CANopen

1 CANopen

CANopen CANopen

1.1 CANopen

CAN(Controller Area Network)

CAN

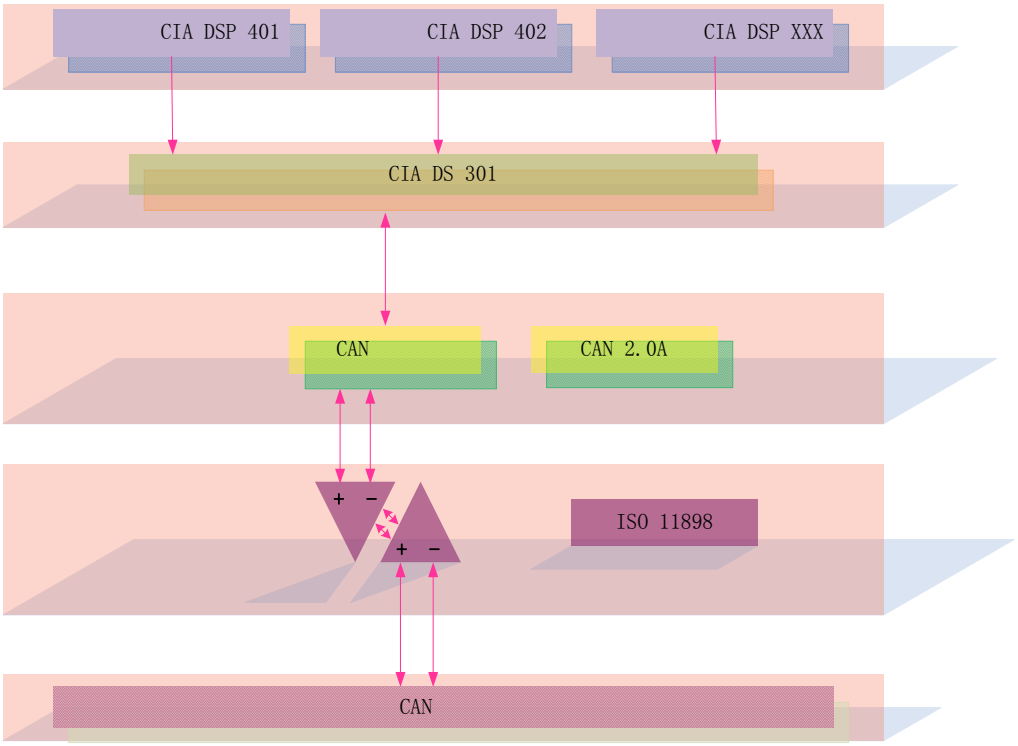
CAN

CANopen CAN CiA(CAN-in-Automation)

CANopen

CANopen CAN

OSI CAN CANopen



CANopen PDO(Process Data Objects) SDO(Service Data Objects) (Time Stamp) (Sync message) (Emergency message) (network management data) (Boot-up message) (NMT message) (Error Control message)

1.2 CANopen

CANopen

CAN 2.0A

CANopen DS 301 V4.02

CANopen DSP 402 V2.01

CANopen

NMT Slave

PDO 3 TxPDO 3 RxPDO
PDO
SDO
Emergency Protocol
CANopen

1.3 CANopen

CANopen (CAN-ID)
CANopen

ID 11 CAN ID 4 7
ID(Node-ID)

				ID						
10	9	8	7	6	5	4	3	2	1	0

Node-ID 1~127(0)
4 PDO(RXPDO) 4 PDO(TXPDO) 1 SDO(
2 CAN-ID) 1 1 (Node Error Control)ID
NMT (NMT Module Control) (SYNC) (Time Stamp)

