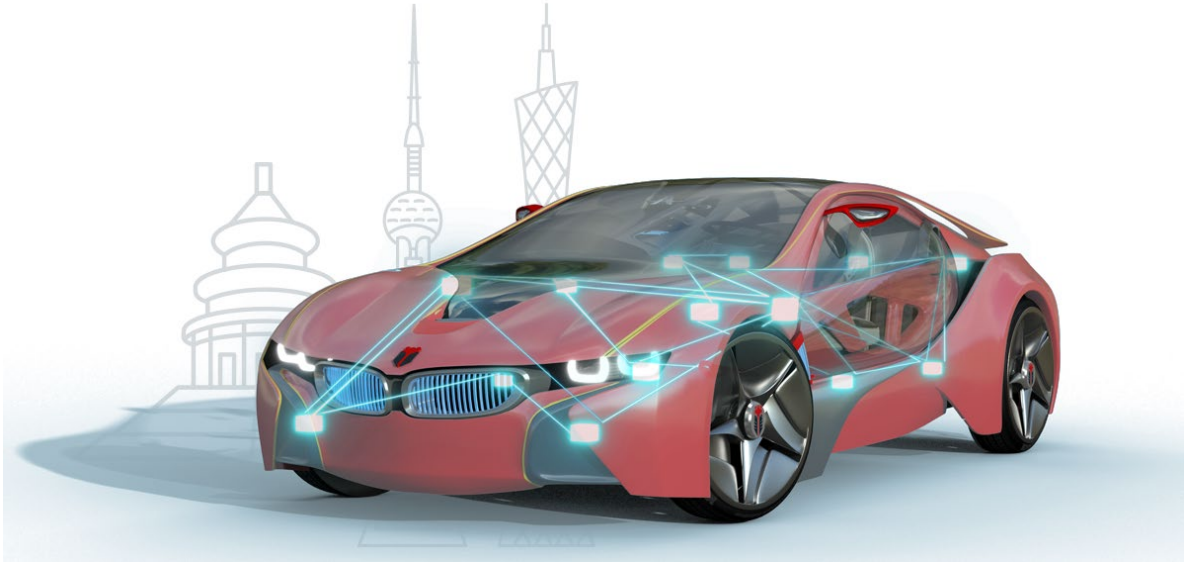
知从玄武 ETHERNET 刷写功能

ZC.XUANWU ETHERNET FLASH

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

2 以太网刷写介绍 ETH FLASH INTRODUCTION

在智能网联汽车发展的时代潮流中，随着处理器运算能力与硬件性能的快速提升，众多创新在汽车领域得以迅速落地。汽车电子控制器在整车中的占比持续攀升，与之相应的是，连接 ECU 的网络带宽需求也大幅增加，这一需求已远远超过 CAN 等传统车载网络的容量上限。此外，随着车辆网联化、智能化进程的推进，云计算与大数据技术的应用，以及高级驾驶辅助系统（ADAS）的广泛普及，构建全新的电子网络总线平台已成为新一代汽车发展的必然选择。

In the trend of the intelligent connected vehicle era, with the rapid development of processor computing power and hardware, many innovations have been rapidly promoted in the automotive environment. The proportion of automotive electronic products in the entire vehicle is also increasing day by day, and the network bandwidth demand for connecting ECUs has correspondingly increased significantly. This demand will far exceed the capacity limit of traditional in-vehicle networks such as CAN. In addition, with the advancement of vehicle networking and intelligence, the application of cloud and big data, and the popularization of advanced driver assistance systems (ADAS), building a new electronic network bus platform has become an inevitable task for the new generation of vehicles.

