

# **R1-EC-5621**

**User Guide**

**操作手冊**

## **User Information**

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# Table of Contents

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<b>Chapter 1 Preface</b> .....	<b>1-1</b>
1.1 Inspection .....	1-1
1.2 Model Explanation.....	1-1
<b>Chapter 2 Specifications</b> .....	<b>2-1</b>
2.1 Product Figure .....	2-1
2.2 Specifications and Dimensions of R1-EC5621 .....	2-2
2.2.1 Electrical Specification .....	2-2
2.2.2 Dimensions .....	2-3
<b>Chapter 3 Product Description</b> .....	<b>3-1</b>
3.1 Description of Each Part.....	3-1
<b>Chapter 4 Wiring</b> .....	<b>4-1</b>
4.1 Wiring Example of Input Point .....	4-1
4.2 Wiring Example of Output Point .....	4-2
<b>Chapter 5 CiA402 Drive Profile</b> .....	<b>5-1</b>
5.1 Operation Mode.....	5-1
5.1.1 Related Object .....	5-1
5.1.2 Switching Operation Modes .....	5-1
5.2 Position Control Mode .....	5-2
5.2.1 Profile Position Mode .....	5-2
5.2.2 Cyclic Synchronous Position Mode .....	5-3
5.2.3 Homing.....	5-4
5.3 Touch Probe Function .....	5-9
<b>Chapter 6 Object Dictionary</b> .....	<b>6-1</b>
6.1 Object List .....	6-1
6.2 General Objects .....	6-2
6.2.1 Device Type (1000h) .....	6-2
6.2.2 Error Register (1001h) .....	6-2
6.2.3 Manufacturer Device Name (1008h) .....	6-2
6.2.4 Manufacturer Software Version (100Ah) .....	6-2
6.2.5 Identity Object (1018h) .....	6-2
6.3 PDO Mapping Objects.....	6-3
6.3.1 Receive PDO Mapping (1601h) .....	6-3
6.3.2 Transmit PDO Mapping (1A00h) .....	6-3
6.4 Sync Manager Communication Objects .....	6-4
6.4.1 Sync Manager Communication Type (1C00h) .....	6-4
6.4.2 Sync Manager PDO Assignment (1C12h to 1C13h) .....	6-4

6.5 Manufacturer Specific Objects.....	6-5
6.5.1 DDA OutputMode (2000h) .....	6-5
6.5.2 DDA InputMode (2001h) .....	6-5
6.5.3 ORG Inverse (2002h) .....	6-5
6.5.4 QZ Inverse (2003h) .....	6-6
6.5.5 Home special mode (2010h) .....	6-7
6.6 Device Control.....	6-7
6.6.1 Error Code (603Fh) .....	6-7
6.6.2 Controlword (6040h) .....	6-7
6.6.3 Statusword (6041h) .....	6-9
6.6.4 Shutdown Option Code (605Bh) .....	6-11
6.6.5 Disable Operation Option Code (605Ch) .....	6-11
6.6.6 Modes of Operation (6060h) .....	6-11
6.6.7 Modes of Operation Display (6061h) .....	6-11
6.6.8 Supported Drive Modes (6502h) .....	6-12
6.7 Profile Position Mode.....	6-13
6.7.1 Target Position (607Ah) .....	6-13
6.7.2 Software Position Limit (607Dh) .....	6-13
6.7.3 Max Profile Velocity (607Fh) .....	6-13
6.7.4 Profile Velocity (6081h) .....	6-14
6.7.5 Profile Acceleration (6083h) .....	6-14
6.7.6 Profile Deceleration (6084h) .....	6-14
6.7.7 Quick Stop Deceleration (6085h) .....	6-14
6.7.8 Motion profile type (6086h) .....	6-14
6.8 Homing Mode.....	6-15
6.8.1 Home Offset (607Ch) .....	6-15
6.8.2 Homing Method (6098h) .....	6-15
6.8.3 Homing Speeds (6099h) .....	6-16
6.8.4 Homing Acceleration (609Ah) .....	6-16
6.9 Position Control Function .....	6-17
6.9.1 Position Demand Value (6062h) .....	6-17
6.9.2 Position Actual Value (6064h) .....	6-17
6.10 Profile Velocity Mode.....	6-17
6.10.1 Velocity Actual Value (606Ch) .....	6-17
6.10.2 Target Velocity (60FFh) .....	6-17
6.11 Touch Probe Function .....	6-18
6.11.1 Touch Probe Function (60B8h) .....	6-18
6.11.2 Touch Probe Status (60B9h) .....	6-18
6.11.3 Touch Probe Position Value (60BAh) .....	6-19
<b>Chapter 7 SDO Error Message Abort Codes.....</b>	<b>7-1</b>

