevention, 802.1X port-based access control, port security, ARP spoofing prevention, DHCP server screening, IP-MAC-Port binding, ARP inspection, DHCP snooping, 802.1X authentication with local and RADIUS database (IPv4 & IPv6)
Advanced Features	IPv4 and IPv6 inspection, SSH v2, IEEE 802.3x flow control
Management	Console port, Web-based GUI and CLI management
SNMP	SNMP v1, v2c and v3
Operating Environment	Operating temperature 0°C to 50°C; humidity 10%–90% non-condensing
Power Supply	100–240 V AC, 50 Hz
EMI Compliance	EMI compliance as per BIS / EN / FCC / CE
Installation	Its Includes standard insatllation as per instruction of Railway Site Engineer
Safety Compliance	Safety compliance as per BIS / UL / IEC / EN 60950 or latest
Make	Cisco/HP/Juniper/D-link/Tejas
122 Fibre Distribution Management system (FDMS)/LIU for 12 Fiber	
Type	Wall Mountable / Rack Mountable (19" or 21") – as
Fiber Capacity	12 Fiber Terminations (SC/LC/FC/APC as per requirement)
Splicing Type	Fusion Splicing with Splice Holder for 12 fibers
Number of Adapters	12 Nos. SC/APC Simplex / LC Duplex Adapters (Single-mode or multi-mode, as required)
Fiber Management	Internal fiber routing guides and bend radius control (min. 30 mm)
Cable Entry Ports	Minimum 2 cable entry ports with rubber grommets
Pigtails	12 Nos. of factory-tested pigtails, min. 1.5-meter length
Splice Tray	At least 1 splice tray with capacity of 12 core fusion splices

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WARRANTY & COMPLIANCE	
Application	Primary use: iSCSI target / NFS / SMB storage for CCTV NVR/VMS systems at Railway stations. Secondary use: Scheduled data backup and file sharing for departmental use.
Warranty	Minimum 3 (Three) years comprehensive warranty on NAS unit from manufacturer/authorized service centre in India. Bundled HDDs: minimum 3-year warranty. Warranty type (on-site / carry-in) shall be clearly declared in bid. Replacement of faulty components within 7 working days.
124 Iron Cage	
Item	Iron Cage for Protection of Cameras
Material	Mild Steel (MS)
Construction	Rigid welded construction
Design	Open grill / mesh type without obstructing camera view
Camera Compatibility	Suitable for 4K / PTZ / Fixed CCTV Cameras
Movement Clearance	Adequate clearance for camera pan / tilt / zoom / operation
Finish	Anti-rust primer with powder coating
Mounting	Wall / Pole / Bracket mounted
Fixing Accessories	Nuts, bolts, clamps and required mounting accessories included
Safety	Smooth finish with no sharp edges
Maintenance	Easy access for camera servicing and maintenance
Protection Purpose	Protection against physical damage, vandalism and accidental impact
Installation	Suitable for indoor & outdoor installation on walls, poles, buildings as per site requirement
127 Portable Cordless Drill Machine	
Battery Voltage	Minimum 18V
Battery Type	Lithium-Ion (Rechargeable)
Torque	Minimum 45 Nm
Speed	Dual Speed (0–500 RPM & 0–1800 RPM or better)
Chuck Size	10 mm to 13 mm Keyless Chuck
Weight	Not more than 1.5 kg
Motor Type	Brushed / Brushless (Preferred: Brushless)
Clutch Settings	Minimum 18 Torque Settings + Drill Mode
Reverse Function	Mandatory
LED Light	Preferred
Charging Time	Within 1–2 hours
Protection	Overload, Overheat & Battery Protection
Build Quality	Heavy-duty Industrial Grade
Make	Bosch / Makita / Dewalt / Equivalent
Warranty	Minimum 1 Year
Accessories	Battery (2 Nos.), Charger, Carry Case
128 Remote Craft Terminal	
laptop	HP, Dell, Sony make
Processor	Intel Core 12th Gen Intel Core i5 or higher
Operating System	Windows 11 professional or higher with life time validity, 100% genuine
Web Cam	Yes (720P or higher)
Memory	16 GB DDR4 or higher
SSD	512 GB or higher
Graphics	Internal
Monitor	15.6" FHD or higher
Software Included	Microsoft Office Professional 2021 or latest with life time validity, 100% genuine
Blue tooth, Wi-Fi	Yes
LAN card	Yes
Port	HDMI-1 port, USB 3.1 or higher 2 port minimum
129 Report Genration Device	
Make	HP / Brother / EPSON or equivalent
Print Technology	Laser
Color Type	Monochrome
Print Speed	Minimum 30 Pages Per Minute (PPM)
Duplex Printing	Automatic
Multifunction Capability	Print, Copy & Scan
Supported Paper Sizes	A4, Letter

