



## Flexible Serial Data Extensions over IP Packet or MPLS Networks

The **Black•Tube CEP RS232** converts RS232 serial data connections into **AES** encrypted IP packets, extending the serial data over very cost effective Ethernet or MPLS based LAN/WAN/MAN wired and wireless networks. Synchronous, Asynchronous, Isochronous or HDLC serial data is encrypted then encapsulated into IP packets. This facilitates the interconnection of Serial Data over IP between Serial Bulk Encryptors (KIV7/OMNI), Data Terminals, Data Acquisition Systems, WAN Routers and Bridges and SCADA RTUs.

### Layer 1 with Isochronous Support

In Layer 1 operating mode every bit is encapsulated into an IP packet. The size and frequency of the IP packets can be set with data bit rates from 75 bits to 256 kilobits per second. Isochronous serial protocols, such as Conitel, are transported synchronously to maintain message alignment. A configured number of incoming packets are buffered in order to compensate for the packet delivery jitter introduced by the network. The size of the Tube bit buffer is configurable to accommodate the peak amount of jitter.

### Asynchronous Over IP

Asynchronous characters from the RS232 interface with 5 to 8 data bits, baud rates from 1.2 to 38.4 kilobits, 1 or 2 stop bits that are with or without parity are efficiently encapsulated into IP packets. The encapsulation supports block mode transfers to minimize the bandwidth required. Additionally the latency is controlled by setting the Tube Bytes per packet.

### HDLC Over IP

In Layer 2 operating mode HDLC Data frames, such as those used by Wide Area Networking protocols PPP and Frame Relay or proprietary Data Links, are transported within IP packets as HDLC over IP. The Serial to Packet conversion only occurs when HDLC frames are active.

### SCADA Protocol Transparency

The **Black•Tube CEP** transports Bit or Byte orientated SCADA protocols transparently because of its unique TDM circuit emulation capability. RTU transmit data is encapsulated into IP packets at 64,000 samples per second and de-encapsulated at the



### Assured Delivery Protocol

In order to assure high quality communications over links with intermittent or noisy performance, such as Wireless.

- Packet out of sequence detection and re-sequencing
- Duplicate skipping
- Lost packet retransmissions with configured delay

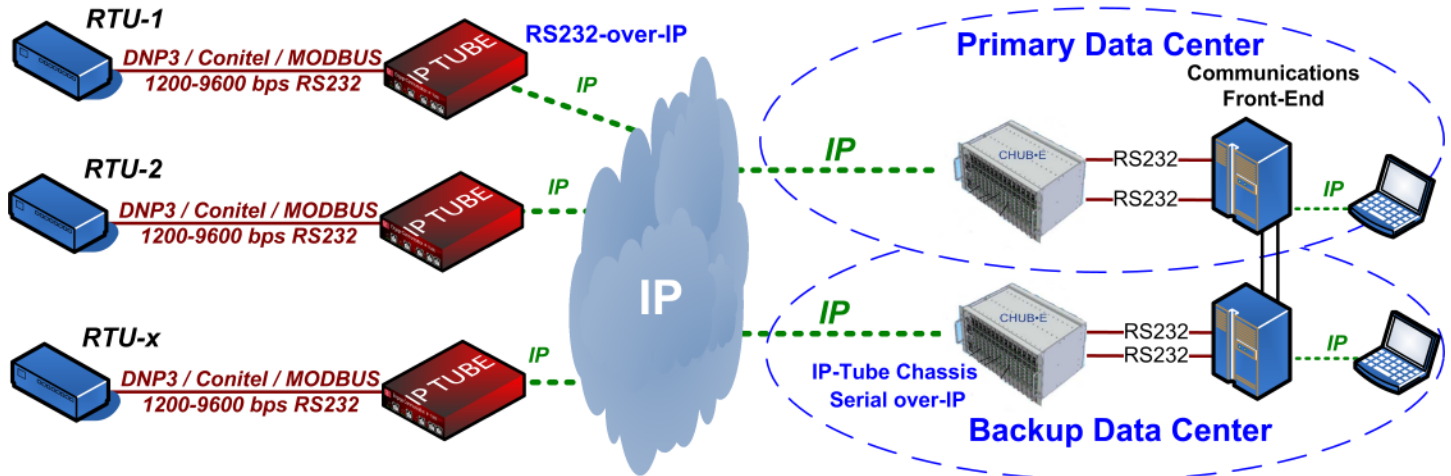
### Protector OPTION -PRO

The protector option utilizes the second LAN interface as a redundant path for the interconnection of the IP encapsulated RS232 data. The extension of the RS232 has a fault tolerant link that is configured to always on, or with switch over criteria.

