

**MOOG**

**DBM - CAN**

# **Application Manual**

## Introduction

This manual provides the necessary information for an effective use of DBM CAN Bus. It must be used in conjunction with the "DBM 04 Installation Manual" and the "DBM 04 User's Manual".

This manual includes:

- Description
- Hardware differences between DBM-CAN and DBM 04 drive
- Software configuration
- Network management
- Emergency
- Objects

The following version, software code and checksums apply:

<b>VERSION:</b>	<b>V01.01</b>
<b>CODE:</b>	<b>SW1067</b>
<b>EPROM DSP:</b>	<b>LO: 8E56</b>
	<b>HI: 9F42</b>
<b>EPROM 8031:</b>	<b>2FC0</b>
<b>EPROM C515:</b>	<b>5D35</b>

## Section 1 - Description

**CAN** is a serial bus system with multi-master capabilities, that is, all CAN nodes are able to transmit data and several CAN nodes can request the bus simultaneously. The serial bus system with real-time capabilities is the subject of the ISO 11898 international standard and covers the lowest two layers of the ISO/OSI reference model. In CAN networks there is no addressing of subscribers or stations in the conventional sense, but instead, prioritized messages are transmitted. A transmitter sends a message to all CAN nodes (broadcasting). Each node decides on the basis of the identifier received whether it should process the message or not. The identifier also determines the priority that the message enjoys in competition for bus access.

Open fieldbus systems enable the construction of machines by connecting components from multiple vendors while minimizing the effort required for interfacing. To achieve an open networking system, it is necessary to standardize the various layers of communication used.

**CANopen** uses the international CAN standard, ISO 11898 as the basis for communication. This standard covers the lower two layers of communication specified by the OSI model. Building on this, the CANopen profile family specifies standardized communication mechanisms and device functionality for CAN-based systems. The profile family which is available and maintained by CAN in Automation (CiA) consists of the application layer and communication profile (DS 301), various frameworks and recommendations (CiA DS-30x) and various device profiles (CiA DS-40x).

# Section 2 - Hardware differences between DBM-CAN and DBM 04

Tab. 2.1 – J1A Connector - Sub-D 9 pos. - CANBUS Signals

Panel side: male

Wiring side: female with conductive shell

Pos.	Name	
1	BUS_H	BUS High signal
2	BUS_H	BUS High signal
3	0V	Digital 0V
4	-	N.C.
5	-	N.C.
6	0V	Digital 0V
7	BUS_L	BUS Low signal
8	BUS_L	BUS Low signal
9	+5V	+5Vdc output

# Section 3 – Software Configuration

## AS - Node Show

Function:	it allows display of the node identification, if unknown. To avoid simultaneous answers on the line from more than one module, it is necessary that serial flat J2 is connected only between power supply and the questioned module. It is different from SA command, which is used to change node identification.
Syntax:	data monitoring: ■ * AS <CR>
Address type:	-
Unit of measure:	-
Range:	-
Default:	-
Password:	no
(*) addressing:	compulsory
Opposite to:	-
See also:	SA

**SA - Selection of the node identification.**

Function:	it is used to assign the module node identification different from default. A module programmed as "node 1" will automatically assign, for the other axes, the following nodes, i.e. 2 - 3 (if triple-axis) or 2 (if double-axis).
Syntax:	data input:     ■ node SA n <CR>
Address type:	axis
Unit of measure:	-
Range:	1 to 99
Default:	1
Password:	no
(*) addressing:	no
Opposite to:	-
See also:	AS

*REMARK: To perform SA command, only one module at the time must be connected to J2 flat cable.*

## Section 4 – Network Management

The network management supports a simplified start of the network and can be expanded modular according to system demand.

**Tab.4.1 - Network Management**

<b>CAN header:</b>									
<i>Byte</i>	<i>Bit7</i>	<i>Bit6</i>	<i>Bit5</i>	<i>Bit4</i>	<i>Bit3</i>	<i>Bit2</i>	<i>Bit1</i>	<i>Bit0</i>	<i>Hex</i>
Byte0	0	0	0	0	0	0	0	0	00
Byte1	0	0	0	0	0	0	1	0	02

<b>CAN data:</b>									
<i>Byte</i>	<i>Bit7</i>	<i>Bit6</i>	<i>Bit5</i>	<i>Bit4</i>	<i>Bit3</i>	<i>Bit2</i>	<i>Bit1</i>	<i>Bit0</i>	<i>Hex</i>
Byte2	C7	C6	C5	C4	C3	C2	C1	C0	CMD
Byte3	A7	A6	A5	A4	A3	A2	A1	A0	xx
Byte4									
Byte5									
Byte6									
Byte7									
Byte8									
Byte9									

Node ID (00 => all Nodes)

<b>C7</b>	<b>C6</b>	<b>C5</b>	<b>C4</b>	<b>C3</b>	<b>C2</b>	<b>C1</b>	<b>C0</b>	<b>Hex</b>	<b>CMD</b>
0	0	0	0	0	0	0	1	01	<b>Start</b>
0	0	0	0	0	0	1	0	02	<b>Stop</b>
1	0	0	0	0	0	0	0	80	<b>Pre Operational</b>
1	0	0	0	0	0	0	1	81	<b>Reset Node</b>
1	0	0	0	0	0	1	0	82	<b>Reset Communication Parameter</b>

## Section 5 – Emergency

The module status is transmitted in case of error via emergency telegrams with high priority. these telegrams have a data length of 8 byte and contain extensive error information.

**Tab.5.1 Emergency**

CAN header:									
Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Hex
Byte0	0	0	0	1	A6	A5	A4	A3	10
Byte1	A2	A1	A0	0	0	0	0	0	00

CAN data:										
Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Hex	
Byte0	0	0	0	0	0	0	0	0	00	Error Code
Byte1	x	x	x	x	0	0	0	0	x0	Error Code
Byte2	0	0	0	0	0	0	0	1	01	Error Register (Obj. 1001)
Byte3	0	0	0	0	0	0	0	0	00	Specific error register
Byte4	0	0	0	0	0	0	0	0	00	Specific error register
Byte5	0	0	0	0	0	0	0	0	00	Specific error register
Byte6	0	0	0	0	0	0	0	0	00	Specific error register
Byte7	0	0	0	0	0	0	0	0	00	Specific error register

Error Code	0000	No Error - Fault Resetted
	1000	Generic Error
	8000	Communication Error (SYNC absence)
	8100	Communication warning reached
	8140	recovered from busoff



