恒润科技

CCP 2.1 协议

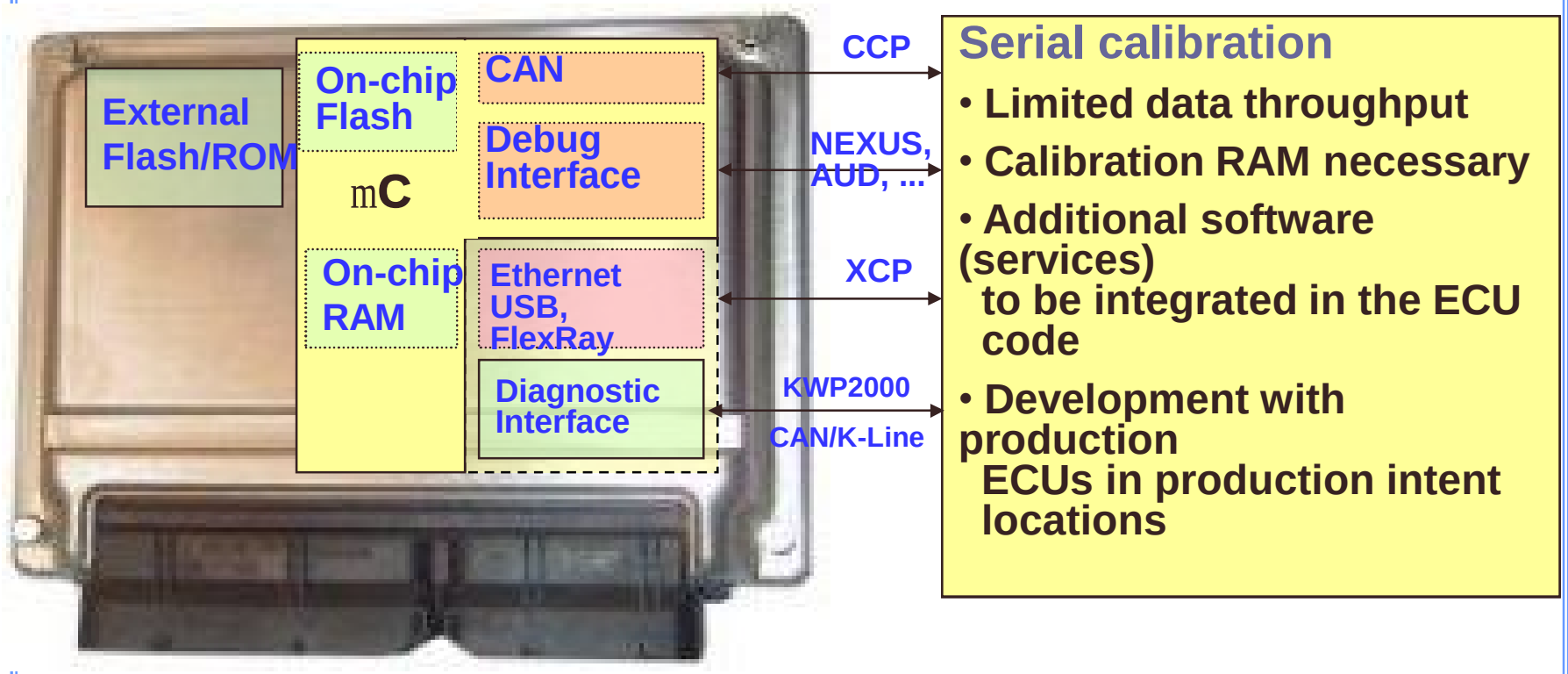
北京恒润科技有限公司

标定的基本概念

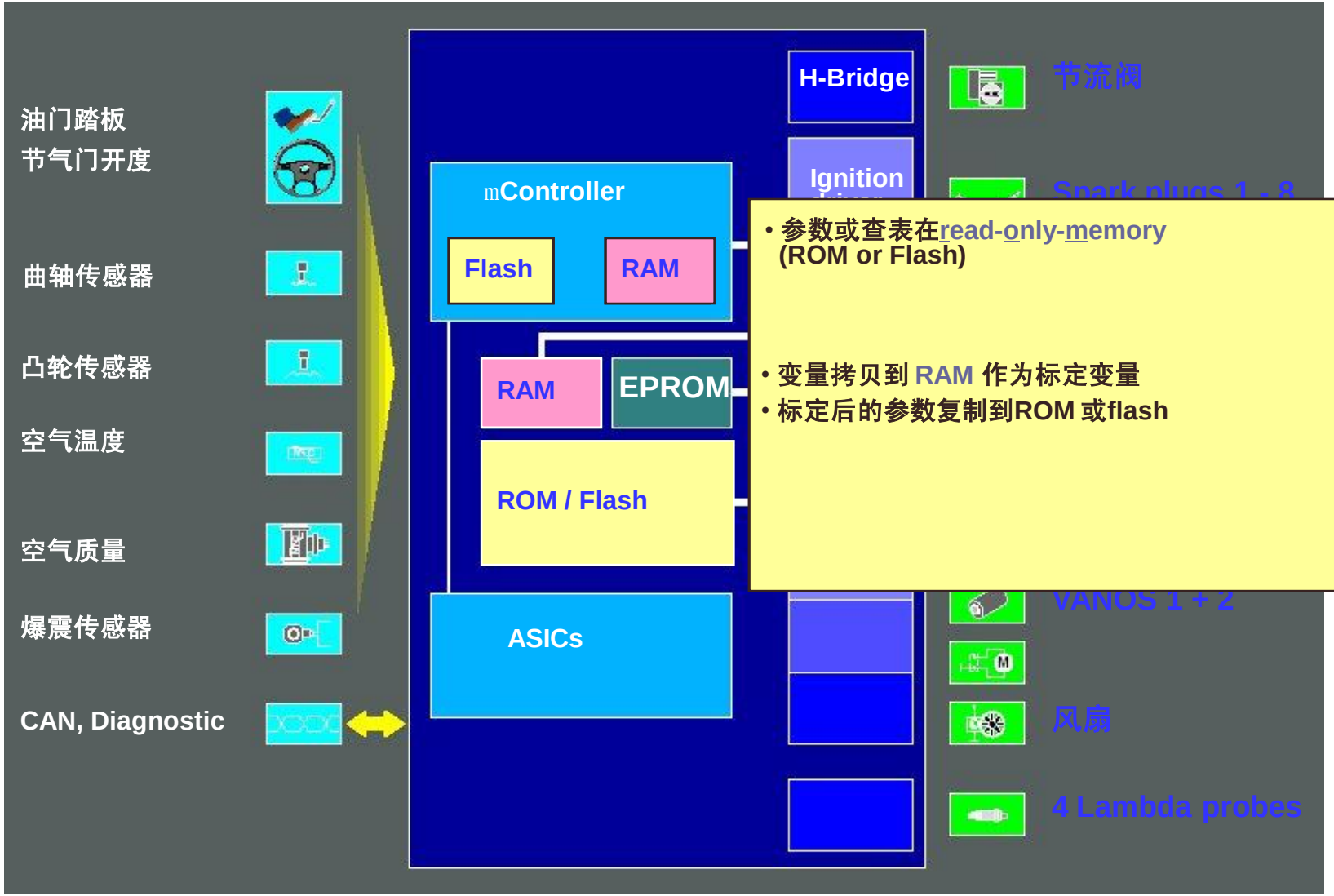
- 基本概念
  - ECU的基本结构
  - 什么是标定？
  - 什么是密钥？
  - 什么是CCP协议？
  - CCP协议的拓扑结构
  - CCP报文
  - Channel的概念
  - DAQList和ODT的概念

ECU基本结构

- ECU结构和接口



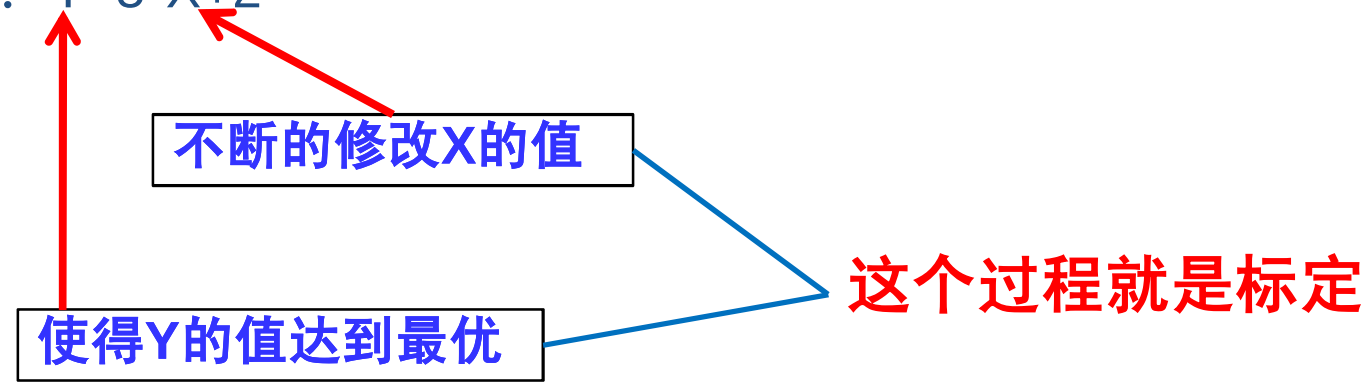
ECU工作过程例子：EMS ECU



什么是标定？

- 标定：根据ECU的性能要求或者整车的性能要求，修改调整或者优化ECU内部参数的过程。
  - 性能要求：
    - 排放性
    - 经济性
    - 动力性等

如：Y=5*X+2



什么是标定？

Calibration

Calibration Engineer

Measurement

Measurement & Calibration Tool （CANape）

Parameter

Control

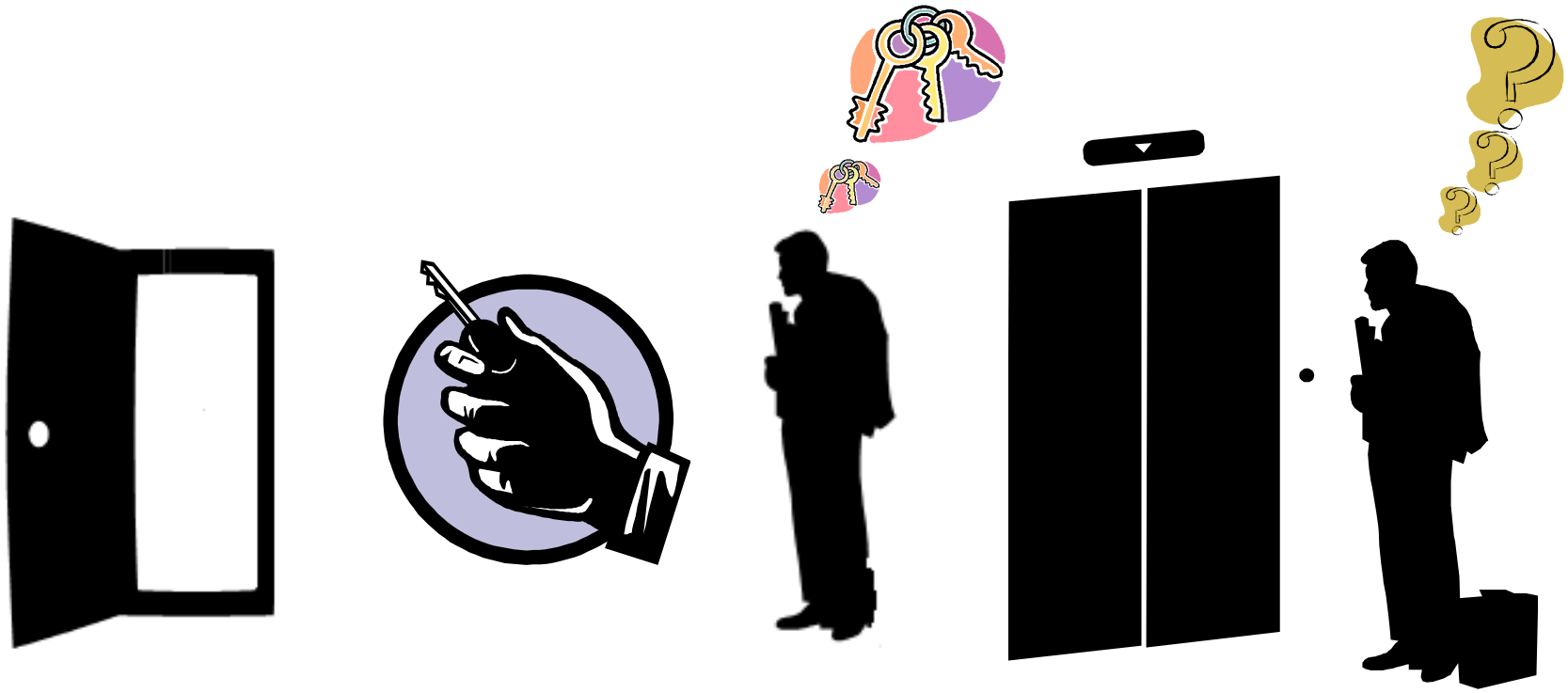
Sensor

Actuator

Controlled Device e.g. Break

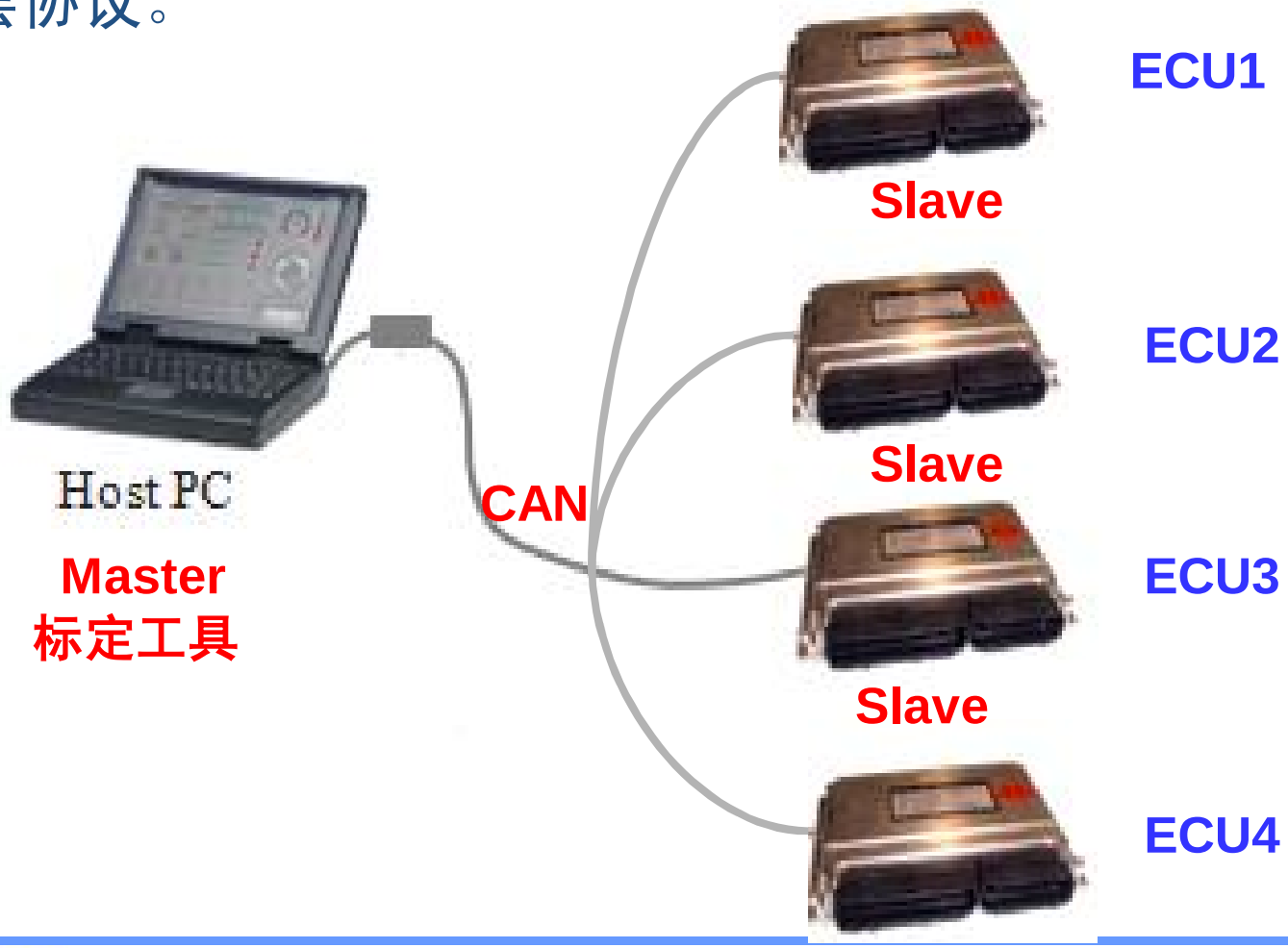
什么是密钥?

