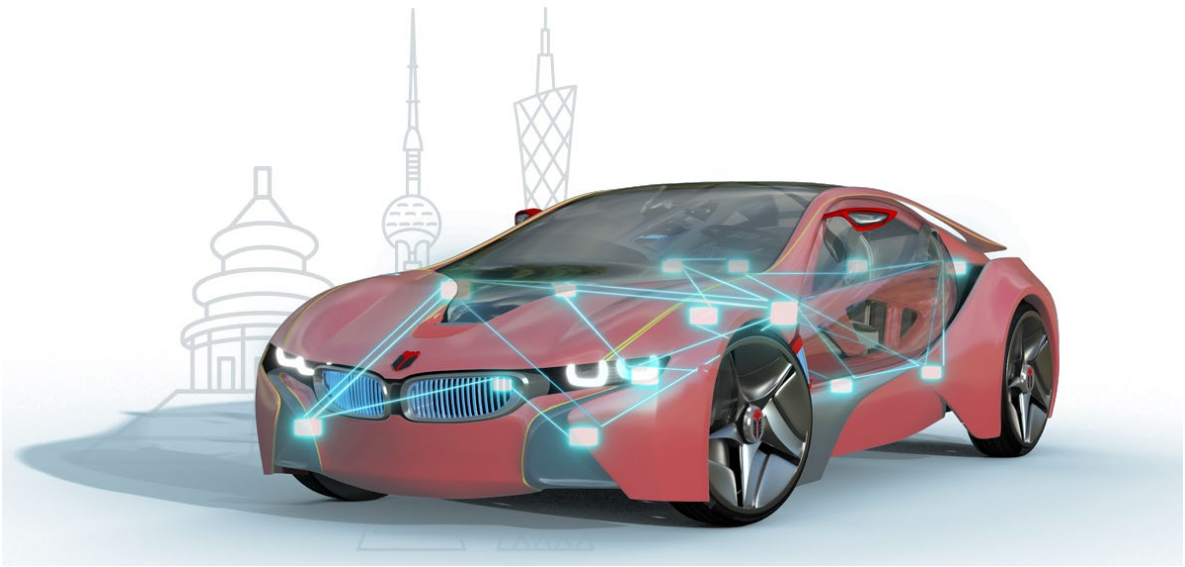
知从木牛基础软件 OBD 产品手册

ZC.MuNiu Basic Software OBD Product Manual

知从木牛基础软件平台

ZC AUTOSAR Basic Software Platform



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1 功能概述 FUNCTIONAL OVERVIEW

知从木牛基础软件平台（ZC.MuNiu）为汽车电子控制器产品开发，提供完整的基础软件平台解决方案。该产品参考 AUTOSAR、OSEK 等国际规范。有基于 AUTOSAR ARTOP 架构的上位机配置工具，支持上汽、一汽、吉利、广汽、长安、长城等整车厂通讯、诊断、网络管理规范。

ZC.MuNiu provides a comprehensive basic software platform solution for the development of automotive electronic control units. This product refers to international standards such as AUTOSAR and OSEK, and has a configuration tool based on the AUTOSAR ATOP architecture that supports communication, diagnostics, and network management specifications for major OEMs like SAIC Motor, FAW, Geely, GAC Group, Changan Automobile, and Great Wall Motors.

知从木牛基础软件平台，主要包括：操作系统、通讯协议栈（CAN\ LIN）、诊断协议栈(UDS\OBD\J1939)、网络管理（OSEK\AUTOSAR）、标定协议栈（XCP\CCP）、存储协议栈、加密模块（CRYPTO）、复杂驱动等模块，配套知从的 Bootloader 刷新程序和上位机工具，可以根据不同的客户项目要求进行配置和再开发。知从科技提供基础软件产品的同时，也提供控制器基础软件功能实现的开发服务。

The platform mainly includes: operating system, communication protocol stack (CAN/LIN), diagnostic protocol stack (UDS/J1939), network management (OSEK/AUTOSAR), calibration protocol stack (XCP/CCP), storage protocol stack, complex driver modules, etc., along with ZC 's bootloader update program and configuration tool, which can be configured and redeveloped according to different customer project requirements. While providing basic software products, ZC also offers development services for the implementation of controller basic software functions.

