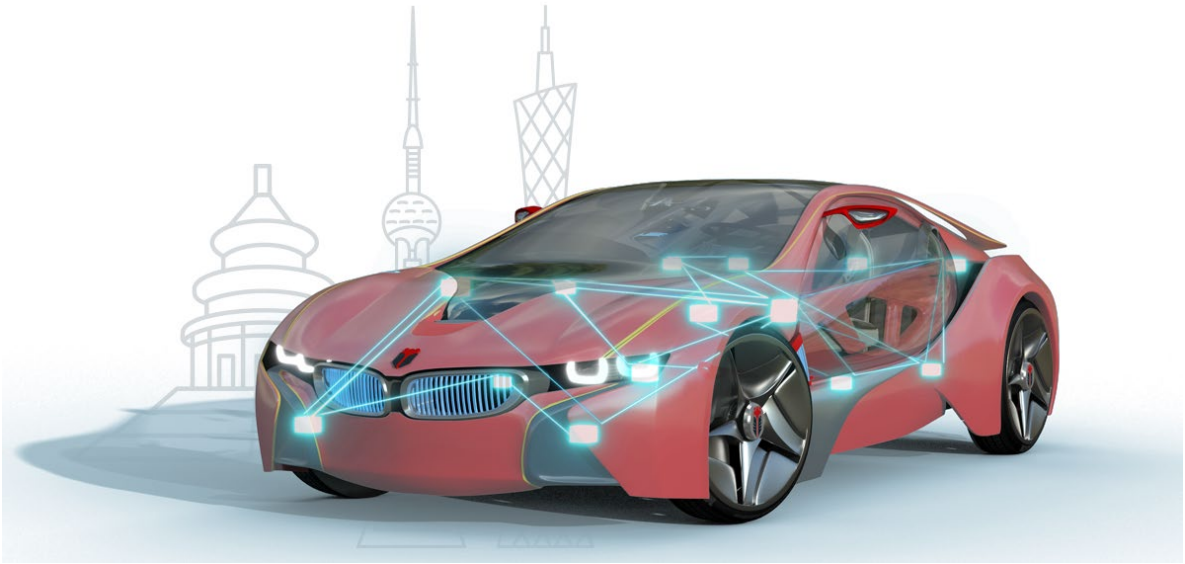
知从木牛 AUTOSAR 软件平台
恩智浦 S32K 产品手册
ZC.MUNIU AUTOSAR SOFTWARE PLATFORM
PRODUCT MANUAL BASED ON NXP S32K

知从木牛基础软件平台

ZC.MuNiu Basic Software Platform



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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 ATOP 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\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。

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 configuration tool based on the AUTOSAR ARTOParchitecture. ZC.MuNiu supports communication, diagnostics, and network management specifications for major OEMs like SAIC, FAW, Geely, GAC, CCAG, and GWM. ZC.MuNiu 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. ZC.MuNiu also provide bootloader update program and configuration tool, which can be configured and redeveloped according to customer requirements. While providing basic software products, ZC also offers development services for the implementation of controller basic software functions.

2 应用领域 APPLICATION FIELD

木牛基础软件平台可应用于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. For example：

- 车身控制器
  Body Control Module
- 电池管理系统(BMS)
  Battery Management System (BMS)
- 网关控制器
  Gateway Controller
- 车载娱乐模块
  In-Vehicle Infotainment Module
- 胎压监控系统
  Tire Pressure Monitoring System
- 门控单元
  Door Control Module
- 车灯控制单元
  Headlamp Control Module
- 电子驻车制动系统
  Electronic Parking Brake System

3 配置环境 CONFIGURATION ENVIRONMENT

配置环境 Configuration Environment	
Hardware (Chip)	S32K144/S32K146/S32K148
Compilers Supported	S32 Design Studio for ARM(2018.R1)、IAR v8.40.1
Evaluation Hardware	S32K144 EVB
Debugger	Lauterbach (Trace32 R.2018.02) Isystem (IC5700)
Configuration Tools	Muniu_v4.4
Configuration Environment	Win7/Win10 64bit

