芯旺微电子
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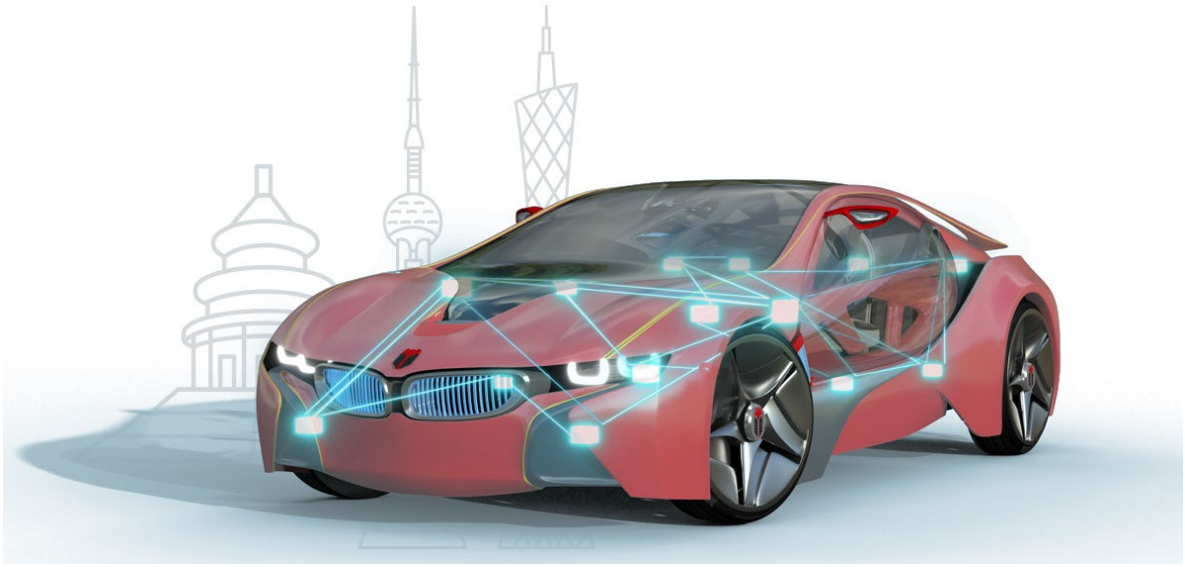
知从科技

