FOX615 SENC1
Quantum-Safe end-to-end encryption for mission-critical real-time communication networks

The encryption card SENC1 secures data transfer in critical infrastructures. It is used in mission-critical real-time applications for controlling and monitoring energy networks.

- Offers end-to-end encryption against cyber-attacks in packet-based transport networks (MPLS-TP)
- Includes an integrated QRNG (Quantum Random Number Generator) for the Quantum-Safe user data encryption.
- 4 (8) x SFP+ 1/10 GbE ports per encryption unit
- Causes near zero delay in PTP (Precision Time Protocol IEEE1588) packets
- Tamper-protected to prevent mechanical manipulation

Overview
For the encryption card on the FOX615 platform, ABB uses a hardware-based QRNG (Quantum Random Number Generator) to generate highly secure keys that really are random. The basis for the trustworthy and protected distribution of keys is provided by a centralized and decentralized generation of keys.

There is no single-point-of-failure and all nodes can securely communicate with one another.

This permanent-encryption method offered by ABB prevents the creation of so-called network islands.

SENC1 encrypts the complete network traffic end-to-end natively on layer 2.5 in MPLS-TP transport networks with ultra low latency times of under four micro-seconds. The card is characterized by parallel high-security end-to-end encryption in mission-critical networks and ensuring very high data availability while providing precise timing.

Highly secure encryption
Encryption and authentication is done through the most secure, state-of-the-art, verified and recommended algorithms currently available to guarantee maximum security.
- Master key (session key encryption)
- Session key (user traffic encryption)
- The Atomic master key exchange without interruption.

For symmetrical encryption, the AES-GCM (Galois Counter Mode) encryption and authentication algorithm with a key length of 256 bit is applied. The session keys are updated every 60 seconds and offer fully automatic key management based on the “set and forget” principle.
Failsafe operation
Failsafe operation plays a vital role in mission-critical networks. Therefore the card can be operated in a redundant setup.

High compatibility
The SENC1 can easily be integrated into existing networks. No adjustments of network structures nor changes on end devices are required.

ABB “Trusted Security”
In the framework of its “Trusted Security” concept, ABB researches, develops and produces in Switzerland and in Europe. ABB Trusted Security includes meeting the highest security requirements, certified employees, a central management of data transfer systems as well as deploying encryption technologies. ABB systems fulfill the applicable standards of the industry and comply with the high requirements operators of mission-critical networks have with respect to high availability and low maintenance.
### Technical Data

#### Hardware

<table>
<thead>
<tr>
<th>4-port (SENC1-4) and 8-port (SENC1-8) hardware version</th>
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<tbody>
<tr>
<td>FPGA based</td>
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<tr>
<td>Fanless version available (SENC1F4, SENC1F8)</td>
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#### Interfaces

<table>
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<tr>
<th>SENC1-4 - 4x 1/10 GbE optical ports (2x encrypt, 2x decrypt)</th>
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<tbody>
<tr>
<td>SENC1-8 - 8x 1/10 GbE optical ports (4x encrypt, 4x decrypt)</td>
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</table>

1 GbE electrical front port and backplane connection for management

#### Data throughput

Up to 10 Gbps

#### Timing

- Latency of user traffic <4 μs
- Delay variation <50 ns (including PTP packets)
- Jitter and wander: Transparent through-timing. PLL bandwidth 50 Hz

#### Quantum Random Number Generator (QRNG)

- Optical component from ID Quantique
- Random numbers for AES-256 encrypted session keys
- Truly random
- Up to 1.5 Mbit/s

#### Tamper Protection

- Tamper-protected features to prevent mechanical manipulation
- Fully covered through metal plates
- Tamper action secured by local on-board battery with >20 years life-time (changeable)

#### Encryption Features

- MPLS-based Encryption Layer 2.5 (MPLS-TP)
- End-to-End encryption of up to 2048 SENC1-4 (4096 SENC1-8) MPLS-TP tunnels
- Encryption and authentication of all communication between the DIRAC server and encryption devices (including transmission of the master key)
- Post-Quantum Cryptography ready.
- For session key encryption and automatic tunnel deployment. Encryption and authentication with AES-CTR Key length: 256 bit Key change: manual, non-disruptive.
- User traffic encryption. Encryption and authentication with AES-GCM (Galois Counter Mode) Key length: 256 bit Key change: automatically min. every 60 seconds, non-disruptive

#### Management

- 1588v2 PTP compatible
- Encrypts PTP packets with near zero delay variation

#### Management Communication Key

- Encryption and authentication with AES-CTR Key length: 256 bit
- Key change: manual, non-disruptive.

#### Master Key

- For session key encryption and automatic tunnel deployment. Encryption and authentication with AES-CTR Key length: 256 bit
- Key change: manual, non-disruptive.

#### Session Key

- User traffic encryption. Encryption and authentication with AES-GCM (Galois Counter Mode) Key length: 256 bit
- Key change: automatically every 60 seconds, non-disruptive

#### 1588v2 PTP compatible

- Encrypts PTP packets with near zero delay variation

#### Management

- FOXMAN-UN
- Sets up the bidirectional LSP / MPLS tunnels as well as the encryption policy for each tunnel

- Dirac Server (Software)
- The DIRAC server is a centralized key management system and is responsible for the generation and distribution of the Master Keys used by the SENC1 Crypto Engines.

- Command line interface (CLI)
- Configuration, supervision, management and activation of the Dirac server and the encryptors
### Technical Data

#### Power supply

| Input voltage nominal (min/max) | –48/–60 V DC (–40.5 V DC … –72 V DC) |

#### Operation environment

| Temperature range and humidity | Acc. to FOX615 environmental specifications |