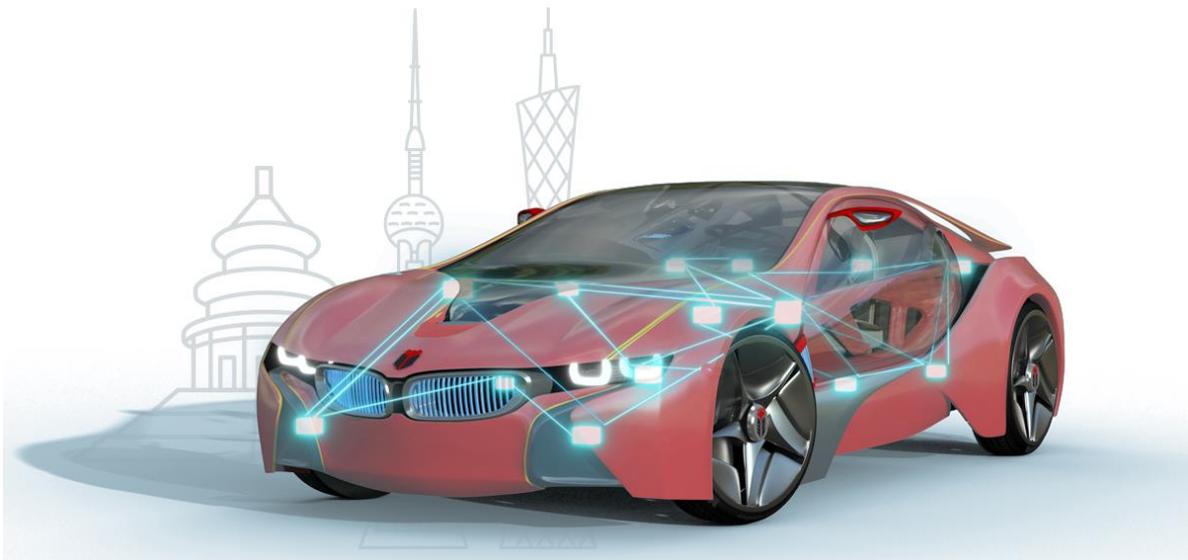


## 知从玄武压缩下载功能介绍

### ZC.XUANWU COMPRESSED TRANSMISSION

知从玄武工具

ZC.XuanWu Tool



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### 1 概述 OVERVIEW

玄武上位机软件用来将电子控制器中的应用程序和数据，从 PC 端下载到电子控制器上。支持UDSonCAN、UDSonEth、UDSonK-Line、UDSonLIN 协议。提供客户协议定制集成，广泛应用在电子控制器产品开发阶段，测试阶段，售后服务阶段。

ZC.XuanWu upper computer software is used to download application programs and data from the PC to the electronic controller. It supports UDS on CAN, UDS on Eth, UDS on K-Line, and UDS on LIN protocols. It offers customized integration of customer-specific protocols and is widely used in the development, testing, and after-sales service stages of electronic controller products.

知从玄武程序刷新与诊断测试工具可应用于 OEM 和 Tier1 多种应用场景下。用户可以方便的在实验室，试验车辆以及实车上方便的进行程序刷写工作。

ZC.XuanWu program refresh and diagnostic testing tools can be applied in various application scenarios for OEMs and Tier 1 suppliers. Users can conveniently perform program flashing work in laboratories, test vehicles, and actual vehicles.

玄武上位机软件目前应用于各类电子控制器的程序刷写：

ZC.XuanWu upper computer software is currently used for program flashing of various electronic controllers:

- 车身控制器 Body Control Module (BCM)
- 空调控制器 Air Conditioning Controller
- DC/DC 控制器 DC/DC Converter
- 电子助力转向控制器 Electric Power Steering Controller
- 发动机控制器 Engine Management System (EMS)
- 变速箱控制器 Transmission Control Module (TCM)
- 电池管理系统 Battery Management System (BMS)

- 整车控制器 Vehicle Control Unit (VCU)
- 电机控制器 Motor Control Unit (MCU)
- 电动助力转向系统 Electric Power Steering System (EPS)
- 防抱死制动系统 Anti-lock Braking System (ABS)
- 电子稳定性控制程序 Electronic Stability Program (ESP)
- 主动防撞系统 Active Collision Avoidance System (ACC)
- 牵引力控制系统 Traction Control System (TCS)
- ADAS 控制器 Advanced Driver Assistance Systems Controller

玄武上位机支持下述设备：

配置环境 Configuration Environment	
Hardware	PCAN 、 Mongoose 、 Kvaser 、 USBCAN ( ZLG ) 、 VN1640 、 TC1016、 OBD-RJ45
Configuration Environment	Win7/10 64bit