- Seed & Key
  - 产品ECU出厂后资源都是受到保护



CCP和CCP协议拓扑结构

- CCP：CAN Calibration Protocol 是基于CAN总线应用层协议。



CCP报文

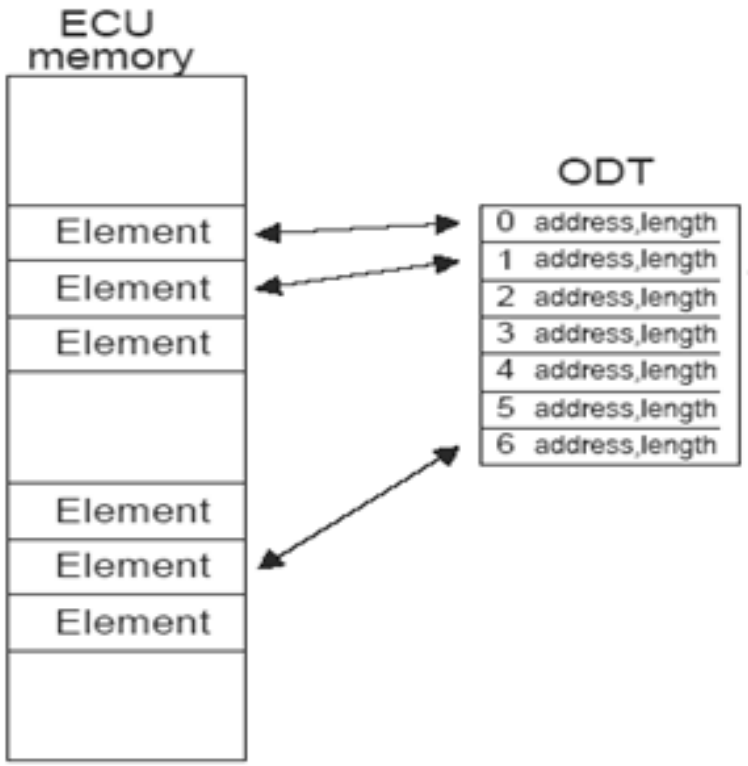
- CCP报文有两个：
  - CRO：Command Receive Object（Master à Slave）
  - DTO：Data Transmit Object（Slave à Master）

基本概念

- ODT：Object Descriptor Table
  - 占7个字节，均为地址和地址对应参数的长度
  - 格式为：

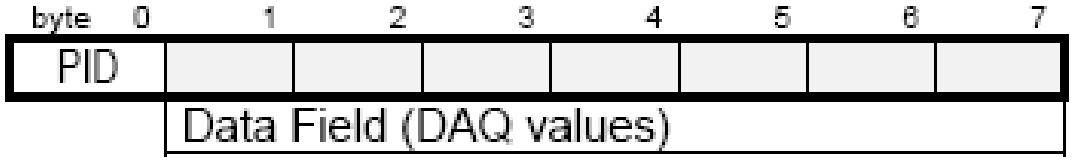
PID	0	1	2	3	4	5	6

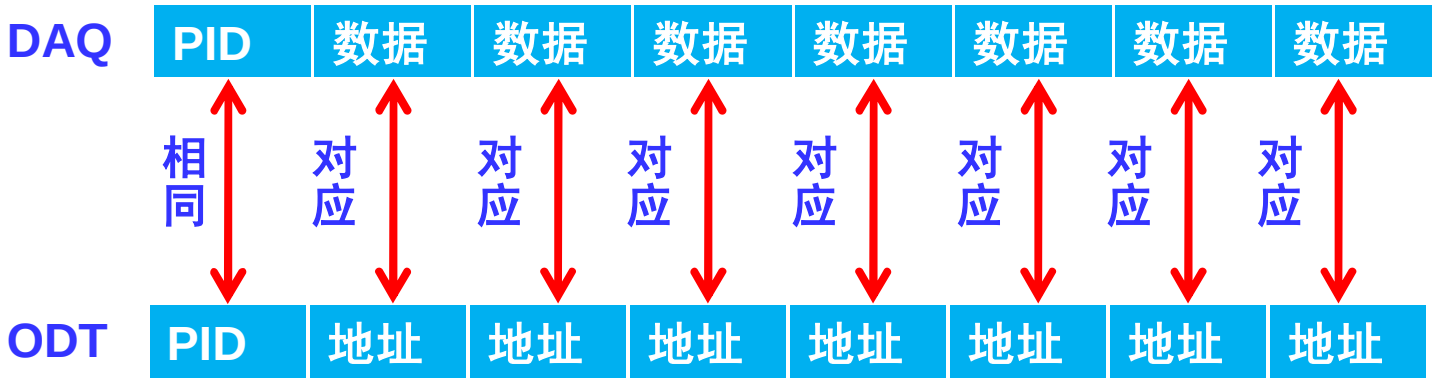
  - 可以有一个或多个ODT



基本概念

- DAQ：Data Acquisition
- 帧格式：





- DAQlist：一个DAQlist里面可以包含多个ODT。

基本概念

- Event Channel：

  1、描述ECU中的同步事件：指周期性的时间触发事件（如：100ms，200ms等）或特定的事件（如：曲轴的转角）。

  2、触发同步传输DAQ List：

  如：用Event Channel A触发10ms、20ms、50ms的周期性报文同步传输。

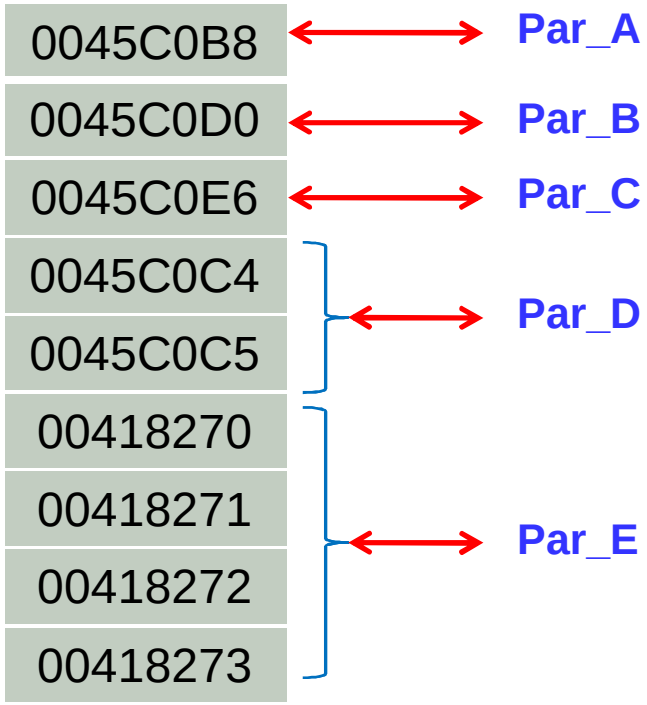
  10ms:Par_A，Par_B，Par_C每个参数大小为一个字节

  20ms:Par_D参数的大小为2个字节

  50ms:Par_E参数的大小为3个字节

  假如有3个DAQlist，每个DAQlist里面有一个ODT：

基本概念



Event Channel A

DAQlist 0:	PID 1	Par_A	Par_B	Par_C				
ODT 0:	PID 1	0045C 0B8	0045C 0D0	0045C 0E6				
DAQlist 1:	PID 2	Par_D	Par_D					
ODT 0:	PID 2	0045C 0C4	0045C 0C5					
DAQlist 2:	PID 3	Par_E	Par_E	Par_E	Par_E			
ODT 0:	PID 3	00418 270	00418 271	00418 272	00418 273			

标定流程

- 标定应用工程师：

  具体到每个供应商或者主机厂标定流程的细节都不太一样（如标定对象）

- 标定研发工程师：均相同（写CCP或XCP驱动代码）

普通的标定流程

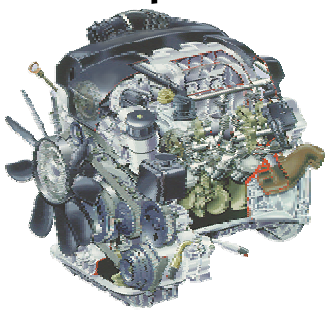
大约有30%-50%的参数需要在Test bench上完成

台架基本标定

台架测试测量

CANape

ECU



普通的标定流程

大约有50%-70%的参数需要在整车上完成

Calibration

修改和优化参数

整车标定、诊断标定、三高标定

CANape

ECU

Measurement

- ECU内部变量
- 外部传感器数据
  (温度、压力、电压
  Lambda, O_2, NO_x, ...)

CCP发展历史

- CCP（CAN Calibration Protocol）基于CAN的应用层协议
- 属于ASAP标准（应用/标定系统的标准化）
- ASAP:Arbeitskreis zur Standardisierung von Applikationssystemen
  Standardization of Application/Calibration Systems task force
  由Audi, BMW, Mercedes-Benz, Porsche和Volkswagen创立
- Helmut Kleinknecht开发，后转给ASAP工作组并在功能方面得到增强
- 1992.09.30 CCP V1.0 （Helmut Kleinknecht）
- 1995.12.07 CCP V1.01b （ASAP）
- 1996.04.26 CCP V1.02 （ASAP草案）
- 1996.06.14 CCP V2.0 （ASAP发布）
- 1998.03.16 CCP V2.01 （ASAP草案）
- 1998.06.23 CCP V2.1 （ASAP草案）
- 1999.02.18 CCP V2.1 （ASAP发布）

CCP的应用范围和领域

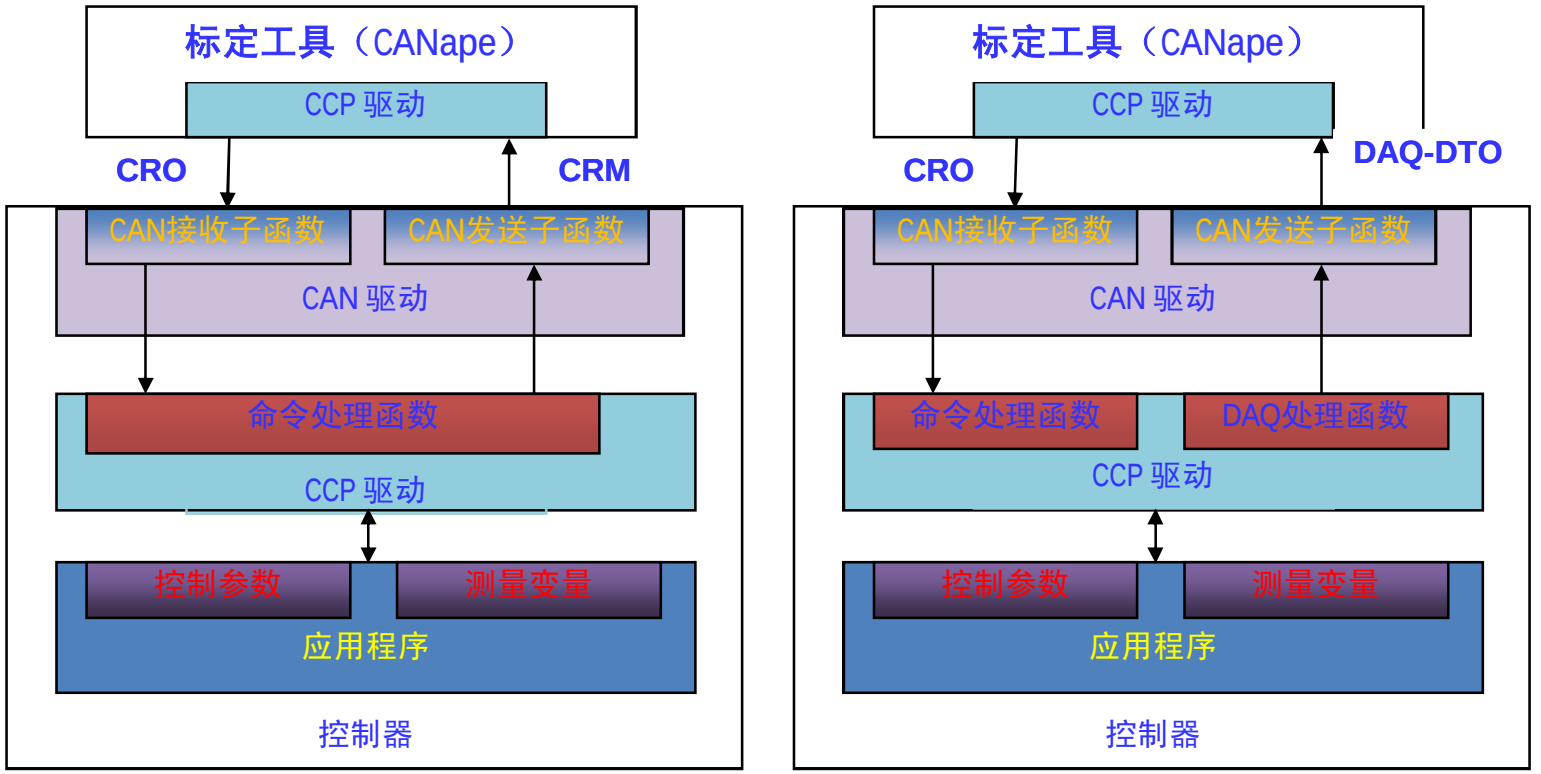
- 任何基于CAN的分布式电控系统ECU开发
- 对ECU进行功能和环境测试的系统
- 被控设备的测试系统和测试台架（发动机、变速箱、悬挂系统、空调控制系统、车身控制系统、刹车防抱死系统）
- 预研车系的测试和测量系统

协议定义

- 普通控制命令(Generic Control Command)
  - Master与某个Slave建立逻辑连接
  - Master与某个Slave断开逻辑连接
  - 数据传输的控制
  - 握手报文（命令返回代码或错误代码）
- 数据采集命令(Data Acquisition Command)
  - 数据传输的初始化（Master）
  - 数据传送的执行（Slave）
- 协议版本管理
  - 版本机制
    1. Major协议版本号（0－255）
    2. Minor协议版本号（0－9）
  - 版本兼容性
    1. 主从设备Major协议版本一定相同
    2. 主设备的Minor协议版本大于或等于从设备的版本
    3. 主从设备必须支持所有Non－Optional命令

报文对象

- CCP使用两条CAN报文
  - CRO: Command Receive Object
  - DTO: Data Transmission Object
  - 报文ID在ECU描述文件（如A2L）中定义，CRO高于DTO



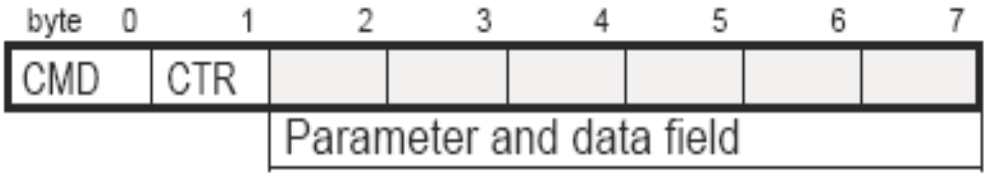
报文对象描述

- CRO：Command Receive Object——从Master到Slave

Type	Rx only
Size	8 bytes message field
Purpose	Reception of commands in the slave device

Parameters in message field:

Position	Type	Description
0	byte	command code = CMD
1	byte	command counter = CTR
2...7	bytes	command related parameter and data area



报文对象描述

- DTO：Data Transmit Object ——从Slave到Master

  根据PID（Packet ID）的不同，DTO可分为：

  - **PID＝255**：Command Return Message（ CRM－DTO ）

    主要是从设备反馈给主设备的响应

  - **PID＝254**：Event Message

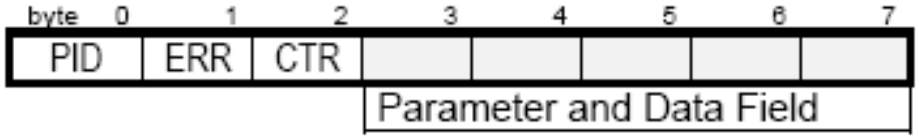
    当从设备检测到内部发生错误机制时，由从设备自行向主设备发送，报告其当前的运行状态，并请求主设备暂停当前工作进程以处理发生的错误。

  - **0≤ PID ≤254**：Data Acquisition Message（DAQ－DTO）

    用在DAQ模式中，由从设备组织，周期性向主设备发送。

报文对象描述

- CRM和事件报文的帧格式：

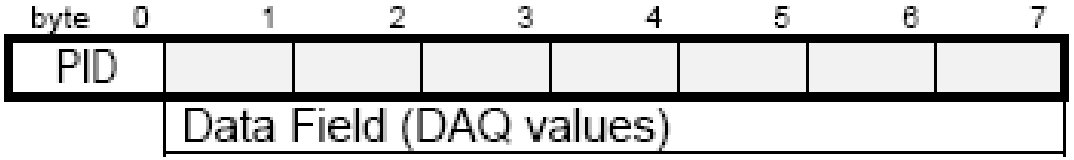


ERR: Command Return- / Error Code.

CTR: Command Counter as received in CRO with the last command.