Connectivity	USB / Wired Network & Wi-Fi
Warm-up Time	Fast warm-up suitable for regular use
Compliance	As per relevant industry standards
Duplex Mode	Print on both sides of paper
Paper Handling	Automatic paper reversal
Power Supply	230V AC, 50 Hz
130 OTDR	
GENERAL	
Type of Instrument	Portable/Handheld Single Mode Optical Time Domain Reflectometer (SM-OTDR), suitable for field use in Railway telecom OFC network installation, testing, commissioning, maintenance and fault location.
Make / Brand	Fujikura / Sumitomo / Swift
OPTICAL PERFORMANCE PARAMETERS	
Fibre Type	Single Mode (SM) fibre as per ITU-T G.652.D standard. (Multimode capability is desirable but not mandatory.)
Operating Wavelengths	Minimum: 1310 nm and 1550 nm (dual wavelength, simultaneous or selectable). Desirable: 1625 nm (third wavelength for live-fibre / dark-fibre monitoring without service interruption).
Dynamic Range (Most Critical Parameter)	Minimum 35 dB at 1310 nm AND minimum 35 dB at 1550 nm. Higher dynamic range (≥ 38 dB) preferred for Railway long-haul OFC routes. Note: Dynamic range directly determines maximum testable fibre length. $35 \text{ dB} \approx 175 \text{ km}$ range at 0.2 dB/km (1550 nm).
Maximum Measurable Fibre Distance	Minimum 200 km at 1550 nm. (Directly related to dynamic range; higher dynamic range = longer measurable distance.)
Distance Range	Selectable ranges: 5 / 10 / 20 / 40 / 80 / 160 km or more. Auto-ranging mode mandatory.
Distance Accuracy	$\pm 1 \text{ m}$ or $\pm 0.005\%$ of distance measured, whichever is greater (as per IEC 61746-1).
Distance Resolution	$\leq 0.1 \text{ m}$ ($\leq 10 \text{ cm}$). Higher resolution preferred for precise splice and fault location.
Event Dead Zone (Splice/Attenuation Dead Zone)	$\leq 5 \text{ m}$ (metres) for attenuation dead zone at 1310 nm with standard launch conditions. Shorter dead zone preferred for dense splice box locations.
Reflectance Dead Zone (Connector Dead Zone)	$\leq 2 \text{ m}$ (metres). Shorter preferred for connector-dense environments.
Loss Measurement Range	0.001 dB to 35 dB (minimum). Total fibre loss measurement with 0.001 dB resolution.
Loss Measurement Resolution	$\leq 0.001 \text{ dB}$ (1 mdB resolution).
Loss Measurement Uncertainty	$\leq \pm 0.05 \text{ dB}$ (splice loss measurement uncertainty as per IEC 61746-1).
Reflectance Measurement Range	-65 dB to -14 dB (minimum). Shall detect Fresnel reflections from connectors and fibre end faces.
Reflectance Measurement Resolution	$\leq 0.1 \text{ dB}$.
Refractive Index Setting	Adjustable refractive index (n) to match fibre under test. Range: 1.440 to 1.500 (minimum). Settable in steps of ≤ 0.0001 .
DISPLAY, INTERFACE & USABILITY	
Display	Colour LCD / TFT touchscreen, minimum 5 inch diagonal. Sunlight-readable display preferred. Backlight with adjustable brightness.
Display Resolution	Minimum 800×480 pixels (WVGA) or higher.
Trace Display	Live OTDR trace display with event markers. Zoom in/out capability (horizontal and vertical). Overlay/comparison of multiple stored traces on same screen.
Event Map / Auto Analysis	Automatic event detection and display in tabular/map format: events, distances, losses, reflectances. Bidirectional averaging (BiDi) capability preferred.
Measurement Modes	Auto mode (one-button): Automatic range, pulse width, and averaging time selection. Manual mode: Full user-control of all parameters. Real-time mode: Continuous trace update.
Optical Output Port (Launch Connector)	FC/PC or Universal adapter compatible. Adapter type and included adapters shall be declared by bidder. Minimum one SC/PC and one FC/PC adapter to be supplied.
BUILT-IN TOOLS & FEATURES	
Visual Fault Locator (VFL)	Built-in VFL: Visible red laser ($650 \text{ nm} \pm 10 \text{ nm}$), minimum output power 0 dBm (1 mW). Continuous and 2 Hz blinking mode. Range: minimum 5 km for macro-bend and break detection.
Optical Power Meter (OPM)	Built-in optical power meter. Wavelengths: minimum 1310 nm and 1550 nm. Range: -50 dBm to +10 dBm. For end-to-end insertion loss measurement.
Optical Light Source (OLS)	Built-in or external CW light source at 1310 nm and 1550 nm. Used in conjunction with OPM for end-to-end loss measurement. (Desirable if built-in; external companion source also acceptable.)
Fibre Length Measurement	Accurate fibre length measurement as a standalone function (without requiring full OTDR trace). Useful for cable drum length verification.
DATA STORAGE, CONNECTIVITY & REPORTING	
Internal Storage	Minimum 4 GB internal storage for OTDR traces, configurations and reports. Expandable via external memory.
External Memory	USB port (minimum USB 2.0 Type-A or Micro-USB) for USB flash drive / PC connectivity. SD/MicroSD card slot desirable.
PC Connectivity	USB to PC connectivity with Windows-compatible OTDR trace analysis software supplied free of cost. Software shall support: trace viewing, event table, pass/fail analysis, report generation, and trace export in .sor (Bellcore/GR-196-CORE standard) and PDF/Excel formats.
Trace File Format	Standard .sor format (Bellcore/ITU-T SR-4731 / GR-196-CORE Issue 2) for inter-operability with standard OTDR analysis software.
Wi-Fi / Bluetooth	Wi-Fi (802.11b/g/n) and/or Bluetooth connectivity desirable for wireless trace transfer and remote access.
Reporting	On-board PDF report generation capability. Report shall include: trace graph, event table, fibre parameters, measurement date/time, operator name field.
POWER SUPPLY & BATTERY	

Form Factor	Hot-pluggable SFP+ (Small Form-Factor Pluggable Plus)
Interface	RJ45 Copper Ethernet Interface
Data Rate	10 Gbps
Standards Compliance	IEEE 802.3an 10GBASE-T, IEEE 802.3ab, IEEE 802.3u or latest
Connector Type	RJ45
Transmission Media	Cat6A/Cat7 UTP/STP Copper Cable
Maximum Distance	Minimum 30 metres over Cat6A cable at 10Gbps
Auto Negotiation	Support 100M/1G/2.5G/5G/10G auto-negotiation
Operating Temperature	0°C to +70°C or better
Power Consumption	Low power consumption, suitable for continuous operation
Compatibility	Compatible with standard SFP+ slots used in Ethernet switches and network equipment
Diagnostics	Digital Diagnostic Monitoring (DDM) support preferred
Application	Suitable for Railway Telecom IP Network, CCTV, Data Communication and OFC Network applications
Warranty	Minimum 1 Year
Accepted Makes	Cisco, TP-Link, Netgear or equivalent

134 10G SFP+ Optical Transceiver Module

Form Factor	Hot-Pluggable SFP+ (Small Form-factor Pluggable Plus)
Data Rate	10 Gbps
Interface	SFP+ Optical Interface
Optical Standard	10GBASE-SR or equivalent
Wavelength	850 nm (for Multimode Fibre) or equivalent
Connector Type	Duplex LC Connector
Transmission Distance	Minimum 300 metres over OM3 Multimode Fibre
Fiber Type	Compatible with OM3/OM4 Multimode Optical Fibre
Compliance Standards	IEEE 802.3ae, SFF-8431, SFF-8472 or latest applicable standards
DDM Support	Digital Diagnostic Monitoring (DDM) support preferred
Power Supply	Powered through SFP+ port
Operating Temperature	0°C to +70°C or better
Compatibility	Compatible with standard 10G SFP+ ports of Ethernet switches and routers
Application	Suitable for Railway Telecom OFC Backbone, IP Network, CCTV and Data Communication Systems
Warranty	Minimum 1 Year
Accepted Makes	Cisco, TP-Link, Netgear or equivalent