PCAN



Mongoose



USBCAN (ZLG)



Kvaser



VN1640



OBD-RJ45



TC1016

## 2 压缩传输介绍 INFORMATION SECURITY FEATURES INTRODUCTION

在智能网联汽车快速发展的时代背景下，车载电子系统日益复杂，车辆产生的数据量呈指数级增长。海量数据的实时处理与传输对车辆网络带宽和存储资源提出了严峻挑战，在此背景下，数据压缩传输技术成为确保高效、可靠通信的关键手段之一。此外，在汽车信息安全领域，压缩传输技术与加密技术形成了协同防护体系。通常采用“先压缩后加密”的处理流程，这不仅能减少需要加密的数据量，提高加密运算效率，还能增强整体安全性——因为压缩后的数据冗余度降低，统计特征减弱，使密码分析攻击更加困难。

Against the backdrop of the rapid development of intelligent and connected vehicles, in-vehicle electronic systems are becoming increasingly complex, and the amount of data generated by vehicles is growing exponentially. Real-time processing and transmission of massive amounts of data pose severe challenges to vehicle network bandwidth and storage resources. Against this background, data compression and transmission technology has become one of the key means to ensure efficient and reliable communication. In addition, in the field of automotive information security, compression and transmission technology and encryption technology have formed a collaborative protection system. Usually, a processing flow of "compress first, then encrypt" is adopted, which not only reduces the amount of data to be encrypted, improves the efficiency of encryption operations, but also enhances overall security—because the redundancy of compressed data is reduced, statistical characteristics are weakened, making cryptanalysis attacks more difficult.

压缩传输技术，特别是 LZSS 算法，在汽车的数据处理与通信中扮演着不可或缺的角色。压缩传输技术可以通过消除数据冗余，在保证信息完整性的前提下，显著降低传输数据量，从而节省带宽资源、提升传输效率，并降低系统功耗，提高了系统响应实时性，还能与信息安全机制协同工作，为构建高效、可靠、安全的智能交通生态系统提供了关键技术支撑。

Compression transmission technology, especially the LZSS algorithm, plays an indispensable role in data processing and communication in the automotive industry. Compression transmission technology can significantly reduce the amount of transmitted data by eliminating data redundancy while ensuring information integrity, thereby saving bandwidth resources, improving transmission efficiency, reducing system power consumption, enhancing system response real-time performance, and collaborating with information security mechanisms to provide key technical support for building an efficient, reliable, and secure intelligent transportation ecosystem.

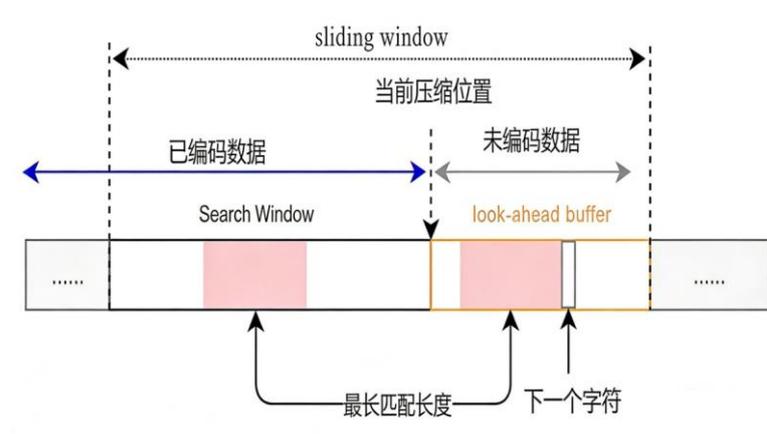
## 2.1 LZSS 算法介绍 Introduction to the LZSS Algorithm

LZSS 是一种基于滑动窗口字典编码的无损数据压缩算法，由 LZ77 算法优化而来。其核心思想是通过在先前已处理的数据中查找并引用重复出现的模式，实现对数据的压缩编码。

LZSS is a lossless data compression algorithm based on sliding window dictionary encoding, optimized from the LZ77 algorithm. Its core idea is to compress and encode data by searching for and referencing repeated patterns in previously processed data.