知从木牛基础软件 芯旺微 KF32A 产品手册

ZC.MUNIU BASIC SOFTWARE PRODUCT MANUAL BASED ON CHIPON KF32A

知从木牛基础软件平台

ZC.MuNiu Basic Software Platform



知从木牛基础软件芯旺微 KF32A 产品手册

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知从木牛基础软件平台

ZC.MuNiu Basic Software Platform

1 功能概述 FUNCTIONAL OVERVIEW

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、启动刷新规范。

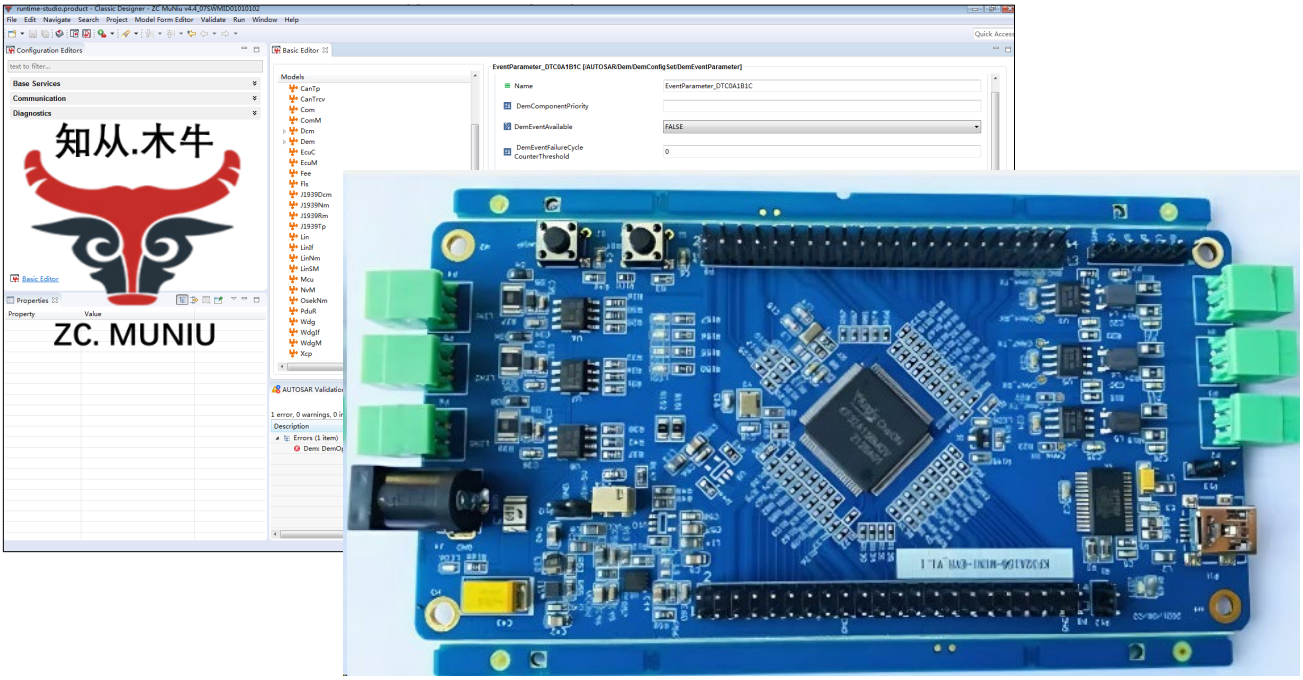
ZC.MuNiu provides a comprehensive basic software platform solution for the development of automotive electronic control units. This product refers to international standards such as AUTOSAR and OSEK, and has a configuration tool based on the AUTOSAR ARTOP architecture. ZC.MuNiu supports communication,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

芯旺微 KF32A 系列微控制器基于 KungFu32 自研内核，为汽车电子领域用户重磅打造的 32 位车规级 MCU 系列产品，聚焦汽车整车芯片应用市场解决方案，可全方位应用于车身控制、新能源与 BMS、仪表辅助、车载空调、门窗控制、雨刷控制、车联网及倒车雷达等。该系列在可靠性和安全性方面进行了着重优化，温度等级达到车规级 Grade1，满足-40℃~125℃工作温度范围，并赋予 AES128 加密/CRC32 校验等功能，可满足汽车行业客户对 MCU 高信息安全性和数据完整性的严苛要求。

Based on KungFu32's self-developed core, KF32A series microcontrollers are a series of 32-bit automotive grade MCUs for users in the field of automotive electronics. Focusing on solutions for the automotive chip application market, they can be used in a full range of applications, such as body control, new energy and BMS, instrumentation assistance, car air-conditioning, door/window control, windshield wiper control, Telematics, and reversing radar, etc. The series is optimized for reliability and security. The series has been optimized in terms of reliability and security, with a temperature rating of Grade 1, meeting the operating temperature range of -40℃~125℃, and AES128 encryption/CRC32 checksum functions, which can meet the stringent requirements of automotive industry customers for high information security and data integrity of MCUs.

上海知从科技作为芯旺微半导体的全球重要合作伙伴，为 KF32A 系列微控制器提供了基础软件平台，主要包括：单核操作系统、通讯协议栈（CAN\LIN）、诊断协议栈(UDS\J1939)、网络管理（OSEK\AUTOSAR）、标定协栈（XCP\CCP）、存储协议栈、复杂驱动模块等，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。

As an important global partner of Semiconductor, Shanghai ZC provides the basic software platform for KF32A series microcontrollers, which mainly includes: single-core operating system, communication protocol stack (CAN\LIN), diagnostic protocol stack (UDS\J1939), network management (OSEK\AUTOSAR), calibration co-stack (XCP\CCP), and storage protocol stack, Complex driver modules, etc., with ZC Bootloader refresher program and host computer tools, can be configured and redeveloped according to the requirements of different customer projects. In addition to the basic software products, ZC also provides development services for the realization of the controller's basic software functions.



