

# Getting Started

A core component of the Fhenix ecosystem is the FHE.sol solidity library.

FHE.sol is a Solidity library designed to facilitate the use of fully homomorphic encryption within Ethereum smart contracts. FHE enables computations to be performed on encrypted data (ciphertexts) without needing to decrypt them first. The results of such computations, when decrypted, are identical to what would have been obtained if the operations had been performed on the unencrypted data (plaintexts).

To find a full list of functions and their descriptions, please refer to the [FHE.sol documentation](#).

## Installation

To get started with FHE.sol, you need to install it as a dependency in your Solidity project. You can do this using npm, yarn or our personal favorite - pnpm. Open your terminal and navigate to your project's directory, then run the following:

- npm
- yarn
- pnpm

npm install @fhenixprotocol/contracts; yarn install @fhenixprotocol/contracts; pnpm install @fhenixprotocol/contracts;

## Usage

### Key Concepts and Types

#### euint

- Encrypted Unsigned Integer
- Description
  - : Represents an encrypted unsigned integer. This type is used for encrypted variables within smart contracts.
  - The currently supported types are: ebool
  - ,euint8
  - ,euint16
  - &euint32
  - .
  - Usage
  - : Store and manipulate encrypted values within smart contracts.

#### inEuint

- Input Encrypted Unsigned Integer
- Description
  - : A type used for passing encrypted values as function arguments. It's the format in which encrypted data is input into the smart contract functions that process encrypted values.
  - The currently supported types are: inEuint8
  - ,inEuint16
  - &inEuint32
  - .
  - Usage
  - : Pass typed encrypted values as function arguments.

## Core Functions of FHE.sol

#### asEuint

- Convert to Encrypted Unsigned Integer
- Purpose
  - : Converts a plaintext number or an inEuint
  - encrypted input into an euint
  - type.

## decrypt

- Decrypt Encrypted Data
- Purpose
- : Decrypts an uint32 encrypted value back to its plaintext form. If the value should only be revealed to a specific address, the `decrypt` function should be used instead. Learn more about sealing [here](#)
- .

## Arithmetic Operations

FHE.sol supports encrypted arithmetic operations like addition and subtraction. These operations can be performed directly on uint32 types, enabling encrypted computations.

## Comparison Operations

- Purpose
- : Perform comparisons between encrypted values (e.g., greater than, less than).
- Usage Example
- : Make decisions based on encrypted values without revealing their contents.

## Example Use Cases

### Encrypting a Value

To encrypt a value, convert a plaintext uint32 into an uint32 :

```
uint32 plaintextValue = 123; uint32 encryptedValue = FHE.asEuint32(plaintextValue);
```

### Decrypting a Value

To decrypt an encrypted value back to plaintext:

```
uint32 decryptedValue = FHE.decrypt(encryptedValue);
```

warning Decryption of data should be done with caution. Decrypted data should be handled with care and should not be exposed to unauthorized parties.

### Performing Encrypted Arithmetic

You can perform arithmetic operations directly on encrypted values. For example, adding two encrypted values:

```
uint32 sum = encryptedValue1 + encryptedValue2;
```

### Conditional Logic with Encrypted Values

Use comparison operations to implement logic based on encrypted values:

```
uint32 result = FHE.select(encryptedValue1.gt(encryptedValue2), encryptedValue1, encryptedValue2);
```

This example chooses between encryptedValue1 and encryptedValue2 based on their encrypted comparison.

## Integrating FHE into Smart Contracts

When incorporating FHE.sol into your smart contracts, consider the following:

- Privacy vs. Gas Cost
- : While FHE provides strong privacy guarantees, it's computationally intensive and can lead to higher gas costs. Balance the need for privacy with the cost implications.
- Data Types
- : Ensure that your use cases are compatible with the data types and operations supported by FHE.sol
- .
- Security
- : Understand the security model of FHE, including its limitations and how it fits into the overall security posture of your application. [Edit this page](#)