传统的车辆诊断通常依赖于专用的诊断工具和设备，限制了远程诊断和跨设备的兼容性。随着互联网协议（IP）的普及，DOIP 作为一种基于 IP 的诊断技术应运而生，它支持通过以太网和 Wi-Fi 等标准网络进行通信，能够更快速、更灵活地进行远程诊断。

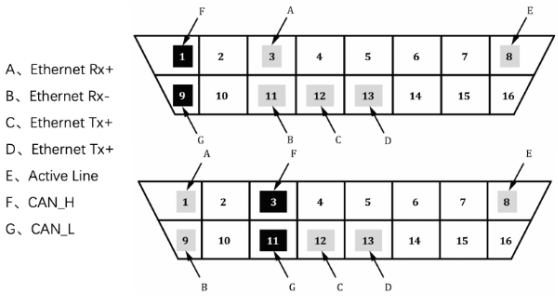
Traditional vehicle diagnostics typically rely on dedicated diagnostic tools and equipment, which limits remote diagnostics and cross-device compatibility.With the popularization of Internet Protocol (IP), DOIP (Diagnostic over IP), an IP-based diagnostic technology, has emerged. It supports communication through standard networks such as Ethernet and Wi-Fi, enabling faster and more flexible remote diagnostics.

2.1 物理层 Physical Layer

100Base-Tx，OBD 接口如下：

OBD接口线如下所示：

13400-4提供了OBD接口的两种布局方案供参考：



2.2 TCP/UDP 层 TCP/UDP Layer

TCP 是一种可靠的传输层协议，它确保数据包正确无误地从源传输到目的地。在 DoIP 中，TCP 用于需要高可靠性的诊断通信，如 ECU 编程。TCP 通过三次握手过程建立连接，确保两端的通信是同步的，并且通过序列号和确认应答机制保证数据的顺序和完整性。

TCP is a reliable transport - layer protocol that ensures data packets are transmitted from the source to the destination accurately and error - free. In DoIP, TCP is used for diagnostic communications that require high reliability, such as ECU programming. TCP establishes a connection through a three - way handshake process to ensure that the communication at both ends is synchronized, and guarantees the order and integrity of data through sequence numbers and acknowledgment mechanisms.

- 车内所有 DoIP 实体均应实现 TCP；

  All DoIP entities in the vehicle shall implement TCP.
- TCP 使用一对端口号来标识连接，TCP 连接时目的端口应当是 TCP_DATA；

  TCP uses a pair of port numbers to identify connections. The destination port for a TCP connection shall be TCP_DATA.
- DoIP 实体应在创建 socket 之后监听 TCP_DATA，用于与试图连接 DoIP 实体的外部测试设备建立通信；

DoIP entity shall listen on TCP_DATA after creating a socket, which is used to establish communication with external test equipment attempting to connect to the DoIP entity.

- 外部测试设备应支持多个 TCP_DATA socket，本地端口将在创建 socket 时自动选择，远程端口应为 TCP_DATA。

  External test equipment shall support multiple TCP_DATA sockets. The local port will be automatically selected when creating a socket, and the remote port shall be TCP_DATA.

UDP 是一种无连接的协议，它允许数据包在没有事先建立连接的情况下发送。这种方法减少了开销，使得通信更快，但也牺牲了可靠性。在 DoIP 中，UDP 用于那些不需要确认的服务，如车辆发现或基本诊断请求。

Unlike TCP, UDP is a connectionless protocol that allows data packets to be sent without establishing a prior connection. This approach reduces overhead, enabling faster communication, but sacrifices reliability. In DoIP, UDP is used for services that do not require acknowledgment, such as vehicle discovery or basic diagnostic requests.

车内所有 DoIP 实体均应实现 UDP 当需要外部设备对车辆 IP 节点进行广播或多播消息请求时，由于 TCP 的传输机制限制无法实现，因此须使用 UDP。

All DoIP entities in the vehicle shall implement UDP.When external devices need to send broadcast or multicast message requests to vehicle IP nodes, since it cannot be achieved due to the limitations of TCP's transmission mechanism, UDP must be used.