135 Metal Armoured Flexible Optical Fiber Patch Cord (20 Mtr)

Fiber Type	Single Mode Optical Fiber 9/125 µm
Configuration	Duplex
Connector Type A	SC Connector
Connector Type B	LC Connector
Cable Length	20 Metres
Cable Construction	Metal Armoured, Flexible and Crush Resistant
Jacket Material	LSZH / FRLS Outer Sheath suitable for indoor telecom applications
Insertion Loss	≤ 0.3 dB per connector
Return Loss	≥ 50 dB
Operating Wavelength	1310 nm and 1550 nm
Connector Polish	UPC/UPC or better
Mechanical Strength	Suitable for repeated handling and field installation
Compliance	IEC/TIA/EIA standards for optical fiber patch cords
Application	Suitable for Railway Telecom OFC Network, Data Communication, CCTV and Network Equipment Interconnection
Warranty	Minimum 1 Year
Reference Makes	IVEONET, D-Link, ANDA Telecom

136 OFC Modern Tool Kit

Fiber Optic Stripper	3-hole precision stripper (250µm/900µm/2-3mm):- 1 No.
Kevlar Cutter	Industrial grade Heavy-duty Kevlar yarn cutter:- 1 No.
Cable Jacket Stripper	Industrial grade OFC outer sheath stripper/slitter (Longitudinal Stripper):- 1 No.
Fiber Cleaver	Industrial grade High precision cleaver (<0.5° angle):- 1 No.
Side Cutting Plier	Industrial grade Insulated cutting plier:- 1 No.
Long Nose Plier	Industrial grade Fine grip plier:- 1 No.
Utility Knife	Industrial grade Heavy-duty cable cutting knife:- 1 No.
Cleaning Kit	IPA bottle + lint-free wipes + swabs:- 1 Set
Connector Cleaner	Pen-type fiber optic cleaner:- 1 No.
Fusion Splice Sleeves	40mm protection sleeves:- 2 packets
Electrical Tape	Standard insulation tape:- 2 Nos.
Cable Ties & Labels	Assorted sizes:- 1 Set
Visual Fault Locator (VFL)	Minimum 30 milliwatt capacity and range minimum 30 km range red laser FC/SC-APC/ST compatible, 630 nm to 650 nm (Visible Red Light), Make Fluke / Grandway / EXFO :- 1 No.

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Warranty	Minimum 2 Years
Suitable Brands	Valrack, NetRack, Rittal or equivalent
Approximate Market Cost	Rs. 18,000 +/- depending on accessories and sheet thickness
141	Surge Protection Device (SPD) for LAN & Telecom Networks
Application	Protection of Ethernet, LAN, IP CCTV, Telecom and Data Communication Networks against lightning and surge voltages
Network Interface	RJ45 Ethernet Interface
Supported Network	10/100/1000 Mbps Ethernet
Protection Lines	All 8 Pins Protected
Nominal Voltage	Suitable for PoE and Non-PoE Ethernet Networks
Response Time	Less than 1 Nanosecond
Surge Current Capacity	Minimum 5 kA (8/20 μ s) per line or better
Insertion Loss	Negligible insertion loss for Gigabit Ethernet operation
Protection Mode	Line-to-Line and Line-to-Ground Protection
Grounding	Dedicated Grounding Terminal
Housing	Industrial Grade Metal Housing
Mounting	DIN Rail or Wall Mount Type
Operating Temperature	-10°C to +60°C or better
Standards	IEC 61643 or equivalent international standards
Application Area	Railway Telecom Networks, OFC Nodes, CCTV Systems, LAN Switches and IP Equipment
Warranty	Minimum 1 Year
Accepted Makes	Ditek, Phoenix Contact, OBO Bettermann or equivalent
142	Cable route Locator
Item Description	Cable Route Tracer cum Locator with RFID Marker detection capability
Make	Radiodetection, Stanlay, Telogica, Dynatel [or TTP Approved make if any is available]
Type	Cable Route Tracer cum Locator with RFID Marker detection capability
Application	Suitable for underground OFC cable route tracing in Railway/Telecom works
Supply & Testing	Supply & Testing of Integrated GPS based utility locator & Bluetooth transmitter with minimum 500mA output current to detect underground metallic utilities before excavation, safe digging, route tracing, and sleeper fault detection
Receiver	Sleek, rugged, ergonomic, lightweight, ABS plastic body
Display	Monochrome display, size 3.7 inch or better
Antennas	5 or more (2 horizontal, 2 vertical, 1 compass)
Ingress Protection	IP65
Depth Measurement Range	30 meters or better
Accuracy	Locate & depth accuracy $\pm 5\%$ & $\pm 3\%$ or better
GPS Accuracy	1-2.5 meters or better
Detection Mode	Combined power & radio mode detecting 50Hz signals and induced radio signals
Interference Rejection	Ability to reject electromagnetic interference from overhead cables and buried utilities
Power Filters	Discrimination between 50Hz to 450Hz harmonics
Auto Measurement	Automatic current & depth measurement without manual input
Directional Indicators	Left & right arrows for positioning
Depth in Power Mode	Approximate depth detection of live cables
Current Direction	Display of current direction with arrows
GPS & Bluetooth	In-built GPS with real-time mapping and Bluetooth communication
GPS Status	Display of GPS lock and satellite count
Data Export	Export locate data with GPS coordinates via USB in Excel, CSV, KML formats
Auto Logging	Minimum 1-year data logging capability
Battery (Receiver)	Self-replaceable Li-ion battery, min 10Ah, ~35 hrs backup
Display Features	Battery status, gain level, signal bar graph, antenna modes, 360° compass
Transmitter	Output power min 10W, voltage 90V, current 500mA (visible on display)
Frequencies	640Hz, 940Hz, 1450Hz, 4kHz, 8kHz, 33kHz, 65kHz, 83kHz, 131kHz, 200kHz
Dual Frequencies	285/570Hz, 320/640Hz, 380/760Hz, 460/920Hz, 4kHz/8kHz or similar
Voltage Booster	Available for high resistance utilities
Bluetooth Control	Remote control up to 300m, frequency shifting capability
Ingress Protection (Tx)	IP65
Accessories Tray	Integrated tray for accessories
Battery (Transmitter)	Li-ion battery min 8.5Ah, ~8 hrs backup
Warranty	3 years warranty
Calibration	Online calibration check via software
Self-Test	Self-diagnostic system
Service Support	OEM/authorized service center in India
EMC Compliance	EN 301 489-1 or equivalent
IP Compliance	EN 60529 or equivalent
Vibration Test	EN 60068-2-64 or equivalent
Shock Test	EN 60068-2-27 or equivalent
Quality Certification	ISO 9001:2015