ZC.MUNIU BASIC SOFTWARE PLATFORM FOR CHIPON KF32A

2 应用领域 APPLICATION FIELD

木牛基础软件平台可应用于芯旺微 KF32A 系列芯片的汽车电子控制器产品开发。例如：
ZC.MuNiu Basic Software Platform can be applied to the development of automotive electronic control unit products using the ChipON KF32A series chips. For example:

- 车身控制器
  Body Control Controller
- 座椅控制器
  Smart Cockpit Controller
- 车载灯控制器
  Lamp Controller
- 车窗控制器
  Window Controller
- 空调控制器
  Air Conditioner Controller
- 仪表控制器
  Instrument Controller
- 智能座舱控制器
  Intelligent Cockpit Controller

3 配置环境 CONFIGURATION TOOL

配置环境 Configuration Environment	
Hardware (Chip)	KF32A
Compilers Supported	ChipON IDE KF32 V2.1.2(内置编译器)
Evaluation Hardware	KF32A156MQT
Debugger	ChipON IDE KF32 V2.1.2
Configuration Tools	Muniu_v5.1.0
Configuration Environment	Win10 64bit

ChipON IDE KF32 编译器选项 ChipON IDE KF32 Compiler Options	
编译选项 Compiler Options	-MMD -MP -MD $(dir $@)$(basename $(notdir $@)).d --kf32-arch=kf32r
链接选项 Linker Options	-llQmath -R1 -lSeriesDIServices -lmath -lio -lstring -lstdlib -lctype -lcrtv2 -T"../KF32A156MQV.ld" --kf32-autoihex --kf32-arch=kf32r --kf32-nodisassemble --with-checksum-fill=0xFF --gc-sections

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，并逐步增加了功能安全、以太网等内容。目前广泛使用 4.2.1、4.2.2 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 to "cooperate on standards and compete on applications", so can improve 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. Functional safety, Ethernet, and other contents are also added. Currently, the widely used versions are 4.2.1 and 4.2.2, as well as version 4.3.1.

汽车在电动化、网联化、智能化的大趋势下，电子电器部件日益增多，电气结构越加复杂，整车开发周期不断缩短。因此一款平台化、智能化的基础软件产品将在这一过程中便显得尤为重要。

In the major trends of electrification, connectivity, and intelligence, the number of automotive electronic and electrical components is increasing. The electrical structure is becoming more complex, and the development cycle of the vehicle is continuously shortening. Basic software plays an increasingly important role.

知从科技能够提供基础软件产品，同时也提供符合 ASPICE Level 3 流程和功能安全 ASIL-D 要求的控制器基础软件功能实现的开发服务，SBC 芯片、BCCIC 芯片各种复杂驱动软件的定制开发。集成知从科技的功能安全产品 SafetyFrame，可以满足功能安全要求。

ZC provides basic software products, as well as development services comply with ASPICE Level 3 processes and functional safety requirements of ASIL-D. ZC also provides customized complex driver software for SBC (Safety Control Board) chips and BCCIC (Battery Cell Control IC) chips. By integrating ZC's functional safety product SafetyFrame, can meet the functional safety requirements.

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 the core technology of the AUTOSAR basic software and can provide on-site support with high quality, fast speed, and low cost.