OBD 系统（On-Board Diagnostics System）是一种车辆故障检测和诊断系统，用于监测和报告车辆排放控制系统的故障和性能。它可以通过使用车载电脑监测车辆在实际使用时排放系统的工作状况，并能监测排放系统的故障，通过点亮故障指示器(MIL)通知车辆驾驶员出现故障，同时存储故障代码识别所监测到的故障。ISO_15031-5_2016 和 GB18352.6-2016 规定了 OBD 系统在车辆排放控制方面的具体要求和指导。

The OBD system (On-Board Diagnostics System) is a vehicle fault detection and diagnostic system designed to monitor and report faults and performance of the vehicle's emission control system. It uses the onboard computer to monitor the operation of the emission system during actual vehicle use and can detect faults in the emission system. When a fault is detected, the system notifies the driver by illuminating the malfunction indicator lamp (MIL) and stores fault codes to identify the detected issues. The ISO_15031-5_2016 and GB18352.6-2016 standards specify the particular requirements and guidelines for the OBD system in terms of vehicle emission control.

2 应用领域 APPLICATION FIELD

汽车 OBD（On-Board Diagnostics）是车辆上的诊断系统，用于监测和报告车辆排放控制系统的故障和性能。OBD 产品广泛应用于以下领域：

The automotive OBD (On-Board Diagnostics) is a diagnostic system on the vehicle, used to monitor and report the faults and performance of the vehicle's emission control system. OBD products are widely applied in the following areas:

- 发动机管理系统（EMS）
  Engine Management System (EMS)
- 变速器控制器（TCU）
  Transmission Control Unit (TCU)
- 制动控制器（BCU）
  Brake Control Unit (BCU)
- 电机控制器（MCU）
  Motor Control Unit (MCU)
- 电子驻车系统（EPB）
  Electronic Parking Brake (EPB)
- 电池管理系统控制器（BMS）
  Battery Management System (BMS)

配置环境 Configuration Environment	
Hardware (Chip)	Aurix TC387
Compilers Supported	Tasking V6.3r1
Evaluation Hardware	TC387QP
Debugger (SW)	TRACE32 PowerView for TriCore V2020.02
Debugger (HW)	PowerDebug PRO Ethernet(Lauterbach) V3.0
Configuration Tools	ZCMuNiu4.4_03ENZST01000101
Configuration Environment	Win7/Win10 64bit

Tasking 编译器选项 Tasking Compiler Options	
Tasking 编译选项 Tasking Compiler Options	-Ctc38x --lsl-core=vtc -t -I"D:\ENZST01\Bsw04_387\prj" -Wa-H"sfr/regtc38x.def" -Wa-gAHLs --emit-locals=-equs,-symbols -Wa-Ogs -Wa--error-limit=42--iso=99 --language=-gcc,-volatile,+strings,-kanji --fp-model=3 --switch=auto --align=0 --default-near-size=0 --default-a0-size=0 --default-a1-size=0 -O2 --tradeoff=0 --compact-max-size=200 -g --error-limit=42 --source
Tasking 链接选项 Tasking Linker Options	-Ctc38x --lsl-core=vtc -t -I"D:\ENZST01\Bsw04_387\prj" -Wl-o"${PROJ}.hex":IHEX:4 --hex-format=s "..\0_Code\5_lsl\user.lsl" -Wl-OtxycL -Wl--map-file="${PROJ}.mapxml":XML -Wl-mcrfiklSmNOduQ -Wl--error-limit=42 -g --fp-model=3 --c++=03

4 开发背景 DEVELOPMENT BACKGROUND

AUTOSAR 组织成立于 2003 年，主要由欧洲汽车制造商、部件供应商及其他电子、半导体和软件系统公司联合建立。致力于为汽车工业开发一个开放的、标准化的软件架构；希望大家“在标准上合作，在应用上竞争”提高基础平台的稳定，降低成本，提高控制器产品开发质量和速度。2006 年底发布了 2.1 版规范，2008 年发布 3.1 版本开始产品化；后续逐步增加了功能安全，以太网等内容，目前广泛使用 2014 年后发布的 4.2.1 和 4.2.2 版本，以及 4.3.1 版本。

The AUTOSAR organization was established in 2003, mainly by European car manufacturers, component suppliers, and other electronics, semiconductor, and software system companies. It is committed to developing an open, standardized software architecture for the automotive industry; the goal is for everyone to "cooperate on standards and compete on applications," improving the stability of the basic platform, reducing costs, and enhancing the quality and speed of controller product development. The 2.1 version of the specification was released at the end of 2006, and the 3.1 version was released in 2008 for productization; subsequently, functional safety, Ethernet, and other contents were gradually added. Currently, the widely used versions are 4.2.1 and 4.2.2 released after 2014, as well as version 4.3.1