## Section 6 - Objects

### 6.1 Object Dictionary

DBM – CAN Object Dictionary										
OBJ	Name	Type		Subindex	Description	Data		PDO Mapping	Axis	Note
-	Network management	-	-	-	-	-	-	No	all	wo
-	Emergency	-	-	-	-	-	-	No	all	ro
1000	Device type	VAR	Unsigned32	-	-	FFFF0402	SDO	No	all	ro
1001	Error register	VAR	Unsigned8	-	-	0X	SDO	No	all	ro
1004	Number of PDOs supported	ARRAY	Unsigned32	00	N° of PDOs supported	00030003h	SDO	No	all	ro
			Unsigned32	01	N° synchronous PDOs	00030003h	SDO	No	all	ro
			Unsigned32	02	N° asynchronous PDOs	00000000h	SDO	No	all	ro
1005	Sync	VAR	Unsigned32	-	-	-	-	No	all	ro
1006	Communication Cycle Period	VAR	Unsigned32	-	-	XXXXXXXX	SDO	No	all	rw
100A	Manufacturer SW version	VAR	Unsigned32	-	Version xx.xx	XXXXXXXX	SDO	No	all	ro
100B	Node ID	VAR	Unsigned16	-	Node ID	XXXX	SDO	No	all	ro
1010	Store Parameters	ARRAY	Unsigned32	00	Largest subindex supported	01	SDO	No	all	ro
			Unsigned32	01	Save ALL parameters	XXXXXXXX	SDO	No	all	rw
1018	Identity Object	RECORD	Unsigned32	00	Number of element	01	SDO	No	all	ro
			Unsigned32	01	Vendor ID	MOOG	SDO	No	all	ro
1600	Mapping Parameter RxPDO1 (Node ID) RxPDO2 (Node ID + 1) RxPDO3 (Node ID + 2)	RECORD	Unsigned32	00	Number of objects	0X	SDO	No	all	rw
			Unsigned32	01	1st object	XXXXXXXX	SDO	No	all	rw
			Unsigned32	02	2nd object	XXXXXXXX	SDO	No	all	rw
			Unsigned32	03	3rd object	XXXXXXXX	SDO	No	all	rw
			Unsigned32	04	4th object	XXXXXXXX	SDO	No	all	rw
1800	TxPDO Communication Parameter TxPDO1 (Node ID) TxPDO2 (Node ID + 1) TxPDO3 (Node ID + 2)	RECORD	Unsigned32	00	Number of element	02	SDO	No	all	ro
			Unsigned32	01	COB – ID	180h + Node ID	SDO	No	all	ro
			Unsigned8	02	Transmission type	XX	SDO	No	all	rw
1A00	Mapping Parameter TxPDO1 (Node ID) TxPDO2 (Node ID + 1) TxPDO3 (Node ID + 2)	RECORD	Unsigned32	00	Number of objects	0X	SDO	No	all	rw
			Unsigned32	01	1st object	XXXXXXXX	SDO	No	all	rw
			Unsigned32	02	2nd object	XXXXXXXX	SDO	No	all	rw
			Unsigned32	03	3rd object	XXXXXXXX	SDO	No	all	rw
			Unsigned32	04	4th object	XXXXXXXX	SDO	No	all	rw

## DBM – CAN Object Dictionary (continued)

OBJ	Name	Type		Subindex	Description	Data		PDO Mapping	Axis	Note
2000	Activate / Deactivate TxPDO	VAR	Unsigned8	-	-	0X	SDO	No	all	rw
Axis 1 (Node ID)										
6040	Controlword	VAR	Unsigned16	-	-	00XX	PDO & SDO1	Yes	1	rw
6041	Statusword	VAR	Unsigned16	-	-	0XXX	PDO & SDO1	Yes	1	ro
6042	Target velocity	VAR	Integer16	-	-	XXXX	PDO & SDO1	Yes	1	rw
6043	Velocity demand	VAR	Integer16	-	-	XXXX	PDO & SDO1	Yes	1	ro
6044	Control effort	VAR	Integer16	-	-	XXXX	PDO & SDO1	Yes	1	ro
6046	Velocity min max amount	ARRAY	Unsigned16	00	Number of element	02	SDO1	No	1	ro
			Unsigned16	01	velocity min amount	XXXX	PDO & SDO1	Yes	1	rw
			Unsigned16	02	velocity max amount	XXXX	PDO & SDO1	Yes	1	rw
6048	Velocity acceleration	RECORD	Unsigned16	00	Number of element	01	SDO1	No	1	ro
			-	01	delta speed	-	-	-	-	-
			Unsigned16	02	delta time	XXXX	SDO1	No	1	rw
6049	Velocity deceleration	RECORD	Unsigned16	00	Number of element	01	SDO1	No	1	ro
			-	01	delta speed	-	-	-	-	-
			Unsigned16	02	delta time	XXXX	SDO1	No	1	rw
6060	Modes of operation	VAR	Integer8	-	-	0X	SDO1	No	1	wo
6061	Modes of operation display	VAR	Integer8	-	-	0X	SDO1	No	1	ro
604C	Dimension Factor	ARRAY	Integer32	00	Number of element	01	SDO1	No	1	ro
			Integer32	01	Numerator (MV)	XXXX	SDO1	No	1	rw
			-	02	Denominator	-	-	-	-	-
6510	DBM Parameter	ARRAY	Unsigned8	00	Number of element	03	SDO1	No	1	ro
			Integer8	01	Proportional gain (KP)	XX	SDO1	No	1	rw
			Integer8	02	Integral gain (KI)	XX	SDO1	No	1	rw
			Integer8	03	Current limit (IL)	XX	SDO1	No	1	rw
67FF	Device type – ax1	VAR	Unsigned32	-	-	00020402	SDO1	No	all	ro