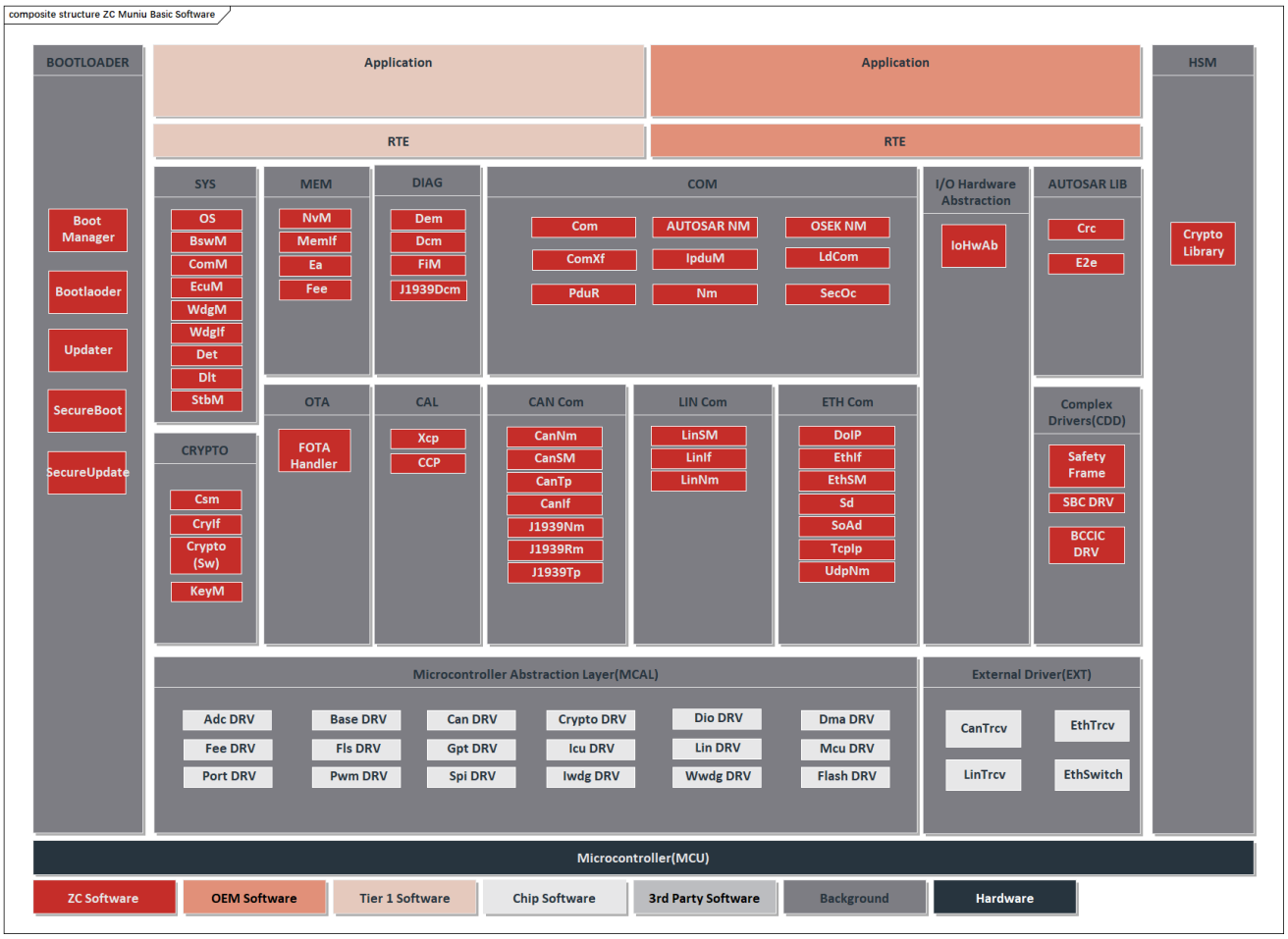
5 功能描述 FUNCTIONAL DESCRIPTION

5.1 产品特点 Product Feature

- 符合 AUTOSAR R20-11 版本 Compliant with AUTOSAR R20-11 version
- ARTOP 架构上位机配置工具，最高适配 AUTOSAR R20-11 版本

  ARTOP architecture upper machine configuration tool, compatible up to AUTOSAR R20-11 version
- 单核操作系统 Single-core Operating System
- 通讯协议栈 Communication Protocol Stack（CAN\LIN）
- 诊断协议栈 Diagnostic Protocol Stack (UDS\J1939)
- 网络管理 Network Management (OSEK\AUTOSAR)
- 标定协议栈 Calibration Protocol Stack（XCP\CCP）
- 存储协议栈 Storage Protocol Stack
- 加密模块 Cryptography Module（CRYPTO）
- 复杂驱动定制开发 Custom Development of Complex Drivers
- 工程服务 Engineering Services