S32DS 编译器选项 S32DS Compiler Options	
S32 Design Studio for ARM 编译选项 **S32 Design Studio for ARM Compiler Options**	-mcpu=cortex-m4 -c –Os -ggdb3 -mcpu=cortex-m4 -mthumb -mlittle-endian -fomit-frame-pointer -msoft-float -fno-common -Wall -Wextra -Wstrict-prototypes -Wno-sign-compare -fstack-usage -fdump-ipa-all -std=c99
S32 Design Studio for ARM 链接选项 **S32 Design Studio for ARM Linker Options**	-mcpu=cortex-m4 -msoft-float -mthumb -e _start -nostartfiles -static -lc -lm -lgcc -lnosys

IAR 编译器选项 IAR Compiler Options	
IAR 编译选项 IAR Compiler Options	--no_wrap_diagnostics --c++ -e --cpu Cortex-M4 --fpu None --debug --dlib_config --endian little --cpu_mode thumb -On --no_cse --no_unroll --no_inline --no_code_motion --no_tbaa --no_clustering --no_scheduling -DCPU_S32K146 -DAUTOSAR_OS_NOT_USED -DM4_DEVICE_RESERVED_ADDR=0x40080000 --diag_suppress Pa050 9
IAR 链接选项 IAR Linker Options	--cpu Cortex-M4 --fpu None -s+ -r -DSTART_FROM_FLASH -DM4_DEVICE_RESERVED_ADDR=0x40080000

OSEK 标准旨在制定汽车电子标准化接口，主要定义了三个组件：实时操作系统（OSEKOS），通讯系统（OSEKCOM）和网络管理系统（OSEKNM）。OSEK 操作系统始于 20 世纪 90 年代，是第一个商业化的汽车嵌入式操作系统。

The OSEK standard aims to establish standardized interfaces for automotive electronic system, mainly defining three components: the OSEK operating system (OSEK OS), the OSEK communication system (OSEK COM), and the OSEK network management system (OSEK NM). The OSEK operating system originated in the 1990s and was the first commercialized automotive embedded operating system.

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 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。平台化、智能化的基础软件起到至关重要。

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.

知从科技提供基础软件产品的同时，也提供符合 ASPICE Level3 流程和功能安全 ASILB\D 要求的控制器基础软件功能实现的开发服务，SBC 芯片、BCCIC 芯片各种复杂驱动软件的定制开发。同时，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 development services comply with ASPICE Level 3 processes and functional safety requirements of ASIL B/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。