知从.木牛（ ZC.MuNiu ）为汽车电子控制器产品开发，提供完整的基础软件平台解决方案。该产品符合 AUTOSAR、OSEK 等国际规范，有基于 AUTOSAR ARTOP 架构的上位机配置工具，支持上汽、一汽、吉利、广汽、长安、长城等整车厂通讯、诊断、网络管理规范。该平台主要包括：操作系统、通讯协议栈（CAN\ LIN）、诊断协议栈(UDS\OBD\J1939)、网络管理（OSEK\AUTOSAR）、标定协议栈（XCP\CCP）、存储协议栈、加密模块（CRYPTO）、复杂驱动等，配套知从 Bootloader 刷新程序和上位机工具，可以根据不同的客户项目要求进行配置和再开发。

ZC.MuNiu provides a comprehensive basic software platform solution for the development of automotive electronic control unit products. This product complies with international standards such as AUTOSAR and OSEK, and features a configuration tool based on the AUTOSAR ATOP architecture, supporting communication, diagnostics, and network management specifications for major vehicle manufacturers like SAIC Motor, FAW, Geely, GAC Group, Changan Automobile, and Great Wall Motors. The platform mainly includes: operating system, communication protocol stack (CAN/LIN), diagnostic protocol stack (UDS/J1939), network management (OSEK/AUTOSAR), calibration protocol stack

(XCP/CCP), storage protocol stack, complex driver modules, etc. It is equipped with ZC 's bootloader update program and upper computer tool, which can be configured and redeveloped according to different customer project requirements.

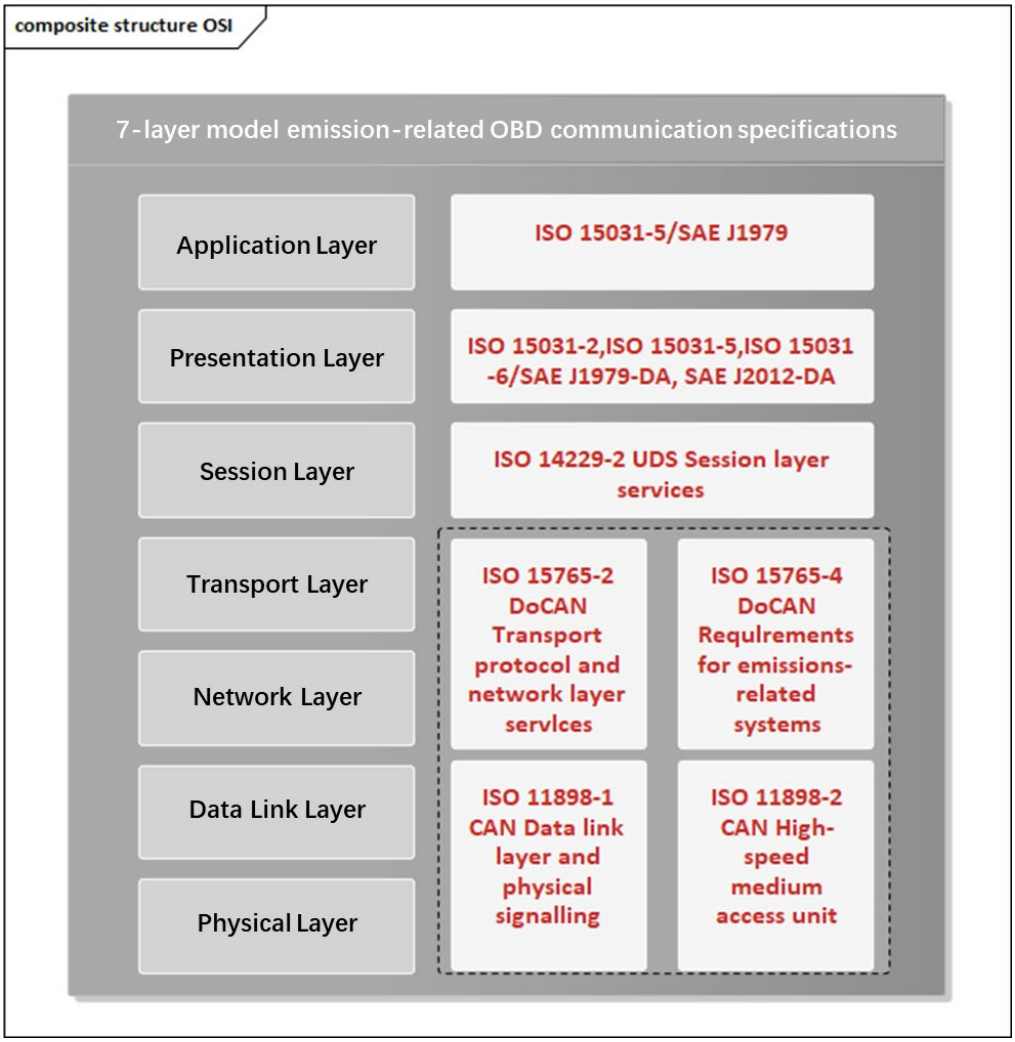
知从科技提供基础软件产品的同时，也提供符合 ASPICE Level2 和功能安全 ASILB\D 要求的控制器基础软件功能实现的开发服务，以及 SBC 芯片等软件的定制开发。