CANopen /			
		COB-ID	
NMT	0000	0x000	
	0001	0x080	1005H,1006H,1007H
	0010	0x100	1012H,1013H
CANopen /			
		COB-ID	
	0001	0x081~0x0FF	1024H,1015H
TXPDO1( )	0011	0x181~0x1FF	1800H
RXPDO1( )	0100	0x201~0x27F	1400H
TXPDO2( )	0101	0x281~0x2FF	1801H
RXPDO2( )	0110	0x301~0x37F	1401H
TXPDO3( )	0111	0x381~0x3FF	1802H
RXPDO3( )	1000	0x401~0x47F	1402H
TXPDO4( )	1001	0x481~0x4FF	1803H
RXPDO4( )	1010	0x501~0x57F	1403H
SDO( )	1011	0x581~0x5FF	1200H
SDO( )	1100	0x601~0x67F	1200H
NMT	1110	0x701~0x77F	1016H~1017H

PDO/SDO / (slave)CAN
NMT (Node Guarding) (Heartbeat) Boot-up

ID ID
(ID) (127)

1.4 (OD)

1.4.1

(Object Dictionary) 16
8

0000H	
0001H 001FH	(Bool), (Integer16)
0020H 003FH	PDO (PDOCommpar)
0040H 005FH	
0060H 007FH	
0080H 009FH	
00A0H 0FFFH	
1000H 1FFFH	PDO
2000H 5FFFH	
6000H 9FFFH	DSP 402
A000H FFFFH	

CANopen

(EDS Electronic Data Sheet)
EDS (
CANopen)

CANopen (communication profile)
CANopen
CANopen (device
profile)

CANopen (
)

1.4.2

DS 301

					/

1.4.3

CANopen

NULL	0	
DOMAIN	2	
VAR	7	8
ARRAY	8	
RECORD	9	

1.4.4

RW	
WO	
RO	
CONST	

1.4.5

CANopen

1000H	VAR		32	RO
1001H	VAR		8	RO
1003H	ARRAY		32	RO
1005H	VAR	PDO ID	32	RW
1006H	VAR		32	RW
1007H	VAR	PDO	32	RW
1008H	DOMAIN			CONST
1009H	VAR			CONST
100AH	VAR			CONST
1014H	VAR		32	RW
1017H	VAR		16	RW
1018H	RECORD		32	RO
1200H	RECORD	SDO	SDO	RO
1400H	RECORD	PDO	PDO	RW
1402H	RECORD	PDO	PDO	RW
1403H	RECORD	PDO	PDO	RW
1404H	RECORD	PDO	PDO	RW
1405H	RECORD	PDO	PDO	RW
1600H	RECORD	PDO	PDO	RW
1602H	RECORD	PDO	PDO	RW
1603H	RECORD	PDO	PDO	RW
1604H	RECORD	PDO	PDO	RW
1605H	RECORD	PDO	PDO	RW

1800H	RECORD	PDO	PDO	RW
1802H	RECORD	PDO	PDO	RW
1803H	RECORD	PDO	PDO	RW
1804H	RECORD	PDO	PDO	RW
1805H	RECORD	PDO	PDO	RW
1A00H	RECORD	PDO	PDO	RW
1A02H	RECORD	PDO	PDO	RW
1A03H	RECORD	PDO	PDO	RW
1A04H	RECORD	PDO	PDO	RW
1A05H	RECORD	PDO	PDO	RW