## DBM – CAN Object Dictionary (continued)

OBJ	Name	Type		Subindex	Description	Data		PDO Mapping	Axis	Note
Axis 2 (Node ID + 1 )										
6840	Controlword	VAR	Unsigned16	-	-	00XX	PDO & SDO2	Yes	2	rw
6841	Statusword	VAR	Unsigned16	-	-	0XXX	PDO & SDO2	Yes	2	ro
6842	Target velocity	VAR	Integer16	-	-	XXXX	PDO & SDO2	Yes	2	rw
6843	Velocity demand	VAR	Integer16	-	-	XXXX	PDO & SDO2	Yes	2	ro
6844	Control effort	VAR	Integer16	-	-	XXXX	PDO & SDO2	Yes	2	ro
6846	Velocity min max amount	ARRAY	Unsigned16	00	Number of element	02	SDO2	No	2	ro
			Unsigned16	01	velocity min amount	XXXX	PDO & SDO2	Yes	2	rw
			Unsigned16	02	velocity max amount	XXXX	PDO & SDO2	Yes	2	rw
6848	Velocity acceleration	RECORD	Unsigned16	00	Number of element	01	SDO2	No	1	ro
			-	01	delta speed	-	-	-	-	-
			Unsigned16	02	delta time	XXXX	SDO2	No	1	rw
6849	Velocity deceleration	RECORD	Unsigned16	00	Number of element	01	SDO2	No	1	ro
			-	01	delta speed	-	-	-	-	-
			Unsigned16	02	delta time	XXXX	SDO2	No	1	rw
6860	Modes of operation	VAR	Integer8	-	-	0X	SDO2	No	2	wo
6861	Modes of operation display	VAR	Integer8	-	-	0X	SDO2	No	2	ro
684C	Dimension Factor	ARRAY	Integer32	00	Number of element	01	SDO2	No	2	ro
			Integer32	01	Numerator (MV)	XXXX	SDO2	No	2	rw
			-	02	Denominator	-	-	-	-	-
6D10	DBM Parameter	ARRAY	Unsigned8	00	Number of element	03	SDO2	No	2	ro
			Integer8	01	Proportional gain (KP)	XX	SDO2	No	2	rw
			Integer8	02	Integral gain (KI)	XX	SDO2	No	2	rw
			Integer8	03	Current limit (IL)	XX	SDO2	No	2	rw
6FFF	Device type – ax2	VAR	Unsigned32	-	-	00020402	SDO2	No	all	ro
Axis 3 (Node ID + 2)										
7040	Controlword	VAR	Unsigned16	-	-	00XX	PDO & SDO3	Yes	3	rw
7041	Statusword	VAR	Unsigned16	-	-	0XXX	PDO & SDO3	Yes	3	ro
7042	Target velocity	VAR	Integer16	-	-	XXXX	PDO & SDO3	Yes	3	rw
7043	Velocity demand	VAR	Integer16	-	-	XXXX	PDO & SDO3	Yes	3	ro
7044	Control effort	VAR	Integer16	-	-	XXXX	PDO & SDO3	Yes	3	ro

## DBM – CAN Object Dictionary (continued)

OBJ	Name	Type		Subindex	Description	Data		PDO Mapping	Axis	Note
7046	Velocity min max amount	ARRAY	Unsigned16	00	Number of element	02	SDO3	No	3	ro
			Unsigned16	01	velocity min amount	XXXX	PDO & SDO3	Yes	3	rw
			Unsigned16	02	velocity max amount	XXXX	PDO & SDO3	Yes	3	rw
7048	Velocity acceleration	RECORD	Unsigned16	00	Number of element	01	SDO3	No	1	ro
			-	01	delta speed	-	-	-	-	-
			Unsigned16	02	delta time	XXXX	SDO3	No	1	rw
7049	Velocity deceleration	RECORD	Unsigned16	00	Number of element	01	SDO3	No	1	ro
			-	01	delta speed	-	-	-	-	-
			Unsigned16	02	delta time	XXXX	SDO3	No	1	rw
7060	Modes of operation	VAR	Integer8	-	-	0X	SDO3	No	3	wo
7061	Modes of operation display	VAR	Integer8	-	-	0X	SDO3	No	3	ro
704C	Dimension Factor	ARRAY	Integer32	00	Number of element	01	SDO3	No	3	ro
			Integer32	01	Numerator (MV)	XXXX	SDO3	No	3	rw
			-	02	Denominator	-	-	-	-	-
7510	DBM Parameter	ARRAY	Unsigned8	00	Number of element	03	SDO3	No	3	ro
			Integer8	01	Proportional gain (KP)	XX	SDO3	No	3	rw
			Integer8	02	Integral gain (KI)	XX	SDO3	No	3	rw
			Integer8	03	Current limit (IL)	XX	SDO3	No	3	rw
77FF	Device type – ax3	VAR	Unsigned32	-	-	00020402	SDO3	No	all	ro

### Default PDO Mapping:

RxPDO1 – Obj. 6040 (byte 0,1); Obj. 6042 (byte 2,3)

TxPDO1 – Obj. 6041 (byte 0,1); Obj. 6044 (byte 2,3)

TxPDO are triggered by SYNC message.

TxPDOs are sent after 1 SYNC.

Speed change is triggered by SYNC message.

## 6.2 Object Description

### Object 1000: Device Type

Object Description	
INDEX	1000h
Name	Device Type
Object Code	Var
Data Type	Unsigned 32
Value Description	
Access	Read only
PDO Mapping	NO
Value Range	Unsigned32
Default Value	00020402h

### Object 1001: Error Register

Object Description	
INDEX	1001h
Name	Error Register
Object Code	Var
Data Type	Unsigned 8
Value Description	
Access	Read only
PDO Mapping	NO
Value Range	Unsigned8
Default Value	00h (no error) (01h generic error)

**Object 1004: Number of PDOs supported**

<b>Object Description</b>	
INDEX	1004h
Name	Number of PDOs supported
Object Code	Array
Number of elements	02h
Data Type	Unsigned32
<b>Value Description</b>	
Sub-Index	00h
Description	Number of PDOs supported
Access	Read only
PDO Mapping	NO
Value Range	Unsigned32
Default Value	11h
Sub-Index	01h
Description	Number of synchronous PDOs
Access	Read Only
PDO Mapping	NO
Value Range	Unsigned32
Default Value	11h
Sub-Index	02h
Description	Number of asynchronous PDOs
Access	Read Only
PDO Mapping	NO
Value Range	Unsigned32
Default Value	00h

**Object 1005: COB-ID SYNC message**

<b>Object Description</b>	
INDEX	1005h
Name	COB-ID SYNC message
Object Code	Var
Data Type	Unsigned 32
<b>Value Description</b>	
Access	Read only
PDO Mapping	NO
Value Range	Unsigned32
Default Value	80h

### **Object 1006: Communication Cycle Period**

<b>Object Description</b>	
INDEX	1006h
Name	Communication Cycle Period
Object Code	Var
Data Type	Unsigned 32
<b>Value Description</b>	
Access	Read / Write
PDO Mapping	NO
Value Range	Unsigned32
Default Value	00000000h (Communication Cycle Period not active)

It is not allowed to use both Communication Cycle Period and Nodeguarding at same time.

