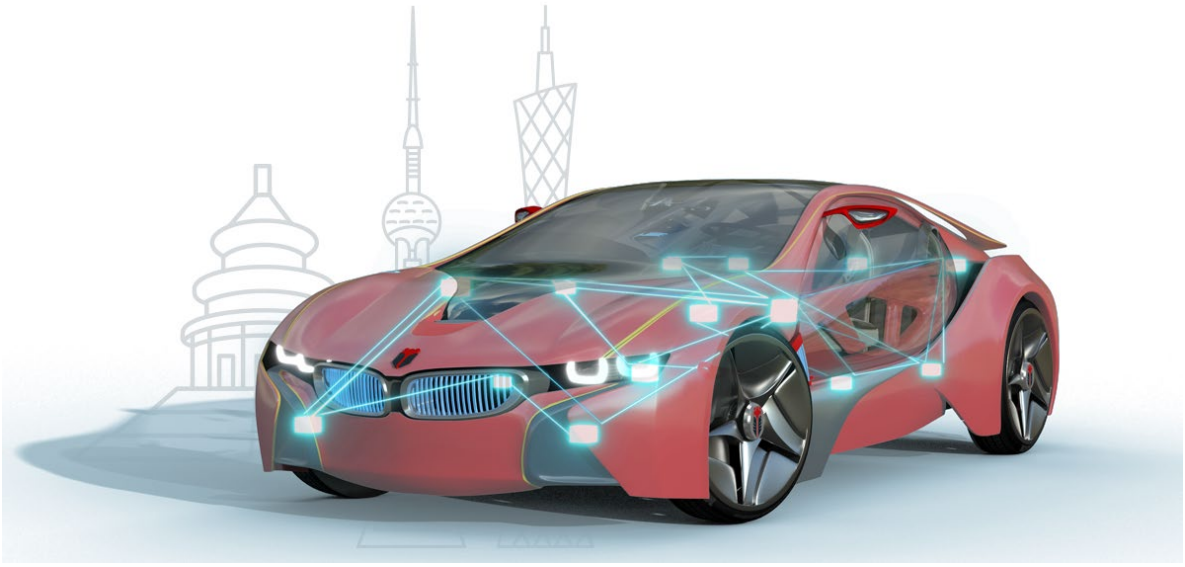
知从木牛配置工具产品手册

ZC.MUNIU CONFIGURATION TOOL PRODUCT MANUAL

知从木牛基础软件平台

ZC.MuNiu Basic Software Platform



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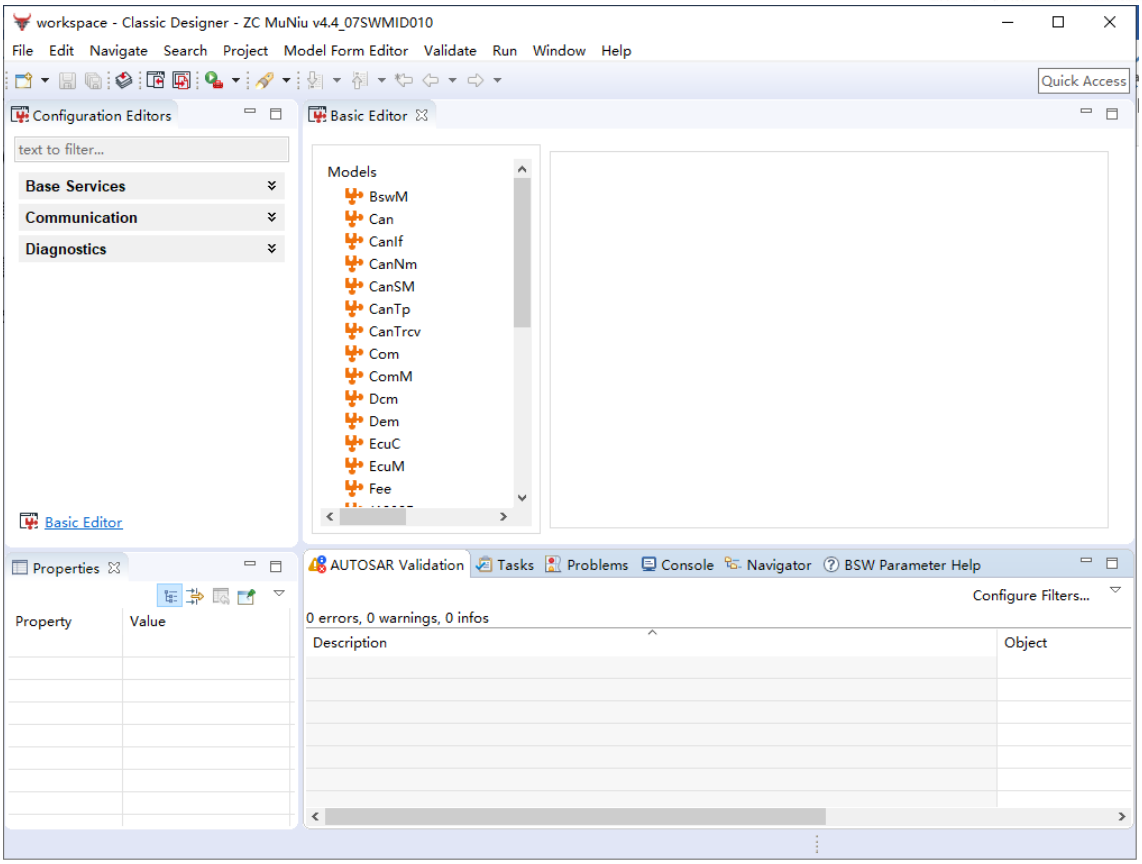
1 功能概述 FUNCTIONAL OVERVIEW

知从木牛配置工具基于最新的 ARTOP 架构开发，支持最新的 AUTOSAR R21-11 标准的基础软件配置工具，提供全套的 BSW 配置和 RTE 生成等功能。目前知从 AUTOSAR 标准的 BSW、复杂驱动、SafetyFrame、CryptoLibrary 等基础软件产品都采用该配置工具。该方案兼容业界主流的标准，包括系统功能设计，ECU 功能映射和组件配置，运行时环境自动代码生成等一系列的工具套件，提供了一套经过实践验证的、开发可重用 ECU 应用软件的基础，可以同 Vector，EB 等工具交叉配合使用。

ZC.MuNiu configuration tool is developed based on the latest ARTOP architecture and supports the latest AUTOSAR 4.4.0 standard for basic software configuration tools, providing a full set of BSW configuration and RTE generation functions. Currently, ZC's AUTOSAR standardized BSW, complex drivers, SafetyLibrary, SafetyFrame, CryptoLibrary, and other basic software products all use this configuration tool. The solution is compatible with mainstream industry standards, including system functional design, ECU function mapping and component configuration, and a suite of tools for automatic code generation in the runtime environment. It provides a set of practical and verified foundations for developing reusable ECU application software, which can be used in conjunction with tools from Vector, EB, and others.



知从木牛配置工具产品特点:

Features of ZC.MuNiu Configuration Tool Product:

- 基于 Eclipse 平台框架，采用插件化和模块化的开发思想，具有跨平台运行，组件化设计，良好的可扩展性。

  Based on the Eclipse platform framework, it adopts the development philosophy of plugin-based and modular design, offering cross-platform operation, component-based architecture, and excellent scalability.

- 提供完整的集成开发环境，支持智能代码编辑、编译、链接和调试功能。

  Provides a complete integrated development environment, supporting intelligent code editing, compilation, linking, and debugging functions.

- 支持 AUTOSAR 开发方法和过程，提供全套 BSW 配置和 RTE 生成等工具。

  Supports the AUTOSAR development methodology and process, offering a full set of BSW configuration and RTE generation tools.

- 基于最新 ARTOP 架构开发，支持最新 AUTOSAR R21-11 标准。

  Developed based on the latest ARTOP architecture, it supports the latest AUTOSAR 4.4.0 standard.

- 支持 BSW 一致性和完整性验证。

  Supports BSW consistency and integrity verification.

- 支持 DBC、LDF、ODX、DEXT、OIL 格式文件导入。

  Supports the import of DBC and ODX format files.

- 支持各种主流的汽车 ECU 芯片，如下表：

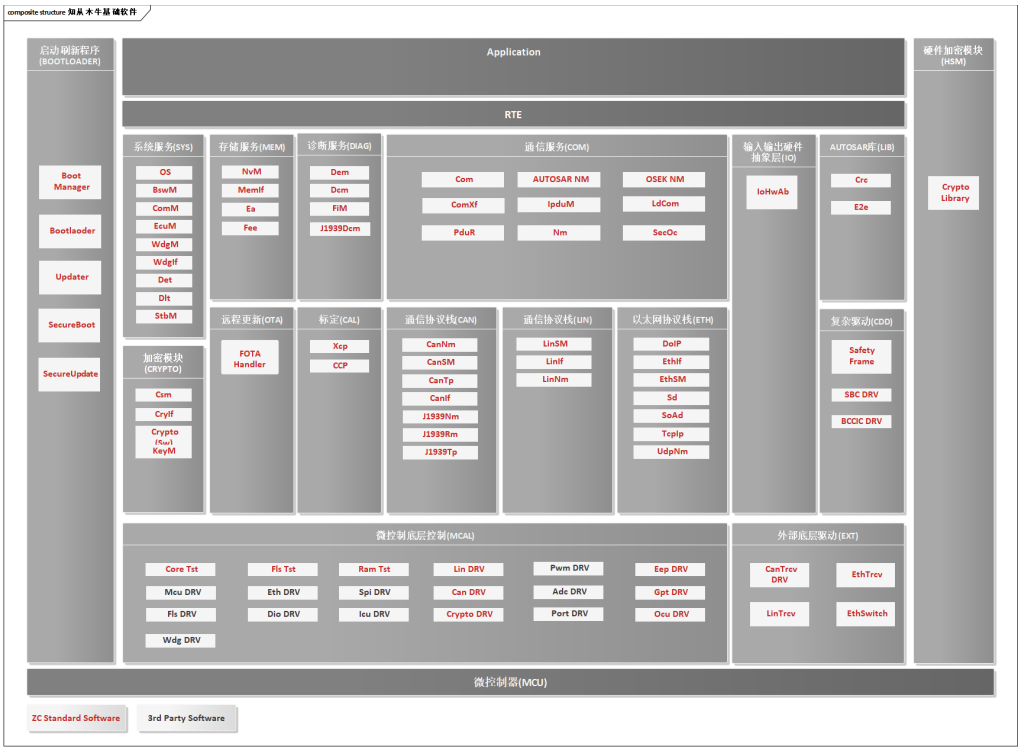
  Compatible with various mainstream automotive ECU chips,