## Black•Tube CEP RS232 Utility Applications

NERC -CIP mandates control center redundancy. RTUs must be accessible from, and be able to connect to, multiple control centers. Black•Tube CEP continuously monitors connectivity to the active control center and automatically switches to the active backup control center (1 to 4 supported).

- Meets NERC mandates for control center redundancy
- Preserves investment in RTU and Central site SCADA
- Facilitates control center redundancy with IP flexibility
- Supports up to four redundant control centers
- Redundant and diverse connectivity

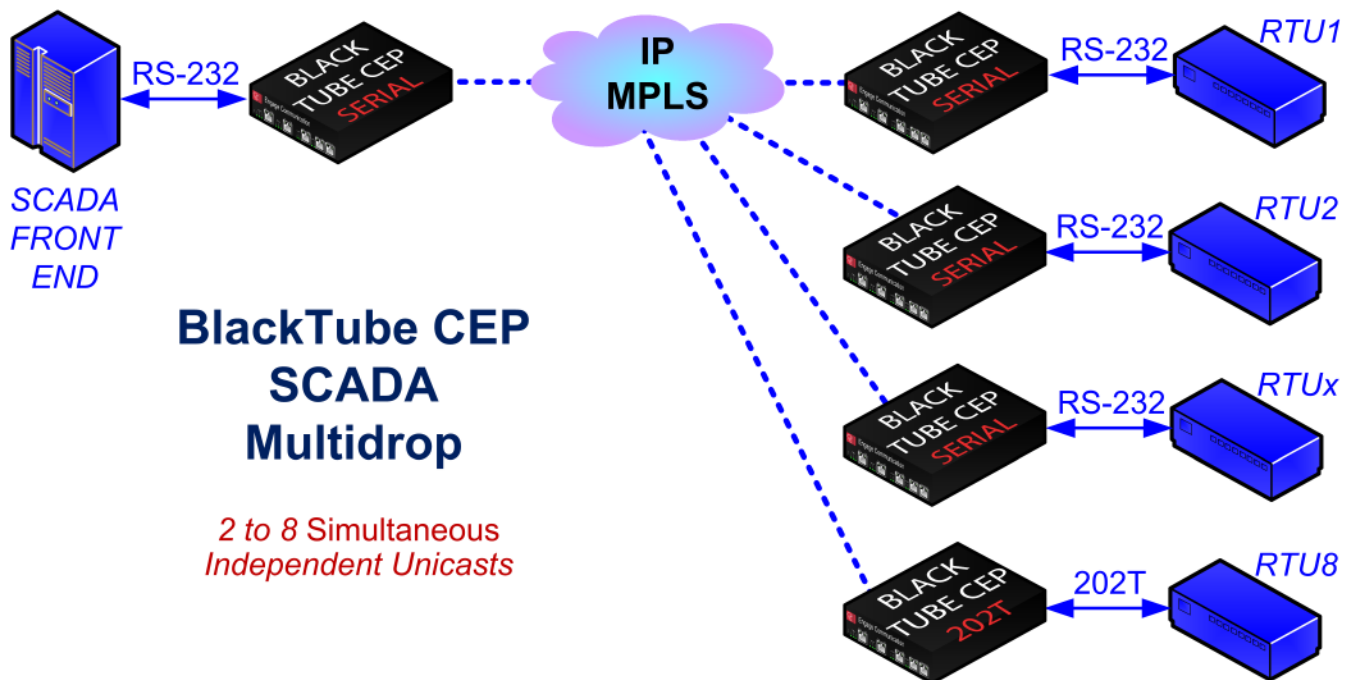


**NERC Redundant and Diverse Connectivity**

## Black•Tube CEP Multidrop

In order to minimize the number of analog telephone circuits required to connect Data Center Front End SCADA controllers to Substation Remote Terminal Units Multi-Drop communication protocol was implemented. The CEP Multi-Drop feature allows a single RS-232 SCADA host connection to communicate with up to 8 remote terminals over a packet based network

The Black•Tube CEP transparently supports Multi-Drop by simultaneously transmitting IP packetized Front End SCADA messages to up to eight remote Black•Tube CEPs. The Black•Tube CEP connected to the addressed RTU detects a control signal and sends the SCADA response back to the Serial interface connected to the Front End polling port.



### BlackTube CEP SCADA Multidrop

*2 to 8 Simultaneous  
Independent Unicasts*

## Black•Tube CEP Management

### Management Module

Black•Tube CEP isolates management and data plane functionality with the use of two separate processor modules. Management processor access is limited to encrypted sessions via SSH, or SNMPv3, that employ AES 256 bit keys and sophisticated NIST passwords. These sessions may be established after authentication via TACACS+ or Radius.