Accessories Included	Receiver, Transmitter, Li-ion batteries, Direct connection lead, Earth stake, 10m cable, Magnet, Clamp, USB cable, Soft bag
Demonstration	Physical testing and verification required
Technical Evaluation	OEM/authorized distributor demonstration required
Training	Training by supplier/OEM
157	9URack SITC
Item Description	9U Wall Mount Network/Telecom Rack complete with standard installation
Compatible Makes	Valrack, President, Rittal, NetRack, TATA, AE Connect, CP Plus or equivalent
Rack Standard	19 Inch EIA-310 Standard Equipment Rack
Rack Height	9U
Dimensions	600 mm (W) × 450 mm (D)
Mounting Type	Wall Mountable
Rack Frame Material	Heavy Duty CRCA/Mild Steel Construction
Frame Thickness	Minimum 1.2 mm CRCA Steel
Front Door	Single Front Toughened Glass Door with minimum 4 mm thick glass
Front Door Frame	CRCA Steel, minimum 0.9 mm thickness, 180° opening, detachable hinges and lockable arrangement
Rear Access	Provision for rear access/removable panel for maintenance
Door Gasket	Polyurethane gasketing on front and rear access panels/doors
Cable Manager	Suitable Cable Management Arrangement for 24 Port RJ45 CAT6 Patch Panel
Equipment Tray	One Heavy Duty Equipment Tray Included
Top & Bottom Covers	Minimum 1.2 mm thickness with cable entry holes, rubber bushes and gland plates
Cable Entry	Minimum 40 mm diameter cable entry holes at top and bottom
Power Distribution Unit	6 Nos. Industrial Grade 5 Pin/5A Sockets with switch, fuse and power indication
Socket Makes	Legrand, Crabtree, Anchor, Zodiac or equivalent
Power Cable	3 Core Power Cable, 3 Metres Long with 15A Mains Plug
Mounting Hardware	20 Sets of Cage Nut, Cup Washer and M6 Screw
Surface Finish	Seven Tank Process Powder Coating
Colour	Dual Tone Dark Grey and Light Grey, Doors in Light Grey
Ventilation	Adequate ventilation slots for heat dissipation
Earthing	Dedicated Earthing Stud and Grounding Arrangement
Installation	Supply, Installation, Mounting and Commissioning complete
Warranty	Minimum 2 Years
161	Minimum 55"Full HD/4K or higher large format display monitor
Type	Large Format Smart Android LED TV
Make	Sony, LG, Samsung
Operating System	Android TV / Google TV (latest available stable version)
Screen Size	55 inches (minimum)
Display Feature	Ultra HD (4K) or higher
Display Resolution	3840 × 2160 pixels
Aspect Ratio	16:9
Viewing Angle	Minimum 178° (Horizontal & Vertical)
Refresh Rate	Minimum 50 Hz
Brightness	Minimum 350 nits
Contrast Ratio	High contrast ratio suitable for indoor display
HDR Support	Yes (HDR 10 or higher)
Audio Output Power	Minimum 20 Watts (RMS)
Audio Technology	Dolby Digital / DTS or equivalent
Speaker Type	Integrated stereo speakers
HDMI Ports	Minimum 2 HDMI ports (HDMI 2.0 or higher), (additional DP port if desirable)
USB Ports	Minimum 2 USB ports
Network Connectivity	Ethernet (LAN)
Wireless Connectivity	Built-in Wi-Fi and Bluetooth
Screen Casting	Built-in screen mirroring / Chromecast support
App Support	Google Play Store / OTT application support
Video Playback Formats	MP4, MPEG, MKV, AVI or equivalent
Audio Playback Formats	MP3, AAC, MPEG, AC3, EAC3
Image Playback Formats	JPEG, PNG
Processor	Quad Core or higher
RAM	Minimum 2 GB
Internal Storage	Minimum 8 GB
Remote Control	Bluetooth / IR remote with voice support
Mounting	VESA wall mount compatible, Wall Hung assembly must included with delivery, as per site condition
Power Supply	180–240 V AC, 50 Hz
Warranty	Minimum 3 Years OEM on-site warranty
Instillation	Complete Installation Wall mounted / table top as per site requirement conditions and requirements with required accessories in an adequate manner.
Accessories	Battery, Remote with Cells, HDMI Cable, Power cable etc.

Duty Cycle	These monitors shall be suitable for 24×7 (round the clock) continuous operation.
Display Capability	One monitor shall be capable of displaying minimum 16 camera views on a single unit.
Inspection	Complete Installation Wall mounted / table top as per site requirement conditions and requirements with required accessories in an adequate manner.
168	19 inch IP-65 Rated Weatherproof 12U Outdoor Rack , Wall Mount / Pole Mount
Usable Height	12 U
Actual Width / Usable Width	572 mm / 19 inch
Actual Depth / Usable Depth	400 mm / 260 mm
Front Door	Steel door on hinges with gasket and locking arrangement
Operating Temperature	0°C to 85°C
Form Factor	LC/SC APC Coupler
Material Thickness	0.9 mm for rack and 1.2 mm for vertical equipment angles
Manufacturing Standard	Manufacturing process conforms to ISO 9001:2015 standards
Side Panels	Fixed side panels – 02 Nos.
Mounting Rails	19 inch wide adjustable mounting rails utilizing full width
Protection Level	IP65
Mounting Provision	Suitable for pole mounting and wall mounting
LIU Standard	24/48 Port SC/LC LIU (with pigtails)
Fitting Type	LIU/FDMS Type
No of Ports	512 minimum SC/LC Type
Optical Splitter (2:8)	04 Minimum SC APC Type
Optical Splitter (2:16)	04 Minimum SC APC Type
Features	Provisions for multiple cable management clips (front and rear)Accommodates splice trays and stackable cassette bracket
173	Solar Panel
1. MODULE TYPE & TECHNOLOGY	
Module Technology	Mono-Crystalline PERC (Passivated Emitter Rear Contact), Half-Cut Cell
Cell Type	M10 / M12 Half-Cut Monocrystalline Silicon Solar Cells
Application	Smart Pole – CCTV / Surveillance Camera Power Supply, Outdoor
Module Wattage (STC)	500 Wp – 550 Wp (as per site requirement)
Module Efficiency	≥ 21.0 % at Standard Test Conditions (STC: 1000 W/m ² , 25°C, AM 1.5)
Number of Cells	132 Half-Cut Cells (66 × 2 Split Configuration)
Module Dimensions (approx)	2094 mm × 1038 mm × 35 mm (±5 mm tolerance)
Module Weight	≤ 28 kg per module
2. ELECTRICAL PARAMETERS (STC: 1000 W/m², 25°C)	
Peak Power (Pmax)	500 Wp – 550 Wp
Open Circuit Voltage (Voc)	49.0 V – 52.0 V
Short Circuit Current (Isc)	13.5 A – 14.5 A
Voltage at MPP (Vmp)	41.5 V – 44.5 V
Current at MPP (Imp)	12.0 A – 13.5 A
Power Tolerance	0 / +5 W (Positive tolerance only)
Temperature Coefficient Pmax	–0.35 % / °C
Temperature Coefficient Voc	–0.28 % / °C
Temperature Coefficient Isc	#ERROR!
NOCT	45 ± 2 °C
Fill Factor (FF)	≥ 80 %
3. MECHANICAL & STRUCTURAL PARAMETERS	
Frame Material	Anodised Aluminium Alloy, Silver/Natural
Glass	3.2 mm Low Iron Tempered Anti-Reflective Coated (ARC) Safety Glass
Backsheet	White Composite / Fluoropolymer Backsheet, UV-resistant
Encapsulant	EVA (Ethylene Vinyl Acetate) / POE
Junction Box	IP68 Rated, with 3 Bypass Diodes
Cable / Connector	4 mm ² Solar PV Cable, MC4 or Equivalent IP67 Connectors
Cable Length	1200 mm per lead (±50 mm)
Front Load (snow/wind)	5400 Pa
Rear Load	2400 Pa
Hail Resistance	35 mm diameter at 97 km/h
4. CERTIFICATIONS & STANDARDS	
IEC Standards	IEC 61215 (Performance), IEC 61730 (Safety)
BIS / MNRE Certification	BIS Certification mandatory; ALMM (Approved List of Models & Manufacturers) listed under MNRE, Govt. of India
IP Rating	IP68 for Junction Box
Fire Safety	IEC 61730-1/-2; Class II (Double Insulated)
Electrical Safety	CE Marking; MCS / CEC Approved (if applicable)
Salt Mist / Ammonia	IEC 61701 (Salt Mist) & IEC 62716 (Ammonia Corrosion) Certified
RoHS Compliance	Yes – Restriction of Hazardous Substances compliant