主流芯片支持 Mainstream Automotive ECU Chips		
序号 No.	芯片型号 Model	厂家 Manufacturer
No.1	S32K1XX	NXP
No.2	S32K3XX	NXP
No.3	MPC5744P	NXP
No.4	MPC5746C	NXP
No.5	MPC5748G	NXP
No.6	TC23X	Infineon
No.7	TC27X	Infineon
No.8	TC37X	Infineon
No.9	TC39X	Infineon
No.10	TMS320f280048	TI
No.11	AWR1642	TI
No.12	SPC58NN	ST
No.13	StellaE1	ST
No.14	KF32A152	ChipOn
No.15	FC4150	Flagchip
No.16	AC7801x	Autochips
No.17	AC781x	Autochips

2 应用领域 APPLICATION FIELD

知从木牛配置工具，给 ECU 控制器软件开发提供友好的人机界面。可以支持标准的 AUTOSAR 基础软件代码模块的配置，以及复杂驱动的配置界面开发。目前主要应用于如下场景：

ZC.MuNiu Configuration Tool offers a user-friendly interface for the development of ECU (Electronic Control Unit) controller software. It supports the configuration of standardized AUTOSAR basic software code modules and the development of configuration interfaces for complex drivers. It is currently mainly applied in the following scenarios:



- 知从木牛基础软件平台标准 AUTOSAR 模块配置

  ZC.MuNiu Basic Software Platform Standard AUTOSAR Module Configuration

- 知从木牛基础软件平台复杂驱动模块配置

  ZC.MuNiu Basic Software Platform Complex Driver Module Configuration

  - SAFETY FRAME
  - CRYPTO LIBRARY
  - BCCIC
  - SBC

- 同芯片企业合作，提供 MCU MCAL 的配置工具

  Collaborate with chip companies to provide configuration tools for MCU MCAL.

3 开发背景 DEVELOPMENT BACKGROUND

随着汽车工业的飞速发展，汽车电子已经成为汽车技术发展过程中的革命性标志。为了应对汽车电子软件开发中不断提高的系统复杂程度，改善软件的一致性和重用性，AUTOSAR 标准在 2003 年被提出并且迅速在产业内取得了广泛认同。在业内的开发工具提供商纷纷推出了符合 AUTOSAR 标准的开发工具链和解决方案后，部分开发商成立了 Artop 组织，解决不同厂商的开发工具之间的数据交互和 AUTOSAR 元模型的多版本的问题，旨在更好的推进 AUTOSAR 开发方法在汽车电子软件开发中的实现。

With the rapid development of the automotive industry, automotive electronics have become a revolutionary sign in the process of automotive technology development. To cope with the increasing system complexity in automotive electronic software development, improve software consistency and reusability, the AUTOSAR standard was proposed in 2003 and quickly gained widespread recognition in the industry. After the development tool providers in the industry launched development tool chains and solutions that conform to the AUTOSAR standard, some developers established the ARTOP organization to solve the problem of data interaction between development tools from different manufacturers and the multi-version issues of the AUTOSAR meta-model, aiming to better promote the implementation of the AUTOSAR development method in the development of automotive electronic software.

其中，一些国际知名公司基于自己原先的开发工具产品提供了面向 AUTOSAR 开发工具链，在业内首先推出了 Artop 的架构的 AUTOSAR Builder。这些开发工具集中都包含了 ECU 配置的功能，但是，这些 ECU 配置的功能大部分都仅针对这些公司的基础软件模块实现提供支持，并不能够支持其他公司的基础软件实现的配置和代码生成。

Among them, some internationally renowned companies have provided AUTOSAR development tool chains based on their original development tool products, and were the first in the industry to launch the Artop architecture of AUTOSAR Builder. These development tools all include the function of ECU configuration, but most of these ECU configuration functions only provide support for the implementation of the company's own basic software modules, and cannot support the configuration and code generation of the basic software implemented by other companies.

与国际大公司的解决方案相比，国内符合 AUTOSAR 开发方法的软件开发平台和 ECU 配置工具非常少，基础软件的开发能力也很薄弱。因此，研发和实现一套符合 AUTOSAR 标准开发流程的开发工具，提供一个支持多厂商多平台的基础软件实现的 ECU 配置环境，对于我国的汽车电子软件发展具有重要的意义。

Compared with the solutions of international giants, there are very few domestic software development platforms and ECU configuration tools that conform to the AUTOSAR development method, and the development capability of basic software is also very weak. Therefore, developing and implementing a set of development tools that conform to the AUTOSAR standard development process, providing an ECU configuration environment that supports the implementation of basic software from multiple manufacturers and platforms, is of great significance to the development of China's automotive electronic software.

知从木牛配置工具是符合国产汽车电子系统架构标准的 ECU 开发解决方案。该方案兼容业界主流的 AUTOSAR 标准，包括从系统功能设计，ECU 功能映射和组件配置，运行时环境自动代码生成等一系列的工具套件，提供了一套经过实践验证的，开发可重用 ECU 应用软件的基础。

ZC.MuNiu configuration tool is an ECU development solution that conforms to the domestic automotive electronic system architecture standard. The solution is compatible with the mainstream AUTOSAR standard in the industry, including a series of tools from system function design, ECU function mapping and component configuration, to automatic code generation of the runtime environment, providing a set of practical and reusable ECU application software development foundation.

4 功能描述 FUNCTIONAL DESCRIPTION

知从木牛配置工具基于最新 ARTOP 架构，支持最新 AUTOSAR R21-11 标准所提供的基础平台上，根据 AUTOSAR 开发方法中定义的 ECU 配置步骤，实现了从配置、验证到代码生成的 ECU 配置全流程的功能。主要优势可以总结为以下几个方面：

ZC.MuNiu configuration tool is based on the latest ARTOP architecture and supports the latest AUTOSAR 4.4.0 standard. It has realized the full process of ECU configuration from configuration, verification to code generation according to the ECU configuration steps defined in the AUTOSAR development method. The main advantages can be summarized in the following aspects:

配置、验证和代码生成全流程功能的实现，完整的实现了 AUTOSAR 开发方法中 ECU 配置阶段的开发要求。

The implementation of the full process of configuration, verification, and code generation fully realizes the development requirements of the ECU configuration phase in the AUTOSAR development method.

支持厂商实现有关的模块信息开插拔易扩展的系统的设计与实现。不同厂商对于基础模块的实现都可以非常方便的集成到知从木牛配置工具中的 BSW Builder 中来，在 BSW Builder 启动过程中动态加载进来，具有较好的可扩展性。

It supports the design and implementation of a system that is easy to expand with pluggable module information related to the manufacturer's implementation. Different manufacturers can easily integrate the implementation of the basic module into the BSW Builder in ZC.MuNiu configuration tool, which is dynamically loaded during the startup process of the BSW Builder and has good scalability.

基于查看器框架的配置界面动态生成方法的实现。基于 EMF 框架基础功能，BSW Builder 将视图层与模型层进行了解耦，并且设计和实现了 BSW Builder 查看器，将 BSW Builder 参数定义模型和配置值模型相结合，动态生成配置界面。

The implementation of the dynamic generation method of the configuration interface based on the viewer framework. Based on the basic functions of the EMF framework, the BSW Builder decouples the view layer from the model layer and designs and implements the BSW Builder viewer, combining the BSW Builder parameter definition model and configuration value model to dynamically generate the configuration interface.

4.1 产品特性 Product Feature

知从木牛配置工具集成开发环境特点如下：

ZC.MuNiu configuration tool integrates a development environment with the following features:

- 基于 Eclipse 平台和 Artop 架构，插件化开发，可扩展性强

  Based on the Eclipse platform and Artop architecture, it is developed in a plug-in manner, offering strong extensibility.
- 支持对 AUTOSAR R21-11 标准各个模块的配置

  Supports configuration for various modules of the AUTOSAR 4.4.0 standard.
- 支持复杂驱动配置工具定制开发

  Supports customized development of complex driver configuration tools.
- 支持配置数据的一致性校验

  Supports consistency verification of configuration data.
- 产品级的自动代码生成

  Product-level automatic code generation.
- 支持 ARXML 格式数据交换

  Supports data exchange in ARXML format.
- 可以根据客户需要灵活配置和裁减功能组件

  Flexible configuration and trimming of functional components according to customer needs.
- 强大的错误检查和提示纠正机制

  Powerful error checking and prompt correction mechanism.

- 支持多种格式数据文件的导入

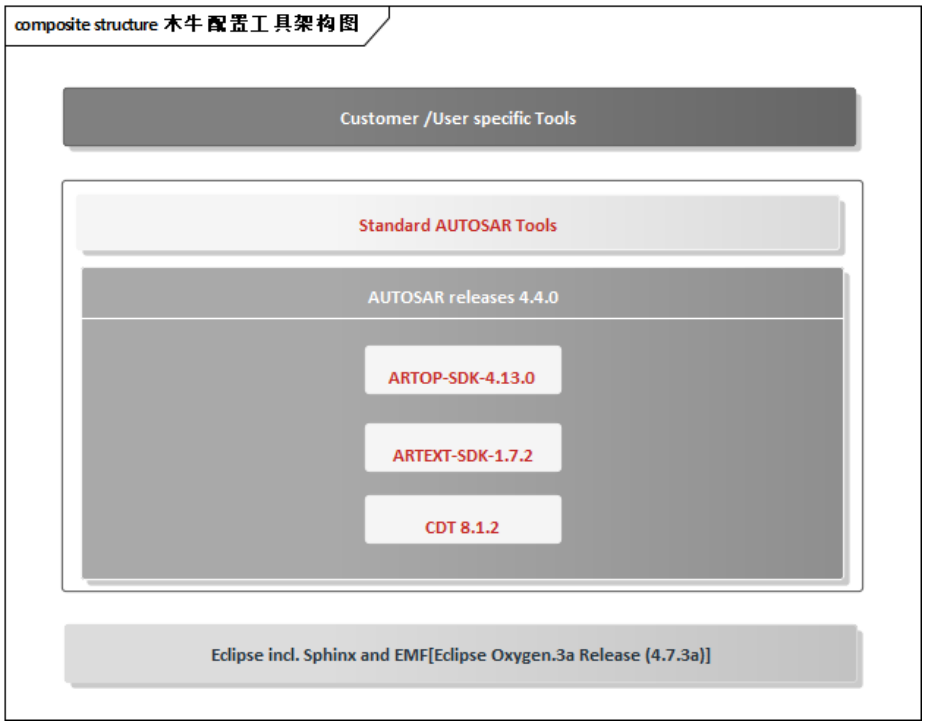
  Supports the import of various format data files.