### **Object 100A: Manufacturer Software Version**

<b>Object Description</b>	
INDEX	100Ah
Name	Manufacturer Software Version
Object Code	Var
Data Type	Unsigned 32
<b>Value Description</b>	
Access	Read Only
PDO Mapping	NO
Value Range	Unsigned32
Default Value	xxxxxxx (Version xx.xx)

### **Object 100B: Node ID**

<b>Object Description</b>	
INDEX	100Bh
Name	Node ID
Object Code	Var
Data Type	Unsigned 16
<b>Value Description</b>	
Access	Read Only
PDO Mapping	NO
Value Range	Unsigned16
Default Value	01h
Data Type	Unsigned 8

## **Object 1010h: Save Parameter**

<b>Object Description</b>	
INDEX	1010h
Name	Save Parameter
Object Code	Array
Number of elements	01h
Data Type	Unsigned32
<b>Value Description</b>	
Sub-Index	00h
Description	Largest subindex supported
Access	Read only
PDO Mapping	NO
Value Range	Unsigned32
Default Value	01h
Sub-Index	01h
Description	Save all parameter (Kp, Ki, Ilimit, MV)
Access	Read / Write
PDO Mapping	NO
Value Range	Unsigned32
Default Value	73617665h (SAVE in ASCII) write 00000001h read Device doesn't save parameters autonomously Device saves parameters on command

Note the parameters that can be saved are: KP, KI, ILimit, MV.



## **Object 1018: Identity Object**

<b>Object Description</b>	
INDEX	1018h
Name	Identity Object
Object Code	Record
Number of elements	01h
Data Type	Unsigned32
<b>Value Description</b>	
Sub-Index	00h
Description	Number of elements
Access	Read only
PDO Mapping	NO
Value Range	Unsigned32
Default Value	1h
Sub-Index	01h
Description	Identity
Access	Read Only
PDO Mapping	NO
Value Range	Unsigned32
Default Value	(47 4F 4F 4D)h (MOOG in ASCII)

## **Object 1600: Receive PDO1 Mapping Parameter (Axis 1)**

<b>Object Description</b>	
INDEX	1600h
Name	Receive PDO mapping
Object Code	Record
Number of elements	01h - 04h
Data Type	PDO Mapping
<b>Value Description</b>	
Sub-Index	00h
Description	Number of mapped application objects in PDO
Access	Write only
PDO Mapping	NO
Value Range	Unsigned32
Default Value	2
Sub-Index	01h - 04h
Description	PDO mapping for the nth application object to be mapped
Access	Write only
PDO Mapping	NO
Value Range	Unsigned32
Default Value	Sub-index 01: Obj 6040h Sub index 02: Obj 6042h

**Object 1600: Receive PDO2 Mapping Parameter (Axis 2)**

<b>Object Description</b>	
INDEX	1600h
Name	Receive PDO mapping
Object Code	Record
Number of elements	01h - 04h
Data Type	PDO Mapping
<b>Value Description</b>	
Sub-Index	00h
Description	Number of mapped application objects in PDO
Access	Write only
PDO Mapping	NO
Value Range	Unsigned32
Default Value	2
Sub-Index	01h - 04h
Description	PDO mapping for the nth application object to be mapped
Access	Write only
PDO Mapping	NO
Value Range	Unsigned32
Default Value	Sub-index 01: Obj 6840h Sub index 02: Obj 6842h

**Object 1600h: Receive PDO3 Mapping Parameter (Axis 3)**

<b>Object Description</b>	
INDEX	1600h
Name	Receive PDO mapping
Object Code	Record
Number of elements	01h - 04h
Data Type	PDO Mapping
<b>Value Description</b>	
Sub-Index	00h
Description	Number of mapped application objects in PDO
Access	Write only
PDO Mapping	NO
Value Range	Unsigned32
Default Value	2
Sub-Index	01h - 04h
Description	PDO mapping for the nth application object to be mapped
Access	Write only
PDO Mapping	NO
Value Range	Unsigned32
Default Value	Sub-index 01: Obj 7040h Sub index 02: Obj 7042h

**Object 1800: Transmit PDO1 Communication Parameter (Axis 1)**

<b>Object Description</b>	
INDEX	1800h
Name	Transmit PDO Communication Parameter
Object Code	Record
Number of elements	01h – 02h
Data Type	PDO Mapping
<b>Value Description</b>	
Sub-Index	00h
Description	Largest subindex supported
Access	Read only
PDO Mapping	NO
Value Range	2
Sub-Index	01h
Description	COB ID used by PDO
Access	Read only
PDO Mapping	NO
Value Range	Unsigned32
Default Value	180h + Node ID
Sub-Index	02h
Description	Transmission type
Access	Read / write
PDO Mapping	NO
Value Range	1 – 240 (only cyclic synchronous type)
Default Value	1

## **Object 1800:      Transmit PDO2 Communication Parameter (Axis 2)**

<b>Object Description</b>	
INDEX	1800h
Name	Transmit PDO Communication Parameter
Object Code	Record
Number of elements	01h – 02h
Data Type	PDO Mapping
<b>Value Description</b>	
Sub-Index	00h
Description	Largest subindex supported
Access	Read only
PDO Mapping	NO
Value Range	2
Sub-Index	01h
Description	COB ID used by PDO
Access	Read only
PDO Mapping	NO
Value Range	Unsigned32
Default Value	180h + Node ID+1
Sub-Index	02h
Description	Transmission type
Access	Read / write
PDO Mapping	NO
Value Range	1 – 240 (only cyclic synchronous type)
Default Value	1

### **Object 1800: Transmit PDO3 Communication Parameter (Axis 3)**

<b>Object Description</b>	
INDEX	1800h
Name	Transmit PDO Communication Parameter
Object Code	Record
Number of elements	01h – 02h
Data Type	PDO Mapping
<b>Value Description</b>	
Sub-Index	00h
Description	Largest subindex supported
Access	Read only
PDO Mapping	NO
Value Range	2
Sub-Index	01h
Description	COB ID used by PDO
Access	Read only
PDO Mapping	NO
Value Range	Unsigned32
Default Value	180h + Node ID + 2
Sub-Index	02h
Description	Transmission type
Access	Read / write
PDO Mapping	NO
Value Range	1 – 240 (only cyclic synchronous type)
Default Value	1

### **Object 1A00: Transmit PDO1 Mapping Parameter (Axis 1)**

<b>Object Description</b>	
INDEX	1A00h
Name	Transmit PDO mapping
Object Code	Record
Number of elements	01h - 04h
Data Type	PDO Mapping
<b>Value Description</b>	
Sub-Index	00h
Description	Number of mapped application objects in PDO
Access	Write only
PDO Mapping	NO
Value Range	Unsigned32
Default Value	2
Sub-Index	01h - 04h
Description	PDO mapping for the nth application object to be mapped
Access	Write only
PDO Mapping	NO
Value Range	Unsigned32
Default Value	Sub-index 01: Obj 6041h Sub index 02: Obj 6044h