算法维护一个固定大小的滑动窗口，该窗口由两部分组成：搜索缓冲区（search buffer）存储最近已编码的数据，前瞻缓冲区（look-ahead buffer）缓存待编码数据。压缩过程中，算法持续在前瞻缓冲区内查找与搜索缓冲区中匹配的最长子串。当匹配长度超过预设阈值时，使用一个位置-长度对（通常包含匹配起始位置和长度信息）替换原始数据；否则直接输出原始字符。这种动态替换机制能够高效消除数据冗余，实现无损压缩效果，示意如下：

The algorithm maintains a fixed-size sliding window, which consists of two parts: the search buffer stores recently encoded data, and the look-ahead buffer caches data to be encoded. During the compression process, the algorithm continuously searches for the longest matching substring in the look-ahead buffer within the search buffer. When the match length exceeds a preset threshold, a position-length pair (usually containing information about the match start position and length) is used to replace the original data; otherwise, the original characters are directly output. This dynamic replacement mechanism can efficiently eliminate data redundancy and achieve lossless compression, as shown below:



## 2.2 压缩传输场景介绍 Compressed Transmission Scenarios

基于 UDS 协议 (ISO 14229-1) 中，压缩传输技术的应用为提升刷写效率提供了一种有效解决方案，通过修改请求下载服务 (SID=0x34) 的相关配置，可定义刷写压缩、加密格式的数据。刷写工具可以告知 ECU 待传输的数据是否经过压缩处理，从而在保证数据完整性的前提下，显著减少实际传输的数据量，缩短刷写时间。

In the UDS protocol (ISO 14229-1), the application of compressed transmission technology provides an effective solution for improving the efficiency of flashing. By modifying the relevant configuration of the Request Download service (SID=0x34), it is possible to define the data format for compressed and encrypted flashing. The flashing tool can inform the ECU whether the data to be transmitted has been compressed, thereby significantly reducing the actual amount of data transmitted and shortening the flashing time while ensuring data integrity.

ISO 14229-1 中定义 34 服务报文格式如图所示：

The format of Service 34 message defined in ISO 14229-1 is shown in the figure below:

A_Data byte	Parameter Name	Cvt	Byte Value	Mnemonic
#1	RequestDownload Request SID	M	0x34	RD
#2	dataFormatIdentifier	M	0x00 – 0xFF	DFI_
#3	addressAndLengthFormatIdentifier	M	0x00 – 0xFF	ALFID
#4	memoryAddress[] = [ byte#1 (MSB) : byte#m ]	M	0x00 – 0xFF	MA_ B1
:		:	:	:
#{m-1}+4		C <sub>1</sub>	0x00 – 0xFF	Bm
#n-(k-1)	memorySize[] = [ byte#1 (MSB) : byte#k ]	M	0x00 – 0xFF	MS_ B1
:		:	:	:
#n		C <sub>2</sub>	0x00 – 0xFF	Bk
C <sub>1</sub> : The presence of this parameter depends on address length information parameter of the addressAndLengthFormatIdentifier				
C <sub>2</sub> : The presence of this parameter depends on the memory size length information of the addressAndLengthFormatIdentifier.				

在具体实现中，dataFormatIdentifier 参数的高四位用于指示压缩方法。当启用压缩传输时，整车厂需明确协议中 memorySize 参数所代表的含义——是指压缩后的数据大小还是原始数据大小。这一设计选择直接影响 ECU 内部 Bootloader 的逻辑实现：若 memorySize 表示压缩后大小，ECU 在接收数据时直接进行字节数比对，并在写入 Flash 前实施解压操作；若表示原始数据大小，则 ECU 需实时计算解压后的数据累积量，并与该参数进行最终校验。

In the specific implementation, the high four bits of the dataFormatIdentifier parameter are used to indicate the compression method. When compressed transmission is enabled, the vehicle manufacturer needs to clarify the meaning represented by the memorySize parameter in the protocol - whether it refers to the size of the compressed data or the size of the original data. This design choice directly affects the logical implementation of the internal Bootloader of

the ECU: if memorySize represents the compressed size, the ECU directly performs byte count comparison when receiving data and implements decompression operations before writing to Flash; if it represents the original data size, the ECU needs to calculate the cumulative amount of decompressed data in real time and perform a final verification with this parameter.

这种灵活性设计使得压缩传输既能适配不同 ECU 的资源约束，又能确保数据传输的完整可靠，为智能网联汽车的高效软件更新提供了关键技术支撑。

This flexible design enables compressed transmission to adapt to the resource constraints of different ECUs while ensuring the integrity and reliability of data transmission, providing key technical support for the efficient software updates of intelligent connected vehicles.