4.2 技术架构 Technical Architecture

知从木牛配置工具基于 AUTOSAR 配置工具最新架构开发。

ZC.MuNiu configuration tool is developed based on the latest architecture of the AUTOSAR configuration tool.

- Eclipse Oxygen.3a Release (4.7.3a)
- ARTOP-SDK-4.13.0 (supports the latest AUTOSAR releases R21-11)
- ARTEXT-SDK-1.7.2 1.6.0.
- CDT 8.1.2



木牛配置工具架构图
ZC.MUNIU CONFIGURATION TOOL ARCHITECTURE DIAGRAM

4.3 运行环境 Run Environment

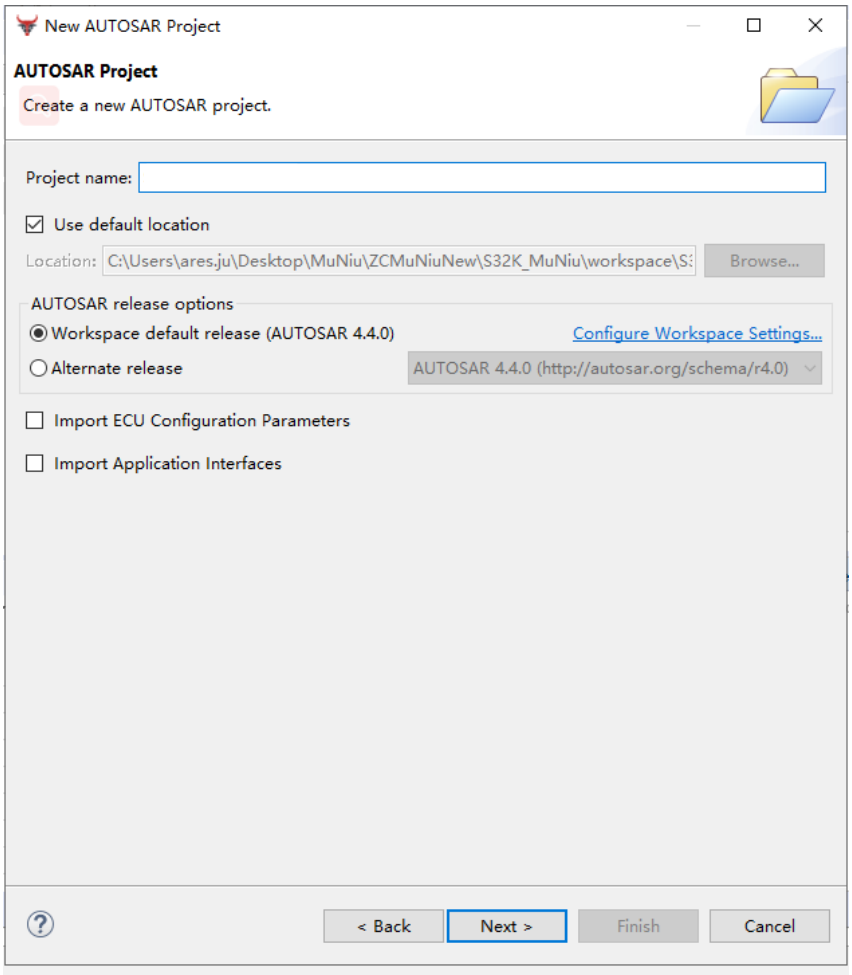
配置环境 Configuration Environment	
Run Environment	Win7/10 64bit

5 使用介绍 INTRODUCTION TO USE

5.1 新建工程 Create a New Project

“File”菜单中选择“New”--->“Project” ---> “AUTOSAR” ---> “AUTOSAR Project”可以打开如下界面，进行创建工程。

Select "New" in the "File" menu, then choose "Project" ---> "AUTOSAR" ---> "AUTOSAR Project" to open the following interface for project creation.

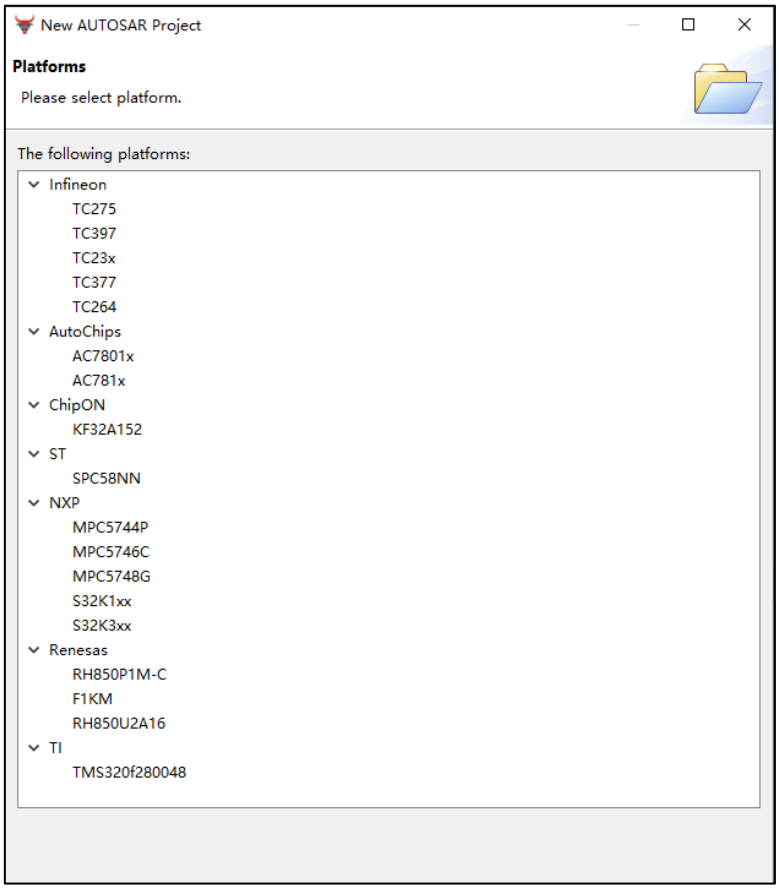


新建工程
CREATE A NEW PROJECT

5.2 选择平台 Select Platform

点击 next，可以打开如下界面，可以选择需要配置的平台。

Click "Next," and you can open the following interface to select the platform that needs to be configured.



创建平台
CREATE PLATFORM

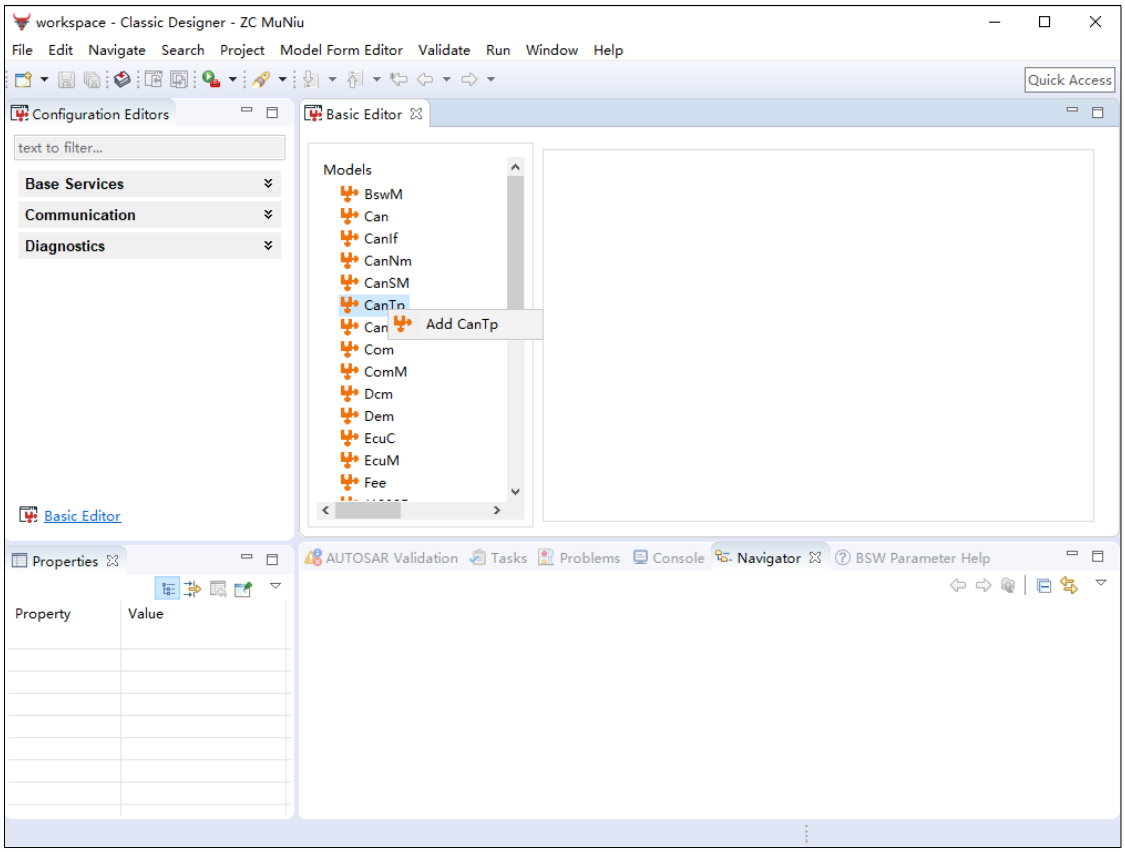
5.3 添加模块 Add Module

在软件主界面中点击“Basic Editor”可以看到该平台下所包含的模块。

In the main interface of the software, click on "Basic Editor" to view the modules included under this platform.