**Object 1A00: Transmit PDO2 Mapping Parameter (Axis 2)**

<b>Object Description</b>	
INDEX	1A00h
Name	Transmit PDO mapping
Object Code	Record
Number of elements	01h - 04h
Data Type	PDO Mapping
<b>Value Description</b>	
Sub-Index	00h
Description	Number of mapped application objects in PDO
Access	Write only
PDO Mapping	NO
Value Range	Unsigned32
Default Value	2
Sub-Index	01h - 04h
Description	PDO mapping for the nth application object to be mapped
Access	Write only
PDO Mapping	NO
Value Range	Unsigned32
Default Value	Sub-index 01: Obj 6841h Sub index 02: Obj 6844h

**Object 1A00: Transmit PDO3 Mapping Parameter (Axis 3)**

<b>Object Description</b>	
INDEX	1A00h
Name	Transmit PDO mapping
Object Code	Record
Number of elements	01h - 04h
Data Type	PDO Mapping
<b>Value Description</b>	
Sub-Index	00h
Description	Number of mapped application objects in PDO
Access	Write only
PDO Mapping	NO
Value Range	Unsigned32
Default Value	2
Sub-Index	01h - 04h
Description	PDO mapping for the nth application object to be mapped
Access	Write only
PDO Mapping	NO
Value Range	Unsigned32
Default Value	Sub-index 01: Obj 7041h Sub index 02: Obj 7044h

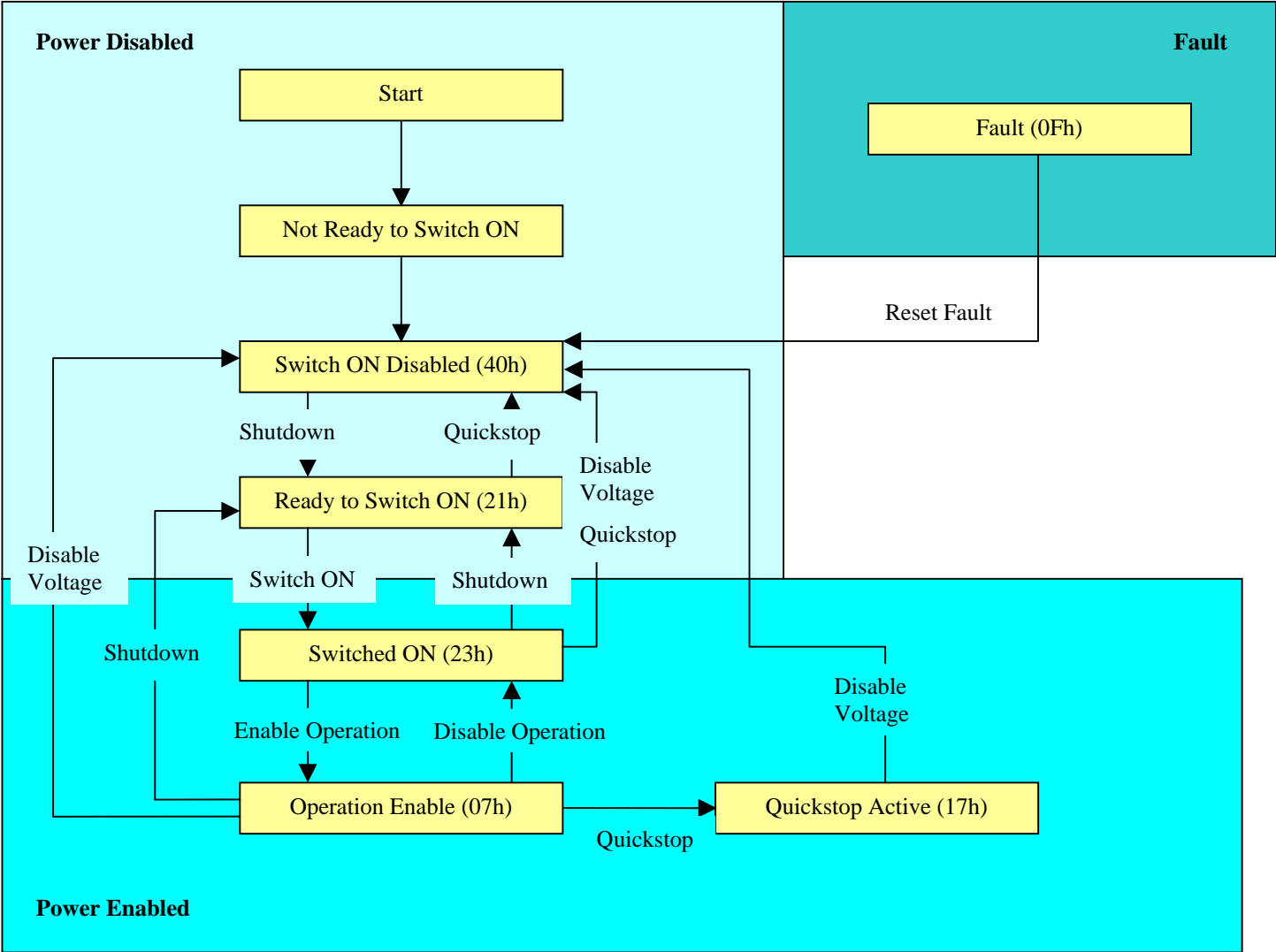
## **Object 2000:      Activate/Deactivate TxPDO**

<b>Object Description</b>	
INDEX	2000h
Name	Activate/Deactivate TxPDO
Object Code	Var
Data Type	Unsigned 8
<b>Value Description</b>	
Access	Read / Write
PDO Mapping	No
Value Range	0 - 7
Default Value	07h (TxPDO1, TxPDO2, TxPDO3 activated)

Value:

b7	b6	b5	b4	b3	b2	b1	b0	TxPDO3	TxPDO2	TxPDO1
0	0	0	0	0	0	0	0	not active	not active	not active
0	0	0	0	0	0	0	1	not active	not active	active
0	0	0	0	0	0	1	0	not active	active	not active
0	0	0	0	0	0	1	1	not active	active	active
0	0	0	0	0	1	0	0	active	not active	not active
0	0	0	0	0	1	0	1	active	not active	active
0	0	0	0	0	1	1	0	active	active	not active
0	0	0	0	0	1	1	1	active	active	active
				Ax3	Ax2	Ax1				