5. WARRANTY & PERFORMANCE GUARANTEE	
Product Warranty (Workmanship)	10 Years from date of supply
Linear Power Output Warranty	25 Years: $\geq 90\%$ at Year 10, $\geq 80\%$ at Year 25
Annual Degradation Rate	$\leq 0.55\%$ per year after Year 1
First Year Degradation	$\leq 2.0\%$
6. COMPATIBLE SOLAR CHARGE CONTROLLER (MPPT TYPE)	
Type	Maximum Power Point Tracking (MPPT)
Rated PV Input Voltage	12V / 24V / 48V Auto-Select or Fixed as per system design
MPPT Voltage Range	12 V – 150 V DC
Maximum PV Input Power	≥ 600 W
Rated Charge Current	20 A – 40 A (as per system design)
Efficiency	$\geq 98\%$
Battery Type Compatibility	Sealed Lead Acid (SLA), AGM, Gel, Li-FePO4
Protection	Over-Charge, Over-Discharge, Short Circuit, Reverse Polarity, Over Temperature
Display	LCD / LED display for V, A, State of Charge (SoC), Fault Codes
IP Protection (Controller)	\geq IP20 (indoor enclosure); if outdoor – IP65
Communication	RS485 / Modbus RTU (preferred for remote monitoring)
Operating Temperature	-20°C to $+55^{\circ}\text{C}$
Certifications	CE, RoHS; BIS IS 16221 as applicable
7. SURGE PROTECTION DEVICE (SPD) – TADIJT CHALAK / TRISHUL TYPE	
Type	Trishul / Tadijt Chalak (Lightning Arrestor cum SPD) for Smart Pole
Application	DC Side Protection for Solar PV Array + AC input protection if applicable
SPD Class	Type 1+2 Combined (Class I+II) as per IEC 61643-11
Maximum Continuous Operating Voltage (Uc)	$\geq 1.2 \times \text{Voc of PV Array (DC side)}$
Impulse Current (Iimp)	≥ 12.5 kA per pole (10/350 μs waveform)
Nominal Discharge Current (In)	20 kA (8/20 μs)
Maximum Discharge Current (Imax)	40 kA (8/20 μs)
Remote Fault Indication	Thermal Disconnecter with Visual Flag (Green/Red) and dry contact for remote monitoring
Mounting	DIN Rail mounting inside pole MDB / enclosure
IP Rating (SPD Module)	\geq IP20 (in enclosure); terminal cover IP44
Earthing	PV system earthing as per IS 3043; dedicated earth electrode $\leq 5 \Omega$ resistance; 25mm ² GI earth conductor from pole to earth pit
8. REPUTED INDIAN MANUFACTURERS – SOLAR PV MODULE	
Make 1 – Adani Solar (Mundra Solar PV Ltd.)	dani Solar (Mundra Solar PV Ltd.) / Waaree Energies Ltd. / Vikram Solar Pvt. Ltd., Kolkata, or equivalent reputed manufacturer meeting all technical specifications
174 Solar Panel complete Instillation on Smart Pole	
1. Work Description	
Site	Smart Pole locations as directed by Site Engineer, Ratlam Division / Western Railway
Applicable Standards	IS 875 (Wind Loads), IS 3043 (Earthing), IS 16221 (Solar Charge Controller), IEC 62446 (PV System Commissioning), CEA Regulations 2010 (amended), Railway Board Guidelines
2. FABRICATED MOUNTING FRAME (POLE TOP)	
Frame Material	MS (Mild Steel) Angle Iron, Galvanized (Hot-Dip), suitable size – minimum 50×50×5 mm or 65×65×6 mm depending on panel weight and wind zone
Galvanizing Standard	IS 2629 / IS 4759 – Hot Dip Galvanized, minimum 85 μm coating
Frame Design	Welded fabricated frame with adjustable tilt angle provision (10° – 30° South-facing tilt); designed for ≥ 150 km/h wind speed
Panel Fixing on Frame	M8 / M10 SS 304 bolts, spring washers and lock nuts at all four corners of module frame; vibration-resistant fastening
Pole Top Fixing	Suitable clamp/bracket welded to pole top boss; Grouting bolts / expansion fasteners into pole body as applicable; Structural design as per IS 800
Frame Load Capacity	Frame to withstand combined dead load (panel weight) + wind load with Factor of Safety ≥ 2.5
Anti-Corrosion Treatment	All cut ends re-painted with zinc-rich primer + finish coat after fabrication; touchup of galvanizing as per IS 2629
3. CABLING & CONDUIT	
Module Interconnection Cable (Series)	1 × 2.5 sq.mm Solar DC PV Cable (TÜV / UL listed, UV-resistant, double insulated, 1500V DC rated)
Module Interconnection Cable (Parallel)	2 × 2.5 sq.mm Solar DC PV Cable (same spec); for parallel string connection
Junction Box to Charge Controller Cable	2 × 10 sq.mm Multistranded Flexible Copper Cable, PVC/XLPE insulated, 1100V grade; Sun-resistant sheathing on exposed runs
Charge Controller to Battery / Load Cable	2 × 6 sq.mm or 2 × 10 sq.mm as per current rating; clearly labelled +ve and –ve
Cable Routing	Through GI / HDPE rigid conduit pipe (minimum 25mm ID) along pole; conduit to be clamped at ≤ 500 mm intervals; waterproof gland entry at pole / enclosure
Conduit Specification	Heavy gauge GI conduit (IS 9537 Part 3) or HDPE rigid conduit (IS 7098 Pt 2) as per site condition; all bends to use factory bends, no field-cut bends
Cable Connectors	MC4 or equivalent IP67 rated connectors for PV string; no bare joints in exposed runs
Cable Identification	Ferrule / sleeve marking at both ends; polarity marking (Red = +ve, Black = –ve)
Minimum Bending Radius	As per cable manufacturer; generally $\geq 6 \times$ cable OD
4. GROUTING BOLTS & HARDWARE	