DS 301

1000H

	1000H
	VAR
	32
	RO
PDO	
	$0\sim2^{32}-1$
	0x20192

1001H

	1001H
	VAR
	8
	RO
PDO	
	$0\sim2^{8}-1$
	0x0

1003H

	1003H
	ARRAY
	32

	0x0
	RW
PDO	

	0~2^8-1
	0x4

	0x1~0x4
	RO
PDO	
	0~2^{32}-1
	0x0

1005H

	1005H
	PDO ID
	VAR
	32
	RW
PDO	
	0~2^{32}-1
	0x80

1006H

	1006H

	VAR
	CONST
PDO	
	DS402 Drive-LeadShine

1009H

	1009H
	VAR
	CONST
PDO	
	V1.04

100AH

	100AH
	VAR
	CONST
PDO	
	V1.00

1014H

	1014H
	VAR
	32
	RW
PDO	
	$0\sim2^{32}-1$
	0x80000000

1017H

	1017H
	VAR
	16
	RW

PDO	
	$0\sim2^{16}-1$
	0x0

1018H

	1018H
	RECORD
	32

	0x0
	RO
PDO	
	1~4
	0x4

	0x1
	ID
	R0
PDO	
	$0\sim2^{32}-1$
	0x00000331

	0x2
	RO
PDO	
	$0\sim2^{32}-1$
	0x0

	0x3
	RO
PDO	
	$0\sim2^{32}-1$
	0x100

	0x4
	RO
PDO	
	$0\sim2^{32}-1$

	0x1

1200H SDO

	1200H
	SDO
	RECORD
	SDO

	0x0
	RO
PDO	
	0x2
	0x2

	0x1
	COB-ID( )
	RO
PDO	
	$0\sim2^{32}-1$
	0x600+Node-ID

	0x2
	COB-ID( )
	RO
PDO	
	$1\sim2^{7}-1$
	0x580+ Node-ID

1400H~1405H PDO

	1400H~1405H
	PDO
	RECORD
	PDO

	0x0
	RO
PDO	
	0x2~0x5
	0x5

	0x1

	PDO COB-ID
	RW
PDO	
	$0\sim2^{32}-1$
	0x1400 0x40000200+ Node-ID 0x1402 0x40000400+ Node-ID 0x1403 0x40000500+ Node-ID 0x1404 0xC0000000 0x1405 0xC0000000

	0x2
	RW
PDO	
	$0\sim2^{8}-1$
	255(B)

	0x3
	RW
PDO	
	$0\sim2^{16}-1$
	0

	0x4
	RW
PDO	
	$0\sim2^{16}-1$
	0

1600H~1605H PDO

	1400H~1405H
	PDO
	RECORD
	PDO

0x0

	0x1~0x8
	PDO
	RW
PDO	
	$0\sim2^{32}-1$
	0x0

1800H~1805H PDO

	1800H~1805H
	PDO
	RECORD
	PDO

	0x0
	RO
PDO	
	0x2~0x5
	0x5

	0x1
	PDO COB-ID
	RW
PDO	
	$0\sim2^{32}-1$
	0x1800 0x00000180+ Node-ID 0x1802 0x00000380+ Node-ID 0x1803 0x00000480+ Node-ID 0x1804 0x80000000 0x1805 0x80000000

	0x2
	RW
PDO	
	$0\sim2^{8}-1$
	0x1800:255(B) 0x1802~0x1805 1

	0x3

	RW
PDO	
	$0\sim2^{16}-1$
	0

	0x4
	RW
PDO	
	$0\sim2^{16}-1$
	0

1A00H~1A05H PDO

	1A00H~1A05H
	PDO
	RECORD
	PDO

	0x0
	RW
PDO	
	1~64

0x000		Node-ID

Node-ID=0 NMT

	NMT
1(01H)	
2(02H)	
128(80H)	
129(81H)	
130(82H)	

1.5.2 NMT

NMT

NMT ⟹ NMT

COB-ID
0x700+Node-ID

NMT

NMT ⟹ NMT

COB-ID	Byte 0
0x700+Node-ID	Bit 6:0

(bit7)

0 6(bits0 6)

0(00H)	
1(01H)	
2(02H)	
3(03H)	
4(04H)	
5(05H)	
127(7FH)	

0

(Heartbeat)