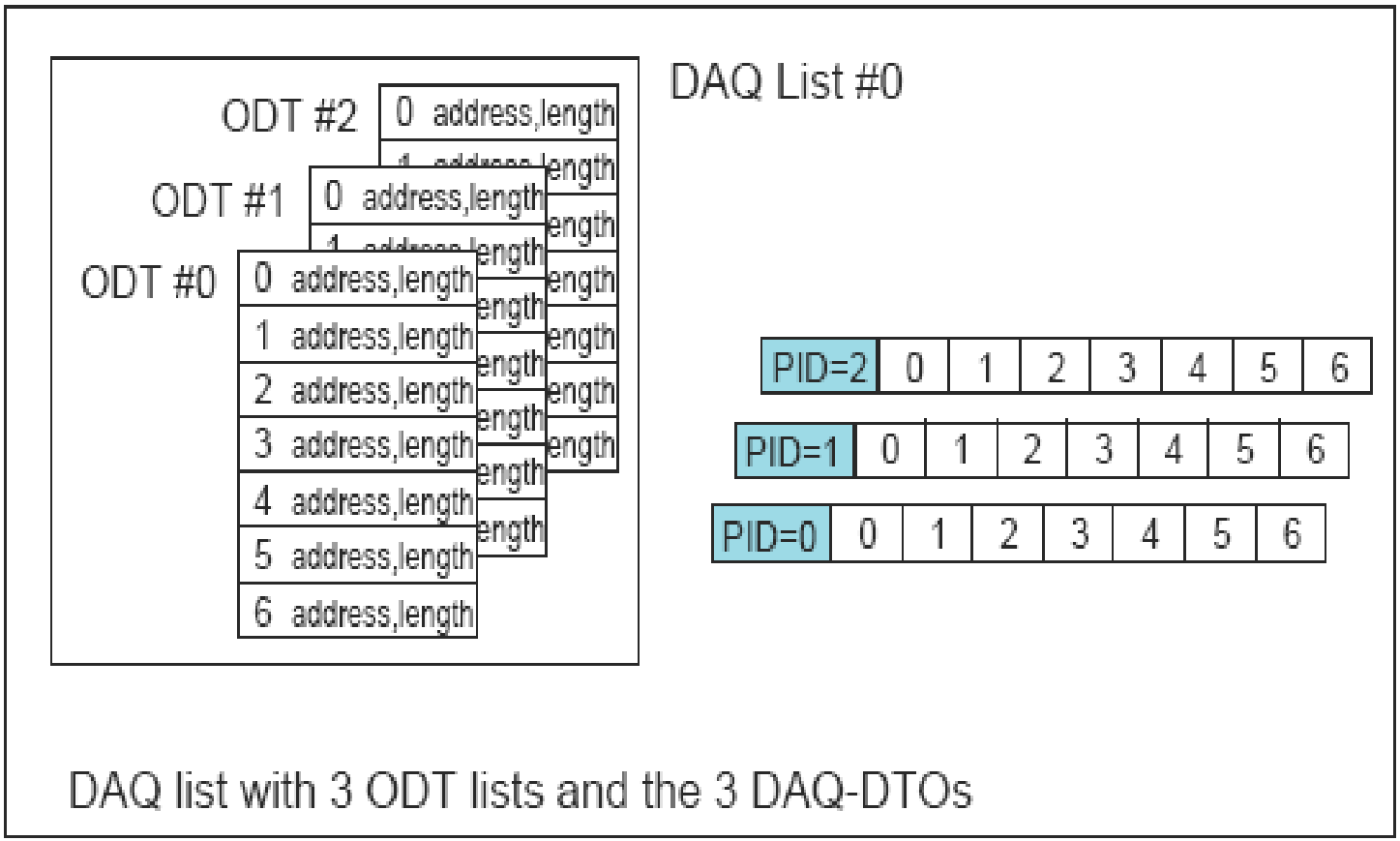
The data lenght code of the CRM must always be 8. Unused data bytes, marked as „don't care„ in the command descriptions, may have arbitrary values.

- DAQ报文的帧格式：



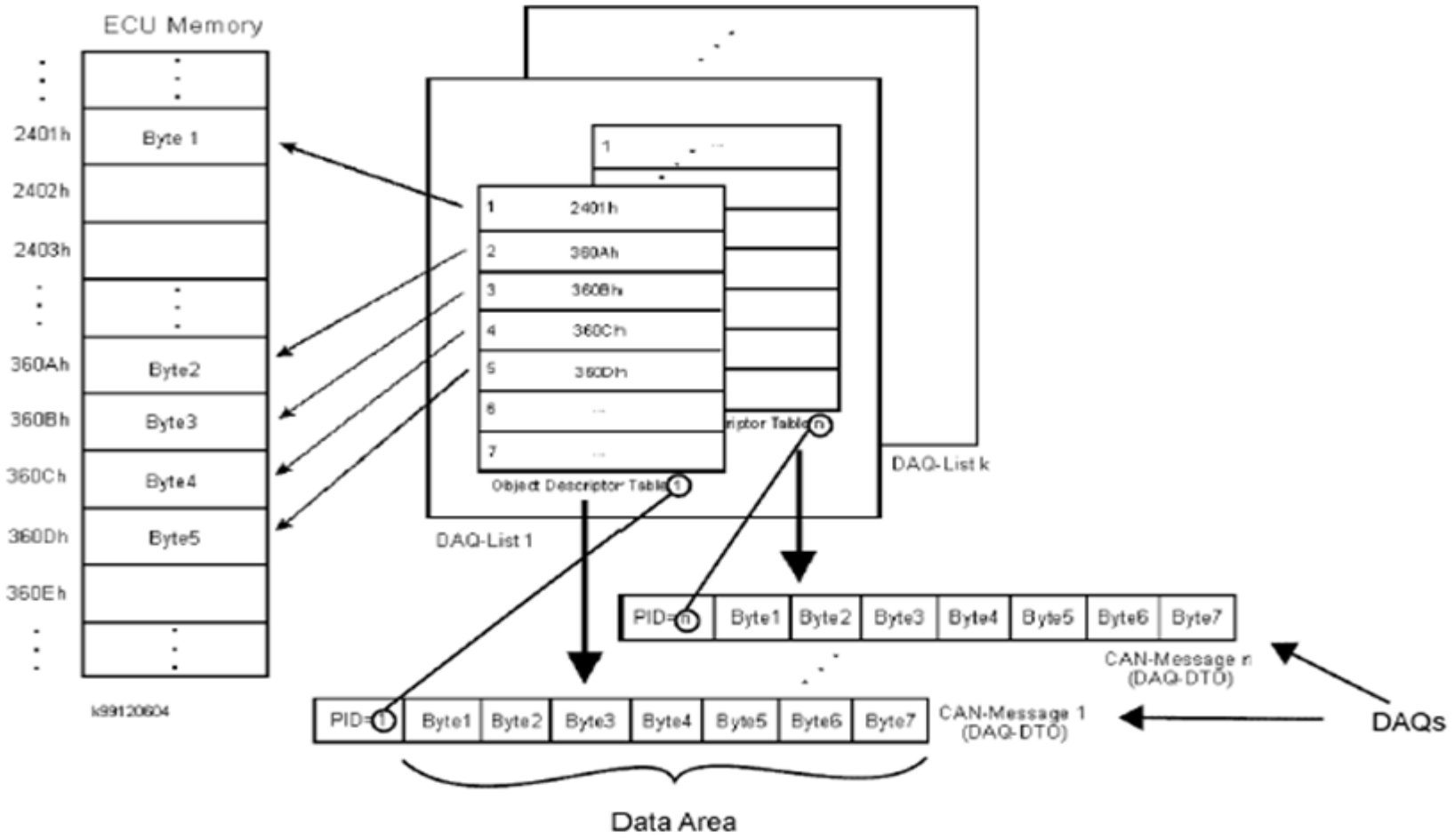
数据采集过程的组织

- ODT——Object Descriptor Table



数据采集过程的组织

- ODT——Object Descriptor Table



11个基本命令

Command	Code	TimeOut to ACK[ms]	Remark
CONNECT	0x01	25	
GET_CCP_VERSION	0x1B	25	
EXCHANG_ID	0x17	25	
SET_MTA	0x02	25	
DNLOAD	0x03	25	
UPLOAD	0x04	25	
GET_DAQ_SIZE	0x14	25	
SET_DAQ_PTR	0x15	25	
WRITE_DAQ	0x16	25	
START_STOP	0x06	25	
DISCONNECT	0x07	25	

17个可选命令

Command	Code	TimeOut to ACK[ms]	Remark
GET_SEED	0X12	25	
UNLOCK	0X13	25	
DNLOAD_6	0X23	25	
SHORT_UP	0X0F	25	
SELECT_CAL_PAGE	0X11	25	
GET_ACTIVE_CAL_PAGE	0X09	25	
SET_S_STATUS	0X0C	25	
GET_S_STATUS	0X0D	25	
BUILD_CHKSUM	0X0E	30000	
CLEAR_MEMORY	0X10	30000	
PROGRAM	0X18	100	
PROGRAM_6	0X22	100	
MOVE	0X19	30000	
TEST	0X05	25	
DIAG_SERVICE	0X20	500	
ACTION_SERVICE	0X21	5000	
START_STOP_ALL	0X08	25	

命令返回码表和错误类别

Code	Description	Error category	State transition to	
0x00	acknowledge / no error	-		
0x01	DAQ processor overload	C0		
0x10	command processor busy	C1	NONE (wait until ACK or timeout)	
0x11	DAQ processor busy	C1	NONE (wait until ACK or timeout)	
0x12	internal timeout	C1	NONE (wait until ACK or timeout)	
0x18	key request	C1	NONE (embedded seed&key)	
0x19	session status request	C1	NONE (embedded SET_S_STATUS)	
0x20	cold start request	C2	COLD START	
0x21	cal. data init. request	C2	cal. data initialization	
0x22	DAQ list init. request	C2	DAQ list initialization	
0x23	code update request	C2	(COLD START)	
0x30	unknown command	C3	(FAULT)	
0x31	command syntax	C3	FAULT	
0x32	parameter(s) out of range	C3	FAULT	
0x33	access denied	C3	FAULT	
0x34	overload	C3	FAULT	
0x35	access locked	C3	FAULT	
0x36	resource/function not available	C3	FAULT	

错误类别的处理

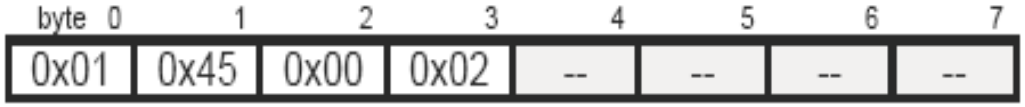
Category	Description	Action	Retries
timeout	no handshake message	retry	2
C0	warning	-	-
C1	spurious (comm error, busy, ...)	wait (ACK or timeout)	2
C2	resolvable (temp. power loss, ...)	reinitialize	1
C3	unresolvable (setup, overload, ...)	terminate	-

基本命令描述

n CONNECT——建立连接（0x01）

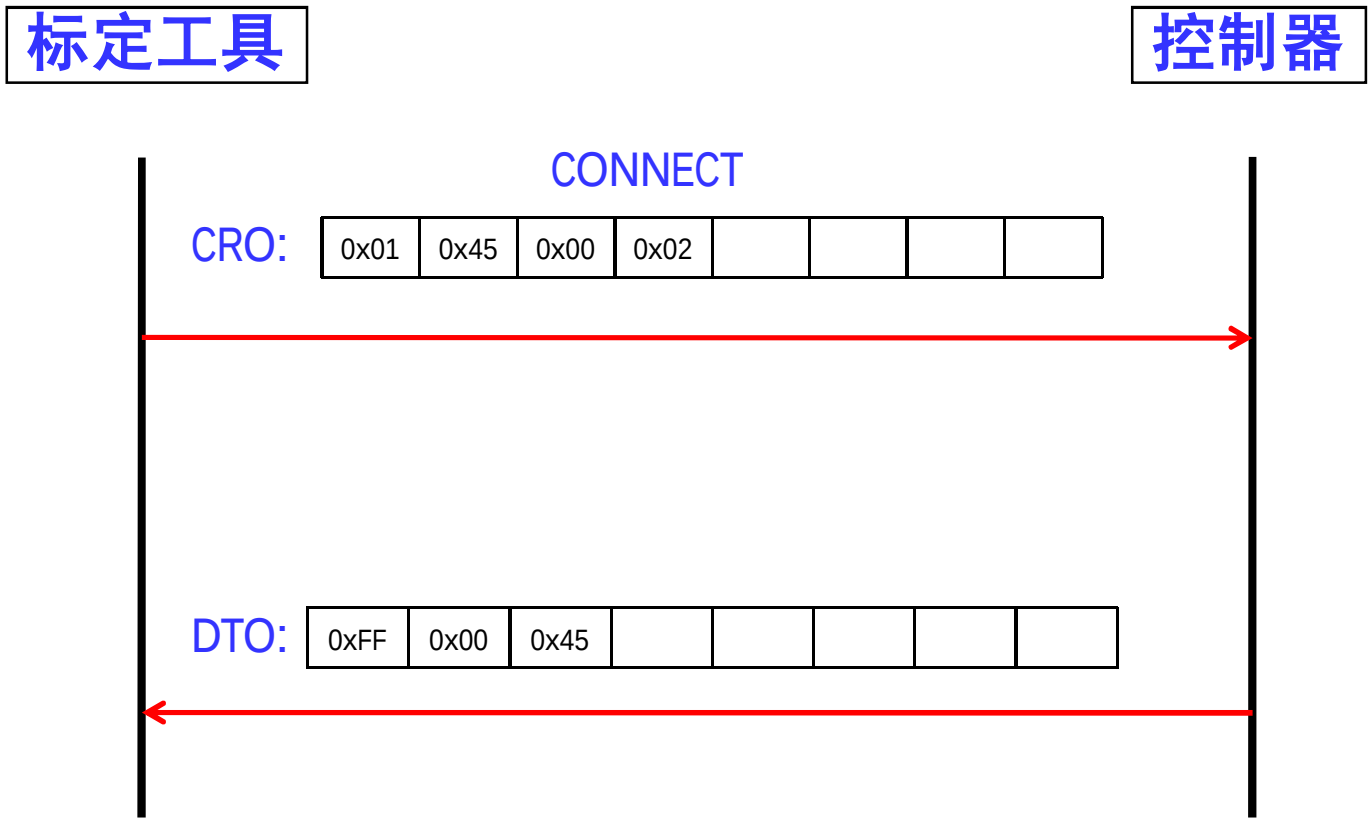
CRO

Position	Type	Description
0	byte	Command Code = CONNECT 0x01
1	byte	Command Counter = CTR
2	word	station address (Intel format)
4...7	bytes	don't care



DTO

Position	Type	Description
0	byte	Packet ID: 0xFF
1	byte	Command Return Code
2	byte	Command Counter = CTR
3...7	bytes	don't care

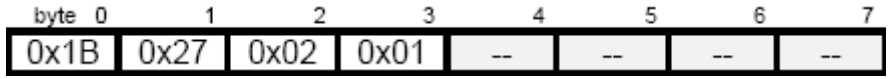


基本命令描述

n GET_CCP_VERSION ——获得CCP版本（0X1B）

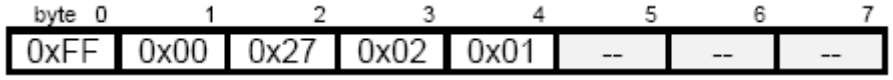
CRO

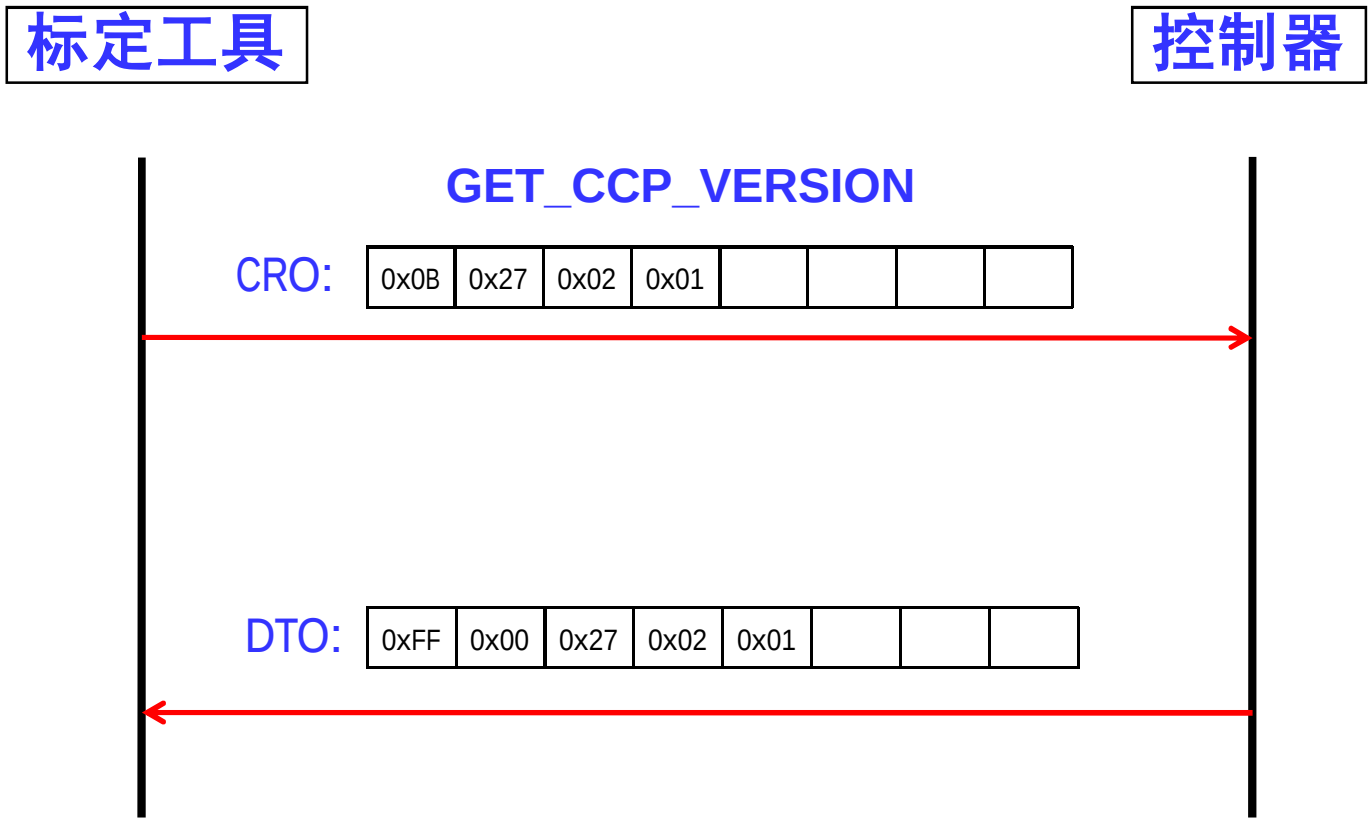
Position	Type	Description
0	Byte	Command Code = GET_CCP_VERSION 0x1B
1	Byte	Command Counter = CTR
2	Byte	Main Protocol version (desired)
3	Byte	Release within version (desired)
4 ...7	Bytes	don't care



DTO

Position	Type	Description
0	Byte	Packet ID: 0xFF
1	Byte	Command Return Code
2	Byte	Command Counter = CTR
3	Byte	Main Protocol version as implemented
4	Byte	Release within version as implemented
5 ... 7	Bytes	don't care