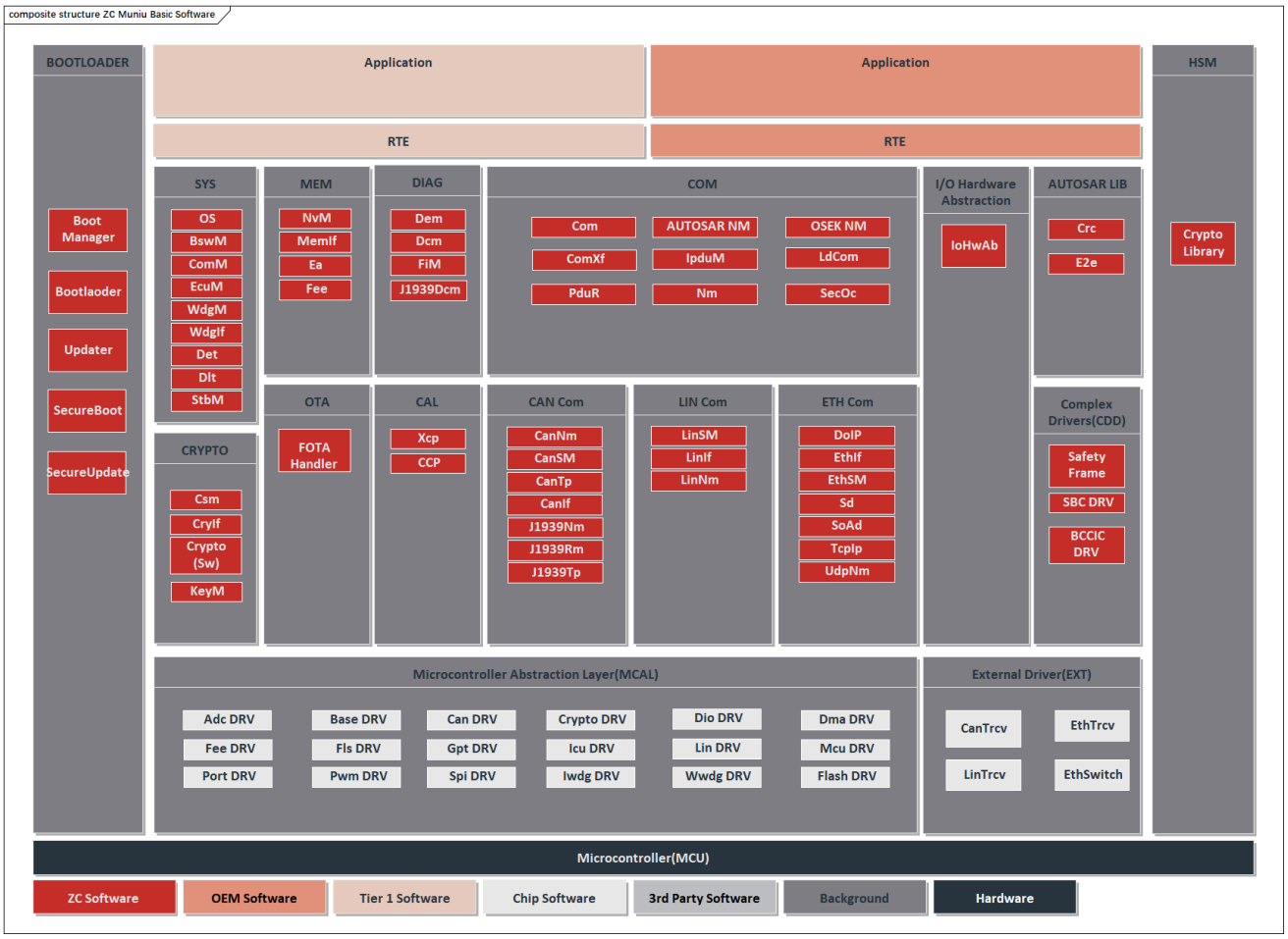
ZC has the core technology of the AUTOSAR basic software. Can provide on-site support with high quality, fast speed, and low cost.

5 功能描述 FUNCTIONAL DESCRIPTION

5.1 产品特点 Product Feature

- 符合 AUTOSAR 4.3.1 版本
  Complies with AUTOSAR 4.3.1
- ARTOP 架构上位机配置工具，符合 AUTOSAR 4.4.0 版本
  ARTOP configuration tool, compliant with AUTOSAR 4.4.0
- 符合 OSEK 标准
  Complies with OSEK
- 操作系统
  Operating system
- 通讯协议栈（CAN\LIN）
  Communication protocol stack (CAN\LIN)
- 诊断协议栈(UDS\J1939)
  Diagnostic protocol stack (UDS\J1939)
- 网络管理（OSEK\AUTOSAR）
  Network management (OSEK\AUTOSAR)
- 标定协栈（XCP\CCP）
  Calibration protocol stack (XCP\CCP)
- 存储协议栈
  Storage protocol stack
- 复杂驱动定制开发
  Customized complex driver development
- 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