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Video Compression	H.265+/H.265/H.264+
Recognition Accuracy	Minimum 95% under standard operating conditions
Vehicle Database	Black List, White List and Authorized Vehicle Database Management
Report Generation	Daily, Weekly, Monthly, Vehicle-wise, Time-wise, Entry/Exit and Custom Reports
Search Facility	Search by Vehicle Number, Date, Time, Vehicle Type and Location
Recorder	Suitable NVR/Server with required storage for minimum 30 days recording
Storage	Enterprise Grade HDD Storage suitable for 30 Days Video Retention
Network Switch	Managed Gigabit Network Switch with adequate ports and uplinks
Software	Centralized ANPR Management Software with Dashboard and Analytics
User Access	Role Based User Management and Audit Logs
Alerts	Instant Alerts for Blacklisted Vehicles and Unauthorized Entry
Integration	Support Integration with CCTV, Command Centre and IP Networks
Network Protocols	TCP/IP, HTTP, HTTPS, RTSP, ONVIF or equivalent
Power Supply	Suitable Power Adapters/PoE Arrangement as required
Installation	Complete Supply, Installation, Testing, Commissioning and Training
Warranty	Minimum 3 Years OEM Warranty and Technical Support
Application	Railway Stations, Parking Areas, Entry Gates, Circulating Areas and Security Monitoring
Popular Makes Available in India	Hikvision, Dahua, Axis Communications or equivalent
Reference Models	Hikvision iDS-2CD7A46G0/P-IZHSY, Dahua ITC431-RW1F-IRL8, Axis Q1700-LE
178 FIBER MULTIPLEXER Make Cygnus 432 GATE-COM or similar	
Fiber Ports (SM SC BiDi)	2 nos. SC Bi-Directional OFC Ring / Linear connectivity (20 km range)
E&M Voice — Omnibus (LC Gate Master/Slave)	1 no. RJ45 Socket 2-wire E&M; Omnibus LC Gate telephone over OFC ring
E&M Voice — RTU / Data Logger (Point-Point)	2 nos. RJ45 Socket 2/4-wire E&M; RTU & Data Logger between LC Gate and Station over OFC linear
Ethernet — CCTV (10/100 Base-T)	2 nos. (min.) RJ45 Socket CCTV camera data over OFC ring
Serial — RS232 / RS422 (RTU / Data Logger)	2 nos. 9-pin D-Sub Female Point-to-point RTU & Data Logger between LC Gate and Station over OFC linear (Desirable)
Potential Free Contacts / PFC (Alarm)	2 nos. — Fiber Link Down alarm; connectable to Data Logger network (desirable)
TOTAL PORTS	11 Ports (2 Fiber + 3 Voice E&M + 2 Ethernet + 2 Serial + 2 PFC Alarm)
GENERAL	
Equipment Function	Simultaneously interconnect Omnibus LC Gate Telephones, CCTV Cameras, and RTU / Data Loggers over optical fiber medium.
Topology Modes	Linear or Ring topology selectable based on interface / fiber connectivity.
Form Factor	Tabletop model/Rack Mountable as per site requirement
FIBER PORTS	
Number of Fiber Ports per Unit	Two (2) fiber ports per unit.
Fiber Type	Single Mode (SM) fiber.
Connector Type	SC Bi-Directional (SC BiDi).
Minimum Driving Range	20 km.
Redundant Fiber Changeover	Automatic changeover facility to redundant fiber link shall be provided; changeover shall be fast and seamless without requiring reset of user devices.
USER / INTERFACE PORTS — VOICE (E&M)	
Port 1 — Omnibus LC Gate Telephone (2-wire E&M)	One (1) no. 2-wire E&M interface with OMNIBUS functionality for LC Gate Master and Slave telephone connectivity over OFC ring topology. Connector: RJ45 Socket.
Ports 2 & 3 — RTU / Data Logger Voice (2/4-wire E&M)	Two (2) nos. 2/4-wire E&M interfaces for point-to-point communication of RTU and Data Logger between LC Gates and Station over OFC linear topology. Connector: RJ45 Socket.
USER / INTERFACE PORTS — ETHERNET	
Ports 4 & 5 — CCTV Ethernet (10/100 Base-T)	Minimum two (2) nos. 10/100 Base-T Ethernet ports for CCTV camera applications over OFC ring topology. Connector: RJ45 Socket.
USER / INTERFACE PORTS — SERIAL DATA	
Ports 6 & 7 — RS232 / RS422 (RTU / Data Logger)	Two (2) nos. RS232 / RS422 interfaces for point-to-point communication of RTU and Data Logger between LC Gates and Station over OFC linear topology. Connector: 9-pin D-Sub Female.
PORT PROTECTION	
Over-voltage & Over-current Protection	Protection against over-voltage and over-current shall be provided on ALL user ports (Voice E&M, Ethernet, and Serial interfaces).
RING / LINEAR TOPOLOGY OPERATION	
Ring Node Connectivity	Each node connects to previous and subsequent neighboring nodes via two fiber ports; ring is closed by connecting last node back to first node.
Fiber Break Resilience (Ring Mode)	Network shall provide uninterrupted communication even if fiber is disconnected in one segment of the ring.
Fallback to Linear Mode	In the absence of redundant fiber link between first and last node, system shall automatically operate in linear topology mode.
ALARMS / POTENTIAL FREE CONTACTS (PFC)	
Number of PFCs	Two (2) Potential Free Contacts (PFCs) for alarm indication — e.g., local and remote Fiber Link Down.
Integration with Data Logger Network	PFCs shall be connectable to a Data Logger network for centralized monitoring of alarms.