5.2 软件架构 Software Architecture



知从木牛基础软件平台架构

ZC.MUNIU BASIC SOFTWARE PLATFORM ARCHITECTURE

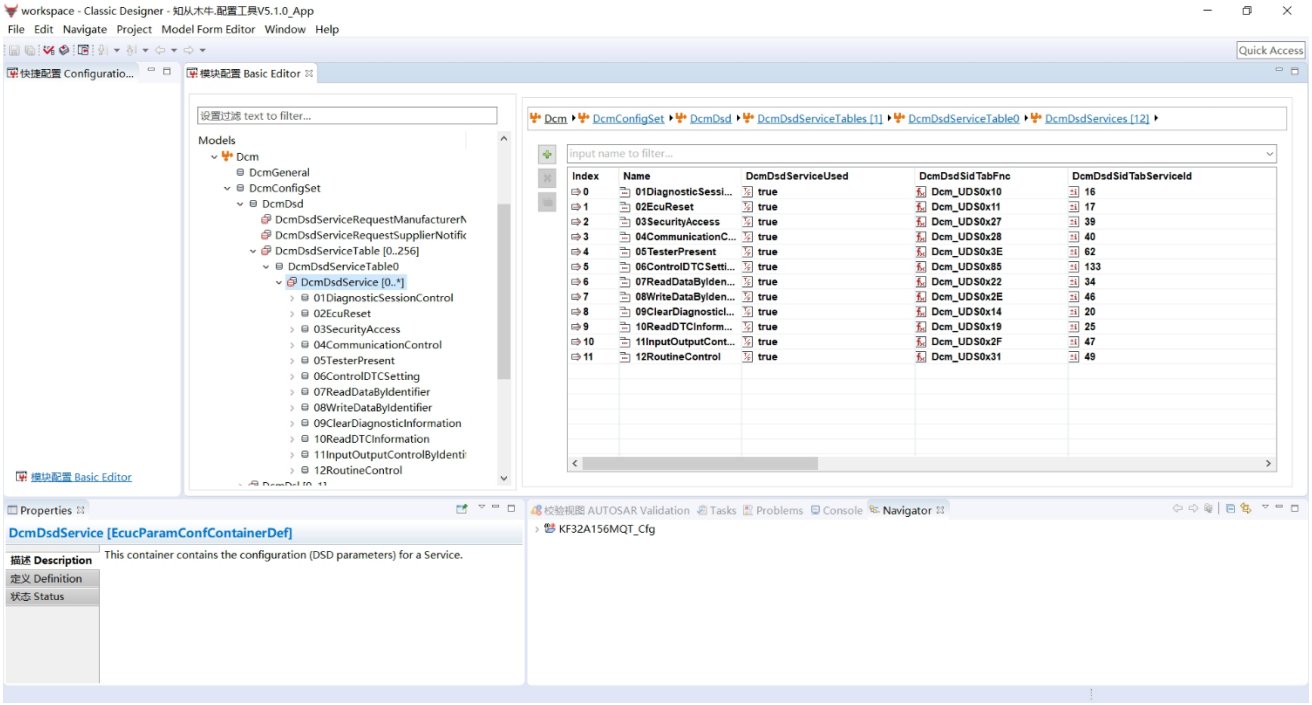
模块 Module	子模块 Submodule		描述 Description
微控制器底层驱动集成包 Microcontroller Abstraction Layer Integrated Package	可集成第三方 MCAL 的集成工程服务包 ZC has an Integrated engineering service package that can be integrated with third-party MCAL.		
外部底层驱动 External Low-Level Driver (EXT)	CanTrcv DRV	CAN收发器驱动 CAN Transceiver Driver	实现外部硬件组件的AUTOSAR基础软件模块 Implement the AUTOSAR basic software module for communication with external hardware components.
	LinTrcv	Lin收发器驱动 Lin Transceiver Driver	
	OS	操作系统 Operating System	
	BSWM	基础软件模式管理 Basic Software Mode	

模块 Module	子模块 Submodule		描述 Description
		Management	
系统服务 System Service (SYS)	COMM	通信管理 Communication Management	实现系统服务的AUTOSAR基础软件模块 Implement the AUTOSAR Basic Software Module for System Services
	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	
	Dlt	诊断日志和跟踪 Diagnostic Log and Trace	
	StbM	同步时基管理器 Synchronized Time-Base Manager	
诊断服务 Diagnostic Service (DIAG)	Dcm	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 Implement the AUTOSAR Basic Software Protocol Stack for Diagnostic Management
	Dem	诊断事件管理器 Diagnostic Event Manager	
	FiM	功能抑制管理器 Functional Suppression Manager	
	J1939Dcm	J1939诊断通信管理器 J1939 Diagnostic Communication Manager	
存储服务 Memory Service (MEM)	EA	EEPROM抽象层 EEPROM Abstraction	实现非易失性存储管理的基础软件协议栈 Implement the Basic Software Protocol Stack for Non-Volatile Storage Management
	FEE	Flash的EEPROM模拟器 Flash EEPROM Emulation	
	MEMIF	存储器抽象层接口 Memory Abstraction Interface	
	NVM	NVRAM管理器 NVRAM Manager	