7.1 SDO Error Message Abort Codes.....7-1

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# Chapter 1 Preface

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## 1.1 Inspection

Please inspect the following items carefully.

1. Package: Make sure the package is complete.
2. Bubble wrap: It can protect the product. Please make sure the sticker is firmly stuck on it.
3. R1-EC5621: Please make sure no damage is shown on its appearance and the accessories are all attached.
4. Installation Guide: Check if there is an installation guide.

## 1.2 Model Explanation

R      1      -      EC      5      6      2      1  
( 1 )   ( 2 )            ( 3 )   ( 4 )            ( 5 )            ( 6 )

( 1 ) Product Type	R: Remote
( 2 ) Product Category	1: Type 1 - Slim
( 3 ) Product Name	EC: EtherCAT Slave Component
( 4 ) Module Type	5: Gateway Special Module
( 5 )	62: Motion Type
( 6 )	1: 1-Axis Pulse Train Output Motion Control

## 1.3 Using R1-EC5621

This product has to be used with R1-EC5500 of Delta Electronics.

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# Chapter 2 Specifications

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## 2.1 Product Figure

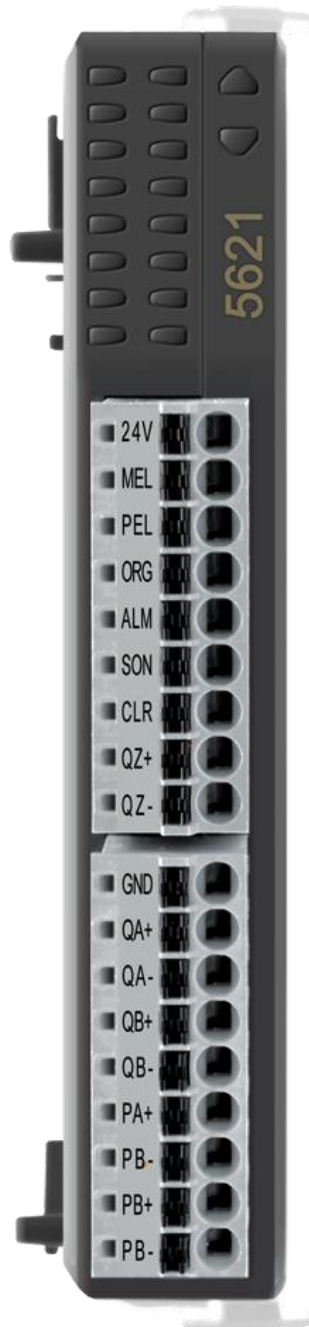


Figure 2.1 Front View

## 2.2 Specifications and Dimensions of R1-EC5621

### 2.2.1 Electrical Specifications

Item	R1-EC5621
Differential Signal Output	1 Channel (PA+, PA-, PB+, PB-)
Differential Signal Input	1 Channel (QA+, QA-, QB+, QB-, QZ+, QZ-)
Power Supply	via E-bus
Voltage of Differential Signal	RS422 Level
Max. Output Current of Differential Signal	RS422 Standard
Range of Pulse Output Frequency	1 Hz ~ 4 MHz
Digital Input 24 V	4 Points (MEL, PEL, ORG, ALM)
Digital Output 24 V	2 Points (CLR, SON)
Active Level (ON > OFF)	< 8 VDC
Active Level (OFF > ON)	> 16.5 VDC
Permissible Current	30 mA
E-bus Current Draw	150 mA
Electrical isolation	500 Vrms (E-bus/ Signal Voltage)
Bit Width during Mapping	32 DI/O (1x16 bit, 1x16 bit Control/Status)
Vibration/Shock Resistance	Conforms to EN 60068-2-6 / EN 60068-2-27/29
Noise Immunity	ESD (IEC 61131-2, IEC 61000-4-2): 8 KV Air Discharge EFT (IEC 61131-2, IEC 61000-4-4): Power Line: 2 KV, Communication I/O: 1 KV RS (IEC 61131-2, IEC 61000-4-3): 80 MHz ~ 1 GHz, 10 V/m
Ambient Temperature	Operation: 0°C ~ 50°C; Storage: -20°C ~ 70°C