在模块上面右键，选择“add”即可添加模块。

Right-click on a module and select "Add" to add a new module.



打开选择模块界面

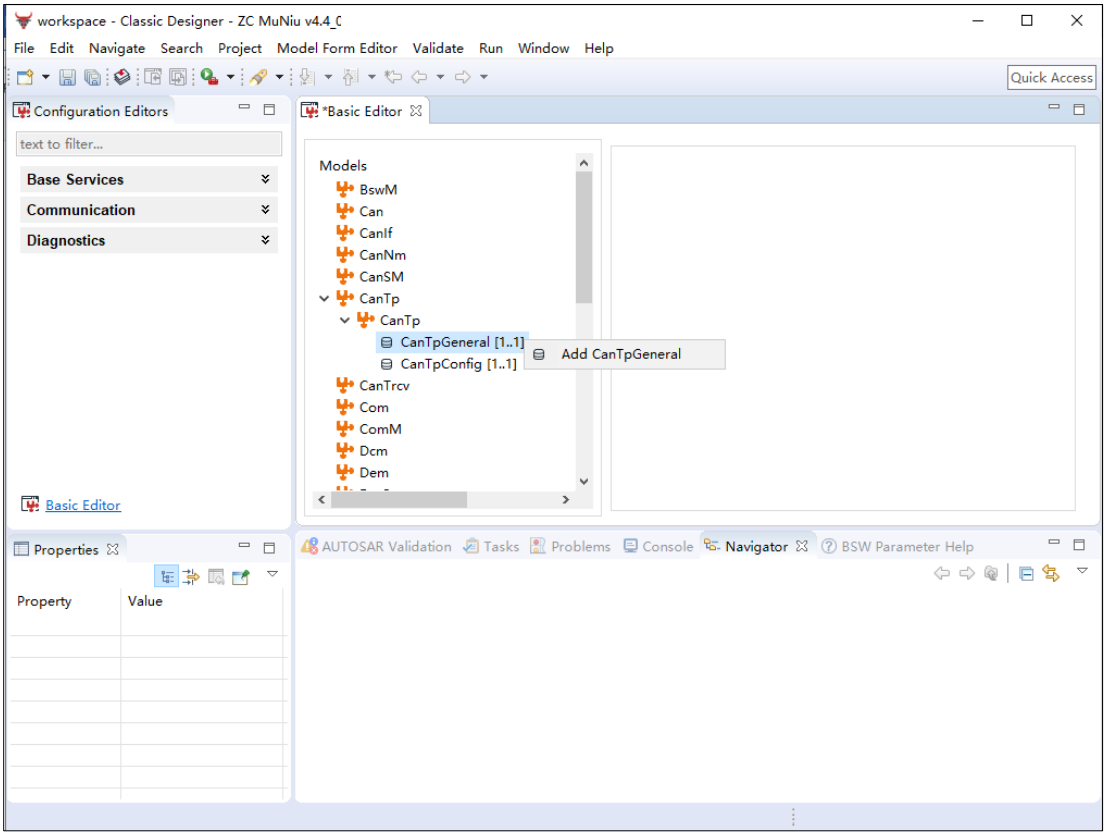
OPEN THE MODULE SELECTION INTERFACE

界面中列出的都是该平台下支持的模块，根据需要进行选择。

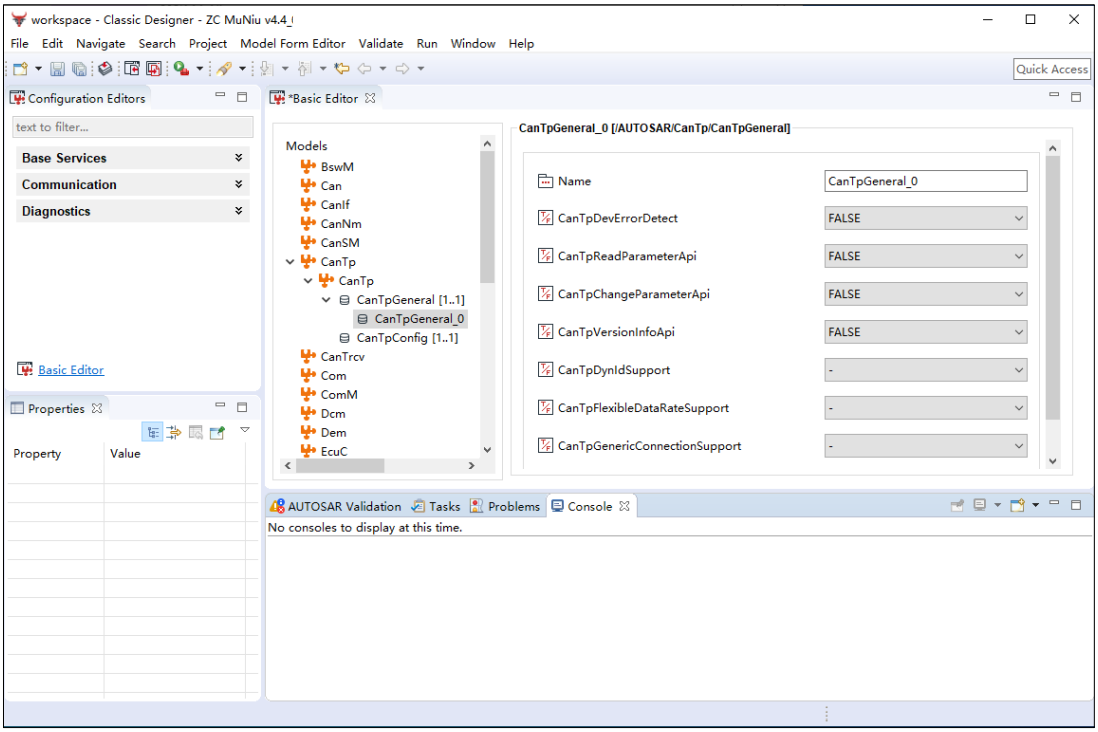
In the interface, all modules supported under the platform are listed for selection based on your needs.

点击模块左边的箭头，即可看到该模包含的配置结构，在需要配置的地方右键进行添加，并单击该配置，即可看到每一个配置项。

By clicking on the arrow to the left of the module, you can view the configuration structure it contains. To add configurations where needed, right-click and select 'Add'. After clicking on a specific configuration, you can see each configuration item.



添加配置
ADD CONFIGURATION

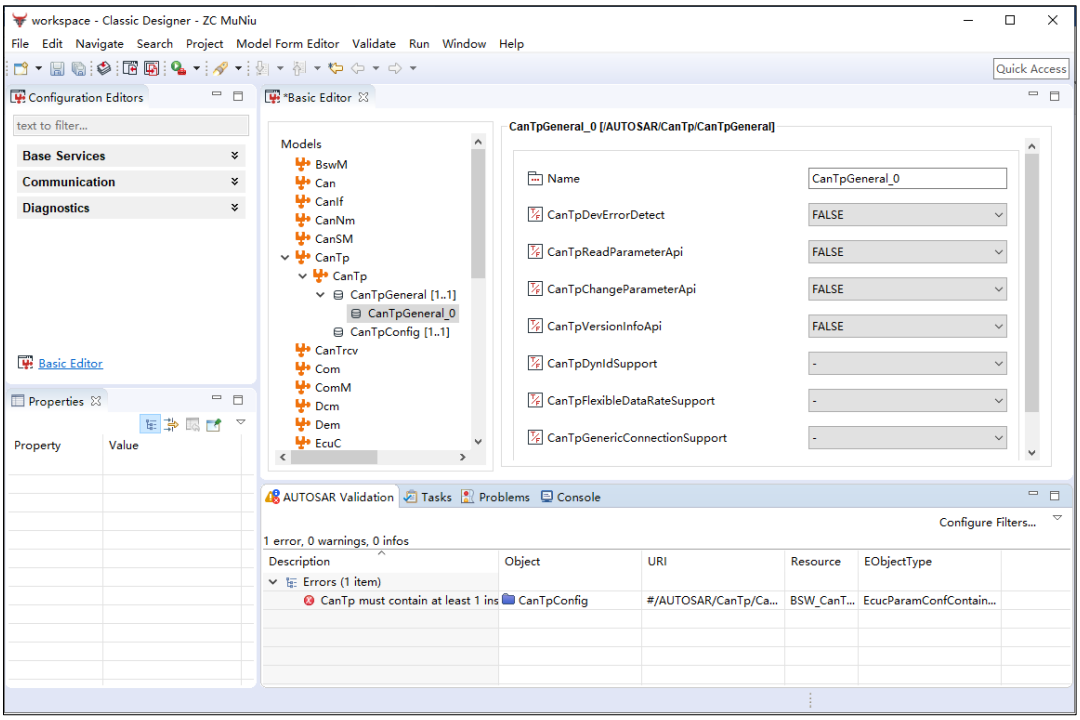


配置项
CONFIGURATION ITEM

5.4 校验生成 Verification and Generation

针对完成配置的模块可以进行校验，以检查配置是否合理，有问题的配置项将会获得提示。

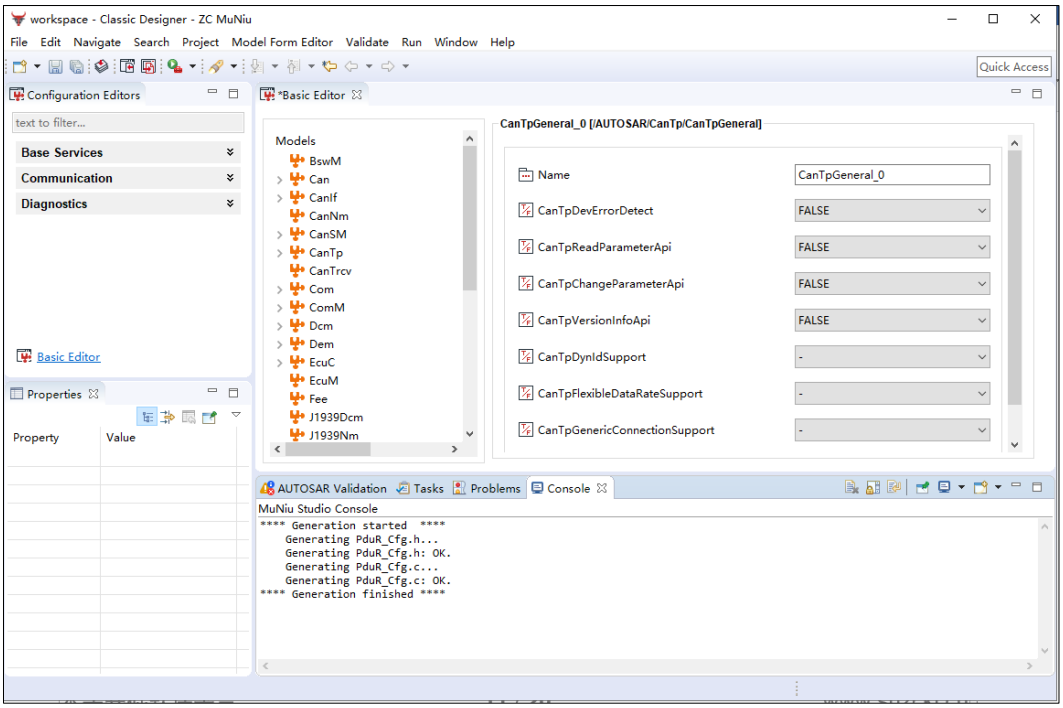
For modules that have been configured, you can perform verification to check if the configuration is reasonable. Any problematic configuration items will be highlighted with prompts.