名称	协议	端口号
UDP_DISCOVERY	UDP	13400
UDP_TEST_EQUIPMENT_REQUEST	UDP	动态分配（49152~65535）

2.3 Doip 协议 Doip Protocol：

Doip 总共有三类报文：节点管理类、诊断类和节点状态类。

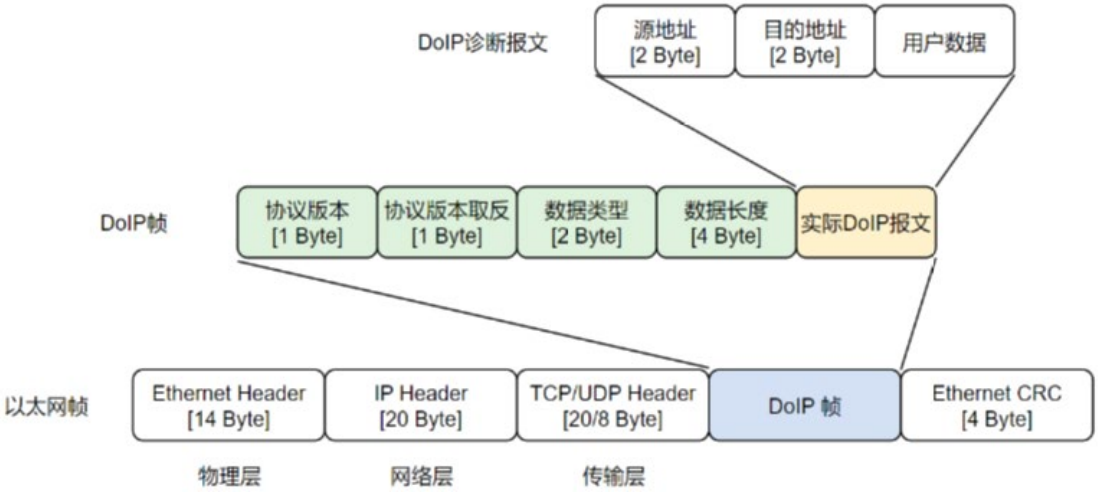
There are three types of messages in Doip: node management, diagnostic, and node status.

负载类型	取值
节点管理类	0x0000 - 0x0008
诊断类	0x8001 - 0x8003
节点状态类	0x4001 - 0x4004
预留	……

类型	负载类型值	负载类型名称	协议
DoIP 首部否定响应	0x0000	DoIP 首部否定响应	UDP/TCP
车辆声明及标识	0x0001	车辆识别请求报文	UDP
	0x0002	带 EID 的车辆识别请求报文	UDP
	0x0003	带 VIN 的车辆识别请求报文	UDP
	0x0004	车辆声明报文 / 车辆识别响应报文	UDP
路由激活	0x0005	路由激活请求报文	TCP
	0x0006	路由激活响应报文	TCP
在线检测	0x0007	在线检查请求报文	TCP
	0x0008	在线检查响应报文	TCP

Doip 在 OSI 模型中位于传输层，故 Doip 报文发送前要封装 ETH 首部、IP 首部及 TCP/UDP 首部，Doip 数据作为 SDU 层层向下传递，直至构成完整的以太网帧，通过物理层的介质发送出去。封装格式如下所示：

Doip is located at the transport layer in the OSI model, so before sending Doip packets, ETH headers, IP headers, and TCP/UDP headers need to be encapsulated. Doip data is passed down as SDUs layer by layer until a complete Ethernet frame is formed and sent out through the physical layer medium. The encapsulation format is as follows:


DoIP诊断报文
源地址
[2 Byte]
目的地址
[2 Byte]
用户数据
DoIP帧
协议版本
[1 Byte]
协议版本取反
[1 Byte]
数据类型
[2 Byte]
数据长度
[4 Byte]
实际DoIP报文
以太网帧
Ethernet Header
[14 Byte]
IP Header
[20 Byte]
TCP/UDP Header
[20/8 Byte]
DoIP 帧
Ethernet CRC
[4 Byte]
物理层
网络层
传输层