### 2.2.2 Dimensions

Dimensions: 100 mm x 73.2 mm x 17.5 mm

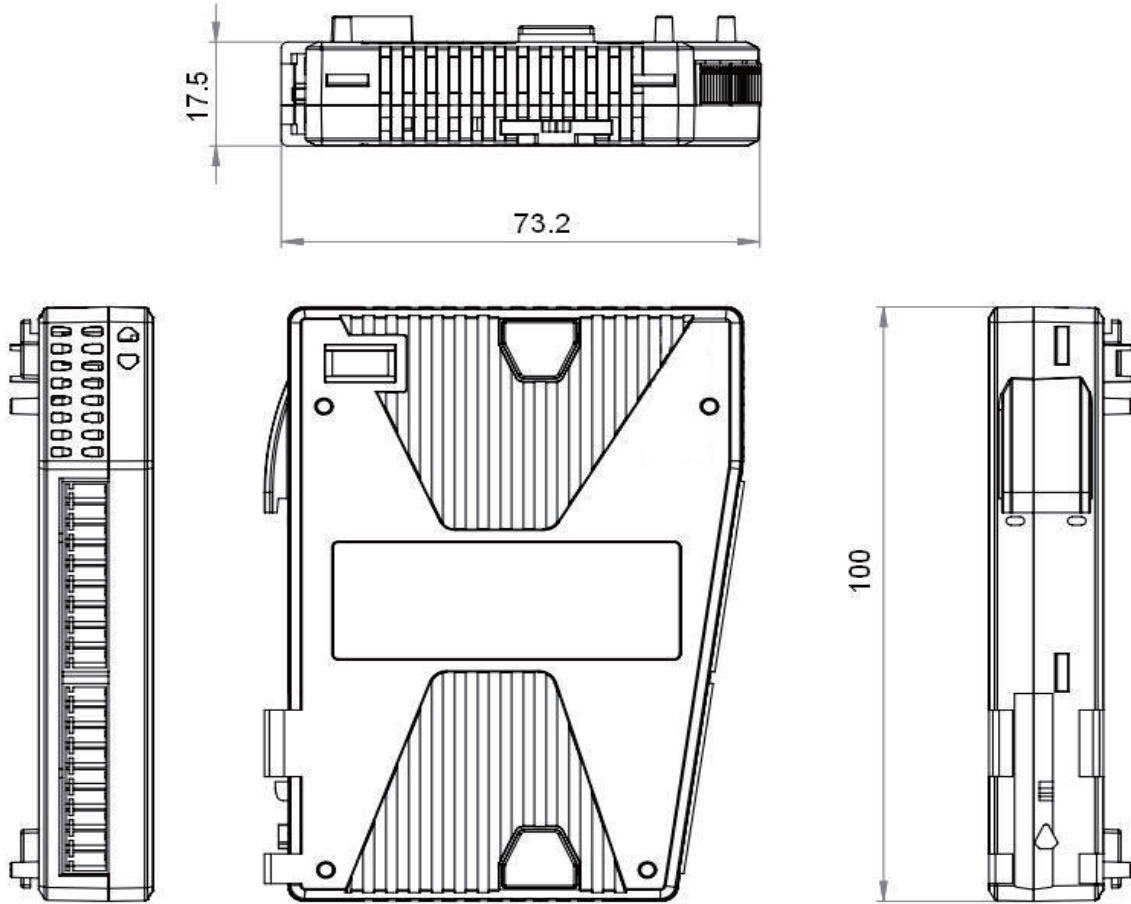


Figure 2.2 Dimension of R1-EC5621

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# Chapter 3 Product Description

## 3.1 Description of Each Part

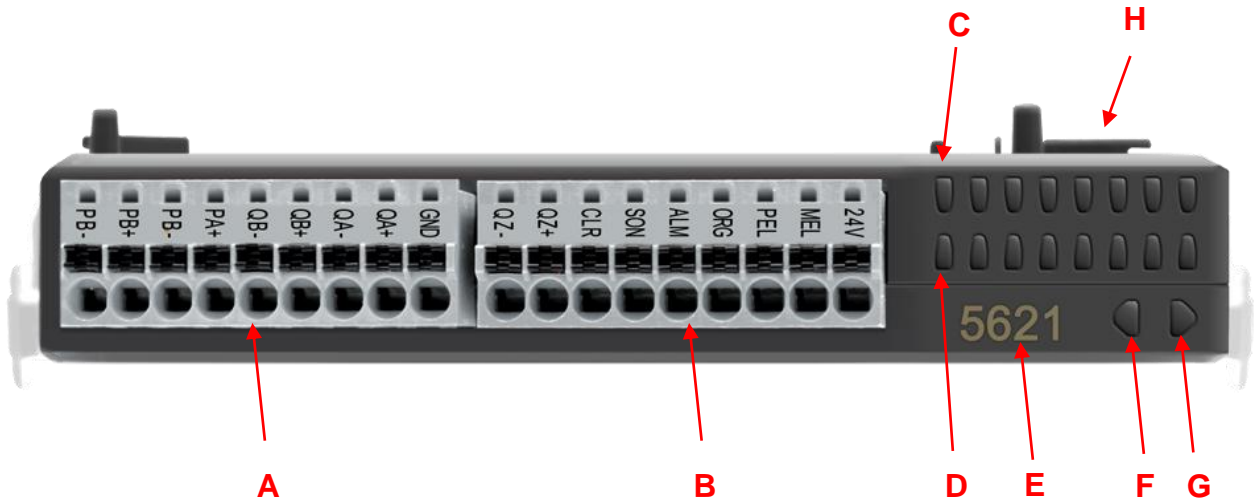


Figure 3.1 Identification of Each Part

No.	Description
A	Single-Axis IO Signal Port
B	Single-Axis IO Port
C	(Part A) Single-Axis IO Signal Indicator
D	(Part B) Single-Axis IO Signal Indicator
E	Product ID Number
F	Status Indicator
G	Power Indicator
H	E-BUS Input Port



Figure 3.2 Pin Definition of Part B

Label	Description
24V	24 V Input
MEL	Negative Limit Signal Input
PEL	Positive Limit Signal Input
ORG	Home Limit Signal Input
ALM	Alarm Signal Input
SON	SVON Signal Output
CLR	Clear Signal Output
QZ+	Encoder Z Phase Signal Input (+)
QZ-	Encoder Z Phase Signal Output (-)