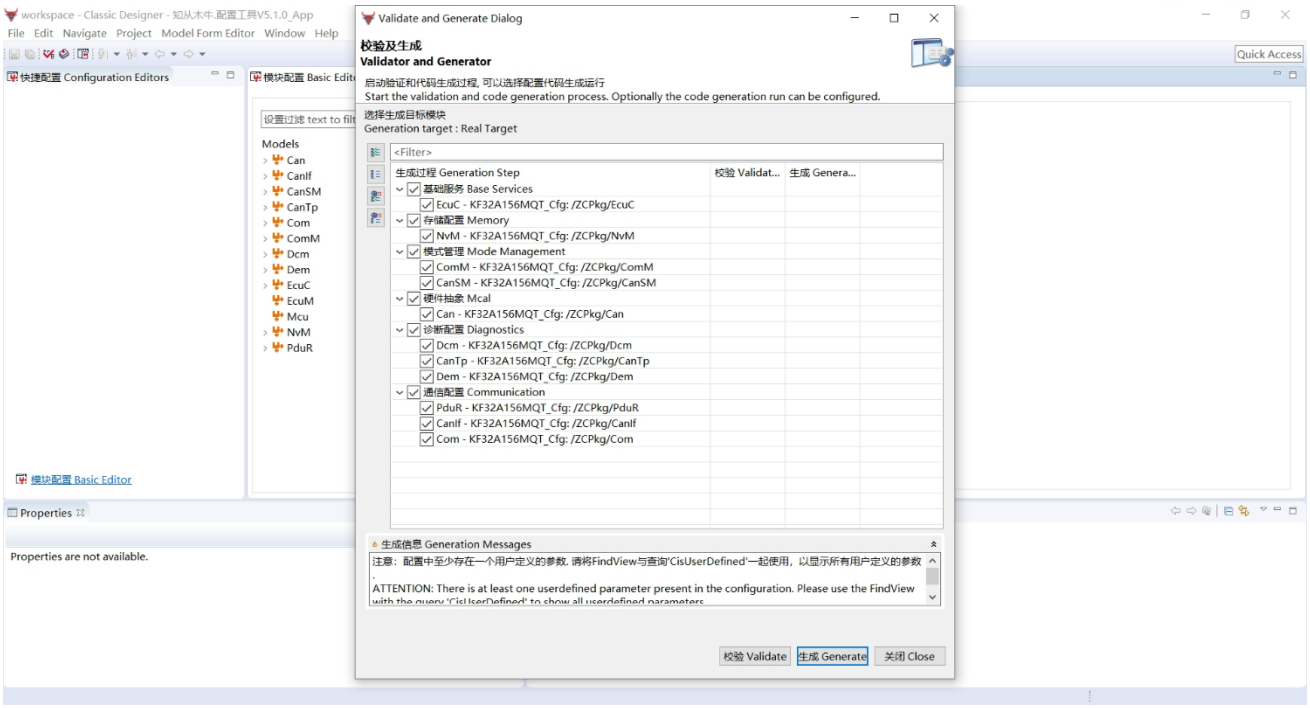
模块 Module	子模块 Submodule		描述 Description
通信服务 Communication Service (COM)	COM	通信 Communication	实现通信管理的基础软件协议栈 Implement the basic software protocol stack for communication management.
	AUTOSAR NM	网络管理接口 Network Management Interface	
	OSEK NM	OSEK网络管理 Network Management Interface	
	PduR	PDU路由 PDU Routing	
	ComXf	COM通信序列化 COM Based Transformer	
	IpduM	I-PDU多路复用 I-PDU Multiplexer	
	LdCom	大数据信号通信 Large Data COM	
	Nm	网络管理 Network Management	
	SecOC	安全车载通信 Secure Onboard Communication	
CAN通信 CAN Communication	CANIF	CAN接口 CAN Interface	实现CAN通信的AUTOSAR基础软件模块 Implement the AUTOSAR basic software module for CAN Communication.
	CANNM	CAN网络管理 CAN Network Management	
	CANSM	CAN状态管理器 CAN State Manager	
	CANTP	CAN传输协议 CAN Transmission Protocol	
	J1939Nm	J1939网络管理 J1939 Network Management	
	J1939Rm	J1939请求消息管理 J1939 Request Manager	
	J1939Tp	J1939传输协议 J1939 Transmission Protocol	
复杂驱动 Complex Driver	SBC DRV	电源芯片驱动 Power Chip Driver	实现复杂驱动功能的AUTOSAR基础软件模块