ZC not only provides basic software products but also offers development services for the implementation of control unit basic software functions that comply with ASPICE Level 2 and functional safety requirements ASIL B/D. In addition, it provides customized software development for SBC (Safety-Critical Base Control) chips and similar components.

知从科技掌握 AUTOSAR 平台软件的开发和应用核心技术，提供本地现场支持，质量好，速度快，成本低。

ZC has mastered the core technology of development and application of the AUTOSAR platform software, providing on-site local support with high quality, fast speed, and low cost.

5.1 OBD 产品特点 Product Feature



知从 OBD 产品按照 OSI 七层模型中排放相关 OBD 通讯规范开发。

ZC's OBD product is developed in accordance with the emission-related OBD communication specifications in the OSI seven-layer model.

物理层和数据链路层：定义了 OBD 通信所使用的物理介质和传输格式。一般使用 ISO 11898 规范。网络层和传输层：定义了 OBD 通信中的网络寻址和路由方式。在 OBD 中，一般使用 ISO 15765-2/3/4 标准。会话层：ISO 14229-2 规范在 OBD 会话层的作用是定义了会话管理机制、诊断服务和报文传输规范。它确保了诊断工具能够与车辆的 ECU 进行有效的通信，并执行相应的诊断操作。表示层：ISO 15031-2、ISO 15031-5、ISO 15031-6、SAE J1979-DA 和 SAE J2012-DA 规范在 OBD 表示层的作用主要是提供了统一的通信标准、诊断服务、故障码定义、诊断参数和报文结构，以确保诊断工具与车辆的 ECU 之间能够进行有效的通信和数

据交换。应用层： ISO 15031-5 规范在应用层的作用是提供了一套标准的诊断服务、数据交换格式和会话管理机制，确保诊断工具与车辆的 ECU 之间能够进行有效的通信。

The Physical Layer and Data Link Layer define the physical media and transmission format used for OBD communication, generally following the ISO 11898 standard. The Network Layer and Transport Layer define the network addressing and routing methods in OBD communication, typically using the ISO 15765-2/3/4 standards. The Session Layer's ISO 14229-2 specification defines session management mechanisms, diagnostic services, and message transmission standards, ensuring effective communication between diagnostic tools and the vehicle's ECUs and performing diagnostic operations. The Presentation Layer's ISO 15031-2, ISO 15031-5, ISO 15031-6, SAE J1979-DA, and SAE J2012-DA specifications provide a unified communication standard, diagnostic services, fault code definitions, diagnostic parameters, and message structures to ensure effective communication and data exchange between diagnostic tools and the vehicle's ECUs. The Application Layer's ISO 15031-5 specification provides a set of standard diagnostic services, data exchange formats, and session management mechanisms to ensure effective communication between diagnostic tools and the vehicle's ECUs.

OBD 产品具有以下特点：

The OBD product has the following characteristics:

- **排放监测和诊断：Emission Monitoring and Diagnostics:**

  OBD 产品能够实时监测排放数据和诊断车辆的各种参数和系统状态。可以读取和解析故障码，提供即时的故障诊断结果，帮助用户快速定位和解决车辆故障。

  The OBD product can monitor emission data in real-time and diagnose various parameters and the status of the vehicle's systems. It can read and interpret fault codes, providing immediate diagnostic results to help users quickly locate and resolve vehicle malfunctions.

- **多功能和全面性：Multifunctionality and Comprehensiveness:**

  OBD 产品包括故障诊断、性能监测、燃油经济性评估、驾驶行为监测等。能够提供全面的车辆信息和反馈，满足用户在维修、改进和管理方面的需求。

  The OBD product includes functions such as fault diagnostics, performance monitoring, fuel economy assessment, and driver behavior monitoring. It provides comprehensive vehicle information and feedback, meeting users' needs in maintenance, improvement, and management.