⟹

COB-ID	Byte 0

0x700+Node-ID	

0	Boot-up
4	
5	
127	

1.5.3 NMT Boot-up

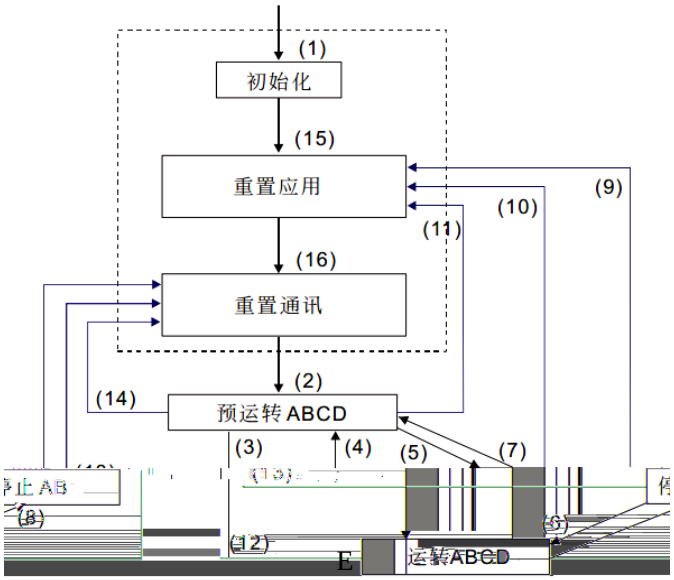
NMT Boot-up NMT

NMT ⟹ NMT

COB-ID	Byte 0
0x700+Node-ID	0

1.5.4 NMT

CANopen



(1)
(2) ( )
(3) (6)
(4) (7) ( )
(5) (8)
(9) (10) (11)
(12) (13) (14)
(15)
(16)

( )

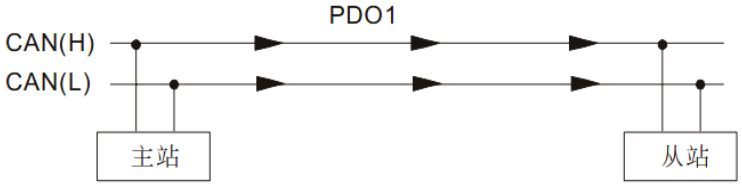
SDO( ) ID

A NMT
B Node Guard
C SDO
D Emergency
E PDO
F Boot-up

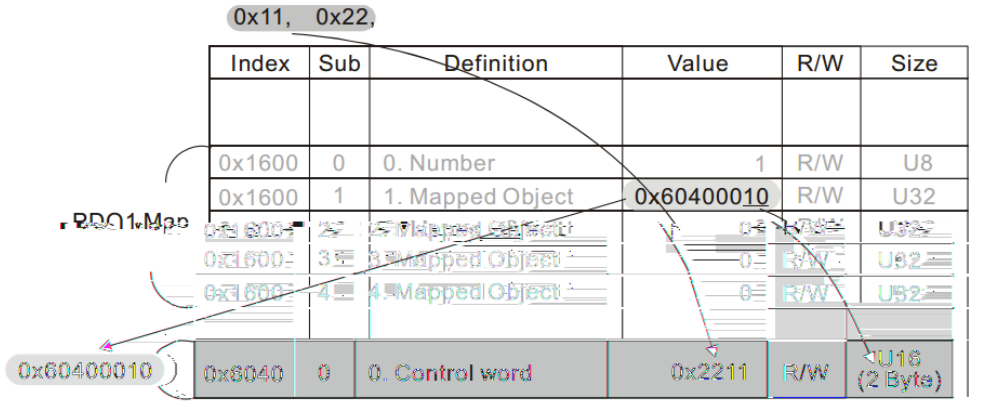
1.6 (PDO)