基本命令描述

n EXCHANGE_ID——交换ID（0x17）

CRO

Position	Type	Description
0	byte	Command Code = EXCHANGE_ID 0x17
1	byte	Command Counter = CTR
2...	bytes	CCP master device ID information (optional and implementation specific)

byte 0	1	2	3	4	5	6	7
0x17	0x23	--	--	--	--	--	--

DTO

Position	Type	Description
0	byte	Packet ID: 0xFF
1	byte	Command Return Code
2	byte	Command Counter = CTR
3	byte	length of slave device ID in bytes
4	byte	data type qualifier of slave device ID (optional and implementation specific)
5	byte	Resource Availability Mask
6	byte	Resource Protection Mask
7	byte	Don't care

byte 0	1	2	3	4	5	6	7
0xFF	0x00	0x23	0x04	0x02	0x03	0x03	--

基本命令描述

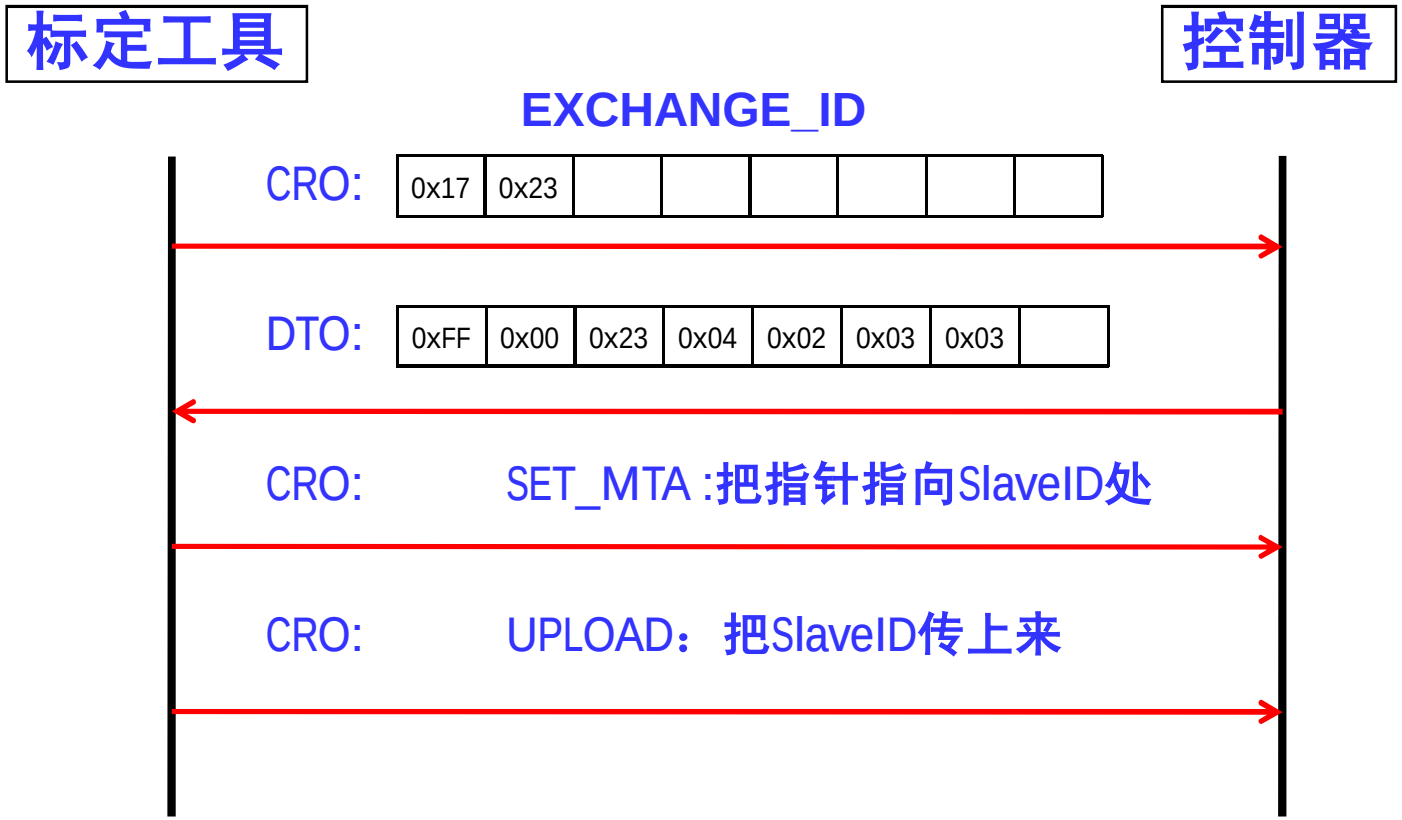
- EXCHANGE_ID（0X17）
  - Resource Availability Mask(功能而言)
  - Resource Protection Mask(该功能是否受到保护)

Bit	7	6	5	4	3	2	1	0
	x	PGM	x	x	X	X	DAQ	CAL
Availability	X	0	X	X	X	X	1	1
Protection	X	0	X	X	X	X	1	1

CAL	Calibration
DAQ	Data Acquisition
PGM	Memory programming
x	reserved for future use

Resource Availability: if bit=TRUE specified resource or function is available.

Resource Protection: if bit=TRUE specified resource or function is protected against unauthorized access (needs UNLOCK).



基本命令描述

n SET_MTA——设置内存传输地址（0X02）

CRO

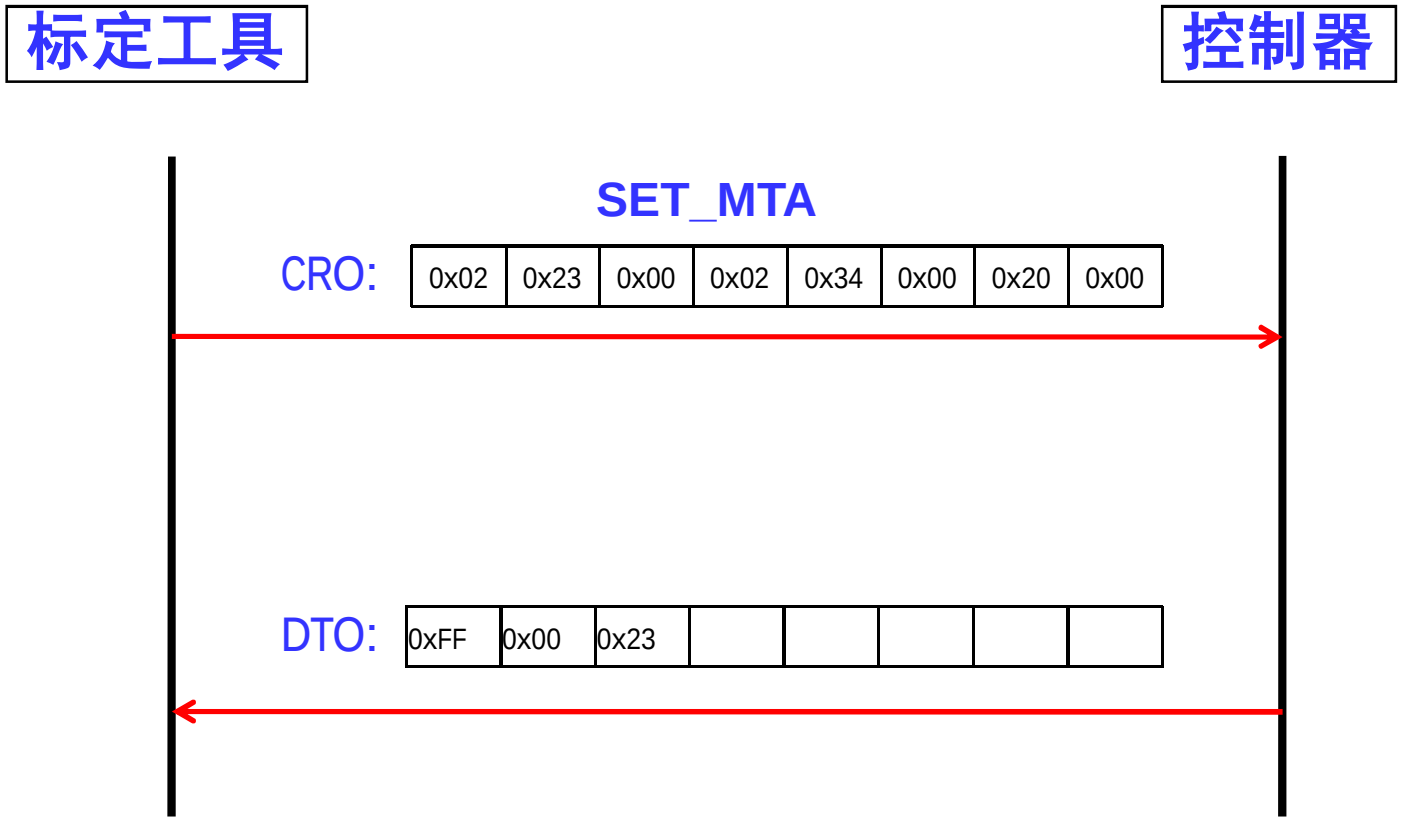
Position	Type	Description
0	byte	Command Code = SET_MTA 0x02
1	byte	Command Counter = CTR
2	byte	Memory transfer address MTA number (0,1)
3	byte	Address extension
4..7	unsigned long	Address

byte 0	1	2	3	4	5	6	7
0x02	0x23	0x00	0x02	0x34	0x00	0x20	0x00

DTO

Position	Type	Description
0	byte	Packet ID: 0xFF
1	byte	Command Return Code
2	byte	Command Counter = CTR
3...7	bytes	don't care

byte 0	1	2	3	4	5	6	7
0xFF	0x00	0x23	--	--	--	--	--



基本命令描述

- DNLOAD——数据下载（0x03）
  - 数据长度信息
  - 执行后进行地址调整

CRO

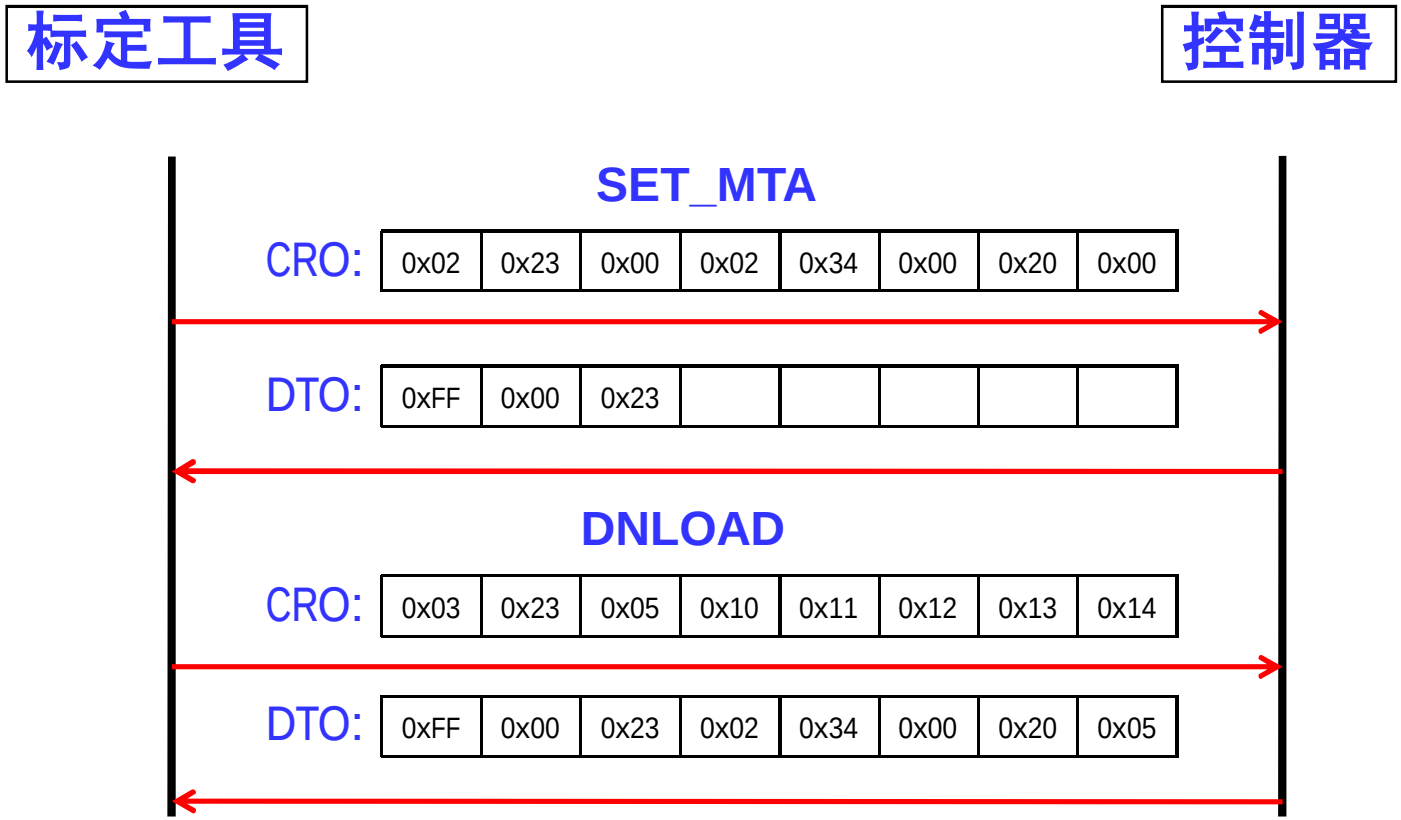
Position	Type	Description
0	byte	Command Code = DNLOAD 0x03
1	byte	Command Counter = CTR
2	byte	size of data block to follow in bytes
3...7	bytes	data to be transferred (up to 5 bytes)

byte	0	1	2	3	4	5	6	7
	0x03	0x23	0x05	0x10	0x11	0x12	0x13	0x14

DTO

Position	Type	Description
0	byte	Packet ID: 0xFF
1	byte	Command Return Code
2	byte	Command Counter = CTR
3	byte	MTA0 extension (after post-increment)
4...7	unsigned long	MTA0 address (after post-increment)

byte	0	1	2	3	4	5	6	7
	0xFF	0x00	0x23	0x02	0x34	0x00	0x20	0x05



基本命令描述

- UPLOAD——数据上载（0x04）
  - 数据长度信息
  - 执行后进行地址调整

CRO

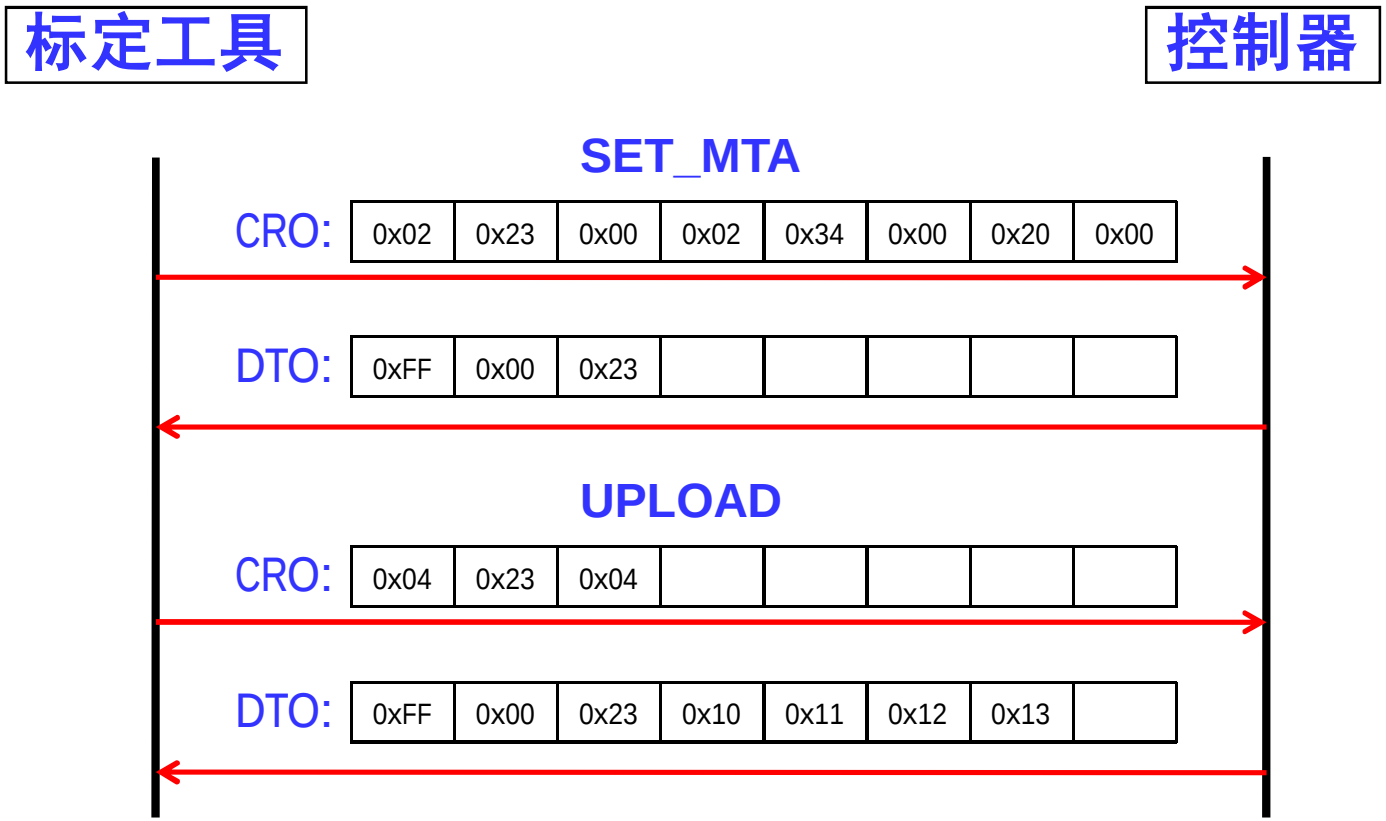
Position	Type	Description
0	byte	Command Code = UPLOAD 0x04
1	byte	Command Counter = CTR
2	byte	Size of data block to be uploaded in bytes
3...7	bytes	don't care

byte 0	1	2	3	4	5	6	7
0x04	0x23	0x04	--	--	--	--	--

DTO

Position	Type	Description
0	byte	Packet ID: 0xFF
1	byte	Command Return Code
2	byte	Command Counter = CTR
3 ... 7	bytes	requested data bytes

byte 0	1	2	3	4	5	6	7
0xFF	0x00	0x23	0x10	0x11	0x12	0x13	--



基本命令描述

n GET_DAQ_SIZE ——获得DAQlist大小(0X14)