- **实时数据和报警：Real-time Data and Alerts:**

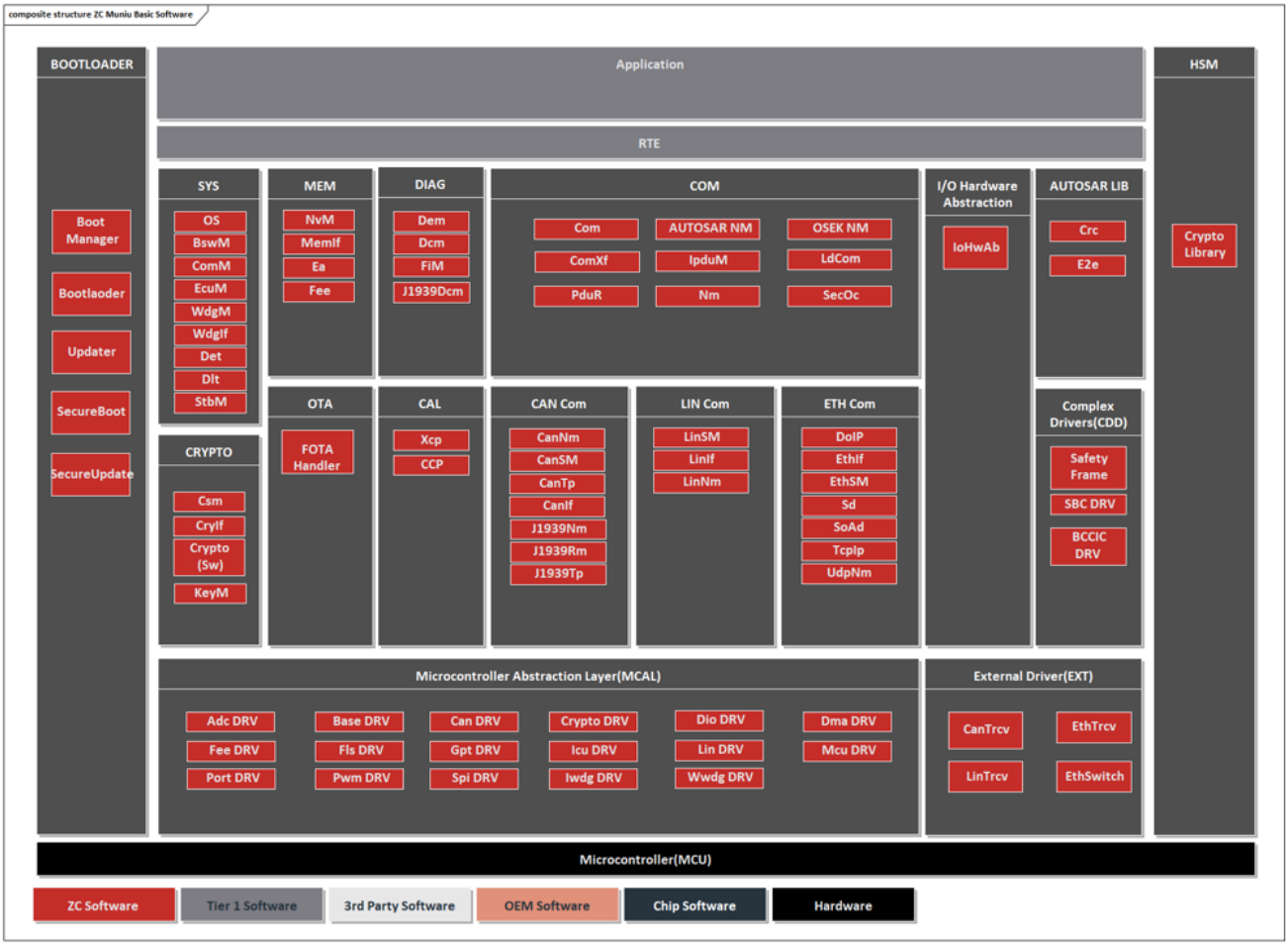
OBD 产品能够实时获取并显示车辆的各种参数，如车速、发动机转速、冷却液温度等。

The OBD product can obtain and display various vehicle parameters in real-time, such as vehicle speed, engine RPM, coolant temperature, etc.