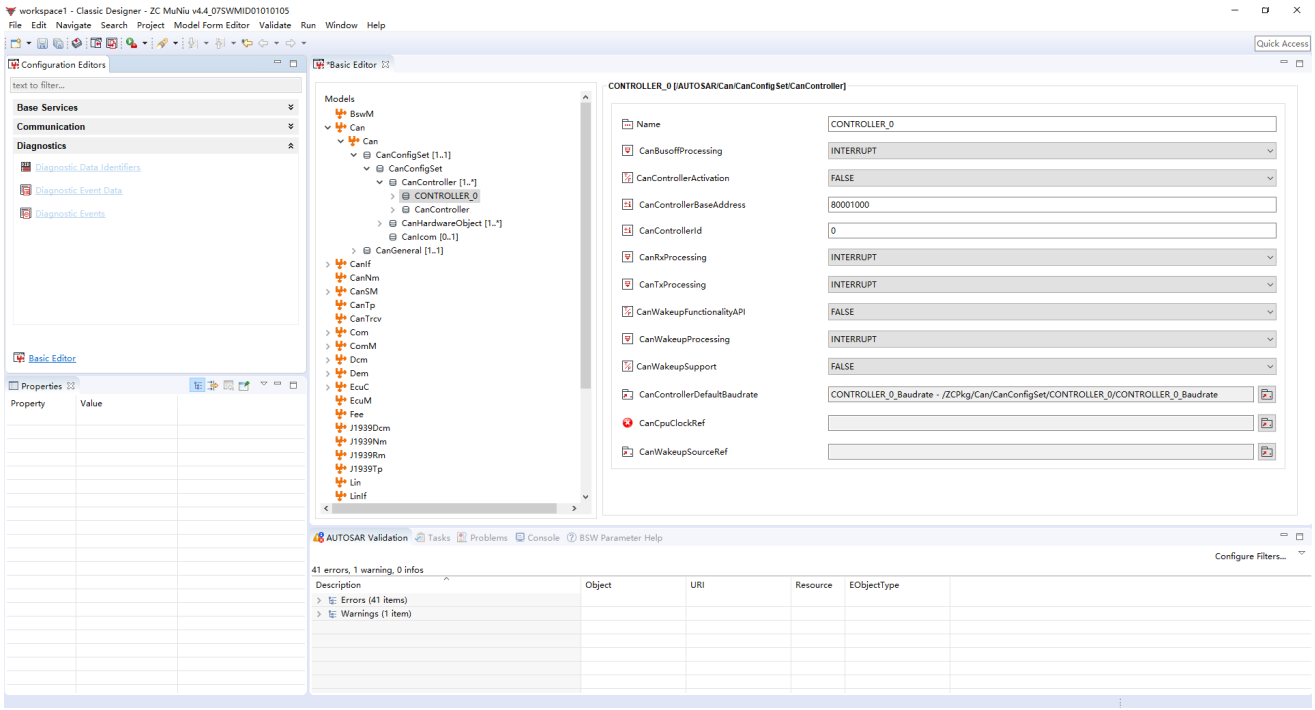
模块 Module	子模块 Submodule		描述 Description
微控制器底层驱动集成包 Microcontroller Abstraction Layer Integrated Package	可集成第三方 MCAL 的集成工程服务包 ZC has an Integrated engineering service package that can be integrated with third-party MCAL		
外部底层驱动 External Low-Level Driver (EXT)	CanTrcv DRV	CAN收发器驱动 CAN Transceiver Driver	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.
	EthTrcv	Eth收发器驱动 Eth Transceiver Driver	
	LinTrcv	Lin收发器驱动 Lin Transceiver Driver	
	EthSwitch	Eth交换机驱动	

模块 Module	子模块 Submodule		描述 Description
		Eth Switch	
系统服务 System Service (SYS)	OS	操作系统 Operating System	实现系统服务的AUTOSAR基础软件模块 Implement the AUTOSAR Basic Software Module for System Services
	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	
	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	实现非易失性存储管理的基础软件协议栈 Implement the Basic
	FEE	Flash 的 EEPROM 模拟器	