Figure 3.3 Pin Definition of Part A

Label	Description
GND	24 V Power Ground
QA+	Encoder A Phase Signal Input (+)
QA-	Encoder A Phase Signal Input (-)
B+	Encoder B Phase Signal Input (+)
QB-	Encoder B Phase Signal Input (-)
PA+	Output Pulse Signal (+)
PA-	Output Pulse Signal (-)
PB+	Direction Signal (+)
PB-	Direction Signal (-)



Figure 3.4 Indicator Definition

Label	Description	Label	Description
1	MEL	9	QA+
2	PEL	10	QA-
3	ORG	11	QB+
4	ALM	12	QB-
5	SON	13	PA+
6	CLR	14	PA-
7	QZ+	15	PB+
8	QZ-	16	PB-

# Chapter 4 Wiring

## 4.1 Wiring Example of Input Point

Wiring of Input Point (MEL, PEL, ORG, ALM)

Connection Type: SINK

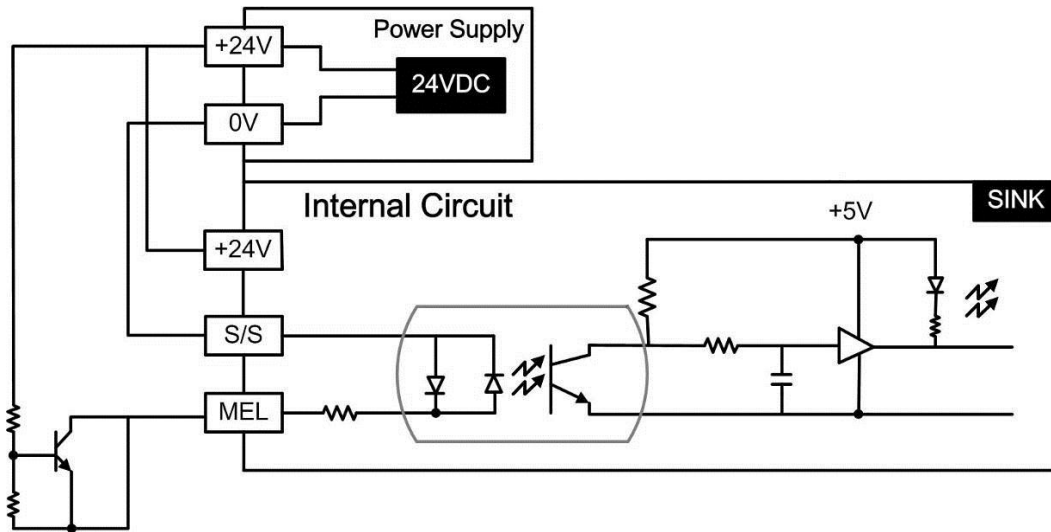


Figure 4.1 Wiring Example of Input Point (SINK)

Wiring of Input Point (QA+, QA-, QB+, QB-, QZ+, QZ-)