总体而言，汽车 OBD 产品具有实时监测排放数据和诊断、多功能和全面性、实时数据和报警、实时数据和报警等特点。这些特点使得 OBD 产品成为车辆维修、性能优化、驾驶安全和行车管理等方面的重要工具。

Overall, automotive OBD (On-Board Diagnostics) products are characterized by real-time monitoring of emission data and diagnostics, multifunctionality and comprehensiveness, real-time data and alerts, and more. These features make OBD products an essential tool for vehicle maintenance, performance optimization, driving safety, and trip management.

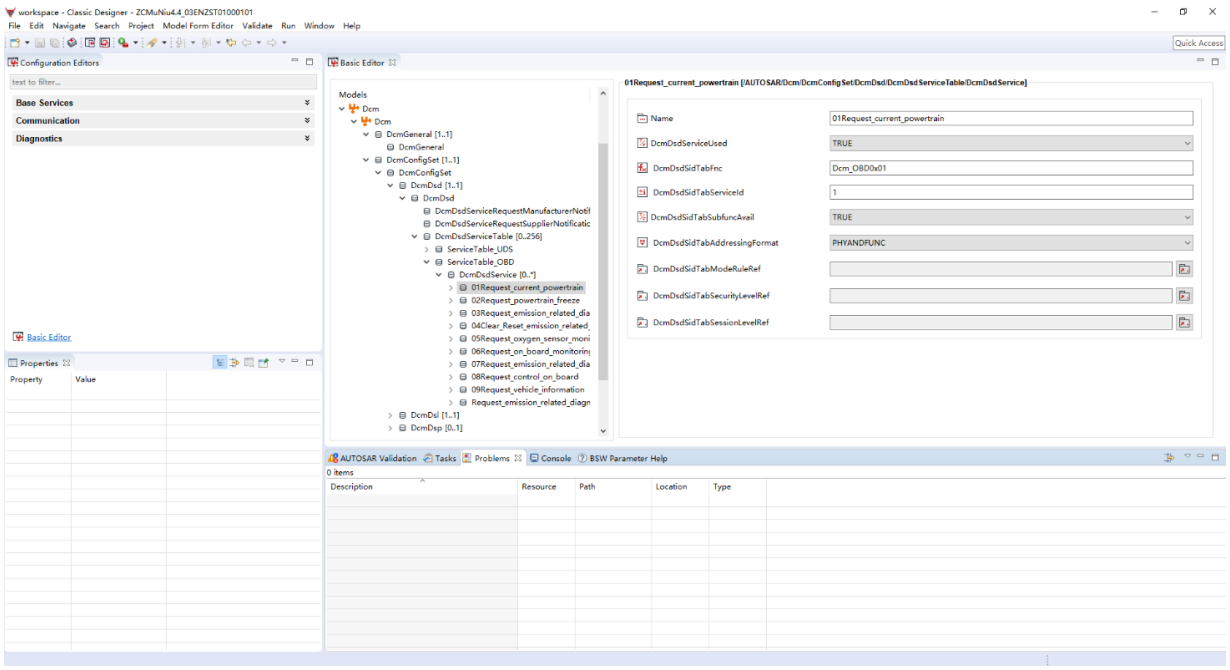
5.2 软件架构 Software Architecture



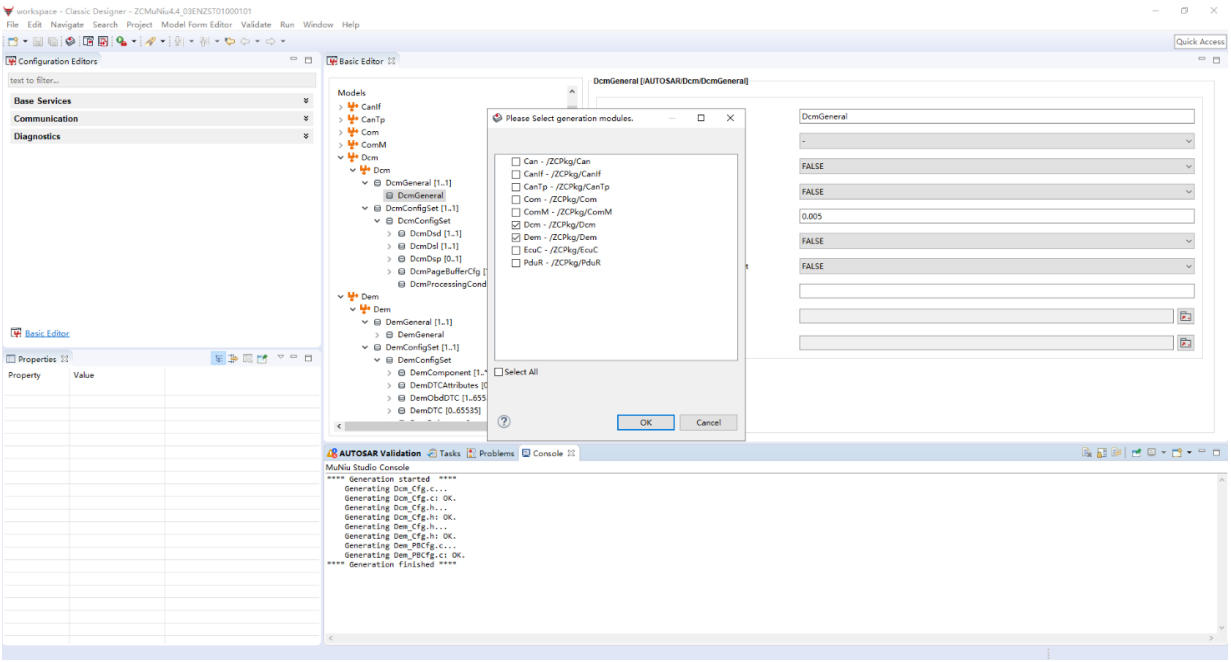
模块 Module	子模块 Submodule		描述 Description
微控制器底层驱动 Microcontroller Abstraction Layer (MCAL)	Can DRV	CAN 驱动 CAN Driver	实现 AUTOSAR 基础软件中硬件驱动的部分 The implementation of hardware driver part in the AUTOSAR basic software
	Lin DRV	LIN 驱动 LIN Driver	
微控制器底层驱动集成包 Microcontroller Abstraction Layer Integrated Package	可集成第三方 MCAL 的集成工程服务包 Integrated engineering service packages that can be integrated with third-party MCAL		
诊断服务 Diagnostic Services (DIAG)	Dcm（OBD）	诊断通信管理器 Diagnostic Communication Manager	实现诊断管理的 AUTOSAR 基础软件协议栈