POWER SUPPLY	
Input Voltage	24V DC or 48V DC (dual-voltage compatible; either supply acceptable).
INDICATORS AND DISPLAY	
LED Indicators	LED indicators for status display of: Test, Power, Fiber Link Up, and Alarm.
7-Segment Displays	Two (2) nos. 7-segment displays showing: (i) Unit node address, (ii) Fault location node address.
ENVIRONMENTAL REQUIREMENTS	
Operating Temperature Range	-10 °C to +70 °C.
Make	CYGNUS/ Prayog Electronics/ Epsilon
167 GI pole 15 Feet for CCTV	
1. ITEM DESCRIPTION & SCOPE	
Item Description	Supply, Erection, Testing and Commissioning of SS CCTV Smart Pole with Solar Power System, Outdoor Cabinet, Networking Equipment, Earthing and SPD (Tadit Chalak / Trishul Type) complete in all respects
Application	Railway CCTV / IP Surveillance, Telecom and Network Infrastructure, Smart Pole for Ratlam Division / Western Railway
2. POLE STRUCTURE	
Pole Material	Stainless Steel Seamless / ERW Pipe, Grade SS-304 (IS 6911). For coastal/industrial zones: SS-316L
Pole Diameter	114.3mm OD (4.5") or 100mm NB, minimum 4mm wall thickness (structural requirement for wind + combined load)
Pole Height	15 Feet (4.575m) Overall: 3 Feet (0.9m) below ground + 12 Feet (3.65m) above ground level
Pole Finish	Mill finish SS; no painting required. Ground level junction to be wrapped with bituminous tape (300mm height) to prevent crevice corrosion
Design Wind Speed	Minimum 150 km/h as per IS 875 Part 3 (Wind Zone III – Madhya Pradesh / Ratlam); combined dead load + wind load; FOS ≥ 2.5
Pole Top Arrangement	Camera mounting bracket + solar panel sub-frame; structural adequacy to be confirmed by fabricator for combined load
3. BASE PLATE & ANCHOR BOLTS	
Base Plate	SS-304 Base Plate, 10mm thick, 300×300mm; 4 Nos. 10mm dia SS-304 support/gusset bars welded to plate and pole
Anchor Bolts	4 Nos. M16×400mm HDG (Hot-Dip Galvanized) anchor bolts with double nut, spring washer and flat washer; bolt projection above plate: 80mm
Grouting	Non-shrink cementitious grout (Fosroc Conbextra GP2 or equivalent) under base plate; minimum 25mm thick grout pad
4. FOUNDATION (MAJBOOT RCC)	
Foundation Type	Reinforced Cement Concrete (RCC) M20 Grade (1:1.5:3) – NOT PCC; "Majboot" (robust) foundation
Pit Size	Minimum 600(L) × 600(W) × 900(D) mm; actual depth as per soil bearing capacity and site engineer direction
Reinforcement	4 Nos. 12mm dia TMT Fe-500 vertical bars; 8mm dia TMT stirrups at 150mm c/c; 50mm clear cover all round
Concrete Curing	Minimum 7 days wet curing; backfilling only after 72 hours of concreting
Surface Finish	Final plastering with CM 1:3 (15mm thick); haunching around pole base (150mm height) to prevent water ponding
Cable Ducts in Foundation	2 Nos. 50mm dia HDPE ducts cast-in for power and OFC cable entry from underground
5. CAMERA MOUNTING BRACKET	
Bracket Type	SS-304 pipe bracket (swan-neck / J-arm type), 40mm OD pipe, outreach 300–500mm (as per site requirement), rated load ≥ 15 kg
Mounting on Pole	Welded / bolted at top of pole; M10 SS-304 bolts; cable entry gland at bracket base (IP67)
Pan-Tilt Plate	SS adjustment plate for camera pan (±30°) and tilt (0–90°) with locking bolts
Cable Entry	Internal cable routing through pole body and bracket pipe; cable exit with IP67 SS gland
Camera Compatibility	Suitable for Fixed / Dome / PTZ IP cameras up to 5 kg; ONVIF compatible cameras as per separate CCTV schedule
6. OUTDOOR CABINET / 6U RACK	
Cabinet Type	6U Wall-mount / Pole-mount Outdoor Network Cabinet; CR Steel 1.5mm min; powder coated RAL 7035 (light grey)
Protection Rating	IP65 minimum (dust-tight + water jet proof); tested as per IEC 60529
Cabinet Dimensions	Internal: minimum 600(H) × 600(W) × 300(D) mm; accommodates 6U rack + cable management + DIN rail + battery space
Thermal Management	Thermostat-controlled cooling fan + intake filter; operating range −10°C to +55°C (Ratlam ambient up to 47°C in summer)
Locking	Three-point locking with key; provision for padlock; tamper-proof hinge screws
DIN Rail & Rack	2 Nos. 35mm DIN rail for MCB / SPD / terminal blocks; 6U 19" rack for FMS / media converter / switch; cable management rings
Power Distribution	1P MCB 63A DP RCCB/ELCB at incomer; 3 Nos. individual 6A/10A MCB protected 5/15A industrial sockets; each socket labelled
Reference Makes	Valrack, NetRack, Rittal, APW President, Legrand or equivalent approved by Railway Engineer
7. NETWORKING & TELECOM EQUIPMENT (IN CABINET)	
Media Converter	Industrial SM Media Converter, 10/100/1000Base-T ↔ 1000Base-FX SFP, −20°C to +70°C, 9–48V DC, DIN rail; SFP module: LC SM 20km; Make: Moxa IMC-P101 / Planet GT-906 / Korenix JFM-series or equiv.
PoE Network Switch	Layer-2 Managed Industrial PoE+ Switch, min 4× GE PoE+ (IEEE 802.3at, 30W/port) + 2× GE SFP uplink; DIN rail; 48V DC input; −20°C to +70°C; VLAN/QoS; Make: Cisco IE-1000 / Moxa EDS-G308 / Hirschmann RS20 or equiv.
Fiber Management System (FMS)	1U/2U Rack-mount FMS, 12/24-port LC/SC SM adaptors, splice tray for 12 fibers, sliding tray, dust caps on all unused ports; Patch cords: LC-LC SM, 1m, 2 Nos. per port