The independent Linux based management plane of the Black•Tube CEP ensures Critical Infrastructure Data is isolated from management network access. The Management Module uses internal serial ports to connect to the Data Plane processor.

Administration and User Logs are available with Syslog.

## NERC CIP Compliance

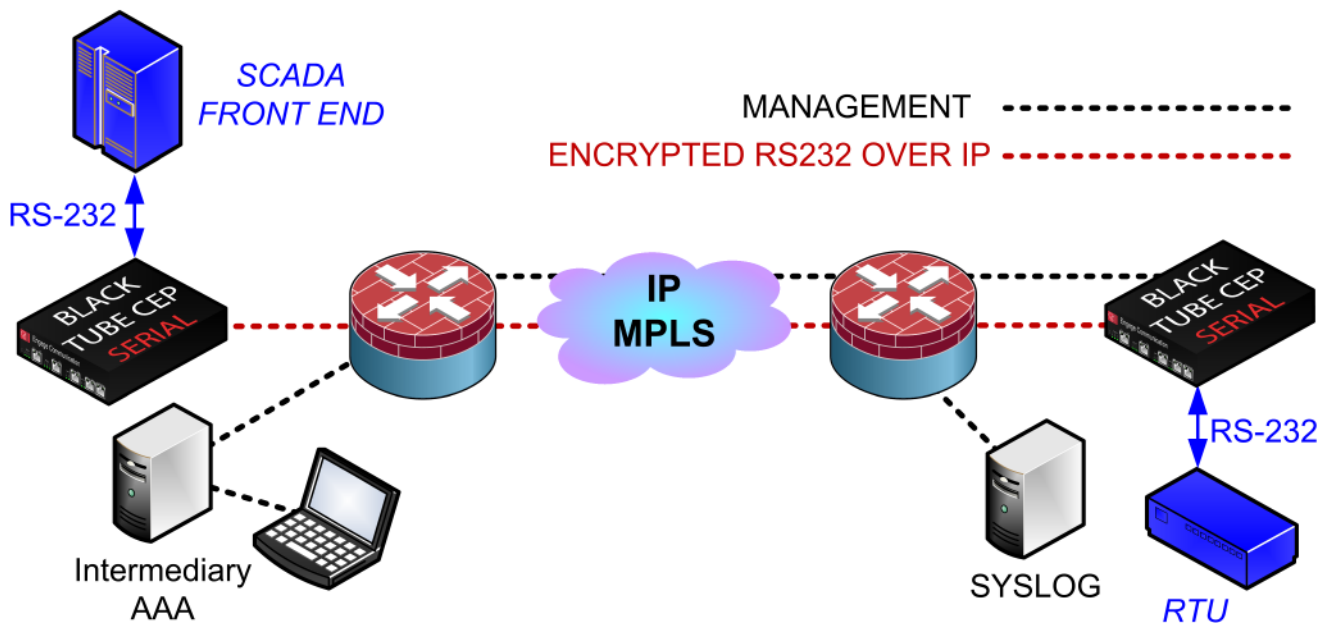
The Black•Tube CEP installations achieve NERC CIP compliance with a combination of internal and external functions.

Internally the Management Module software has the sophistication to implement comprehensive policies and privileges for administrator and user accounts. Administrator policy includes removal, disabling or renaming.

Interoperability with external functions such as Syslog, Network Timing Protocol, TACACS+ and Radius with its support for RSA SecureID delivers trusted compliance.

Electronic Security Perimeter	CIP-005 Requirement	IPTube CEP Solution
The Black•Tube CEP in combination with industry standard services meets the Electronic Security Perimeter's NERC CIP-005 specifications. In addition Control Plane isolation from the Data plane provides a higher level of security for the Cyber Assets.	R2.1 - Deny Access by Default	• Accounts must be created to allow access
	R2.2 - Enable only needed ports	• Each Port may be enabled or disabled
	R2.4 - Strong Technical Controls	• RSA's SecureID two-factor Authentication
	R3.2 - Unauthorized Access	• Alert messages via Syslog or TACACS+
	R5.3 - Access Logging	• Syslog of Access and Command interactions
System Security Management	CIP-007 Requirement	IPTube CEP Solution
Access control is Authenticated, Authorized and Accounted for with Radius or TACACS+. Security Patches managed proactively.	R2.1-3 - Ports and Services	• Unused Serial Ports and Services are disabled
	R3 - Security Patch Management	• Kernel and application upgrade alerts
	R5.3 - Secure Passwords	• Require minimum length, strength, frequency
	R6.4 - Security Status Logs	• Syslog and AAA via TACACS+