模块 Module	子模块 Submodule		描述 Description
	Dem（OBD）	诊断事件管理器 Diagnostic Event Manager	The implementation of AUTOSAR Basic Software Protocol Stack for Diagnostic Management
	FiM	功能抑制管理器 Functional Suppression Manager	
系统服务 System Services (SYS)	OS	操作系统 Operating System	实现系统服务的AUTOSAR基础软件模块 The implementation of AUTOSAR Basic Software Module for Encryption Functions
	BswM	基础软件模式管理 Basic Software Mode Management	
	ComM	通信管理 Communication Management	
	Det	开发错误追踪 Development Error Tracking	
	EcuM	ECU管理 ECU Management	
	WdgIF	看门狗接口 Watchdog Interface	
	WdgM	看门狗管理器 Watchdog Manager	
加密模块 Cryptography Module（CRYPTO）	Csm	加密服务管理 Encryption Service Management	实现加密功能的AUTOSAR基础软件模块 The implementation of AUTOSAR Basic Software Module for Encryption Functions
	CryIf	加密接口 Encryption Interface	
	Crypto(Sw)	加密驱动 Encryption Driver	
复杂驱动 Complex Driver（CDD）	Safety Frame	功能安全 Functional Safety	实现复杂驱动功能的AUTOSAR基础软件模块 The implementation of AUTOSAR Basic Software Module for Complex Driver Functions
……			