PDO / PDO
PDO PDO(TxPDO) PDO(RxPDO) PDO
(PDO 1400H PDO
1800H)
PDO DSP 402
1600H 1A00H

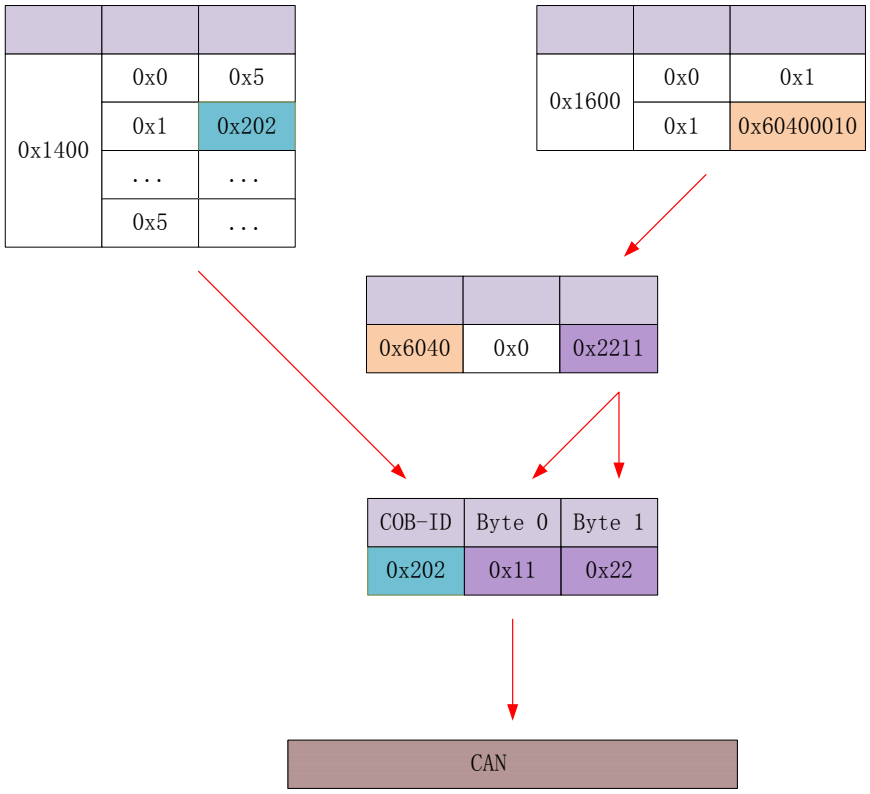
PDO

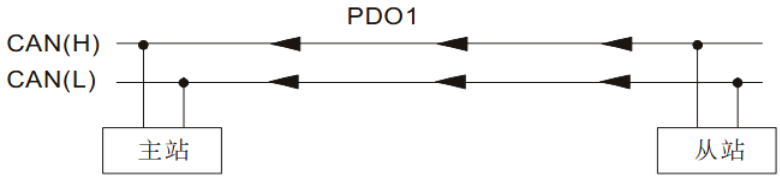


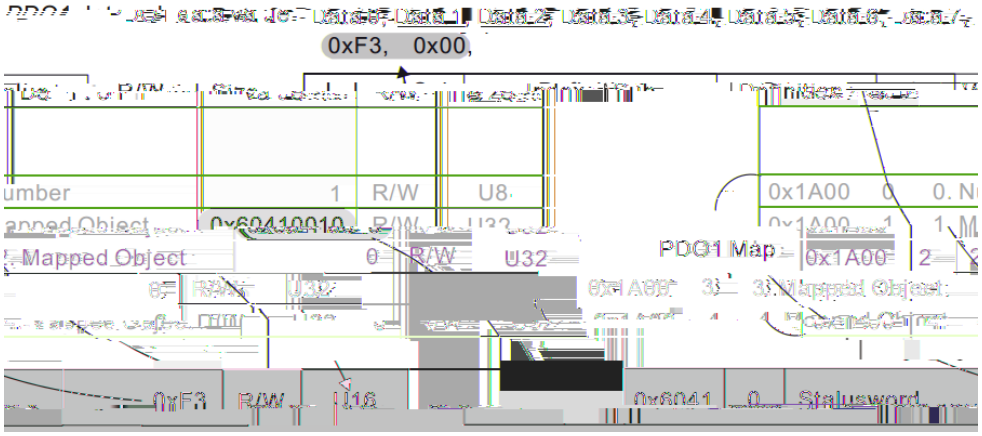
PDO1 data value Data 0, Data 1, Data 2, Data 3, Data 4, Data 5, Data 6, Data 7,



PDO (1400H) PDO (1600H) PDO
(2)