模块 Module	子模块 Submodule	描述 Description
(CDD)	BCCIC DRV	电池管理系统采样芯片驱动 Battery Management System Sampling Chip Driver	Implement the AUTOSAR basic software module for Complex Driver
	Safety Frame	功能安全框架 Safety Frame	

5.3 配置工具 Configuration Tool



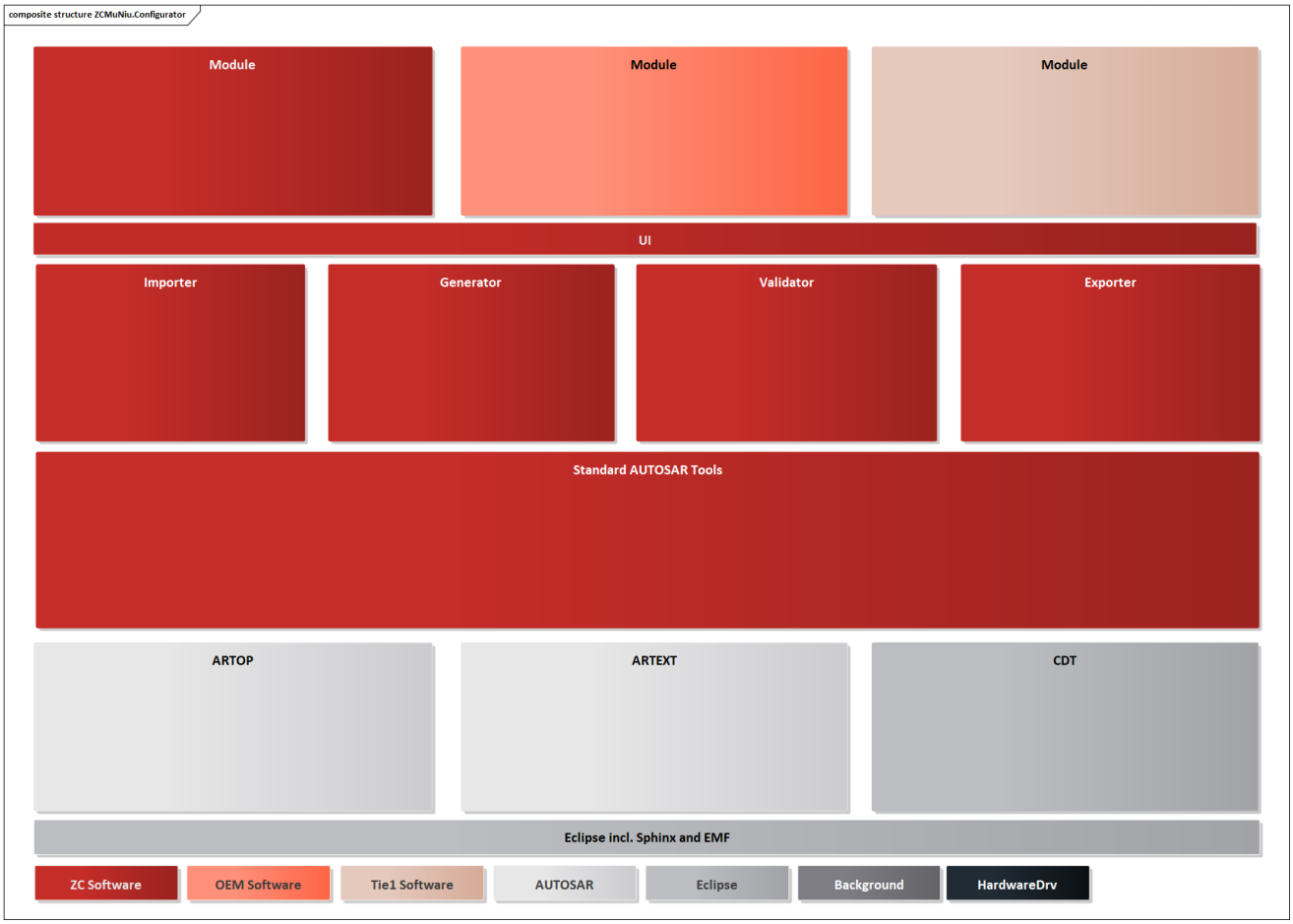
木牛配置工具主界面
MUNIU CONFIGURATION TOOL MAIN INTERFACE



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 customers and enhance the scalability of the basic software platform, the MuNiu basic software platform has implemented the configurability of each module and has also developed a configuration tool. Customers can complete the configuration of each module according to different requirements on the configuration tool, generate configuration code files, and integrate the generated configuration files into the project.