### 3 玄武压缩下载功能介绍 XUANWU INFORMATION COMPRESSED TRANSMISSION

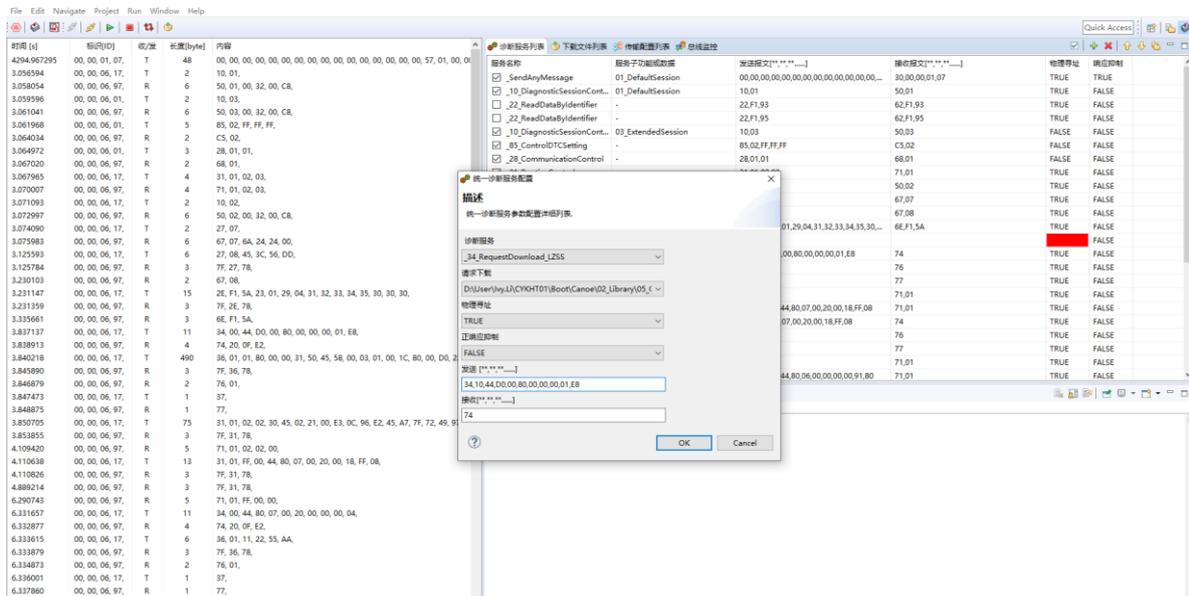
#### 3.1 压缩传输配置 Compressed Transmission

玄武支持用户向 ECU 发送单条或多条诊断报文，针对压缩传输，玄武支持在新建 UDS 0x34 服务时进行配置，选择\_34\_RequestDownload\_LZSS，点击 Path-File 选择文件，通过 LZSS 算法对于配置的刷写文件进行压缩，通过诊断服务进行刷写工作。

ZC.XuanWu supports users to send single or multiple diagnostic messages to the ECU. For compressed transmission, Xuanwu supports configuration when creating a new UDS 0x34 service. Select \_34\_RequestDownload\_LZSS, click Path-File to select a file, compress the configured flashing file using the LZSS algorithm, and perform the flashing operation through the diagnostic service.

玄武默认 dataFormatIdentifier 为 0x10，用户需要配置刷写文件起始地址、刷写文件 Size。

ZC.XuanWu's default dataFormatIdentifier is 0x10, and users need to configure the starting address and size of the flash file.



在 ECU 软件日益复杂的背景下，高效、可靠的软件更新能力已成为汽车电子系统的关键需求。玄武作为一款适配性强的刷写工具，通过自定义配置实现兼容各类 Bootloader 规范。针对 CAN 等低速总线场景，工具支持压缩传输以提升大数据量刷写效率；同时，为满足研发、生产及售后各环节的安全要求，亦可对刷写文件进行加密保护。玄武不仅确保了数据传输的稳定性与安全性，更能根据实际刷写规范提供灵活的功能支持，成为支撑整车软件生命周期管理的重要工具。

Against the backdrop of increasingly complex ECU software, efficient and reliable software updating capabilities have become a critical requirement for automotive electronic systems. Xuanwu, as a highly adaptable flashing tool, achieves compatibility with various Bootloader specifications through customizable configurations. For low-speed bus scenarios such as CAN, the tool supports compressed transmission to enhance flashing efficiency for large data volumes. Simultaneously, to meet the security requirements across R&D, production, and after-sales stages, it also enables encryption of flashing files to prevent data tampering and unauthorized usage. Xuanwu not only ensures the stability and security of data transmission but also provides flexible functional support tailored to actual flashing specifications, establishing itself as a vital tool for managing the entire vehicle software lifecycle.

## 4 证书 CERTIFICATE

玄武软件著作权登记证书  
XUANWU SOFTWARE COPYRIGHT REGISTRATION CERTIFICATE

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