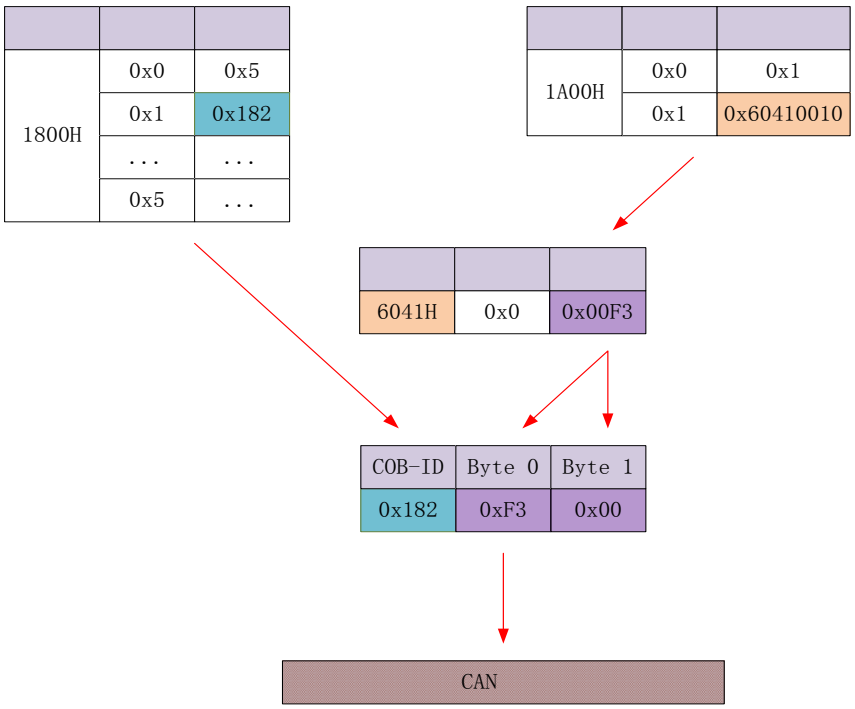






PDO (1800H) PDO (1A00H) PDO

(2)



1.7 (SDO)

SDO (client)
CANopen (server) CAN
CAN 8 ( )

/

Byte 0	Byte 1:2	Byte 3	Byte 4:7
SDO			

SDO 0x20F0 ID 2 1801H 3

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
602	2B	01	18	03	F0	20	00	00
582	60	01	18	03	00	00	00	00

SDO 1801H 3

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
602	40	01	18	03	00	00	00	00

582	4B	01	18	03	F0	20	00	00

SDO SDO

/

Bit	7	6	5	4	3	2	1	0
	1	0	0	-	-	-	-	-

SDO 0 1 2

4 7 32 D

1.8 (Emergency Object)

8

COB-ID	Byte 0:1	Byte 2	Byte 3:7
0x080+Node-ID		(1001H)	

C

(1003H)

SDO

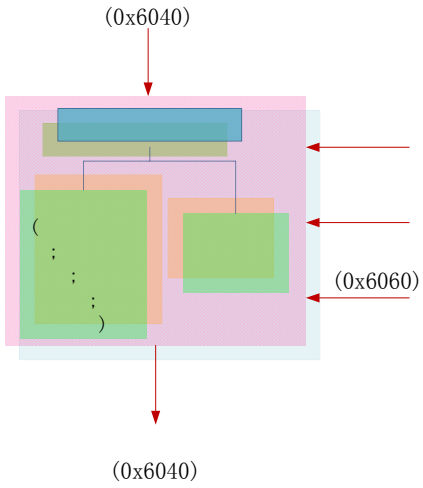
(1001H)