**Fig.6.1 State Machine**





## **Object 6040: Controlword - Axis 1**

<b>Object Description</b>	
INDEX	6040h
Name	Controlword
Object Code	Var
Data Type	Unsigned 16
<b>Value Description</b>	
Access	Read / Write
PDO Mapping	Possible
Value Range	0 - 65535
Default Value	(See Fig.6.1 State Machine Diagram)

**Tab.6.2 Controlword**

Transition	From		To	Command	Standard	Moog Italiana	6040 (hex)
1	Not Ready to Switch On	→	Switch On Disabled				
2	Switch On Disabled	→	Ready to Switch On	Shutdown	x x x x x 1 1 0	x x x x x 1 1 0	x6
3	Ready to Switch On	→	Switched On	Switch On	x x x x x 1 1 1	x x x x x 1 1 1	x7
4	Switched On	→	Operation Enable	Enable Operation	x x x x 1 1 1 1	x x x x 1 1 1 1	xF
5	Operation Enable	→	Switched On	Disable Operation	x x x x 0 1 1 1	x x x x 0 1 1 1	x7
6	Switched On	→	Ready to Switch On	Shutdown	x x x x x 1 1 0	x x x x x 1 1 0	x6
7	Ready to Switch On	→	Switch On Disabled	Quick Stop	x x x x x 0 1 x	x x x x x 0 1 x	x2
8	Operation Enable	→	Ready to Switch On	Shutdown	x x x x x 1 1 0	x x x x x 1 1 0	x6
9	Operation Enable	→	Switch On Disabled	Disable Voltage	x x x x x x 0 x	x x x x x x 0 x	x0
10	Switched On	→	Switch On Disabled	Disable Voltage	x x x x x x 0 x	x x x x x x 0 x	x0
				Quick Stop	x x x x x 0 1 x	x x x x x 0 1 x	x2
11	Operation Enable	→	Switch On Disabled	Quick Stop	x x x x x 0 1 x	x x x x x 0 1 x	x2
15	Fault	→	Switch On Disabled	Reset Fault	1 x x x x x x x	x x x x x x x x	8x
					b b b b b b b b	b b b b b b b b	
					7 6 5 4 3 2 1 0	7 6 5 4 3 2 1 0	

## Object 6041: Statusword - Axis 1

Object Description	
INDEX	6041h
Name	Statusword
Object Code	Var
Data Type	Unsigned 16
Value Description	
Access	Read only
PDO Mapping	Possible
Value Range	0 - 65535
Default Value	(See Fig.6.1 State Machine Diagram)

**Tab.6.3 Statusword**

State	Standard								Moog Italiana								6041 (hex)
Switch On Disabled	x	1	x	x	0	0	0	0	0	1	0	0	0	0	0	0	40
Ready to Switch On	x	0	1	x	0	0	0	1	0	0	1	0	0	0	0	1	21
Switched On	x	0	1	x	0	0	1	1	0	0	1	0	0	0	1	1	23
Operation Enabled	x	0	x	x	0	1	1	1	0	0	0	0	0	1	1	1	07
Quick Stop Active	x	0	0	x	0	1	1	1	0	0	0	1	0	1	1	1	17
Fault (SYNC absence)	-	-	-	-	-	-	-	-	0	0	0	0	1	1	1	1	0F
Fault (generic)	x	0	x	x	1	1	1	1	0	0	0	0	1	1	1	1	0F
	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	
	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	

**Object 6042: Target Velocity - Axis 1**

<b>Object Description</b>	
INDEX	6042h
Name	Target Velocity
Object Code	Var
Data Type	Integer 16
<b>Value Description</b>	
Access	Read / Write
PDO Mapping	Possible
Value Range	- 32768 / 32767
Default Value	0

**Object 6043: Velocity Demand - Axis 1**

<b>Object Description</b>	
INDEX	6043h
Name	Velocity Demand
Object Code	Var
Data Type	Integer 16
<b>Value Description</b>	
Access	Read Only
PDO Mapping	Possible
Value Range	- 32768 / 32767
Default Value	(drive output variable)

### **Object 6044: Control Effort - Axis 1**

<b>Object Description</b>	
INDEX	6044h
Name	Control Effort
Object Code	Var
Data Type	Integer 16
<b>Value Description</b>	
Access	Read Only
PDO Mapping	Possible
Value Range	- 32768 / 32767
Default Value	(drive output variable)

### **Object 6046: Velocity min-max amount - Axis 1**

<b>Object Description</b>	
INDEX	6046h
Name	Velocity min-max amount
Object Code	Array
Number of elements	2
Data Type	Unsigned 16
<b>Value Description</b>	
Sub-Index	01h
Description	Velocity min amount
Access	Read / Write
PDO Mapping	Possible
Value Range	Unsigned 16
Default Value	00h
Sub-Index	02h
Description	Velocity max amount
Access	Read / Write
PDO Mapping	Possible
Value Range	Unsigned16
Default Value	0C00h

### **Object 6048: Velocity acceleration - Axis 1**

<b>Object Description</b>	
INDEX	6048h
Name	Velocity acceleration
Object Code	Record
Number of elements	1
Data Type	Unsigned 16
<b>Value Description</b>	
Sub-Index	02h
Description	Delta Time
Access	Read / Write
PDO Mapping	NO
Value Range	Unsigned 16
Default Value	00h

### **Object 6049: Velocity deceleration - Axis 1**

<b>Object Description</b>	
INDEX	6049h
Name	Velocity deceleration
Object Code	Record
Number of elements	1
Data Type	Unsigned 16
<b>Value Description</b>	
Sub-Index	02h
Description	Delta Time
Access	Read / Write
PDO Mapping	NO
Value Range	Unsigned 16
Default Value	00h

### **Object 6060: Modes of Operation - Axis 1**

<b>Object Description</b>	
INDEX	6060h
Name	Modes of Operation
Object Code	Var
Data Type	Integer 8
<b>Value Description</b>	
Access	Write Only
PDO Mapping	NO
Value Range	01h - 02h
Default Value	02h (velocity mode)

## **Object 6061: Modes of Operation Display - Axis 1**

<b>Object Description</b>	
INDEX	6061h
Name	Modes of Operation Display
Object Code	Var
Data Type	Integer 8
<b>Value Description</b>	
Access	Write Only
PDO Mapping	NO
Value Range	01 - 02h
Default Value	02h (velocity mode)