校验配置
VERIFY CONFIGURATION

校验完成后，可以进行代码生成步骤，可以在界面中看到生成的过程和结果。

Verification of the configuration can be carried out after the setup is complete. Once the verification is done, you can proceed to the code generation step. You can observe the process and outcome of the generation right within the interface.



生成代码
GENERATE CODE

如下是生成的头文件示例：

Here is an example of a generated header file:

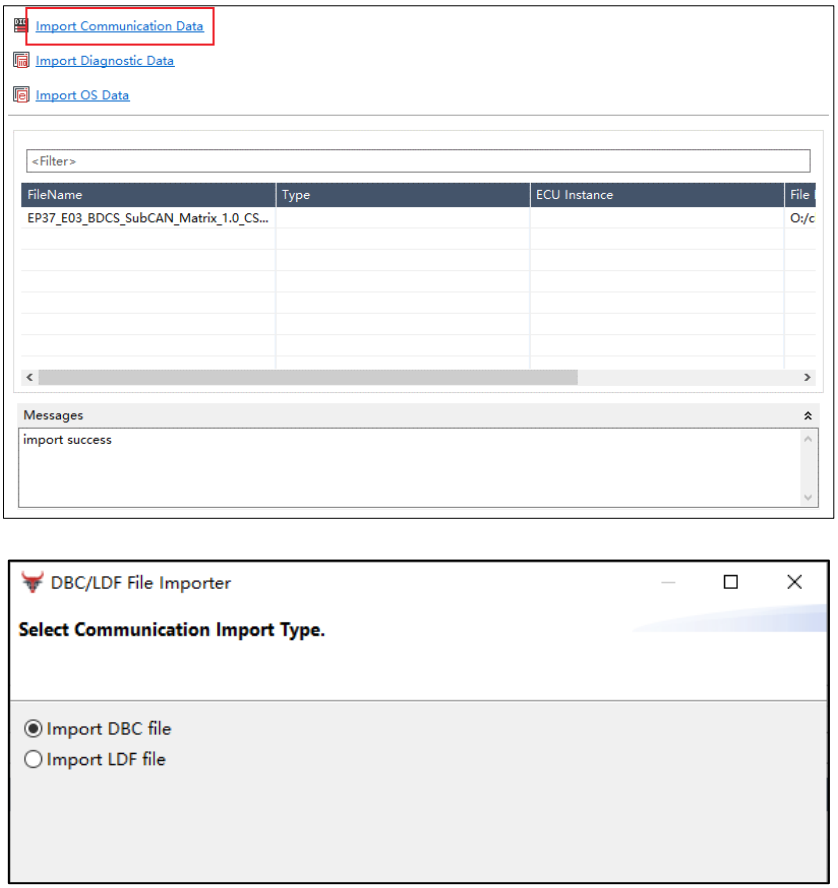
```
/*==========================================================================================================*/
/*
 *  @Copyright (C) 2019, 上海知从科技有限公司       Shanghai ZC Technology Co., Ltd.              All rights reserved.
 *
 *              This software is copyright protected and proprietary to Shanghai ZC Technology Co., Ltd.
 *              Shanghai ZC Technology Co., Ltd. grants to you only those rights as set out in the license conditions.
 *              All other rights remain with  Shanghai ZC Technology Co., Ltd.
 */
/**********************************************************************************************************/
/*
 *  @file       <AdcTst_Cfg.h>
 *
 *  @brief      <ADC自检模块的配置项>
 *
 *  <Compiler: MULTI7.1.4    MCU: SPC58NH84>
 *
 *  @Version    <01.00.00>
 *
 *  @author     <東玉童>
 *
 *  @ASIL :
 *
 *  @Generate Date        <2023/03/30>
 */
/*==========================================================================================================*/

#ifndef  ADCTST_CFG_H
#define  ADCTST_CFG_H

/*==========================================================================================================*/
/*                                                Includes                                                  */
/*==========================================================================================================*/
#include "Std_Types.h"
#include "Cdd_Mcu_Safety.h"
/*==========================================================================================================*/
/*                                            Macro Definitions                                             */
/*==========================================================================================================*/

#define BandgapValue                (1.22f)                 /* bandgap基准电压 */
#define RefVoltage                  (3.3f)                    /*Digital Bandgap Voltage */
#define SARADC                      SAR_ADC_12BIT_1.ICDR[12]                                /*ADC转换校验位*/

#define ADC_12bit_0_channel                     SAR_ADC_12BIT_0.ICDR[38]                    /*ADC0使用的内部通道*/
#define ADC_12bit_1_channel                     SAR_ADC_12BIT_1.ICDR[16]                    /*ADC1使用的内部通道*/
#define ADC_12bit_2_channel                     SAR_ADC_12BIT_2.ICDR[5]                     /*ADC2使用的内部通道*/
#define ADC_12bit_3_channel                     SAR_ADC_12BIT_3.ICDR[62]                    /*ADC3使用的内部通道*/

#define ADCTST_SARBIST_ADC_RESULT_0 (IoHwResultADC4[9])
```

自动生成的头文件示例
AUTOMATICALLY GENERATED HEADER FILE EXAMPLE

5.5 导入 DBC 文件 Import DBC Files

（1）如图所示，在创建工程和设置好平台后，点击 Import Communication Data 按钮并选择 Import DBC file，开始导入 DBC 文件。

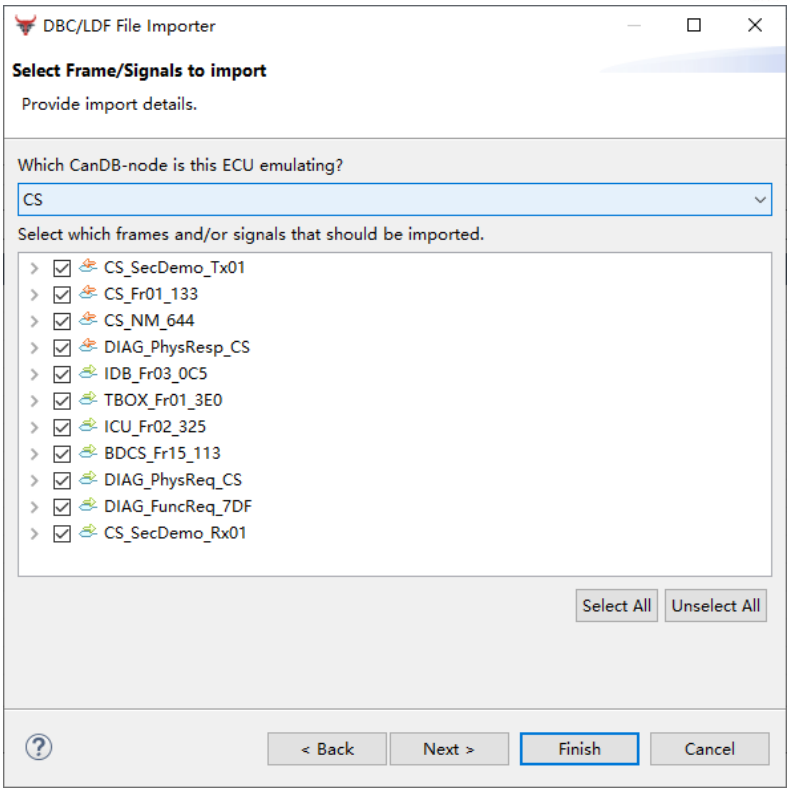
As shown in the figure, after creating the project and setting up the platform, click the "Import Communication Data" button and select "Import DBC file" to start importing the DBC file.



导入 DBC 文件
IMPORT DBC FILES

（2）选择合适的 DBC 文件，选择需要的 ECU 结点：

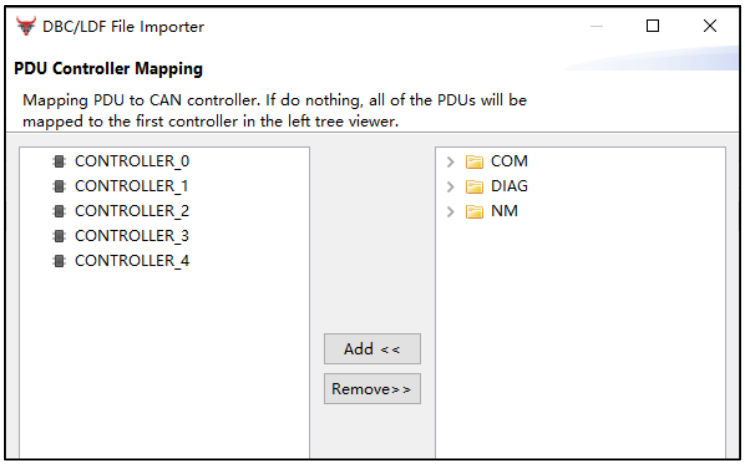
Select the appropriate DBC file and the required ECU nodes.