0	
1	
2	
3	
4	
5	
6	
7	

2 CANopen

2.1

DSP 402

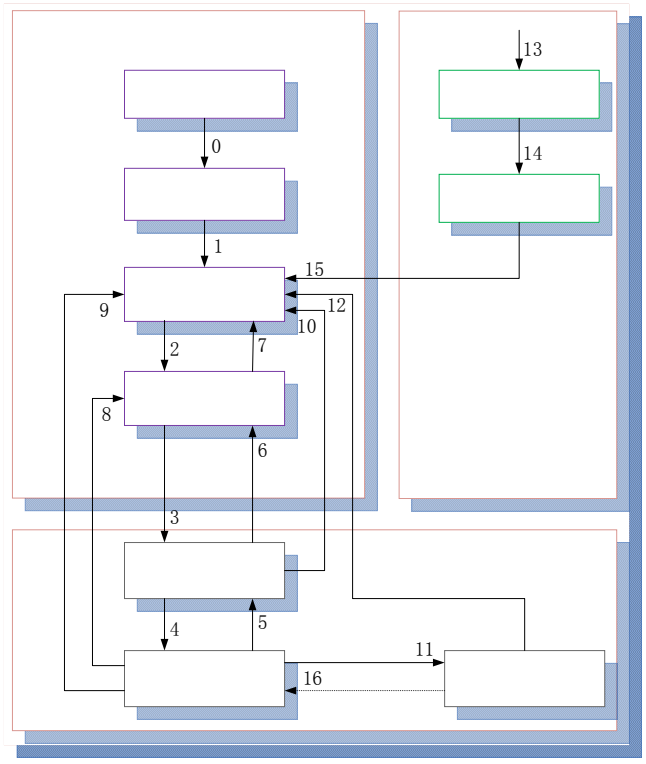


2.1.1

(0x6060) CANopen

2.1.2

2.5.4



PDS **0** **1** **PDS**

Switch On Disabled **13** **14**

0

0

0

2.2

2.2.1

1.4.3

2.2.2

CANopen

6040H	VAR		16	RW
6041H	VAR		16	RO
6060H	VAR		8	RW
6061H	VAR		8	RO
6064H	VAR		32	RW
606CH	VAR		32	RW
607AH	VAR		32	RW
607CH	VAR		32	RW
6081H	VAR		32	RW
6083H	VAR		32	RW
6084H	VAR		32	RW
6085H	VAR		32	RW
6093H	ARRAY		32	RW
6098H	VAR		8	RW
6099H	ARRAY		32	RW
609AH	VAR		32	RW
60FFH	VAR		32	RW

6040H

	6040H
	VAR
	16

	RW
PDO	
	0~2^{16}-1
	0

(6040H)

	15:11	10:9	8	7	6:4	3	2	1	0

7 3:0

	7 3:0					
	0		1	1	0	2;6;8
	0	0	1	1	1	3*
	0	1	1	1	1	3**
	0			0		7;9;10;12
	0		0	1		7;10;11
	0	0	1	1	1	5
	0	1	1	1	1	4;16
						15

* **

(6040H) 6:4 ( )

A

6041H

	6041H
	VAR
	16
	RO
PDO	
	0~2^{16}-1
	0

15:14	
13:12	
11	
10	
9	

8	
7	
6	
5	
4	
3	
2	
1	
0	

6 3:0

6 3:0	
, , 0 , 0000	
, , 1 , 0000	
, , 01 , 0001	
, , 01 , 0011	
, , 01 , 0111	
, , 00 , 0111	
, , 0 , 1111	

6061H

	6061H
	VAR
	8
PDO	
	-2^7~2^7-1
	0

(6060)