OFC Type	SM G.652D as per existing OFC network; Fusion splicing, splice loss ≤ 0.1 dB; OTDR test report to be submitted after commissioning
UPS / Battery Backup	Provide 12V/24V sealed VRLA AGM battery with charging circuit (or Solar MPPT controller) for uninterrupted operation; autonomy: minimum 8 hours (off-grid) / 30 min (grid + UPS mode) as per system design
8. SOLAR PANEL & MPPT SYSTEM (COMPLETE)	
Solar Module	500–550 Wp Mono-PERC Half-Cut, ALMM listed (MNRE), BIS certified; makes: Adani Solar / Waaree / Vikram Solar (refer Sheet: Solar Panel Spec)
Mounting Frame	MS angle iron 50×50×5mm minimum, Hot-Dip Galvanized (IS 2629), tilted sub-frame at pole top; tilt 23–25° South-facing; designed for 150 km/h wind load; separate structural check by fabricator
MPPT Charge Controller	As per Solar Panel Spec sheet; installed inside outdoor cabinet; rated for system Voc/Isc; with display; RS485/Modbus for remote monitoring
Cabling	1×2.5 sqmm (series connection), 2×2.5 sqmm (parallel), 2×10 sqmm junction-to-controller; TÜV-listed UV-resistant solar DC cable; MC4 IP67 connectors; routed through HDPE conduit inside pole
Battery Bank	2× 12V 100Ah Sealed VRLA Gel or Li-FePO ₄ (24V, 100Ah system); housed in lockable battery box at pole base; vented as per battery manufacturer requirement
9. EARTHING SYSTEM	
Earth Electrode	GI Pipe 40mm dia × 3m long, 4mm wall (IS 3043 Type A) OR Copper-Bonded Rod 17.2mm × 3m; one electrode per pole
Earth Conductor	25mm ² GI flat (25×3mm) or 16mm ² bare copper from pole base to electrode; no joints; clamped at 300mm intervals
Earth Pit	Masonry / precast pit with RCC cover; filled with charcoal + salt mixture; Earth resistance $\leq 5 \Omega$ (fall-of-potential test); result to be recorded
SS Pole to Earth Bond	SS pole connected to earth via bimetallic (SS/Cu) connector + 16 sqmm Cu conductor to avoid galvanic corrosion; NOT direct GI-to-SS contact
Equipotential Bonding	All metallic parts (pole, solar frame, cabinet body, FMS tray, rack, battery box) bonded to common Cu earth bus bar 25×3mm in cabinet; minimum 6 terminals on bus bar
Standards	IS 3043, IEC 62305, IS 2309; Railway earthing circular as applicable
10. SPD – TADIJT CHALAK / TRISHUL TYPE (LIGHTNING PROTECTION)	
Lightning Air Terminal	Franklin Rod / Trishul SS-316 spike (25cm) at top of pole above camera/solar; connected via 50mm ² bare copper conductor along pole to dedicated earth electrode
DC SPD (Solar System)	Type 1+2 Combined DC SPD (IEC 61643-11); $U_c \geq 1.2 \times V_{oc}$; $I_{imp} \geq 12.5$ kA (10/350 μ s); $I_n \geq 20$ kA (8/20 μ s); $U_p \leq 2.5$ kV; DIN rail inside cabinet; earth ≤ 0.5 m path; with fault indication flag
AC SPD (if grid supply used)	Type 2 AC SPD (IEC 61643-11); $I_n \geq 20$ kA (L-N and N-PE); $U_p \leq 1.5$ kV; DIN rail; with remote fault contact; Make: Phoenix Contact / OBO Bettermann / Citel / Havells or equiv.
Network SPD	For Ethernet/CAT cable: Category 6 LAN SPD at cabinet entry; $U_p \leq 50$ V; for RJ45 In-line; Make: Phoenix Contact FL CAT6 or equiv.
Standards	IEC 61643-11 (SPD), IEC 62305 (Lightning Protection), IS 2309 (Air Terminal), Railway Board Circular on Surge Protection
Reference Makes (SPD)	Phoenix Contact, OBO Bettermann, Citel, Havells, Schneider iQuick or Railway-approved equivalent
11. CABLE ROUTE & UNDERGROUND WORK	
OFC Duct	32mm dia HDPE duct (IS 14930 Pt 2) for OFC; burial depth minimum 600mm in Railway area; sand bedding 100mm above and below; brick protection course
Power Cable Conduit	25mm dia GI conduit (IS 9537 Part 3) for power cable underground; GI to be connected to earth at entry/exit
Route Markers	Permanent route markers (CC block or GI stake) at every 5m and at change of direction; cable route drawing to be submitted
Cable Identification	Ferruled at both ends; OFC: fibre-wise colour coding per TIA-598; power: Red=+ve / Black=-ve / Green=Earth
12. IDENTIFICATION, LABELLING & DOCUMENTATION	
Pole Name Plate	SS-316 riveted nameplate at 1.5m height: Railway logo, pole ID (e.g. RTM-CCTV-001), installation date, contractor; as per Railway format
Cabinet Door Chart	Laminated circuit directory chart inside cabinet door: circuit-wise description, MCB ratings, cable sizes
Test Records	Earth resistance test report; OTDR test report; IR test report; commissioning checklist – to be handed over to Railway Engineer
As-Built Drawings	Cable routing drawing; pole foundation drawing; cabinet wiring diagram – in A3 format, soft + hard copy
13. WARRANTY, STANDARDS & REFERENCE MAKES	
Warranty	2 Years comprehensive from date of commissioning; Defect Liability Period as per GCC 2022; all parts and labour included in warranty
Applicable Standards	IS 2062 (Steel), IS 6911 (SS Pipe), IS 875-3 (Wind), IS 3043 (Earthing), IS 2309 (Lightning), IEC 62305, IEC 61643, IEC 60529 (IP), RDSO/SPN/TC/0091 (CCTV), GCC 2022, Railway Board guidelines
SS Pipe Makes	Jindal Stainless (Hisar) / Ratnamani Metals / Venus Pipes / Sanghvi Overseas or Railway-approved equivalent
Cabinet Makes	Valrack / NetRack / Rittal / APW President / Legrand or Railway-approved equivalent
Networking Makes	Cisco / Moxa / Hirschmann / Korenix / Planet for switches and media converters; Phoenix Contact / OBO / Citel for SPD
Solar Makes	Adani Solar / Waaree Energies / Vikram Solar (ALMM listed, MNRE approved)