## NERC CIP 05 BlackTube CEP Compliant Operation



## Technical Specifications

**LAN Network Interface:**

- LAN1/LAN2: Two Data Plane 10/100 Base T
- MLAN: Control Plane 10/100 Base T

**LAN Network Protocols Supported:**

- IP, TCP, UDP, ICMP, Telnet, DHCP, DDNS, SSH
- Network Time Protocol - NTP

**RS232 Interfaces:**

- 1-3 DCE/DTE RS232: 2 DB25F Connectors;  
1 DB60F connector: Requires an adaptor cable- DB60M to 1 DB25M

**RS232 Interface Clocking:**

- Synchronous: 75 bits to 256 kilobits per seconds
- Asynchronous, Isochronous : 75/300/600 bits per second  
1.2/2.4/4.8/9.6/19.2/38.4 Kilobits per second

**RS232 Interface Control Signal Extension:**

- Comprehensive DTR/DSR/RTS/CTS/DCD State Processing and Extension
- DTR & RTS Enveloped Transmission • CD ReCEPTION

**RS232 Over IP Protocol:**

- Serial Over IP • Circuit Extension Services Over IP • HDLC Over IP
- Multi-Drop: 2 to 8

**Protocols Supported:**

- HDLC, SDLC, PPP, Frame Relay
- Conitel, Modbus, DNP, Proprietary, Bit or Byte, AutoBaud

**SCADA Encryption Algorithm:**

- AES 256-bit • Fully Automatic key management

**Management:**

- Secure Socket Shell - SSH V2 - Session Encryption
- Centralized Authentication, Authorization and Accounting  
- TACACS+, RADIUS, Two Factor Authentication
- Syslog with NTP Time Stamping
- Console Port for Out of Band Management
- SNMP V3 Public and Private MIB support with configured traps

**Quality of Service Support:**

- IP Type of Service (TOS) CLI configured
- IANA Registered UDP Port 3175
- 802.1p/q mac level prioritization

**Regulatory:**

- CE • Safety -IEC60950 • EMC - CFR 47 Part 15 Sub Part B:2002, EN55022:1994+A1&A2, EN55024, ICES-003 1997, CISPR 22 Level A

**Dimensions:**

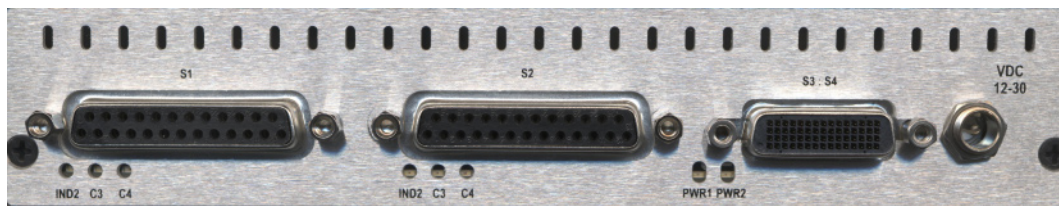
- Dimensions: 9" (L) x 7.3" (W) x 1.50" (H)

**Environmental:**

- 0° to 132° F (-10° to 50°C) operating temperature
- Up to 90% operating humidity (non-condensing)
- Optional Extended Temperature Range (-40°C to 70°C)

**Power:**

- 12-30 VDC, 1.0A. • Screw Locking Connector
- Universal Adapter 100/240 VAC 50/60 Hz
- Optional -48V 0.25 Amp • Hot Standby



### How to Order — Black•Tube CEP RS232

Part No.	Description	Notes
CEP-007-2232-0x	Black•Tube CEP RS232	Specify # of RS232 Ports Enabled (1 to 3)
CH-CEP-007-2232-0x	Chassis Slot Card: Black•Tube CEP RS232	Specify # of RS232 Ports Enabled (1 to 3)
Base Option		Specify as suffix
-EXT	Extended Temperature	-40C to 70C
-PRO	Protector Option	Fault Tolerant Network Interconnect
-Y	Serial Redundancy	Serial Interface hardware redundancy
Power Options	Specify as suffix	Hot Standby Configuration 2nd Power Suffix
-HSPDC	Connector for Dual DC Supply	
-WIREDC	Power Supply Module 12/26 VDC Screw Term	
-N48VDC	Power Supply Module Negative 48 Volt DC	Isolated Negative 48 Volt Power
Rack Mount Option		Specify as suffix
-RACKMNT	19" Wide Rack Mount Brackets	Enclosure Nut Serts Installed
Wall Mount Option		
-WALLMNT	Right Angle Wall Mount Brackets	Enclosure Nut Serts Installed