6064H

	6064H
	VAR
	32
	RO
PDO	
	-2^{31}~2^{31}-1
	0x0

606CH

	606CH
	VAR
	32
	RO
PDO	
	-2^{31}~2^{31}-1
	0x0

607AH

	607AH
	VAR
	32
	RW
PDO	
	-2^{31}~2^{31}-1
	0x0

607CH

	607CH

	VAR
	32
	RW
PDO	
	-2^{31}~2^{31}-1
	0x0

6081H

	6081H
	VAR
	32
	RW
PDO	
	0~2^{32}-1
	0x0

6083H

	6083H
	VAR
	32
	RW
PDO	
	0~2^{32}-1
	0x0

6084H

	6084H
	VAR
	32
	RW
PDO	
	0~2^{32}-1
	6083

6085H

	6085H
	VAR

	32
	RW
PDO	
	$0\sim2^{32}-1$
	0x0

6093H

	6093H
	ARRAY
	32

	0x0
	RO
PDO	
	0x2
	0x2

	0x1
	RW
PDO	
	$1\sim2^{32}-1$
	0x1

	0x2
	RW
PDO	
	$1\sim2^{32}-1$
	0x1

6098H

	6098H
	VAR
	8
	RW
PDO	
	$-2^{7}\sim2^{7}-1$
	0x0

-1 ~ -128	
1~6	1~6
7~16	
17~22	17~22
23~35	
36~127	

6099H

	6099H
	ARRAY
	32

	0x0
	RO
PDO	
	0x2

	32
	RW
PDO	
	0~2^{32}-1
	0x0

60FFH

	60FFH
	VAR
	32

3.2

3.2.1

(6060H) (3)
(60FFH) (pulse/s)
(6083H) (pulse/s^2)
(6084H) (pulse/s^2)
(6040H)
(6040H) A

3.2.2

(6041H)
(606CH)

3.3

3.3.1

(6060H) (6)
(6098H) Cia402 (6098H 1~14 16~30)
[6099H(0x1)] [6099H(0x2)](pulse/s)
/ (609AH) (pulse/s^2)
(607CH) (pulse)
(6040H)
(6040H) A

3.3.2

(6041H)

3.4

3.4.1

(6085H) (mm/s^2)
(6040H)
PDS

3.4.2

(6041H)

A

(6040H)

(6060H 1) (6040H)

	15:9	8	7	6	5	4	3	2	1	0
				/						

(6040H)

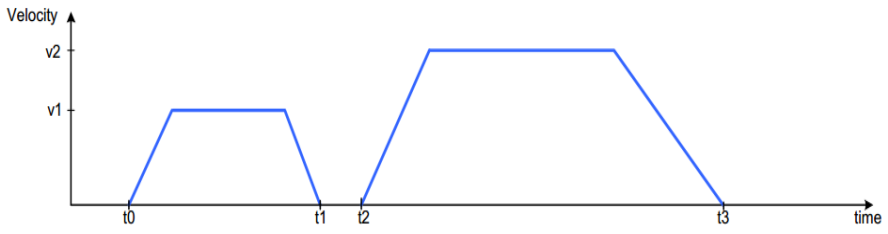
0x06	0x07	0x0F	0x4F	0x5F
+	+	+	+	+

(6040H)

0x06	0x07	0x0F	0x1F
+	+	+ ( )	+

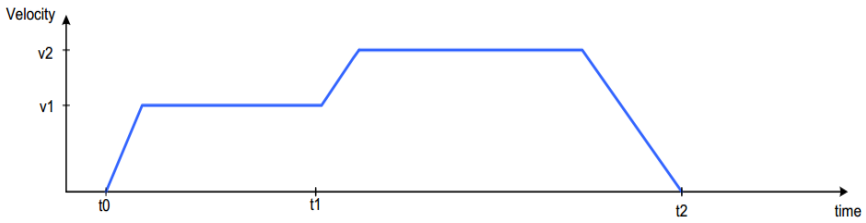
(6040H) ( )

((6040H) 0 1)



(6040H) 1 (

)



(6040H) 0 1

PP

(6060H 3) (6040H)

	15:9	8	7	6:4	3	2	1	0

(6040H) (8)

0x06	0x07	0x0F	0x10F	0x00F
+	+	+	+	

(6060H 6) (6040)

	15:9	8	7	6:5	4	3	2	1	0

(6040H)

0x06	0x07	0x0F	0x1F	0x0F
+	+	+	+	

(6040H) 0x0F 0x1F

(6040H) 0x02

(6040H)

0x80

B

PDO

	PDO				
0					

0504 0002H	( )
0504 0003H	( )
0504 0004H	CRC ( )
0504 0005H	
0601 0000H	
0601 0001H	
0601 0002H	
0602 0000H	
0604 0041H	PDO
0604 0042H	PDO
0604 0043H	
0604 0047H	
0606 0000H	
0606 0010H	
0606 0012H	
0606 0013H	
0609 0011H	
0609 0030H	( )
0609 0031H	
0609 0032H	
0609 0036H	
0800 0000H	
0800 0020H	
0800 0021H	
0800 0022H	
0800 0023H	(