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

木牛基础软件平台的配置工具是基于 Eclipse 平台，并基于 ARTOP 架构，实现 AUTOSAR 模型和 ARXML 的解析。除了 AUTOSAR 标准定义的模块之外，还支持 OEM 和 Tie1 厂商二次开发自己的模块。配置完成后，可生成各个模块的配置代码。

ZC.MuNiu basic software platform configuration tool is based on the Eclipse platform and is built on the ARTOP architecture, which implements the parsing of the AUTOSAR model and ARXML. In addition to the modules defined by the AUTOSAR standard, it also supports OEM and Tie1 manufacturers to develop their own modules for secondary development. After the configuration is completed, the configuration code for each module can be generated.

5.4 功能安全 Functional Safety

木牛功能安全平台提供符合 ASPICE Level 3 流程和功能安全 ASIL-D 要求的开发服务，并遵循 ISO 26262 标准实现。木牛平台通过集成多个功能安全相关模块，为客户提供全面的功能安全解决方案：

ZC.MuNiu SafetyFrame Platform provides development services that are compliant with the ASPICE Level 3 and functional safety ASIL-D requirements, and follows the ISO 26262 standard implementation. By integrating multiple functional safety related modules, the Wooden Bull platform provides customers with a comprehensive functional safety solution:

- 看门狗管理：通过 WdgIf（看门狗接口）和 WdgM（看门狗管理器）实现对系统关键任务的监控，支持内部和外部看门狗，确保系统运行状态的实时监控
  Watchdog Management: Implements monitoring of system-critical tasks through WdgIf (Watchdog Interface) and WdgM (Watchdog Manager), supporting both internal and external watchdogs to ensure real-time monitoring of system operational status.
- 端到端保护：实现 E2E 通信保护机制，通过 CRC 校验、计数器、时间戳等方式，确保数据在传输过程中的完整性和正确性
  End-to-End Protection: Implements E2E communication protection mechanisms, ensuring data integrity and correctness during transmission through CRC verification, counters, and timestamps.
- 存储保护：通过 EA、FEE 和 NVM 等存储管理模块，实现关键数据的 CRC 校验和数据冗余备份，保证数据存储的可靠性
  Memory Protection: Implements CRC verification and data redundancy backup for critical data through storage management modules including EA (EEPROM Abstraction), FEE (Flash EEPROM Emulation), and NVM (Non-Volatile Memory Manager), ensuring storage reliability.
- OS SC4：实现 AUTOSAR OS 可扩展等级 4（SC4）特性，提供内存保护机制、时间保护和服务保护，满足安全关键应用需求（说明：基于芯片硬件对内存保护和时间保护的支持情况进行开发，当前 KF32A 系列没有对应硬件支持）
  OS SC4: Implements AUTOSAR OS with Scalability Class 4 (SC4) features, providing memory protection mechanisms, timing protection monitoring, and service protection for safety-critical applications. (Note: Developed based on the chip hardware support for memory protection and time protection, the current KF32A series does not have corresponding hardware support)

6 过程文档 PROCESS DOCUMENTATION

开发流程 Development Process	文档描述 Documentation Description
需求收集 Requirement Collection	客户需求文档 Customer Requirement Document
软件需求分析 Software Requirement Analysis	需求分析文档 Requirement Analysis Document
	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 Architectural Design	软件架构说明书 Software Architecture Specification
	软件架构的追踪表 Software Architecture Traceability Matrix
	软件失效模式分析 Software FailureMode EffectAnalysisReport
	软件相关失效分析报告 Software Dependent FailureAnalysisReport
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

开发流程 Development Process	文档描述 Documentation Description
	Software Unit Verification Strategy
软件集成和集成测试 **Software Integration and Integration Testing**	集成策略 Integration Strategy
	集成手册 Integration Manual
	集成测试策略 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**	系统测试报告 System 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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公众号 业务联系

成为全球领先的汽车基础软件公司
To Be the Global Leading Automotive Basic Software Company