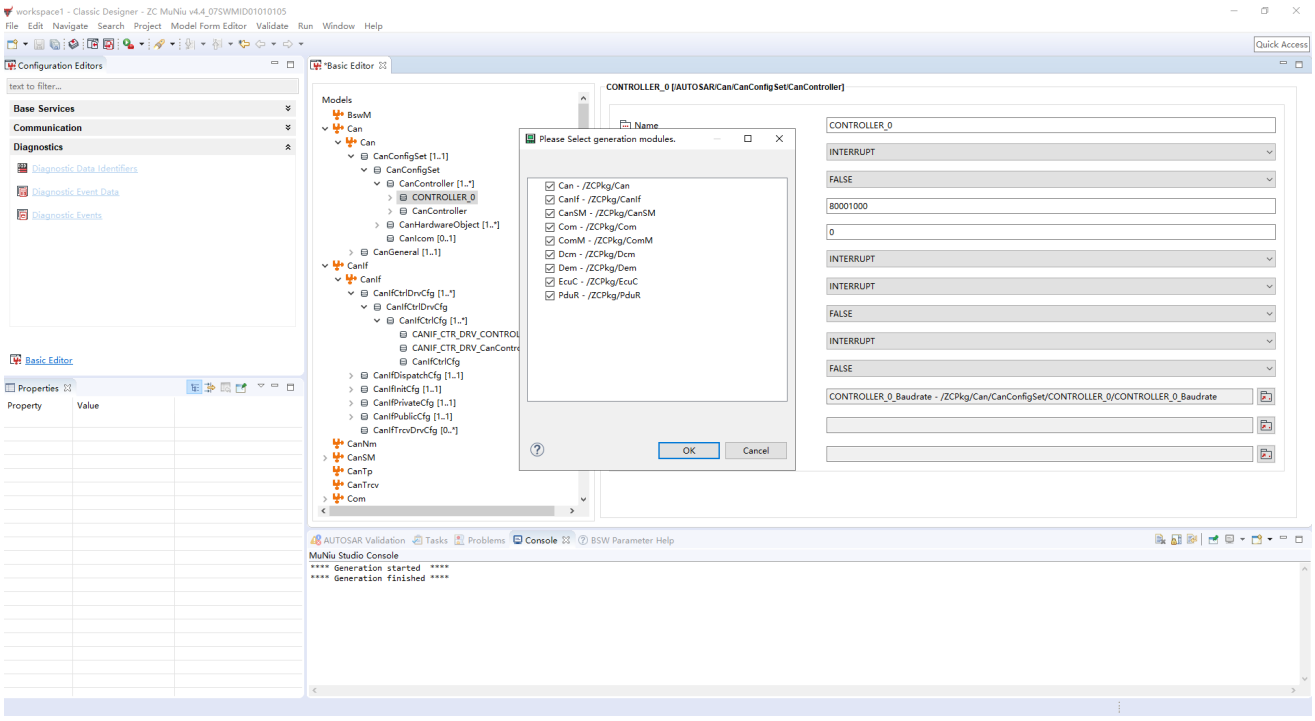
模块 Module	子模块 Submodule		描述 Description
	MEMIF	存储器抽象层接口	Software Protocol Stack for Non-Volatile Storage Management
	NVM	NVRAM管理器	
通信服务 Communication Service (COM)	COM	通信 Communication	实现通信管理的基础软件协议栈 Implement the basic software protocol stack for communication management.
	AUTOSAR NM	网络管理接口 Network 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	

模块 Module	子模块 Submodule		描述 Description
	J1939Tp	J1939传输协议 J1939 Transmission Protocol	
ETH通信 ETH Communication	DoIP	IP诊断协议 IP Diagnostic Protocol	实现ETH通信的AUTOSAR基础软件模块 Implement the AUTOSAR basic software module for ETH Communication
	EthIf	ETH接口 ETH Interface	
	EthSM	ETH状态管理器 ETH State Manager	
	Sd	服务发现 Service Discovery	
	SoAd	Socket适配器 Socket Adapter	
	TcpIp	TCP IP协议栈 TCP IP Protocol Stack	
	UdpNm	UDP网络管理 UDP Network Management	
复杂驱动 Complex Driver (CDD)	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 Implement the AUTOSAR basic software module for Complex Driver
	BCCIC DRV	电池管理系统采样芯片驱动 Battery Management System Sampling Chip 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 requirements of customer and enhance the extensibility of the basic software platform, ZC.MuNiu has implemented configurable modules and configuration tool. Customers can use the configuration tool to configthe modules according to their specific needs, generate configuration code files, and integrate these files into projects.

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.

6 证书 CERTIFICATE

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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

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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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