CRO

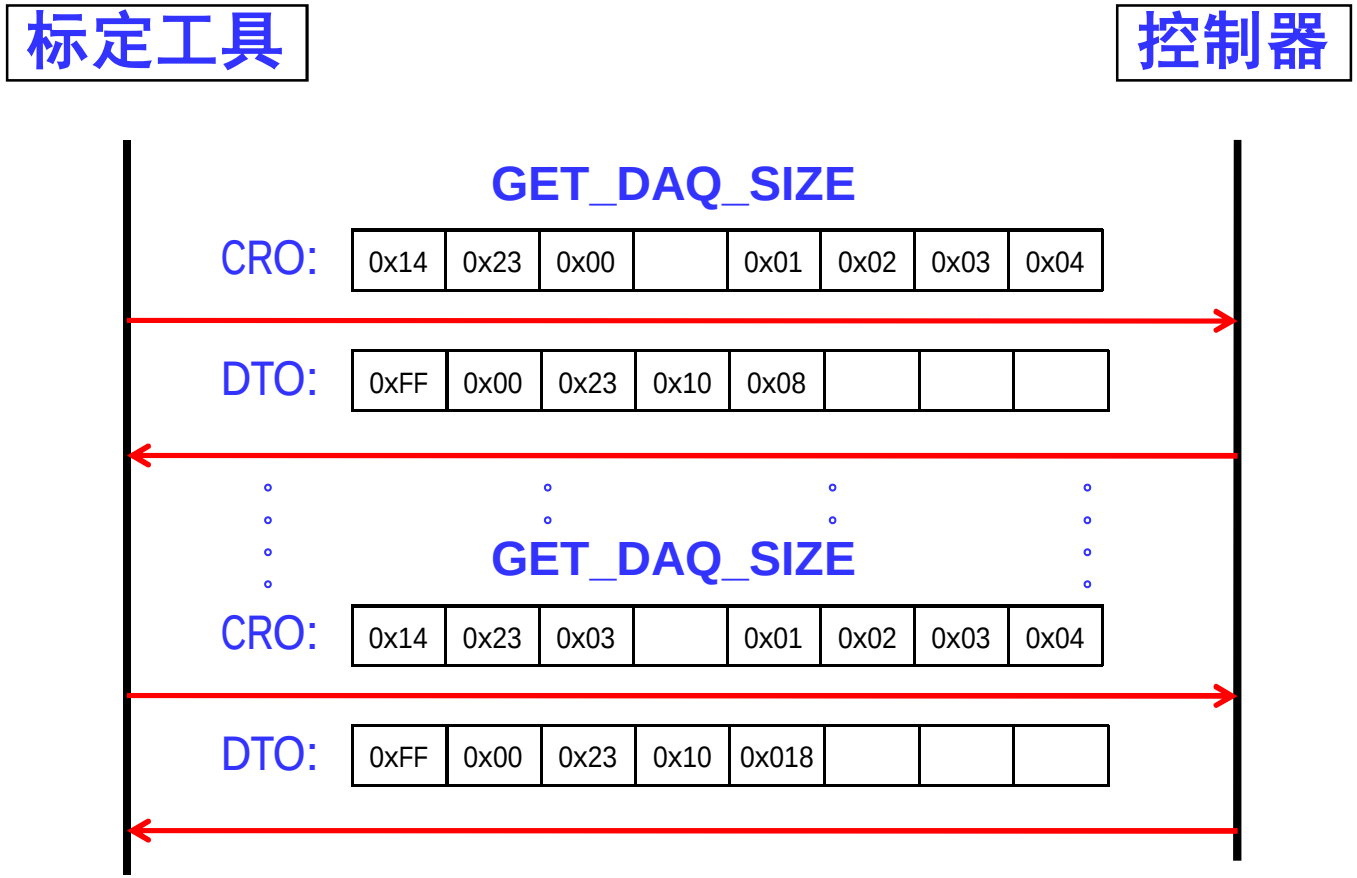
Position	Type	Description
0	byte	Command Code = GET_DAQ_SIZE 0x14
1	byte	Command Counter = CTR
2	byte	DAQ list number (0,1,...)
3	byte	don't care
4..7	unsigned long	CAN Identifier of DTO dedicated to list number

byte 0	1	2	3	4	5	6	7
0x14	0x23	0x03	--	0x01	0x02	0x03	0x04

DTO

Position	Type	Description
0	byte	Packet ID: 0xFF
1	byte	Command Return Code
2	byte	Command Counter = CTR
3	byte	DAQ list size (= number of ODTs in this list)
4	byte	First PID of DAQ list
5 ... 7	bytes	don't care

byte 0	1	2	3	4	5	6	7
0xFF	0x00	0x23	0x10	0x08	--	--	--

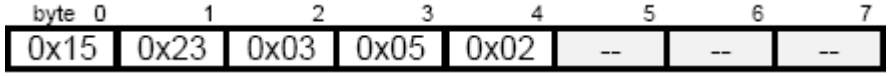


基本命令描述

n SET_DAQ_PTR ——设置DAQlist指针(0X15)

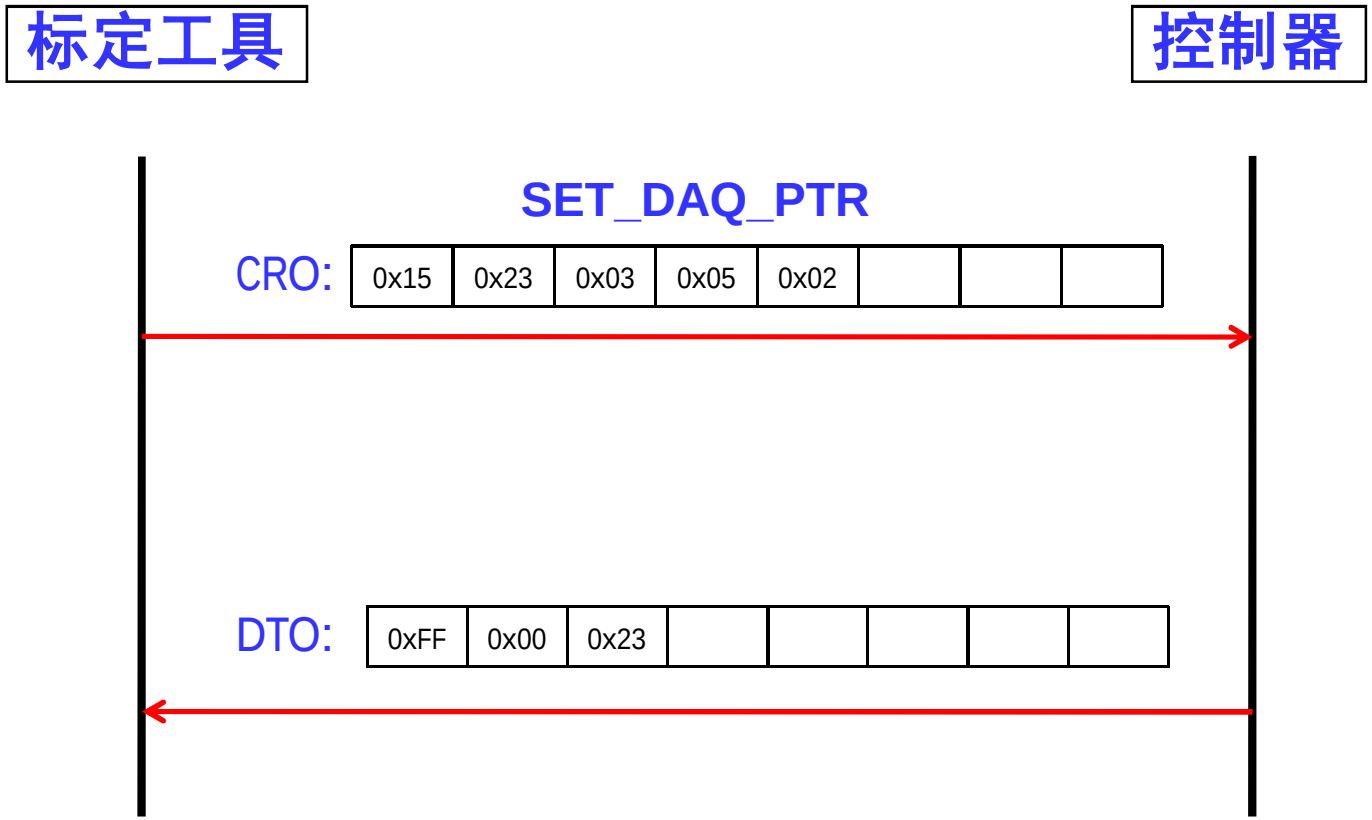
CRO

Position	Type	Description
0	byte	Command Code = SET_DAQ_PTR 0x15
1	byte	Command Counter = CTR
2	byte	DAQ list number (0,1,...)
3	byte	Object Descriptor Table ODT number (0,1,...)
4	byte	Element number within ODT (0,1,...)
5...7	bytes	don't care



DTO

Position	Type	Description
0	byte	Packet ID: 0xFF
1	byte	Command Return Code
2	byte	Command Counter = CTR
3 ... 7	bytes	don't care

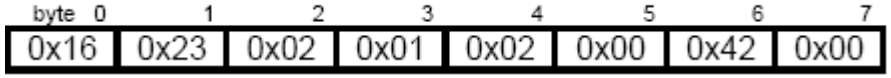


基本命令描述

n WRITE_DAQ——写DAQlist入口（0X16）

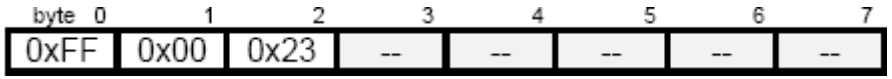
CRO

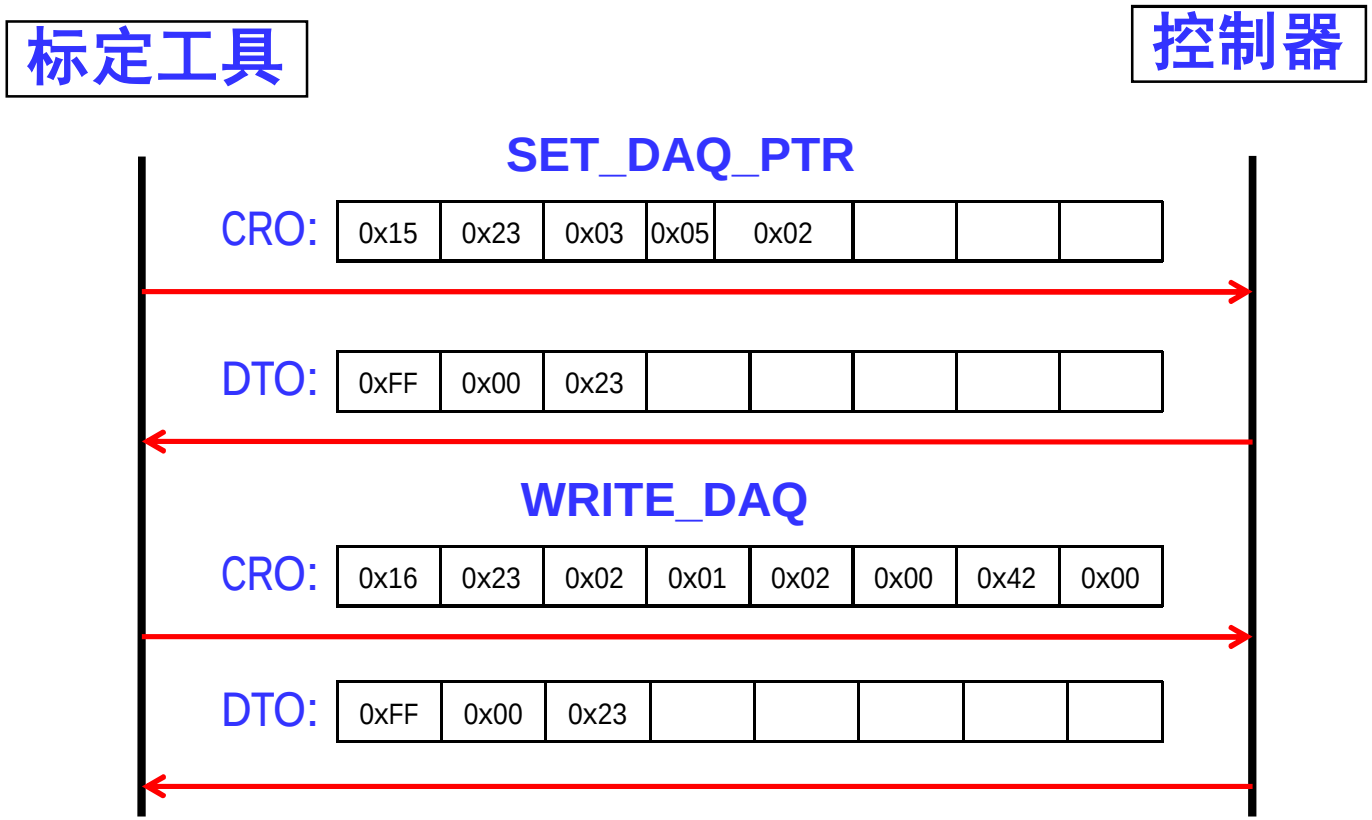
Position	Type	Description
0	byte	Command Code = WRITE_DAQ 0x16
1	byte	Command Counter = CTR
2	byte	Size of DAQ element in bytes { 1, 2, 4 }
3	byte	Address extension of DAQ element
4...7	unsigned long	Address of DAQ element



DTO

Position	Type	Description
0	byte	Packet ID: 0xFF
1	byte	Command Return Code
2	byte	Command Counter = CTR
3 ... 7	bytes	don't care





基本命令描述

n STOP_START ——开始/停止数据传输(0X06)

CRO

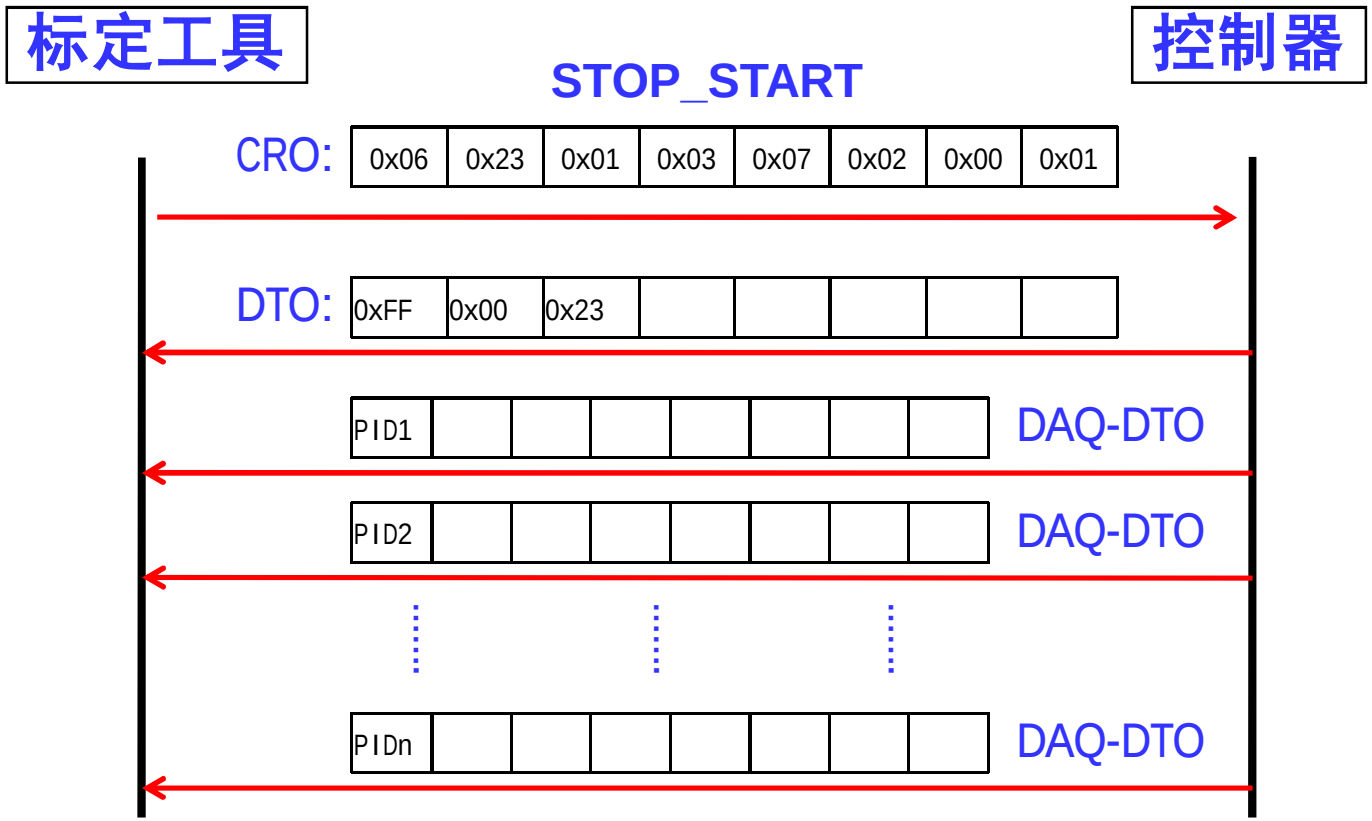
Position	Type	Description
0	byte	Command Code = START_STOP 0x06
1	byte	Command Counter = CTR
2	byte	Mode : start / stop / prepare data tranmission
3	byte	DAQ list number
4	byte	Last ODT number
5	byte	Event Channel No.
6, 7	word	Transmission rate prescaler

byte 0	1	2	3	4	5	6	7
0x06	0x23	0x01	0x03	0x07	0x02	0x00	0x01

DTO

Position	Type	Description
0	byte	Packet ID: 0xFF
1	byte	Command Return Code
2	byte	Command Counter = CTR
3 ... 7	bytes	don't care

byte 0	1	2	3	4	5	6	7
0xFF	0x00	0x23	--	--	--	--	--

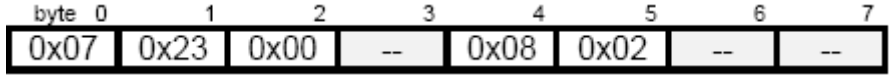


基本命令描述

n DISCONNECT ——断开连接(0X07)