Connection Type: Differential

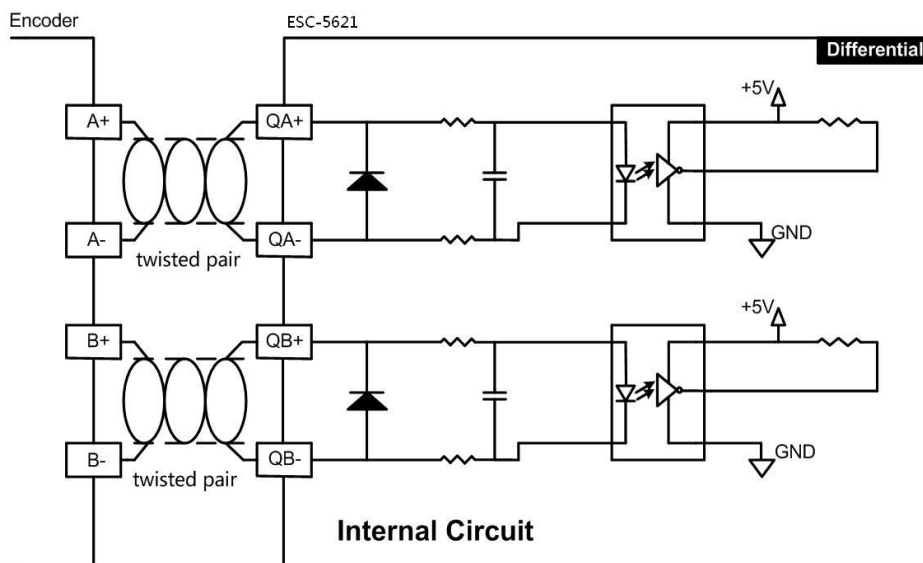


Figure 4.2 Wiring Example (Differential Type)

## 4.2 Wiring Example of Output Point

Wiring of Output Point (SVON, RALM)

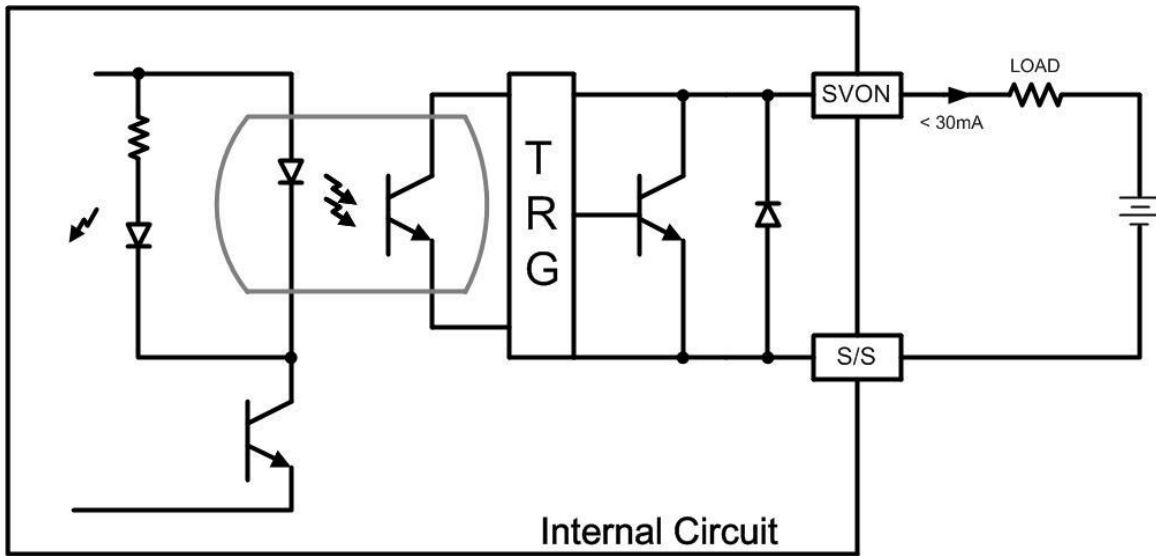


Figure 4.3 Wiring Example of Output Point

Wiring of Output Point (PA+, PA-, PB+, PB-)