3 玄武 DOIP 刷写介绍 XUANWU DOIP FLASH INTRODUCTION

3.1 硬件连接 HardWare Connect

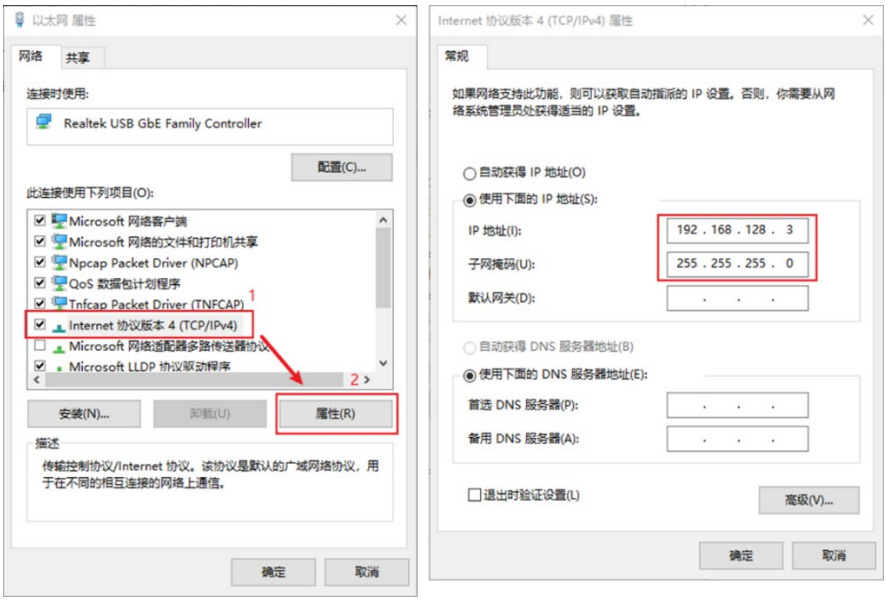
将 RJ45 端口连到电脑端，另一端与 ECU 相连，另一端需要根据 ECU 当前端口进行适配，常见端口有 RJ45 或者 OBD。

Connect the RJ45 port to the computer end and the other end to the ECU. The other end needs to be adapted according to the current port of the ECU. Common ports include RJ45 or OBD.

3.2 刷写配置 Flash Config

根据 ECU 当前的 IP 地址，在网络适配器中将电脑与 ECU 设置处于同一网段下。

Set the computer and ECU to be in the same network segment based on the current IP address of the ECU.



玄武打开以后，根据需要设置 ECU 的配置信息。

After opening ZC.XuanWu, set the ECU configuration information as needed.