选择 ECU 节点
ELECT ECU NODE:

（3）将 COM 模块及 DIAG 模式和 CAN Controller 模块进行绑定：

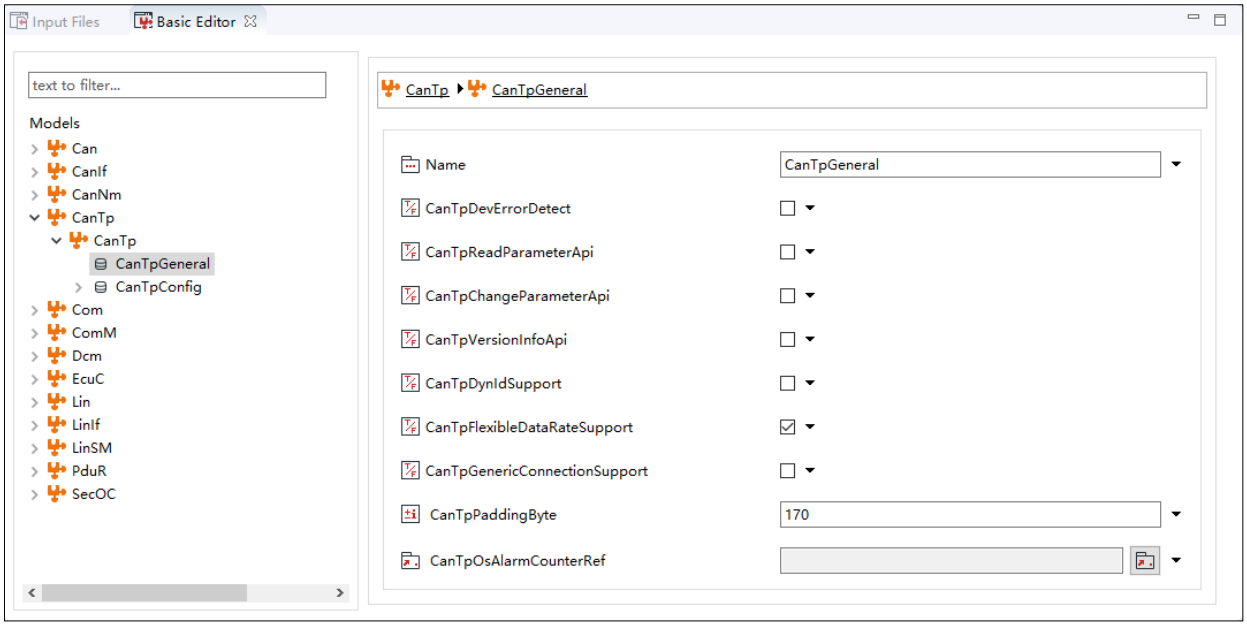
Bind the COM module, DIAG mode, and CAN Controller module:



绑定 CONTROLLER
BIND CONTROLLER

（4）最后生成的效果如下图所示。

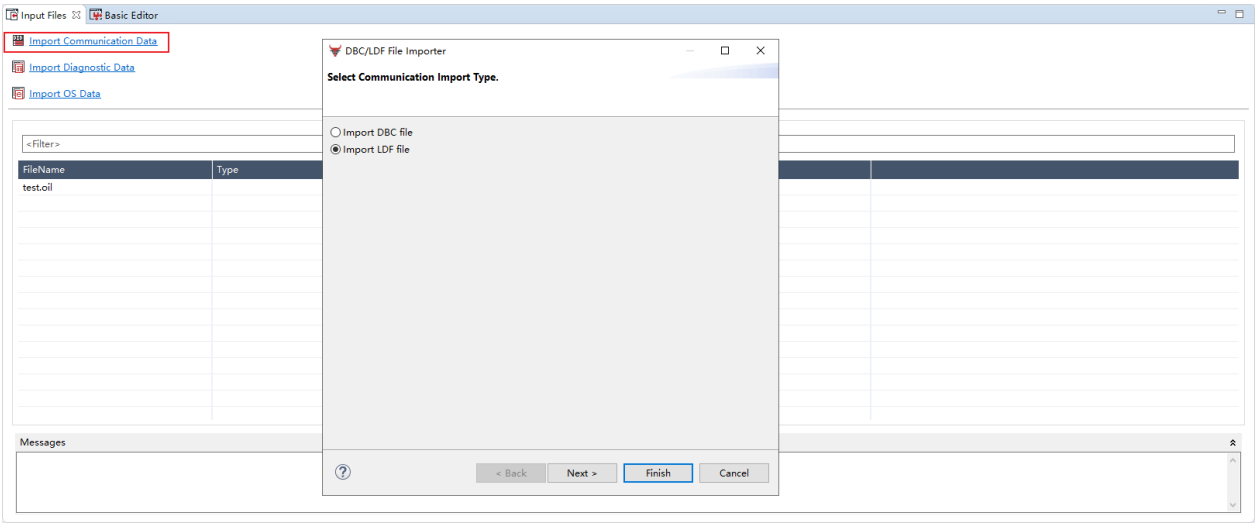
The final generated effect is shown in the figure below.



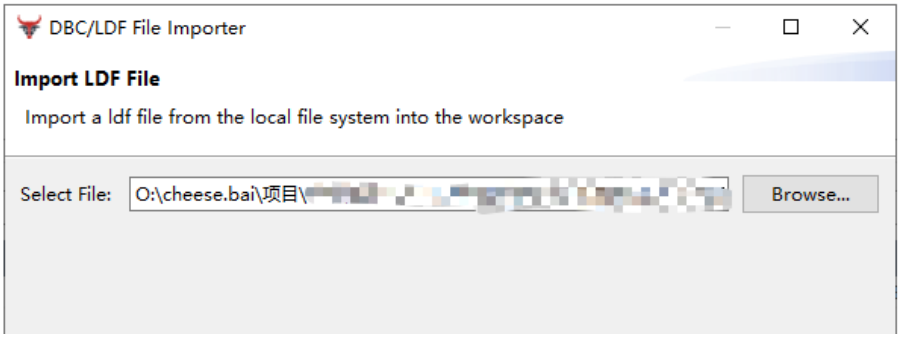
导入 DBC 文件后生成的配置
THE CONFIGURATION GENERATED AFTER IMPORTING THE DBC FILE.

5.6 导入 LDF 文件 Import LDF File

(1) 选择导入 LDF 文件
Select to import the LDF file

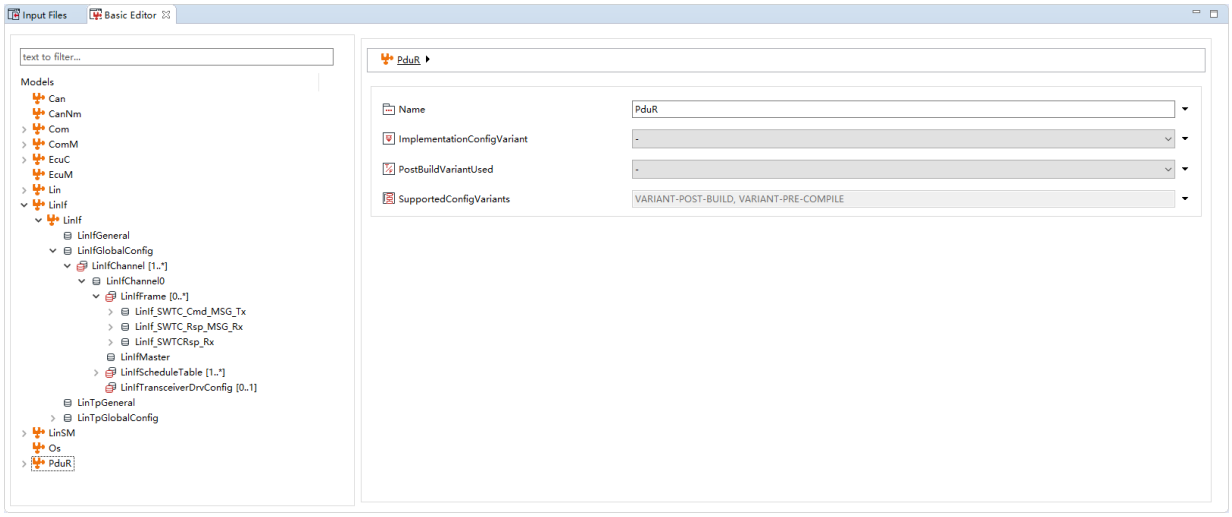


(2) 选择文件路径
Select the file path



（3） 生成的效果如下：

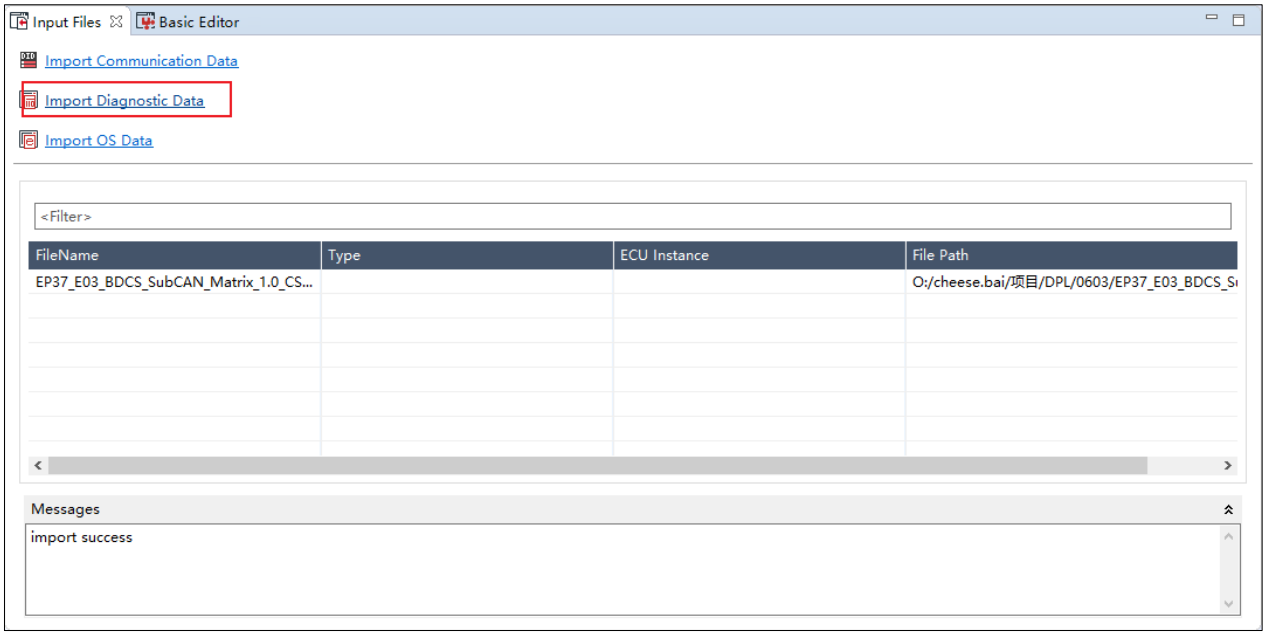
The generated effect is as follows:

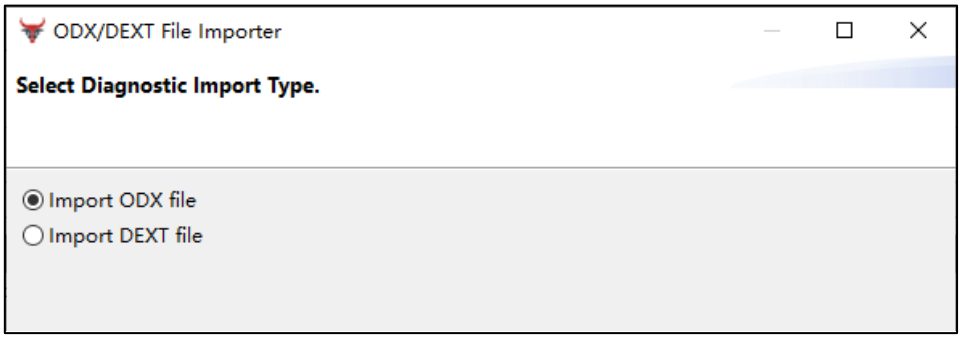


5.7 导入 ODX 文件 Import ODX File

（1）如图所示，在创建工程和设置好平台后，点击 Import Diagnostic Data 按钮并选择 Import ODX File，开始导入 ODX 文件。

As shown in the figure, after creating the project and setting up the platform, click the "Import Diagnostic Data" button and select "Import ODX File" to start importing the ODX file.

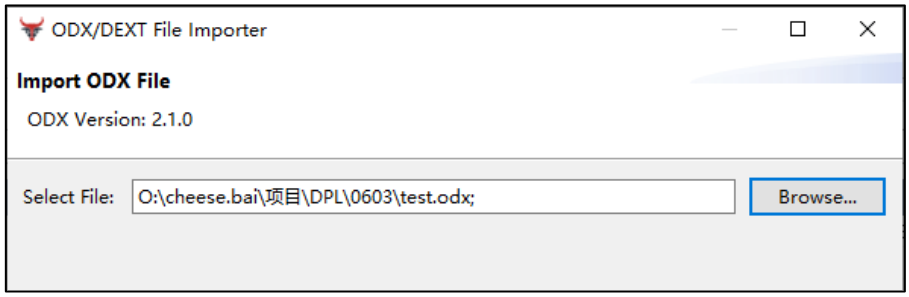




导入 ODX 文件
IMPORT ODX FILE

(2) 选择 ODX 文件:

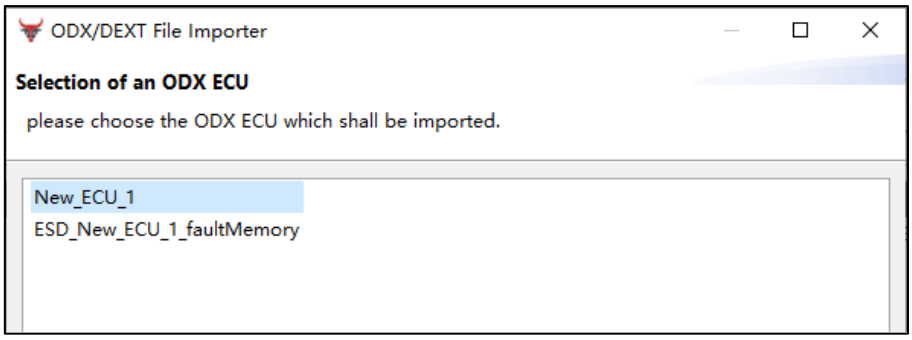
Select ODX File



选择 ODX 文件
SELECT ODX FILE

(3) 选择 ECU 节点:

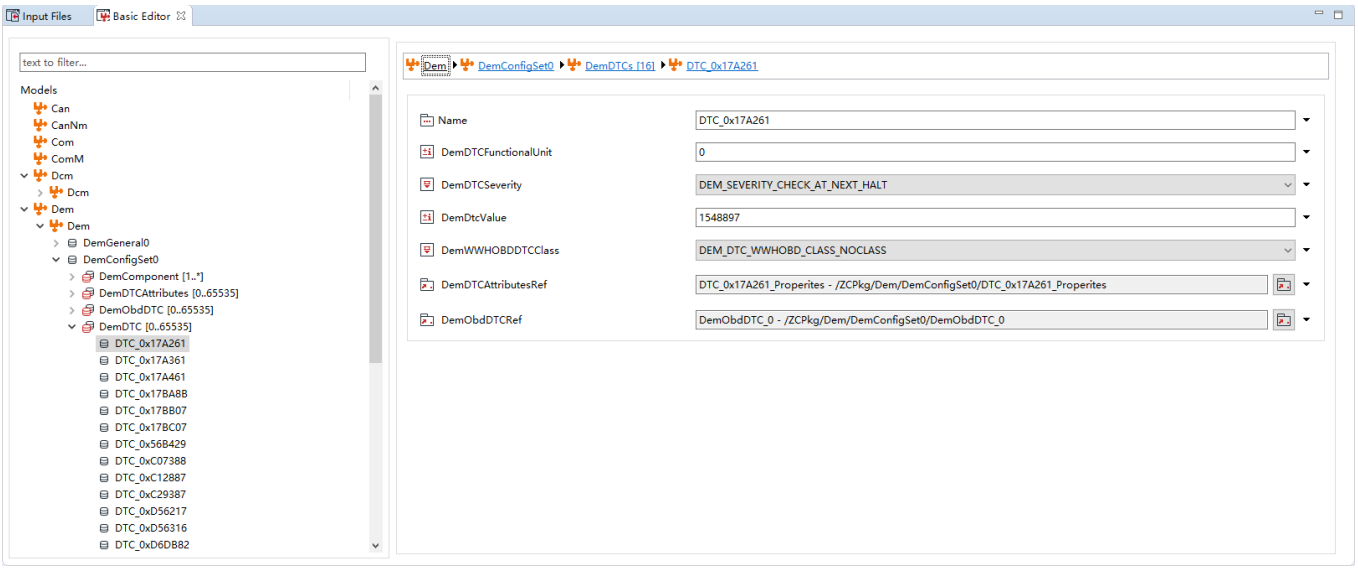
Select the ECU node:



选择 ECU 节点
SELECT THE ECU NODE:

(4) 最后，生成配置，效果如下图：

Finally, generate the configuration. The effect is shown in the figure below.

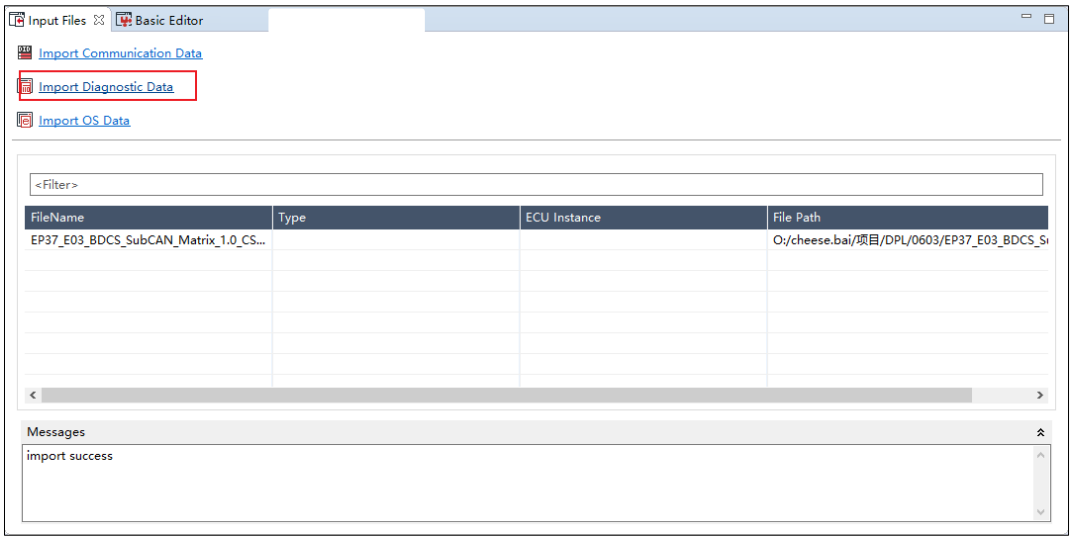


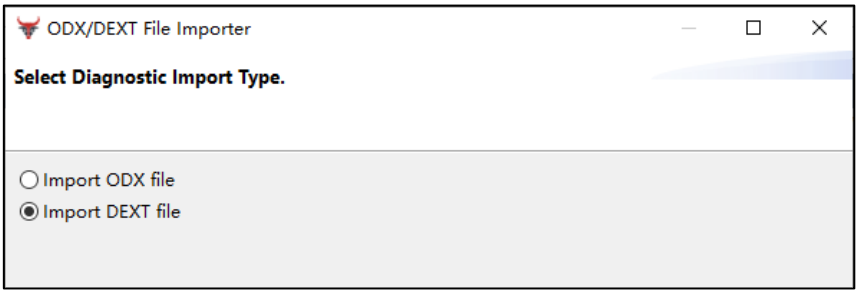
导入 ODX 文件后生成配置
GENERATE THE CONFIGURATION AFTER IMPORTING THE ODX FILE.