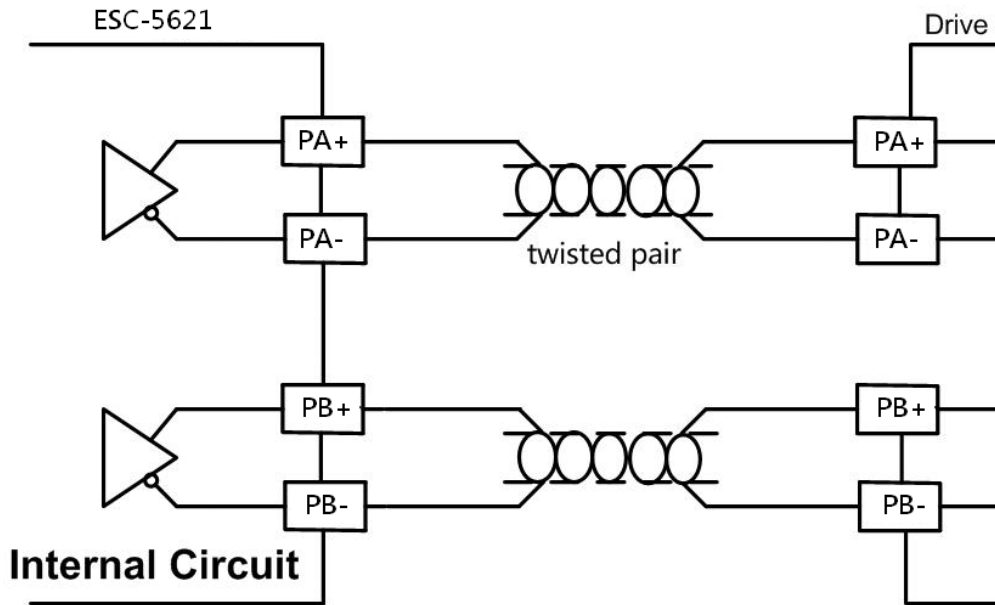


Figure 4.4 Wiring Example of Output Point



# Chapter 5 CiA402 Drive Profile

## 5.1 Operation Mode

R1-EC5621 supports the following operation modes:

- Profile Position Mode
- Homing Mode
- Cyclic Sync Position Mode

### 5.1.1 Related Objects

Index	Sub Index	Name	Access	PDO Mapping	Units	Type
6060h	-	Modes of operation	RW	NO	-	SINT
6061h	-	Modes of operation display	RO	NO	-	SINT
6502h	-	Supported drive modes	RO	NO	-	UDINT

### 5.1.2 Switching Operation Modes

Operation modes can be switched via 6060h. The host station is in charge of synchronously updating all data of operation modes. If the host station switches to another operation mode, R1-EC5621 will immediately switch to the given mode. The following table illustrates the behavior during switching modes.

New Operation Mode	Behavior when Switching to a New Operation Mode
Profile Position Mode	Controlword bit4 = 0 → Operation mode is changed, but motor will be stopped. Controlword bit4 = 1 → New positioning will be started immediately.
Homing Mode	Controlword bit4 = 0 → Operation mode is changed, but motor will be stopped. Controlword bit4 = 1 → Homing will be started immediately.
Cyclic Sync Position Mode	New operation mode will be started immediately.

## 5.2 Position Control Mode

### 5.2.1 Profile Position Mode

The function of Profile Position mode is to specify the velocity and acceleration, allowing the motor to reach the target position from the start position. Below is the block diagram of Profile Position mode.