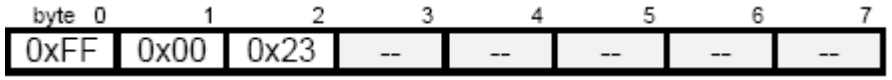
CRO

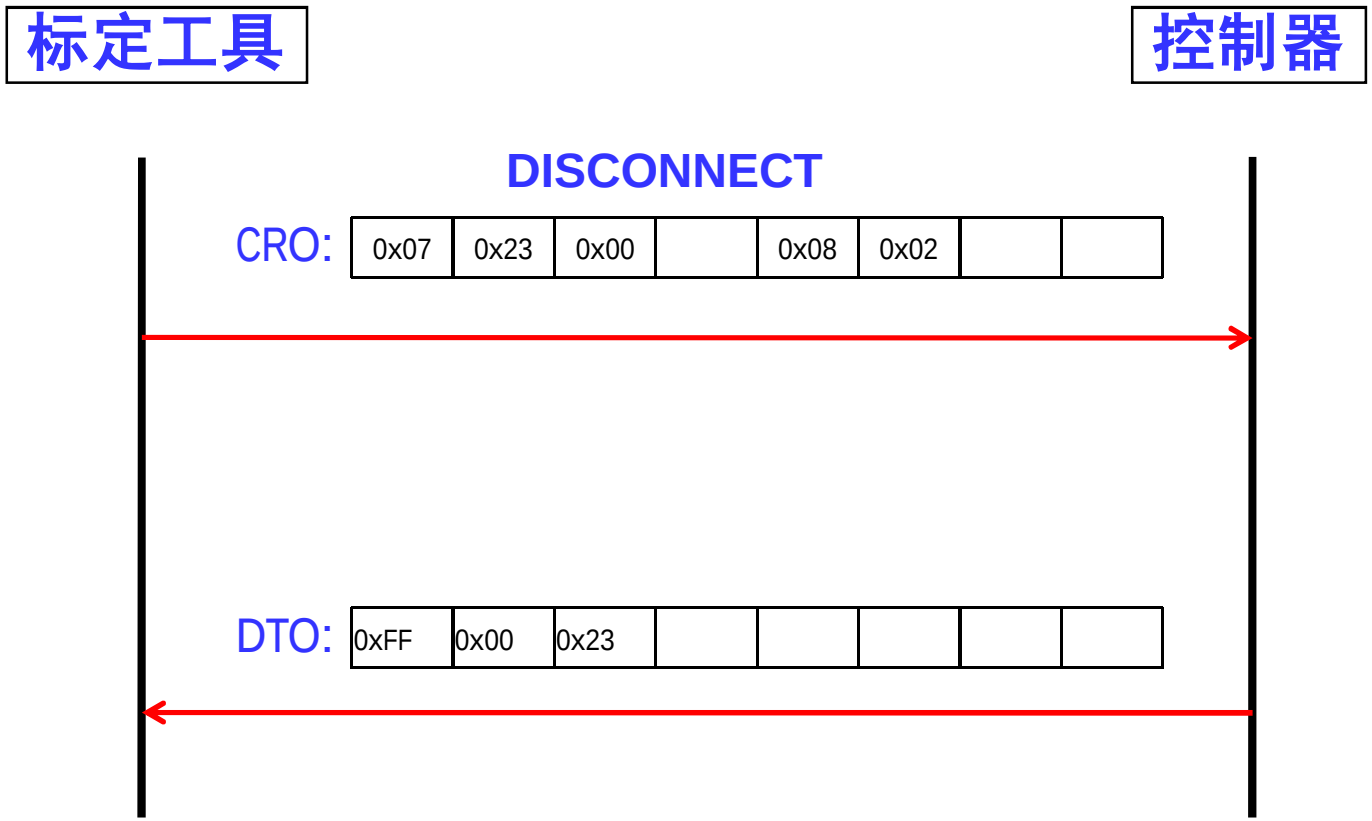
Position	Type	Description
0	byte	Command Code = DISCONNECT 0x07
1	byte	Command Counter = CTR
2	byte	0x00 temporary, 0x01 end of session
3	byte	don't care
4,5	word	Station address (Intel format)
6...7	bytes	don't care



DTO

Position	Type	Description
0	byte	Packet ID: 0xFF
1	byte	Command Return Code
2	byte	Command Counter = CTR
3 ... 7	bytes	don't care



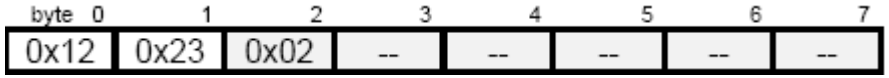


可选命令描述

- GET_SEED——获取被请求资源的种子（0x12）

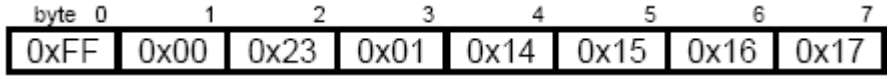
CRO

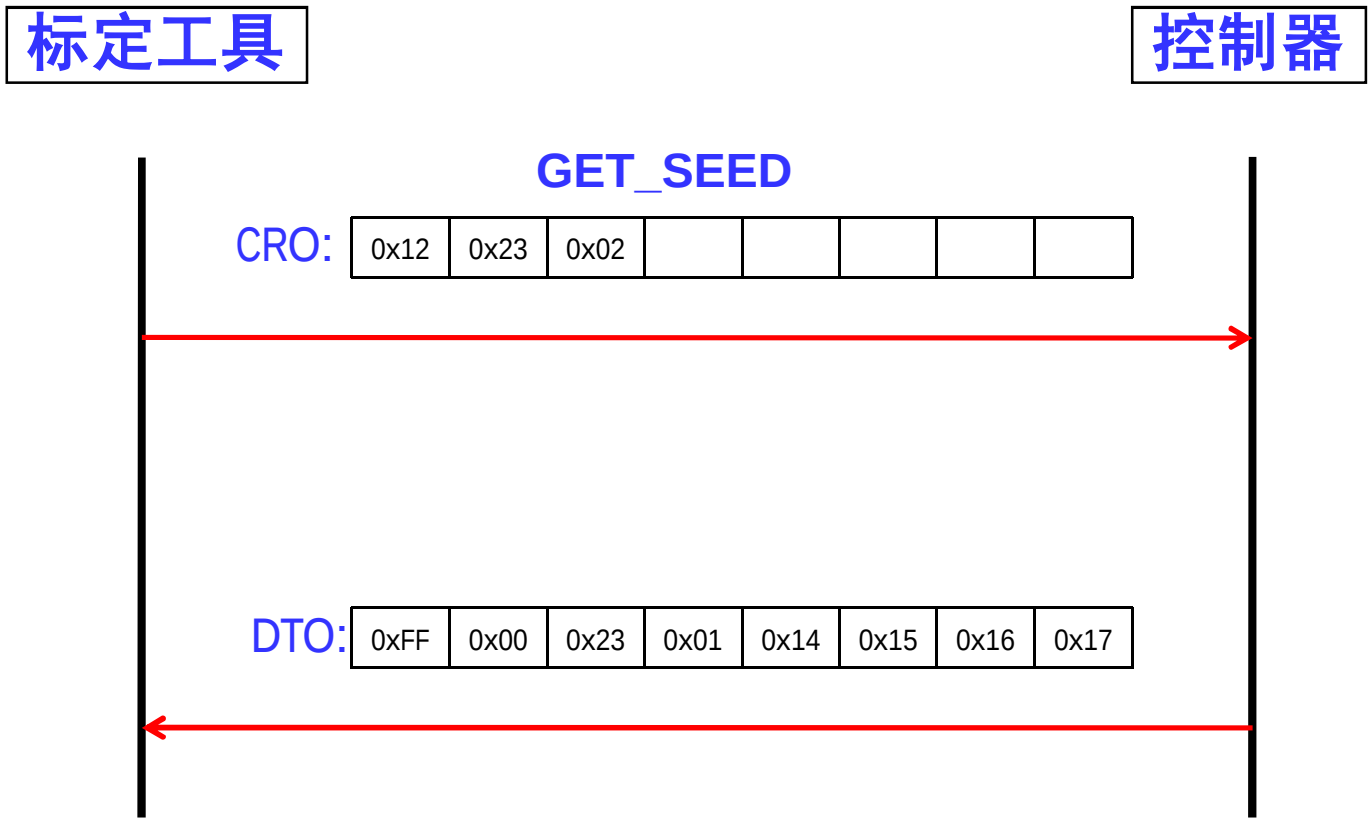
Position	Type	Description
0	byte	Command Code = GET_SEED 0x12
1	byte	Command Counter = CTR
2	byte	Requested slave resource or function (Resource Mask)
3...7	bytes	don't care



DTO

Position	Type	Description
0	byte	Packet ID: 0xFF
1	byte	Command Return Code
2	byte	Command Counter = CTR
3	byte	Protection status (TRUE or FALSE)
4...7	bytes	'seed' data





可选命令描述

n UNLOCK——解锁保护（0x13）

CRO

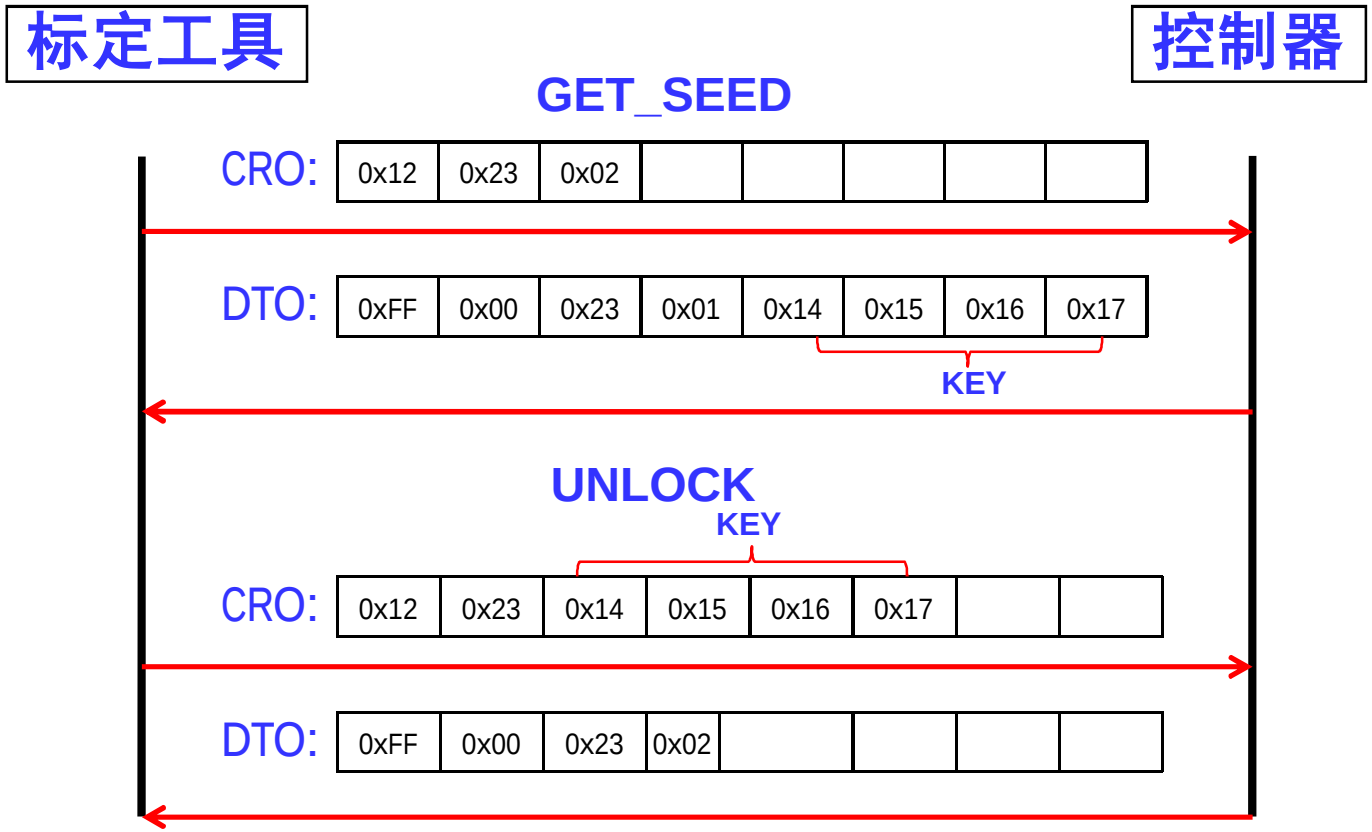
Position	Type	Description
0	byte	Command Code = UNLOCK 0x13
1	byte	Command Counter = CTR
2...	bytes	'key'

byte 0	1	2	3	4	5	6	7
0x13	0x23	0x14	0x15	0x16	0x17	--	--

DTO

Position	Type	Description
0	byte	Packet ID: 0xFF
1	byte	Command Return Code
2	byte	Command Counter = CTR
3	byte	Current Privilege Status (Resource Mask)
4...7	bytes	don't care

byte 0	1	2	3	4	5	6	7
0xFF	0x00	0x23	0x02	--	--	--	--



可选命令描述

- DNLOAD_6 ——数据下载6个字节（0X23）

CRO

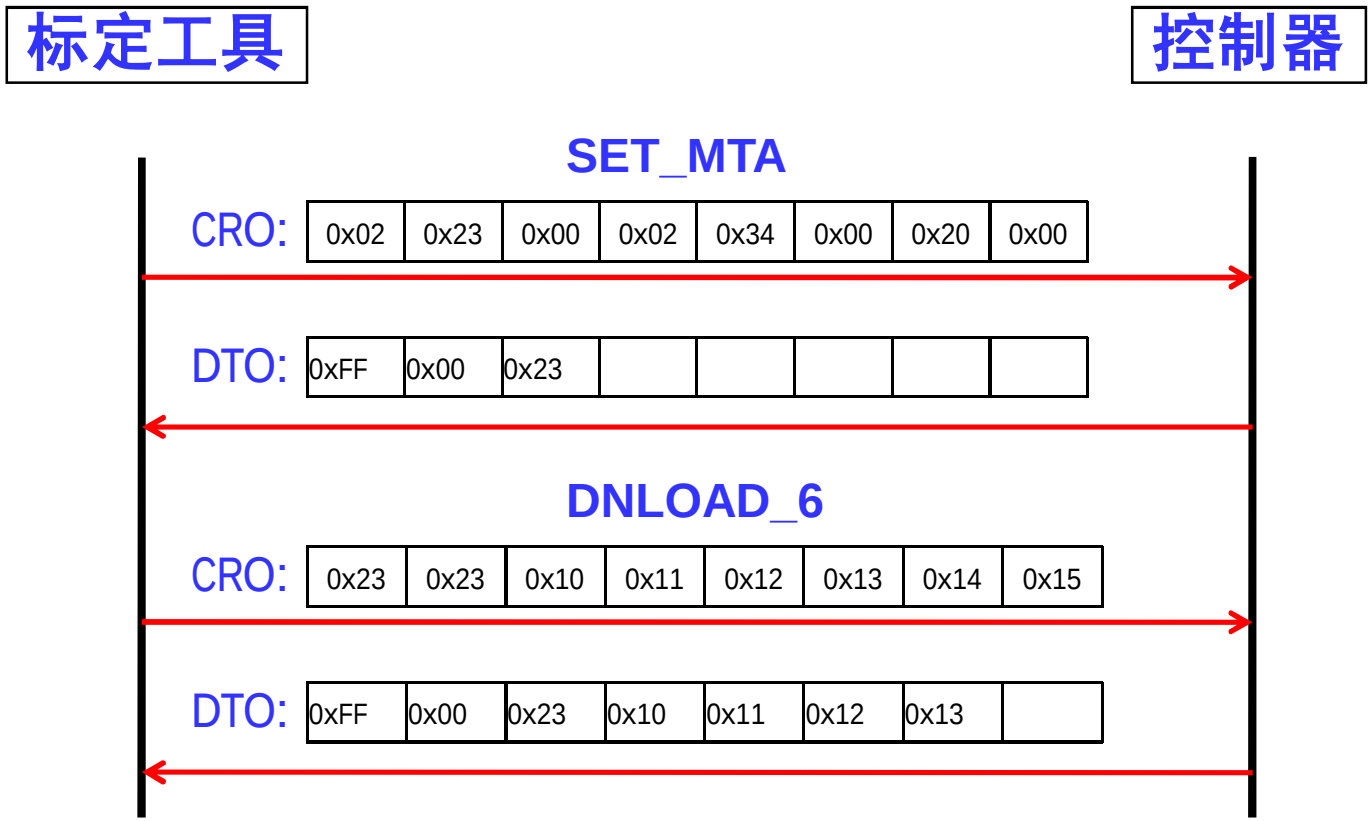
Position	Type	Description
0	byte	Command Code = DNLOAD_6 0x23
1	byte	Command Counter = CTR
2...7	bytes	6 bytes of data to be transferred