5.8 导入 DEXT（ARXML）文件 Import DEXT(ARXML) File

（1）如图所示，在创建工程和设置好平台后，点击 Import Diagnostic Data 按钮并选择 Import Dext File，开始导入 Dext 文件。

As shown in the figure, after creating the project and setting up the platform, click the "Import Diagnostic Data" button and select "Import Dext File" to start importing the Dext file.

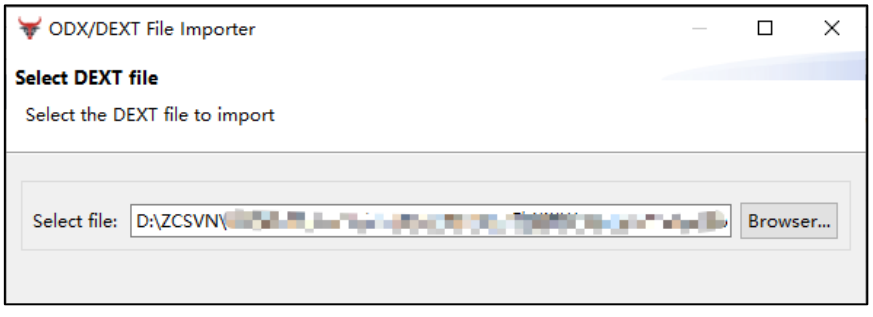




导入 DEXT 文件入口
DEXT FILE IMPORT ENTRY

（2） 选择 DEXT 文件：

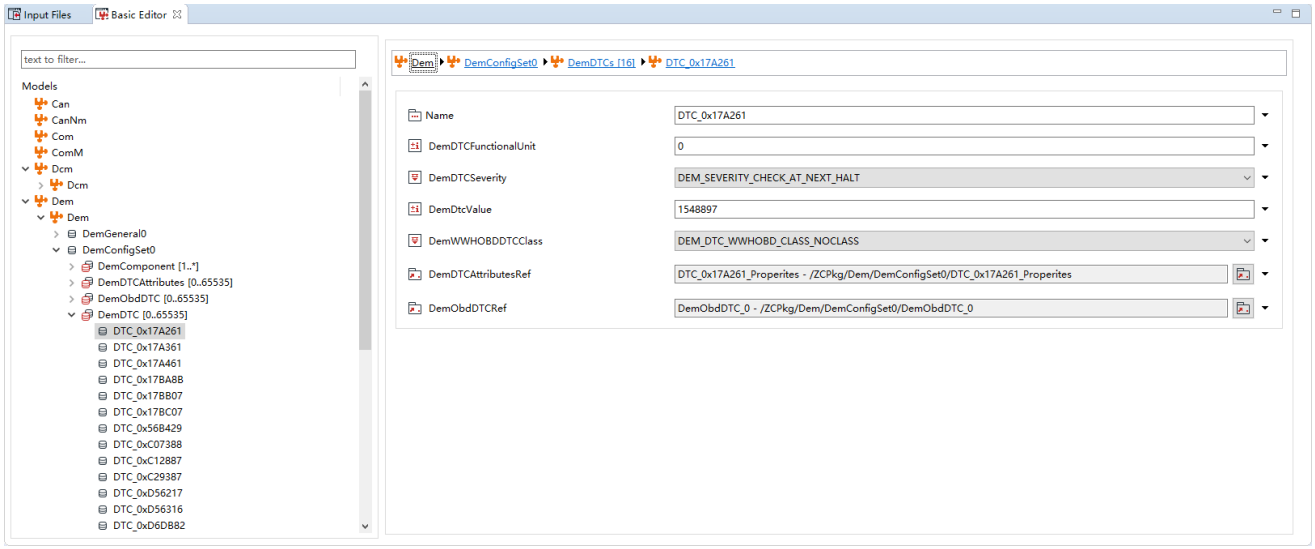
Select DEXT File：



选择 DEXT 文件
SELECT DEXT FILE

（3）最后，生成配置，效果如下图：

Finally, generate the configuration. The effect is shown in the figure below.



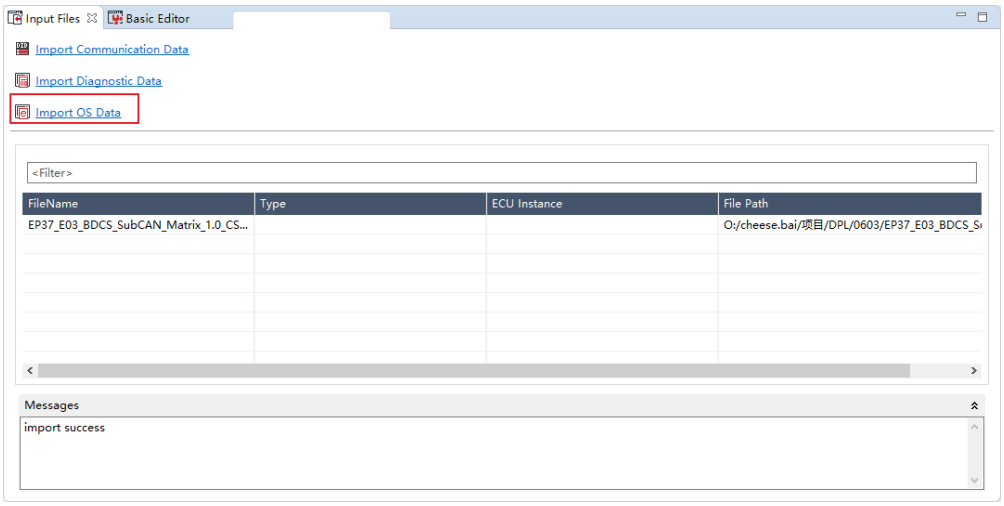
导入 DEXT 文件后生成配置

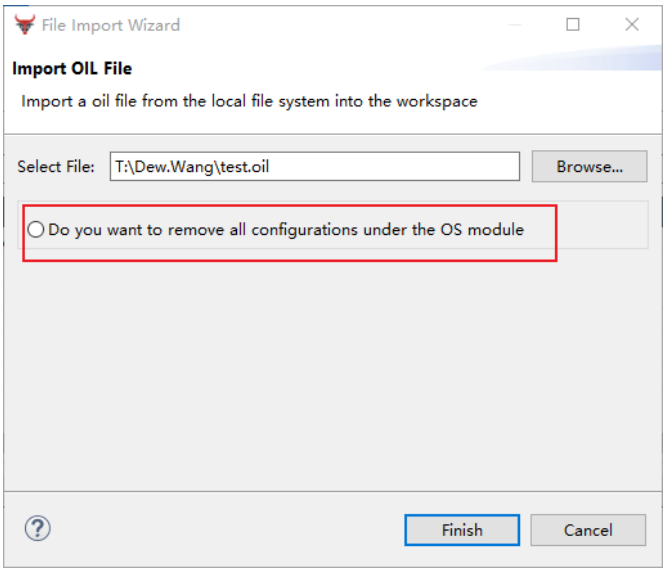
GENERATE THE CONFIGURATION AFTER IMPORTING THE DEXT FILE.

5.9 导入 OIL 文件 Import OIL File

（1）如图所示，在创建工程和设置好平台后，点击 Import OS Data 开始导入 OIL 文件。

As shown in the figure, after creating the project and setting up the platform, click "Import OS Data" to start importing the OIL file.

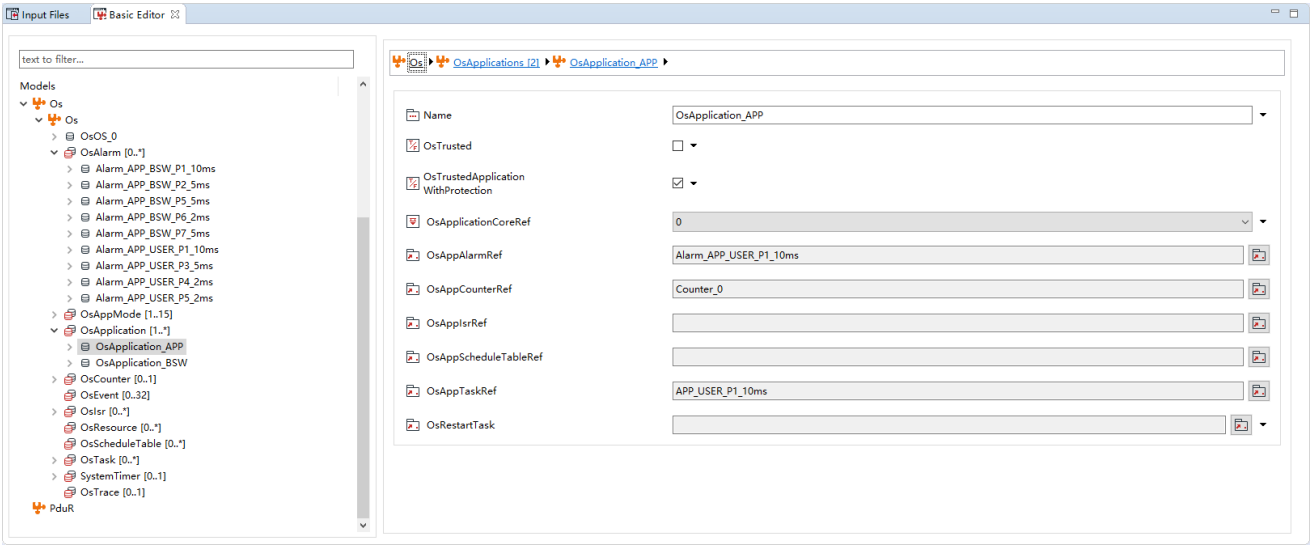




是否与现有模块合并
MERGE WITH THE EXISTING MODULES OR NOT

（2）最后，生成配置，效果如下图：

Finally, generate the configuration. The effect is shown in the figure below.



6 证书 CERTIFICATE

中华人民共和国国家版权局

计算机软件著作权登记证书

证书号：软著登字第11960422号

软件名称：知从木牛基础软件配置工具软件
[简称：知从木牛]
V5.1.0

著作权人：上海知从科技有限公司

开发完成日期：2023年05月20日

首次发表日期：2023年05月23日

权利取得方式：原始取得

权利范围：全部权利

登记号：2023SR1373249

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2023年11月03日

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