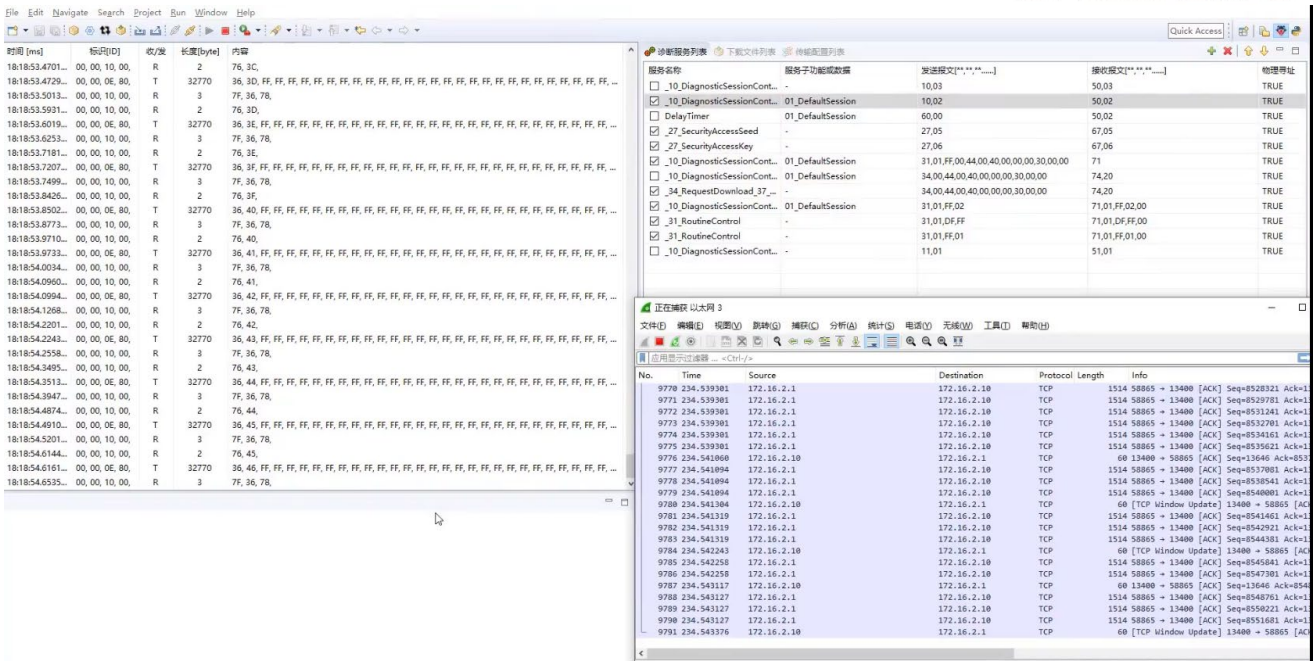
还可以对维持上位机和 ECU 之间的 TCP 连接进行心跳设置。

It is also possible to set the heartbeat to maintain the TCP connection between the upper computer and ECU.

3.3 连接及刷写 Connect and Flash

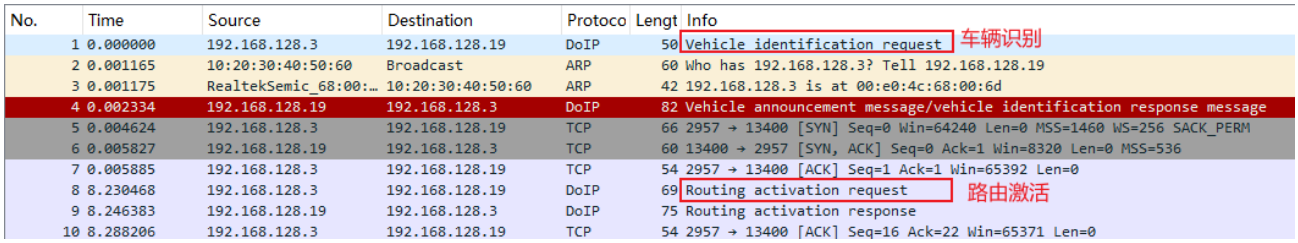
点击连接之后，玄武会自动发送车辆识别，路由激活等指令，成功和 ECU 建立连接之后，便可开始刷写。

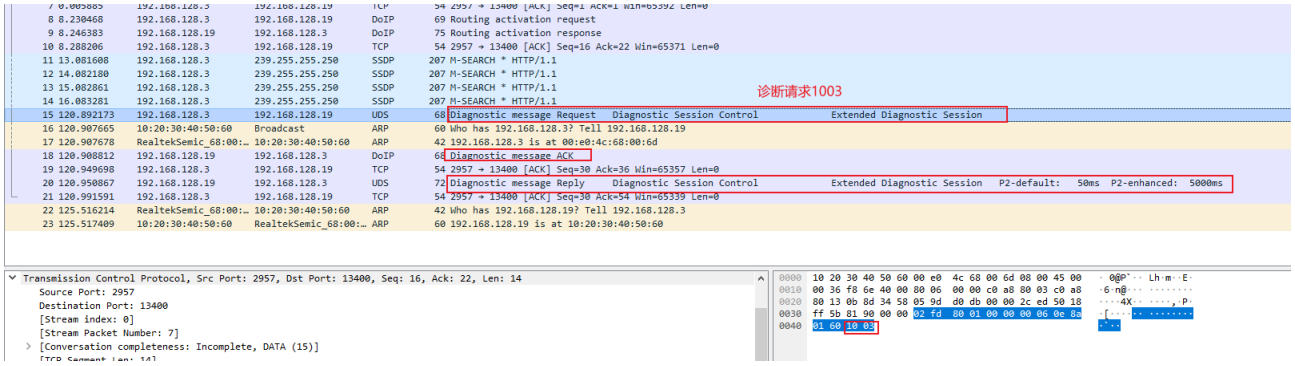
After clicking on the connection, Xuanwu will automatically send commands such as vehicle identification and route activation. Once a successful connection is established with the ECU, flashing can begin.



期间可通过 WireShark 工具进行抓包观察原始以太网报文。

During this period, the WireShark tool can be used to capture and observe the original Ethernet packets.





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[简称：知从玄武]
V10.1.0

著 作 权 人： 上海知从科技有限公司

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2024年10月17日

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