byte	0	1	2	3	4	5	6	7
	0x23	0x25	0x10	0x11	0x12	0x13	0x14	0x15

DTO

Position	Type	Description
0	byte	Packet ID: 0xFF
1	byte	Command Return Code
2	byte	Command Counter = CTR
3	byte	MTA0 extension (after post-increment)
4..7	unsigned long	MTA0 address (after post-increment)

byte	0	1	2	3	4	5	6	7
	0xFF	0x00	0x25	0x02	0x34	0x00	0x20	0x06



可选命令描述

- SHORT_UP ——上传数据最多为5个字节（0X0F）

CRO

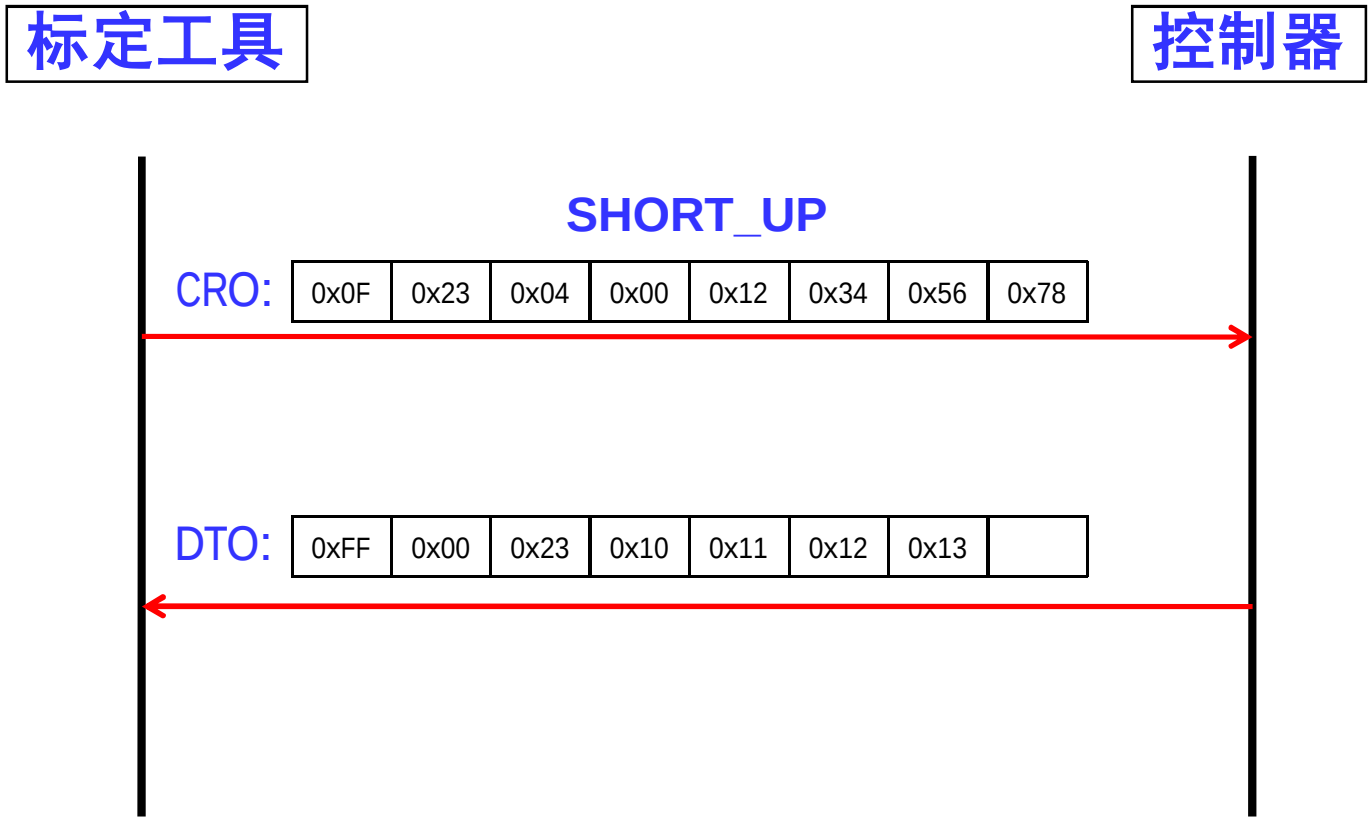
Position	Type	Description
0	byte	Command Code = SHORT_UP 0x0F
1	byte	Command Counter = CTR
2	byte	Size of data block to be uploaded in bytes (1...5)
3	byte	Address extension
4	unsigned long	Address

byte 0	1	2	3	4	5	6	7
0x0F	0x23	0x04	0x00	0x12	0x34	0x56	0x78

DTO

Position	Type	Description
0	byte	Packet ID: 0xFF
1	byte	Command Return Code
2	byte	Command Counter = CTR
3 ... 7	bytes	requested data bytes

byte 0	1	2	3	4	5	6	7
0xFF	0x00	0x23	0x10	0x11	0x12	0x13	--

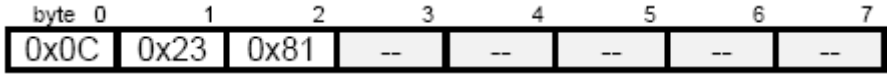


可选命令描述

n SET_S_STATUS——设置Session状态（0X0C）

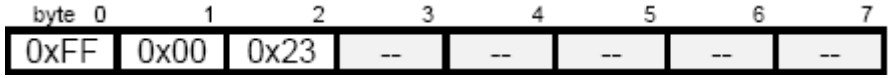
CRO

Position	Type	Description
0	byte	Command Code = SET_S_STATUS 0x0C
1	byte	Command Counter = CTR
2	byte	Session status bits (see table below)
3...7	byte	don't care



DTO

Position	Type	Description
0	byte	Packet ID: 0xFF
1	byte	Command Return Code
2	byte	Command Counter = CTR
3 ... 7	bytes	don't care



可选命令描述

n SET_S_STATUS——设置Session状态（0X0C）

Bit	7	6	5	4	3	2	1	0
	RUN	STORE	res	res	res	RESUME	DAQ	CAL
	1	0	Res	Res	Res	0	0	1

bit 0	CAL	Calibration data initialized
bit 1	DAQ	DAQ list(s) initialized
bit 2	RESUME	Request to save DAQ setup during shutdown in ECU. ECU automatically restarts DAQ after startup.
bit 6	STORE	Request to save calibration data during shut-down in ECU
Bit 7	RUN	Session in progress
bit 3..5	res	reserved

Bits are set (1) if expression is TRUE.

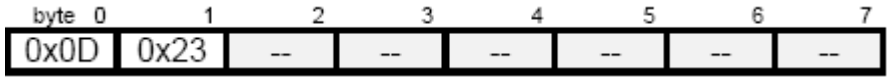
The session status bits are read/write to the slave device andare be cleared on power-up, on session log-off and in applicable fault conditions.

可选命令描述

n GET_S_STATUS ——获得Session状态（0X0D）

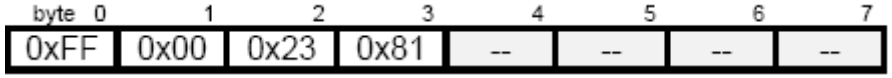
CRO

Position	Type	Description
0	byte	Command Code = GET_S_STATUS 0x0D
1	byte	Command Counter = CTR
2...7	bytes	don't care



DTO

Position	Type	Description
0	byte	Packet ID = 0xFF
1	byte	Command Return Code
2	byte	Command Counter = CTR
3	byte	Session status
4	byte	additional status information qualifier
5	bytes	additional status information (**optional**)



可选命令描述

n BUILD_CHESUM ——计算校验和（0X0E）

CRO

Position	Type	Description
0	byte	Command Code = BUILD_CHKSUM 0x0E
1	byte	Command Counter = CTR
2..5	unsigned long	block size in bytes
6, 7	bytes	don't care

byte	0	1	2	3	4	5	6	7
	0x0E	0x23	0x00	0x00	0x80	0x00	--	--

DTO

Position	Type	Description
0	byte	Packet ID: 0xFF
1	byte	Command Return Code
2	byte	Command Counter = CTR
3	byte	➲ size of checksum data
4 ... 7	bytes	➲ checksum data (implementation specific)

byte	0	1	2	3	4	5	6	7
	0xFF	0x00	0x23	0x02	0x12	0x34	--	--

可选命令描述

n CLEAR_MEMORY ——清除某内存范围（0X10）

CRO

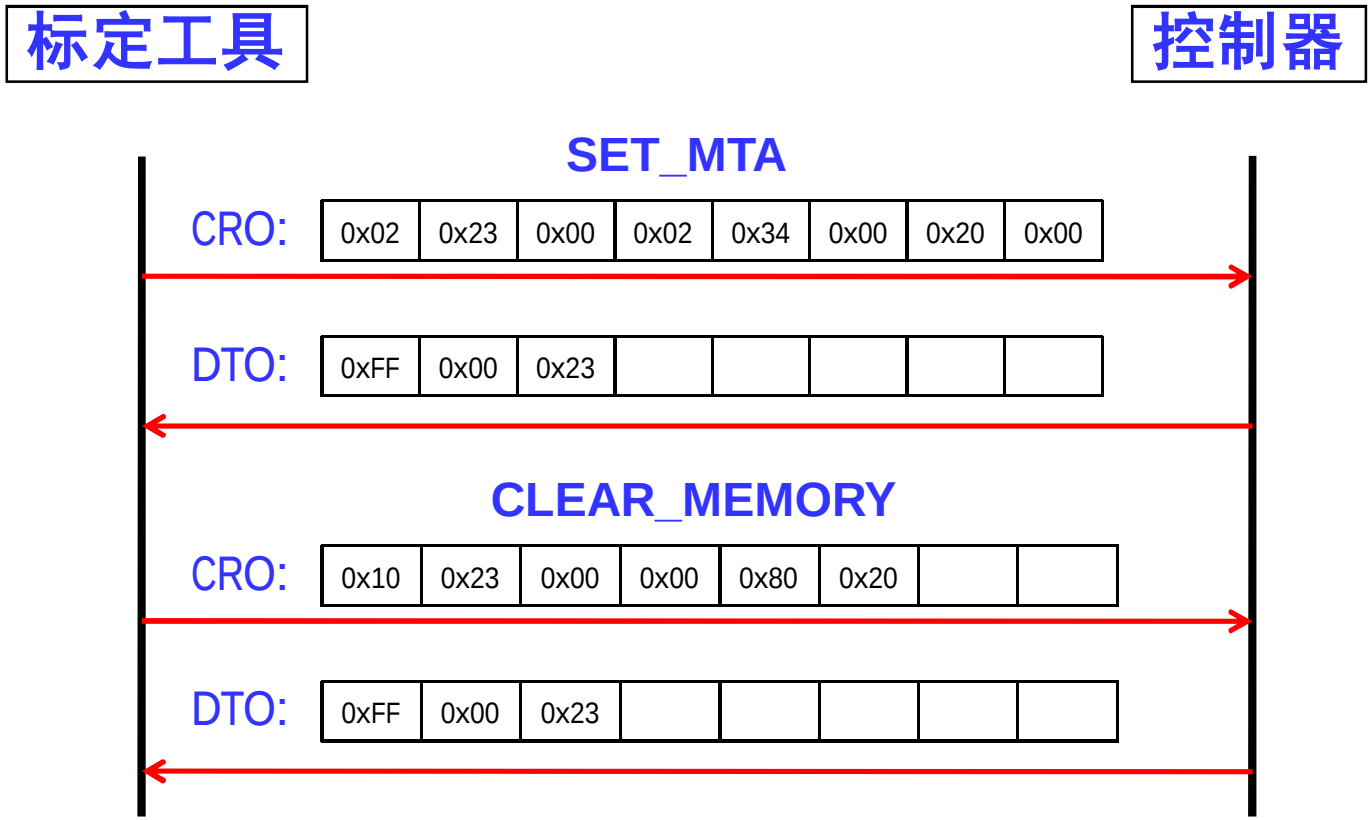
Position	Type	Description
0	byte	Command Code = CLEAR_MEMORY 0x10
1	byte	Command Counter = CTR
2..5	long	Memory size
3...7	bytes	don't care

byte	0	1	2	3	4	5	6	7
	0x10	0x23	0x00	0x00	0x80	0x00	--	--

DTO

Position	Type	Description
0	byte	Packet ID: 0xFF
1	byte	Command Return Code
2	byte	Command Counter = CTR
3 ... 7	bytes	don't care

byte	0	1	2	3	4	5	6	7
	0xFF	0x00	0x23	--	--	--	--	--



可选命令描述

- PROGRAM ——下载最多5个编程字节（0X18）

CRO

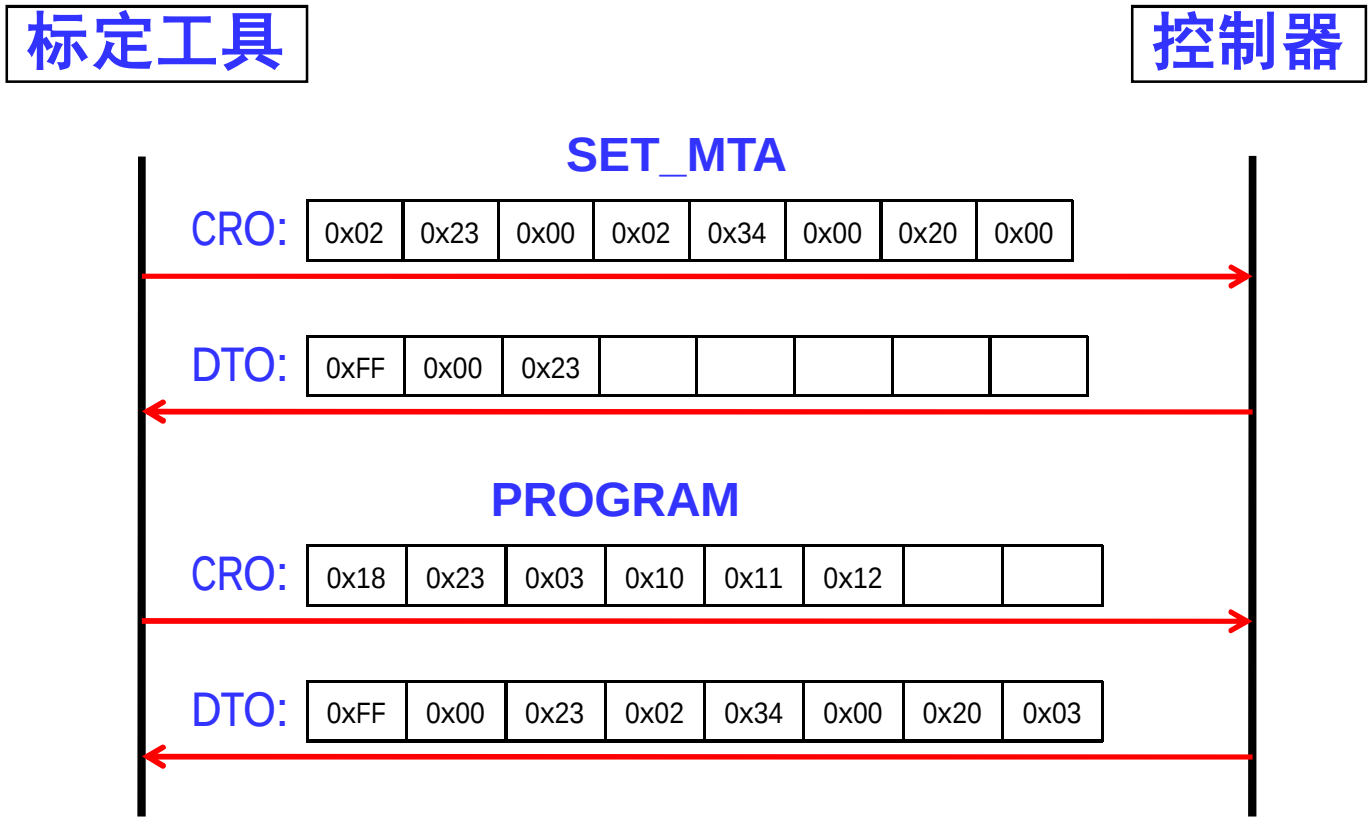
Position	Type	Description
0	byte	Command Code = PROGRAM 0x18
1	byte	Command Counter = CTR
2	byte	Size of data block to follow (bytes)
3...7	bytes	Data to be programmed (max. 5 bytes)

byte	0	1	2	3	4	5	6	7
	0x18	0x23	0x03	0x10	0x11	0x12	--	--

DTO

Position	Type	Description
0	byte	Packet ID: 0xFF
1	byte	Command Return Code
2	byte	Command Counter = CTR
3	byte	MTA0 extension (after post-increment)
4	unsigned long	MTA0 address (after post-increment)