## **Object 604C: Dimension factor - Axis 1**

<b>Object Description</b>	
INDEX	604Ch
Name	Numerator
Object Code	Array
Number of elements	1
Data Type	Integer 32
<b>Value Description</b>	
Sub-Index	01h
Description	MV
Access	Read / Write
PDO Mapping	NO
Value Range	012Ch - 2710h
Default Value	DBS Default

$$V_{out(d)} = V_{in(d)} \frac{MV_{(d)}}{4096_{(d)}}$$

**Object 6510: DBM Parameter**

<b>Object Description</b>	
INDEX	6510h
Name	DBM Parameter
Object Code	Array
Number of elements	3
Data Type	Integer 8
<b>Value Description</b>	
Sub-Index	01h
Description	KP - Proportional Gain
Access	Read / Write
PDO Mapping	NO
Value Range	00h - FFh
Default Value	DBM default
Sub-Index	02h
Description	KI – Integral Gain
Access	Read / Write
PDO Mapping	NO
Value Range	00h - FFh
Default Value	DBM Default
Sub-Index	03h
Description	IL – Current Limit
Access	Read / Write
PDO Mapping	NO
Value Range	00 - 64h
Default Value	DBM Default

**Object 67FF: Device Type – Axis 1**

<b>Object Description</b>	
INDEX	67FFh
Name	Device Type
Object Code	Var
Data Type	Unsigned 32
<b>Value Description</b>	
Access	Read only
PDO Mapping	NO
Value Range	Unsigned32
Default Value	00020402h



### **Object 6840: Controlword - Axis 2**

<b>Object Description</b>	
INDEX	6840h
Name	Controlword
Object Code	Var
Data Type	Unsigned 16
<b>Value Description</b>	
Access	Read / Write
PDO Mapping	Possible
Value Range	0 – 65535
Default Value	(See Fig.6.1 State Machine Diagram)

### **Object 6841: Statusword - Axis 2**

<b>Object Description</b>	
INDEX	6841h
Name	Statusword
Object Code	Var
Data Type	Unsigned 16
<b>Value Description</b>	
Access	Read only
PDO Mapping	Possible
Value Range	0 – 65535
Default Value	(See Fig.6.1 State Machine Diagram)

### **Object 6842: Target Velocity - Axis 2**

<b>Object Description</b>	
INDEX	6842h
Name	Target Velocity
Object Code	Var
Data Type	Integer 16
<b>Value Description</b>	
Access	Read / Write
PDO Mapping	Possible
Value Range	- 32768 / 32767
Default Value	0

### **Object 6843: Velocity Demand - Axis 2**

<b>Object Description</b>	
INDEX	6843h
Name	Velocity Demand
Object Code	Var
Data Type	Integer 16
<b>Value Description</b>	
Access	Read Only
PDO Mapping	Possible
Value Range	- 32768 / 32767
Default Value	(drive output variable)

### **Object 6844: Control Effort - Axis 2**

<b>Object Description</b>	
INDEX	6844h
Name	Control Effort
Object Code	Var
Data Type	Integer 16
<b>Value Description</b>	
Access	Read Only
PDO Mapping	Possible
Value Range	- 32768 / 32767
Default Value	(drive output variable)

### **Object 6846: Velocity min-max amount - Axis 2**

<b>Object Description</b>	
INDEX	6846h
Name	Velocity min-max amount
Object Code	Array
Number of elements	2
Data Type	Unsigned 16
<b>Value Description</b>	
Sub-Index	01h
Description	Velocity min amount
Access	Read / Write
PDO Mapping	Possible
Value Range	Unsigned 16
Default Value	00h
Sub-Index	02h
Description	Velocity max amount
Access	Read / Write
PDO Mapping	Possible
Value Range	Unsigned16
Default Value	0C00h

### **Object 6848: Velocity acceleration - Axis 2**

<b>Object Description</b>	
INDEX	6848h
Name	Velocity acceleration
Object Code	Record
Number of elements	1
Data Type	Unsigned 16
<b>Value Description</b>	
Sub-Index	02h
Description	Delta Time
Access	Read / Write
PDO Mapping	NO
Value Range	Unsigned 16
Default Value	00h

### **Object 6849: Velocity deceleration - Axis 2**

<b>Object Description</b>	
INDEX	6849h
Name	Velocity deceleration
Object Code	Record
Number of elements	1
Data Type	Unsigned 16
<b>Value Description</b>	
Sub-Index	02h
Description	Delta Time
Access	Read / Write
PDO Mapping	NO
Value Range	Unsigned 16
Default Value	00h

### **Object 6860: Modes of Operation - Axis 2**

<b>Object Description</b>	
INDEX	6860h
Name	Modes of Operation
Object Code	Var
Data Type	Integer 8
<b>Value Description</b>	
Access	Write Only
PDO Mapping	NO
Value Range	01h - 02h
Default Value	02h (velocity mode)

## **Object 6861: Modes of Operation Display - Axis 2**

<b>Object Description</b>	
INDEX	6861h
Name	Modes of Operation Display
Object Code	Var
Data Type	Integer 8
<b>Value Description</b>	
Access	Write Only
PDO Mapping	NO
Value Range	01h – 02h
Default Value	02h (velocity mode)

## **Object 684C: Dimension factor - Axis 2**

<b>Object Description</b>	
INDEX	684Ch
Name	Numerator
Object Code	Array
Number of elements	1
Data Type	Integer 32
<b>Value Description</b>	
Sub-Index	01h
Description	MV
Access	Read / Write
PDO Mapping	NO
Value Range	012Ch – 2710h
Default Value	DBS Default

$$V_{out(d)} = V_{in(d)} \frac{MV_{(d)}}{4096_{(d)}}$$

## **Object 6D10: DBM Parameter - Axis 2**

<b>Object Description</b>	
INDEX	6510h
Name	DBM Parameter
Object Code	Array
Number of elements	3
Data Type	Integer 8
<b>Value Description</b>	
Sub-Index	01h
Description	KP – Proportional Gain
Access	Read / Write
PDO Mapping	NO
Value Range	00h – FFh
Default Value	DBM default
Sub-Index	02h
Description	KI – Integral Gain
Access	Read / Write
PDO Mapping	NO
Value Range	00h - FFh
Default Value	DBM Default
Sub-Index	03h
Description	IL – Current Limit
Access	Read / Write
PDO Mapping	NO
Value Range	00 - 64h
Default Value	DBM Default

## **Object 6FFF: Device Type – Axis 2**

<b>Object Description</b>	
INDEX	6FFFh
Name	Device Type
Object Code	Var
Data Type	Unsigned 32
<b>Value Description</b>	
Access	Read only
PDO Mapping	NO
Value Range	Unsigned32
Default Value	00020402h

### **Object 7040: Controlword - Axis 3**

<b>Object Description</b>	
INDEX	7040h
Name	Controlword
Object Code	Var
Data Type	Unsigned 16
<b>Value Description</b>	
Access	Read / Write
PDO Mapping	Possible
Value Range	0 - 65535
Default Value	(See Fig.6.1 State Machine Diagram)