5.3 配置工具 Confifuration Tool



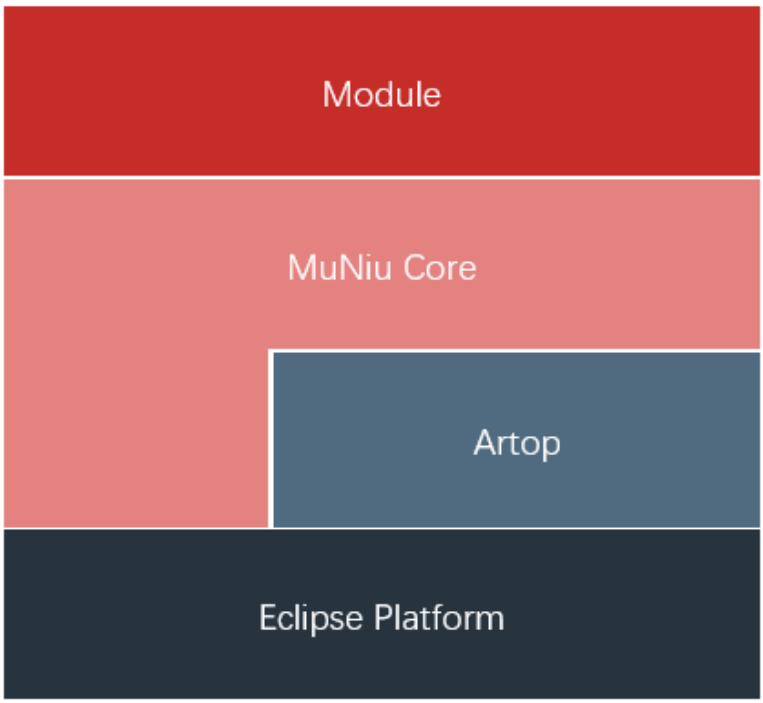
木牛配置工具主界面
MUNIU CONFIGURATION TOOL MAIN INTERFACE



木牛配置工具生成配置代码
MUNIU CONFIGURATION TOOL GENERATES CONFIGURATION CODE

为了满足客户的不同项目需求，提高基础软件平台的扩展性， 木牛基础软件平台实现了各个模块可配置性，并且实现了配置工具。客户可根据不同需求，在配置工具上完成各个模块的配置工作，可生成配置代码文件，将生成的配置文件集成到工程中即可。

To meet the diverse project requirements of our clients and enhance the extensibility of the basic software platform, ZC.MuNiu Basic Software Platform has implemented configurable modules and a configuration tool. Customers can use the configuration tool to tailor the modules according to their specific needs, generate configuration code files, and integrate these generated configuration files into their projects. This approach allows for a high degree of customization and adaptability, ensuring that the software platform can be easily adapted to various applications and use cases.



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

木牛操作系统 OS 产品的配置工具基于 Eclipse 平台，并基于 ARTOP 架构，实现 AUTOSAR 模型和 ARXML 的解析。MuNiu Core 完成配置工具的 UI 界面，在 MuNiu Core 之上的 Module，实现 AUTOSAR 各个模块的配置。配置完成后，可生成各个模块的配置代码。

The configuration tool for ZC.MuNiu Operating System product is based on the Eclipse platform and is based on the ARTOP architecture, implementing the parsing of AUTOSAR models and ARXML. ZC.MuNiu Core completes the UI interface of the configuration tool, and the Module above ZC.MuNiu Core implements the configuration of various AUTOSAR modules. After the configuration is completed, the configuration code for each module can be generated.

6 过程文档 PROCESS DOCUMENTATION

开发流程 Development Process	文档描述 Document Description
需求收集 Requirement Collection	需求文档 Requirement Document
软件需求分析 Software Requirement Analysis	软件需求追踪表 Software Requirement Traceability Matrix
	问题沟通表 Issue Communication Form
软件架构设计 Software Architecture Design	软件架构说明书 Software Architecture Specification
	软件架构的追踪表 Software Architecture Traceability Matrix
软件详细设计和单元设计 Software Detailed Design and Unit Design	软件详细设计说明书 Software Detailed Design Specification
	配置工具设计文档 Configuration Tool Design Document
	软件详细设计追踪表 Software Detailed Design Traceability Matrix
	软件详细设计评审表 Software Detailed Design Review Form
软件单元测试 Software Unit Testing	QAC 分析报告 QAC Analysis Report
	Tessy 测试报告 Tessy Test Report
	软件单元验证策略 Software Unit Verification Strategy
软件集成和集成测试 Software Integration and	集成策略 Integration Strategy
	集成手册 Integration Manual
	集成测试策略

开发流程 Development Process	文档描述 Document Description
Integration Testing	Integration Test Strategy
	集成测试报告 Integration Test Report
	资源分析报告 Resource Analysis Report
软件系统测试 **Software System Testing**	符合性测试报告 Compliance Test Report
	系统测试报告 System Test Report
	性能测试报告 Performance Test Report
	系统测试报告评审 System Test Report Review
发布 **Release**	发布文档 Release Documentation

7 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6824926号

软件名称：知从木牛基础软件平台
[简称：知从木牛]
V4.4

著作权人：上海知从科技有限公司

开发完成日期：2020年06月18日

首次发表日期：2020年09月30日

权利取得方式：原始取得

权利范围：全部权利

登记号：2021SR0100609

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2021年01月19日

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