byte	0	1	2	3	4	5	6	7
	0xFF	0x00	0x23	0x02	0x34	0x00	0x20	0x03



可选命令描述

n PROGRAM_6 ——下载6个编程字节（0X22）

CRO

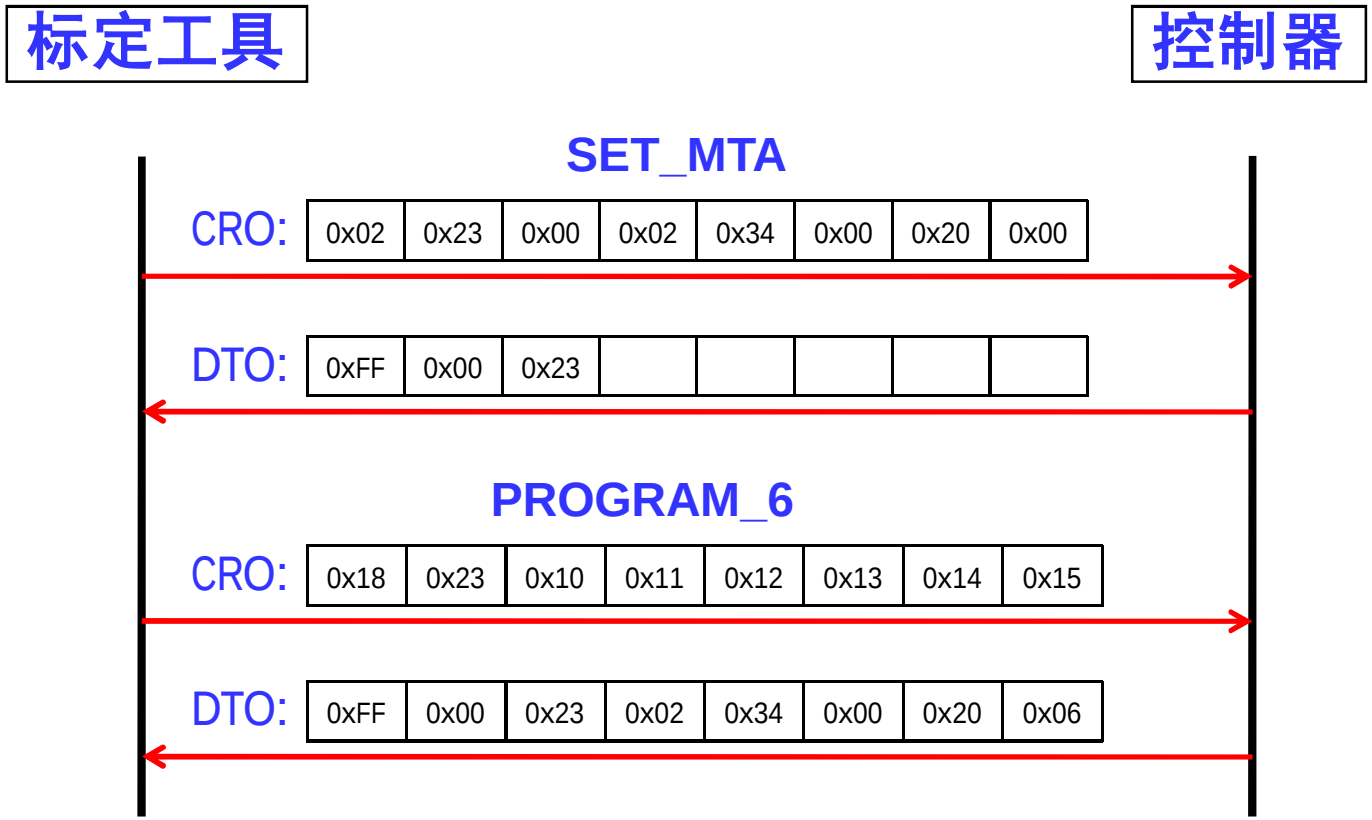
Position	Type	Description
0	byte	Command Code = PROGRAM_6 0x22
1	byte	Command Counter = CTR
2...7	bytes	Data to be programmed (6 bytes)

byte	0	1	2	3	4	5	6	7
	0x22	0x23	0x10	0x11	0x12	0x13	0x14	0x15

DTO

Position	Type	Description
0	byte	Packet ID: 0xFF
1	byte	Command Return Code
2	byte	Command Counter = CTR
3	byte	MTA0 extension (after post-increment)
4	unsigned long	MTA0 address (after post-increment)

byte	0	1	2	3	4	5	6	7
	0xFF	0x00	0x23	0x02	0x34	0x00	0x20	0x06

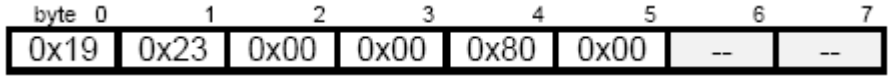


可选命令描述

n MOVE ——移动某内存块（0X19）

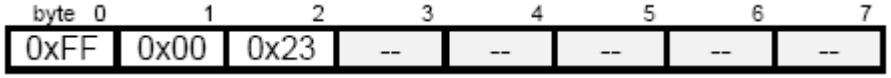
CRO

Position	Type	Description
0	byte	Command Code = MOVE 0x19
1	byte	Command Counter = CTR
2..5	long	Size (number of bytes) of data block to be moved
6,7	bytes	don't care



DTO

Position	Type	Description
0	byte	Packet ID: 0xFF
1	byte	Command Return Code
2	byte	Command Counter = CTR
3 ... 7	bytes	don't care



可选命令描述

n DIAG_SERVICE ——诊断服务（0X20）

CRO

Position	Type	Description
0	byte	Command Code = DIAG_SERVICE 0x20
1	byte	Command Counter = CTR
2,3	word	Diagnostic service number
4...7	bytes	Parameters, if applicable

byte 0	1	2	3	4	5	6	7
0x20	0x23	0x08	--	--	--	--	--

DTO

Position	Type	Description
0	byte	Packet ID = 0xFF
1	byte	Command Return Code
2	byte	Command Counter = CTR
3	byte	length of return information in bytes
4	byte	data type qualifier of return information (to be defined)
5...7	bytes	don't care

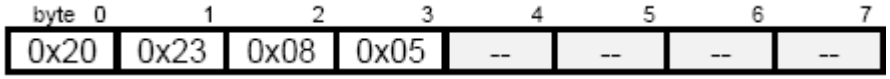
byte 0	1	2	3	4	5	6	7
0xFF	0x00	0x23	0x20	0x00	--	--	--

可选命令描述

n ACTION_SERVICE ——行为服务（0X21）

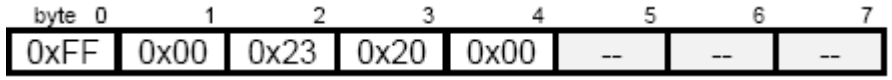
CRO

Position	Type	Description
0	byte	Command Code = ACTION_SERVICE 0x21
1	byte	Command Counter = CTR
2,3	word	Action service number
4...7	bytes	Parameters, if applicable



DTO

Position	Type	Description
0	byte	Packet ID = 0xFF
1	byte	Command Return Code
2	byte	Command Counter = CTR
3	byte	length of return information in bytes
4	byte	data type qualifier of return information (to be defined)
5...7	bytes	don't care



可选命令描述

n TEST ——测试可用性（0X05）

CRO

Position	Type	Description
0	byte	Command Code = TEST 0x05
1	byte	Command Counter = CTR
2,3	little-endian word	station address (Intel format)
4...	bytes	don't care

DTO

Position	Type	Description
0	byte	Packet ID: 0xFF
1	byte	Command Return Code = ACK 0x00
2	byte	Command Counter = CTR
3 ...7	bytes	don't care

可选命令描述

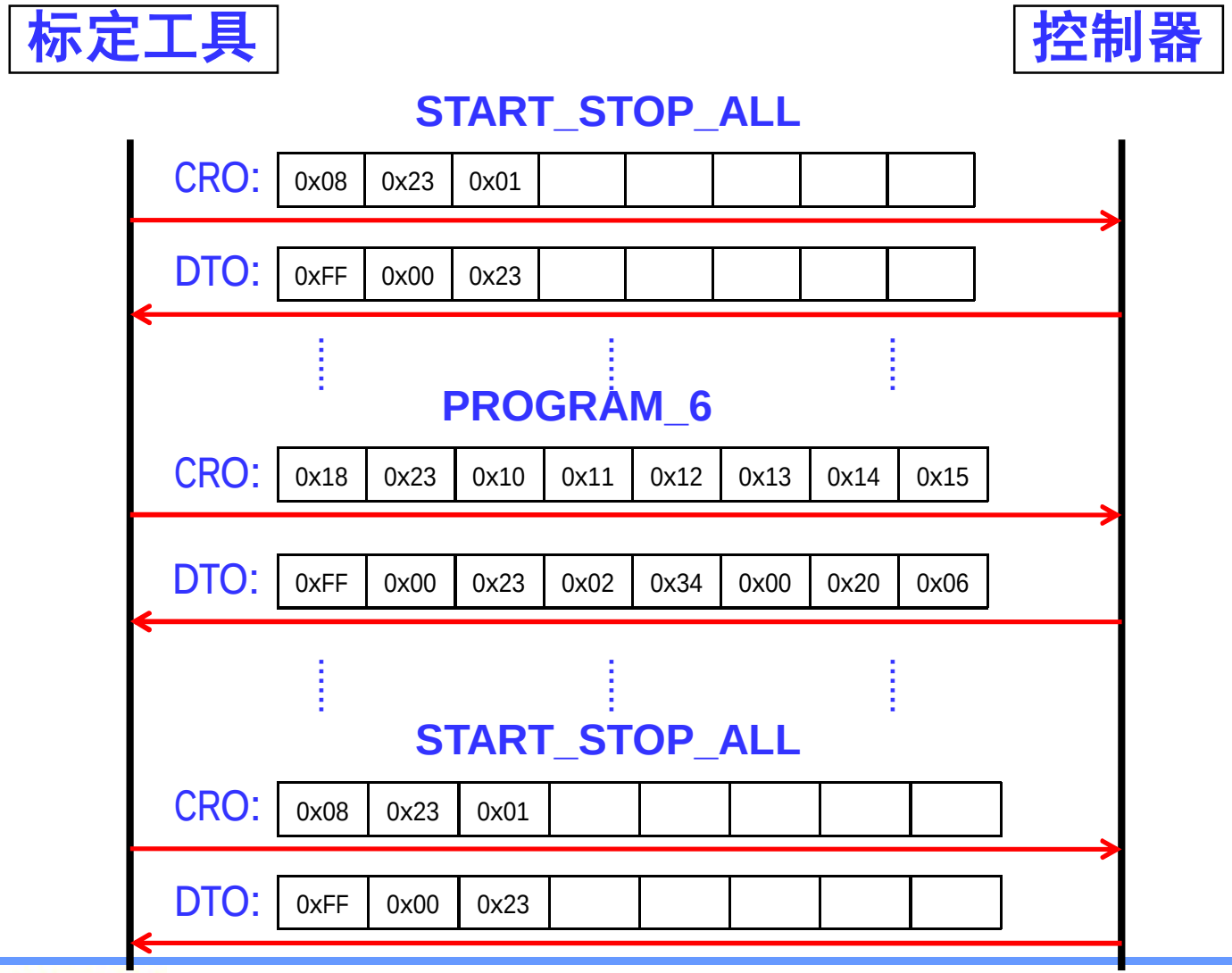
n START_STOP_ALL ——开始/停止同步数据传输（0X08）

CRO

Position	Type	Description
0	byte	Command Code = START_STOP 0x08
1	byte	Command Counter = CTR
2	byte	0x00 stops, 0x01 starts data transmission
3 ... 7	bytes	don´t care

DTO

Position	Type	Description
0	byte	Packet ID: 0xFF
1	byte	Command Return Code
2	byte	Command Counter = CTR
3 ... 7	bytes	don't care



可选命令描述

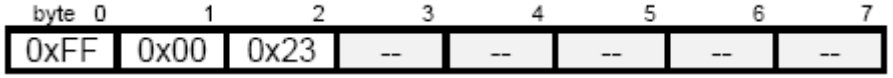
- SELECT_CAL_PAGE —— 选择标定数据页（0X11）

CRO

Position	Type	Description
0	byte	Command Code = SELECT_CAL_PAGE 0x11
1	byte	Command Counter = CTR
2...7	bytes	don't care

DTO

Position	Type	Description
0	byte	Packet ID: 0xFF
1	byte	Command Return Code = ACKNOWLEDGE 0x00
2	byte	Command Counter = CTR
3 ... 7	bytes	don't care



可选命令描述

- GET_ACTIVE_CAL_PAGE —获得当前激活的标定页(0X09)

CRO

Position	Type	Description
0	Byte	Command Code = GET_ACTIVE_CAL_PAGE 0x09
1	Byte	Command Counter = CTR
2...7	Bytes	don't care

DTO

Position	Type	Description
0	Byte	Packet ID: 0xFF
1	Byte	Command Return Code
2	Byte	Command Counter = CTR
3	Byte	Address extension
4 ... 7	unsigned long	Address

应用例子

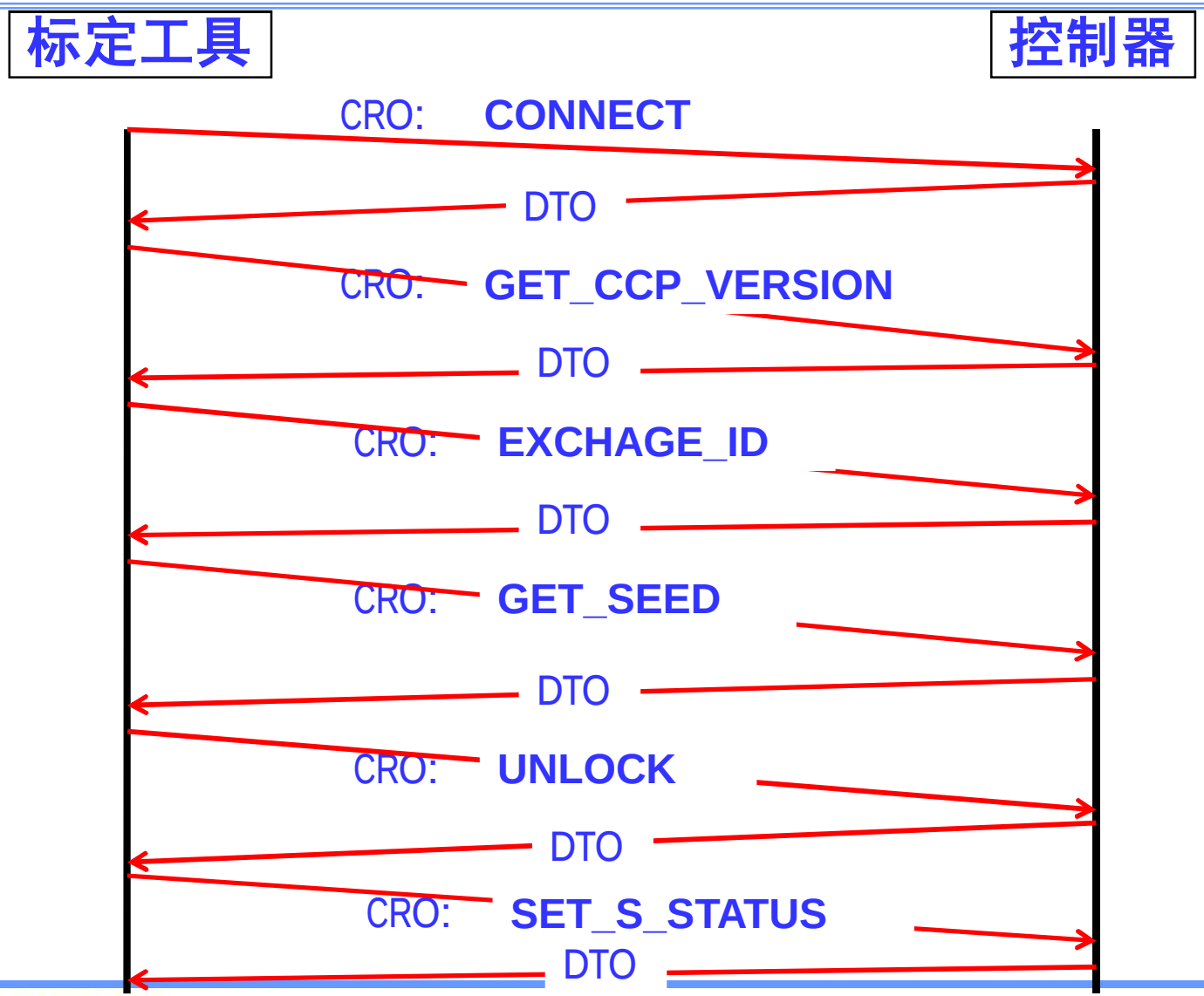
n Session log-in

Command	Description	Remark
CONNECT	Connect logically	
GET_CCP_VERSION	Aggree on protocol version	
EXCHANGE_ID	Exchange station identifications	Plug 'n Play
GET_SEED	Get seed for key, returns key	if 'seed&key' is used
UNLOCK	Unlock protection by sending received key	if 'seed&key' is used
SET_S_STATUS	Set session status (set one or more status bits)	

n Block DownLoad

Command	Description	Remark
CONNECT	Connect	Bypass, if already connected
SET_MTA	Set memory transfer address to destination block	
DOWNLOAD	n • data download, corresponding to size of the block to be downloaded	

Session log-in



应用例子

n Block UpLoad

Command	Description	Remark
CONNECT	Connect	Bypass, if already connected
SET_MTA	Set memory transfer address to source block	
UPLOAD	n • data upload, corresponding to size of the block to be uploaded	

n Calibration Data Initialization

Command	Description	Remark
CONNECT	Connect	Bypass, if already connected
SET_S_STATUS	Set session status (xxxx xxx0)	CAL = off
loop	n •	
SET_MTA	Set memory transfer address to destination block	
BUILD_CHKSUM	Build checksum of block	
DOWNLOAD	download block, if checksum does not match	
SELECT_CAL_PAGE	Select calibration data page	
SET_S_STATUS	Set session status with bit CAL=1 (xxxx xxx1)	now calibration session is running

应用例子

n DAQ list Initialization

Command	Description	Remark
CONNECT	Connect	Bypass, if already connected
SET_S_STATUS	Set session status with DAQ=0 (xxxx xx0x)	
GET_DAQ_SIZE	Allocate DAQ list	see section 'Organization of DAQ'
loop	n •	
SET_DAQ_PTR	Set destination pointer	
WRITE_DAQ	write list data	
SET_S_STATUS	Set session status with DAQ=1 (xxxx xx1x)	
START_STOP	Start transmission of DAQ DTOs and set parameters	

n Code Update

Command	Description	Remark
CONNECT	Connect	Bypass, if already connected
SET_MTA	Set memory transfer address to start address	
CLEAR_MEMORY	clear memory of slave device	
loop	n •	
PROGRAM	PROGRAM depending on size of sector or device	
PROGRAM	Size = 0	End of programming sequence

This procedure may also be embedded in a service used for programming of a FLASH EPROM.

谢　谢!

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V1.0	2007.12.27	马开献