### **Object 7041: Statusword - Axis 3**

<b>Object Description</b>	
INDEX	7041h
Name	Statusword
Object Code	Var
Data Type	Unsigned 16
<b>Value Description</b>	
Access	Read only
PDO Mapping	Possible
Value Range	0 - 65535
Default Value	(See Fig.6.1 State Machine Diagram)

### **Object 7042: Target Velocity - Axis 3**

<b>Object Description</b>	
INDEX	7042h
Name	Target Velocity
Object Code	Var
Data Type	Integer 16
<b>Value Description</b>	
Access	Read / Write
PDO Mapping	Possible
Value Range	- 32768 / 32767
Default Value	0

### **Object 7043: Velocity Demand - Axis 3**

<b>Object Description</b>	
INDEX	7043h
Name	Velocity Demand
Object Code	Var
Data Type	Integer 16
<b>Value Description</b>	
Access	Read Only
PDO Mapping	Possible
Value Range	- 32768 / 32767
Default Value	(drive output variable)

### **Object 7044: Control Effort - Axis 3**

<b>Object Description</b>	
INDEX	7044h
Name	Control Effort
Object Code	Var
Data Type	Integer 16
<b>Value Description</b>	
Access	Read Only
PDO Mapping	Possible
Value Range	- 32768 / 32767
Default Value	(drive output variable)

### **Object 7046: Velocity min-max amount - Axis 3**

<b>Object Description</b>	
INDEX	7046h
Name	Velocity min-max amount
Object Code	Array
Number of elements	2
Data Type	Unsigned 16
<b>Value Description</b>	
Sub-Index	01h
Description	Velocity min amount
Access	Read / Write
PDO Mapping	Possible
Value Range	Unsigned 16
Default Value	00h
Sub-Index	02h
Description	Velocity max amount
Access	Read / Write
PDO Mapping	Possible
Value Range	Unsigned16
Default Value	0C00h

### **Object 7048: Velocity acceleration - Axis 3**

<b>Object Description</b>	
INDEX	7048h
Name	Velocity acceleration
Object Code	Record
Number of elements	1
Data Type	Unsigned 16
<b>Value Description</b>	
Sub-Index	02h
Description	Delta Time
Access	Read / Write
PDO Mapping	NO
Value Range	Unsigned 16
Default Value	00h

### **Object 7049: Velocity deceleration - Axis 3**

<b>Object Description</b>	
INDEX	7049h
Name	Velocity deceleration
Object Code	Record
Number of elements	1
Data Type	Unsigned 16
<b>Value Description</b>	
Sub-Index	02h
Description	Delta Time
Access	Read / Write
PDO Mapping	NO
Value Range	Unsigned 16
Default Value	00h

### **Object 7060: Modes of Operation - Axis 3**

<b>Object Description</b>	
INDEX	7060h
Name	Modes of Operation
Object Code	Var
Data Type	Integer 8
<b>Value Description</b>	
Access	Write Only
PDO Mapping	NO
Value Range	01h - 02h
Default Value	02h (velocity mode)



### **Object 7061: Modes of Operation Display - Axis 3**

<b>Object Description</b>	
INDEX	7061h
Name	Modes of Operation Display
Object Code	Var
Data Type	Integer 8
<b>Value Description</b>	
Access	Write Only
PDO Mapping	NO
Value Range	01h - 02h
Default Value	02h (velocity mode)

### **Object 704C: Dimension factor - Axis 3**

<b>Object Description</b>	
INDEX	704Ch
Name	Numerator
Object Code	Array
Number of elements	1
Data Type	Integer 32
<b>Value Description</b>	
Sub-Index	01h
Description	MV
Access	Read / Write
PDO Mapping	NO
Value Range	012Ch - 2710h
Default Value	DBS Default

$$V_{out(d)} = V_{in(d)} \frac{MV_{(d)}}{4096_{(d)}}$$

**Object 7510: DBM Parameter - Axis 3**

<b>Object Description</b>	
INDEX	7510h
Name	DBM Parameter
Object Code	Array
Number of elements	3
Data Type	Integer 8
<b>Value Description</b>	
Sub-Index	01h
Description	KP – Proportional Gain
Access	Read / Write
PDO Mapping	NO
Value Range	00h - FFh
Default Value	DBM default
Sub-Index	02h
Description	KI – Integral Gain
Access	Read / Write
PDO Mapping	NO
Value Range	00h - FFh
Default Value	DBM Default
Sub-Index	03h
Description	IL – Current Limit
Access	Read / Write
PDO Mapping	NO
Value Range	00 – 64h
Default Value	DBM Default

**Object 77FF: Device Type – Axis 3**

<b>Object Description</b>	
INDEX	77FFh
Name	Device Type
Object Code	Var
Data Type	Unsigned 32
<b>Value Description</b>	
Access	Read only
PDO Mapping	NO
Value Range	Unsigned32
Default Value	00020402h

**CAN data:**

Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Hex
Byte0	1	0	0	0	0	0	0	0	80
Byte1	xx	xx	xx	xx	xx	xx	xx	xx	xx
Byte2	xx	xx	xx	xx	xx	xx	xx	xx	xx
Byte3	xx	xx	xx	xx	xx	xx	xx	xx	xx
Byte4	AC0.7	AC0.6	AC0.5	AC0.4	AC0.3	AC0.2	AC0.1	AC0.0	xx
Byte5	AC1.7	AC1.6	AC1.5	AC1.4	AC1.3	AC1.2	AC1.1	AC1.0	xx
Byte6	EC0.7	EC0.6	EC0.5	EC0.4	EC0.3	EC0.2	EC0.1	EC0.0	xx
Byte7	CL1.7	CL1.6	CL1.5	CL1.4	CL1.3	CL1.2	CL1.1	CL1.0	xx

LSB Index  
MSB Index  
subindex  
AC 0  
AC 1  
EC 0  
CL 1

Object NOT available:	
AC 0 =	00
AC 1 =	00
EC 0 =	02
CL 1 =	06

Sub Index NOT available:	
AC 0 =	11
AC 1 =	00
EC 0 =	09
CL 1 =	06

Value range exceeded:	
AC 0 =	30
AC 1 =	00
EC 0 =	09
CL 1 =	06

Object cannot be mapped	
AC 0 =	41
AC 1 =	00
EC 0 =	04
CL 1 =	06

Data cannot be stored	
AC 0 =	20
AC 1 =	00
EC 0 =	00
CL 1 =	08

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