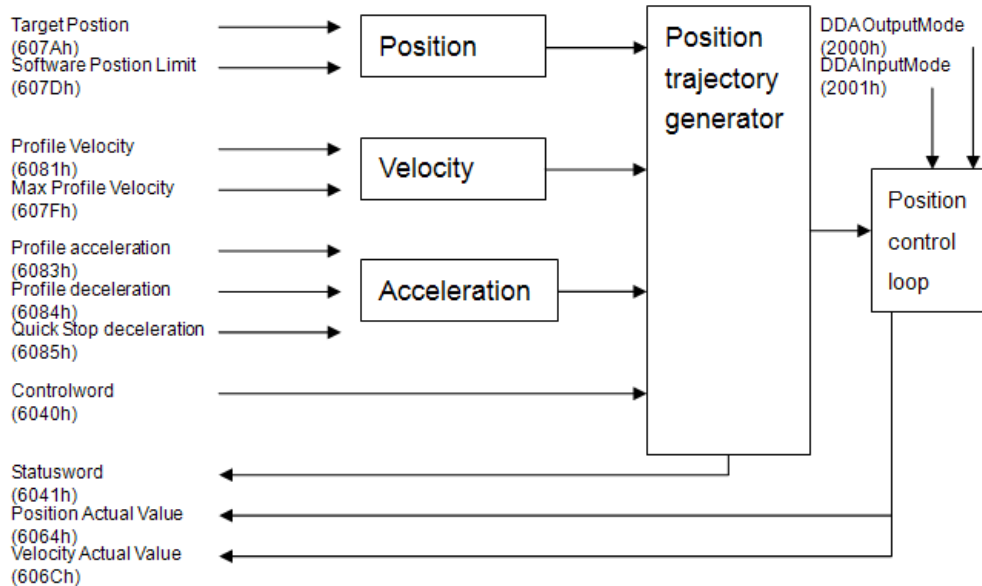


Figure 5.1 Block Diagram of Profile Position Mode

#### Related Objects

Index	Sub	Name	Access	PDO Mapping	Units	Type
6040h	-	Controlword	RW	Yes	-	UINT
6041h	-	Statusword	RO	Yes	-	UINT
6064h	-	Position actual value	RO	Yes	Pos Units	DINT
606Ch	-	Velocity actual value	RO	No	Vel Units	DINT
607Ah	-	Target position	RW	Yes	Pos Units	DINT
607Dh	-	Software position limit	-	-	-	-
	1	Min. position limit	RW	No	Pos Units	DINT
	2	Max. position limit	RW	No	Pos Units	DINT
607Fh	-	Max. profile velocity	RW	No	Vel Units	UDINT
6081h	-	Profile velocity	RW	No	Vel Units	UDINT
6083h	-	Profile acceleration	RW	No	Acc Units	UDINT
6084h	-	Profile deceleration	RW	No	Acc Units	UDINT
6085h	-	Quick stop deceleration	RW	No	Acc Units	UDINT

### 5.2.2 Cyclic Synchronous Position Mode

Cyclic Synchronous Position mode is used to control the offset of single-axis or multi-axis per cycle via cyclic synchronization time and thus achieving multi-axis interpolation.

The interpolation time period defines the time period between two updates of the target position and/or additive position and shall be used for intercycle interpolation. Target position shall be interpreted absolute value.

The following is block diagram of Cyclic Synchronous Position mode:

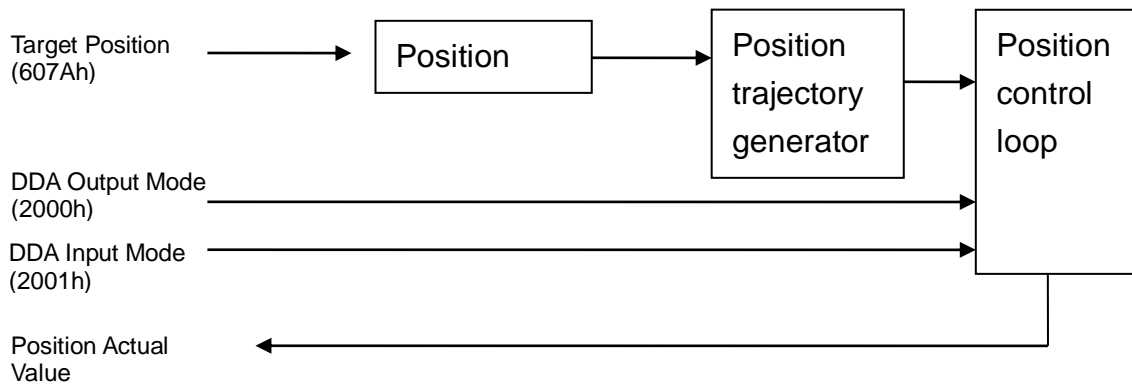


Figure 5.2 Block Diagram of Cyclic Synchronous Position Mode

#### Related Objects

Index	Sub Index	Name	Access	PDO Mapping	Units	Type
607Ah	-	Target position	RW	Yes	Pos Units	DINT
607Dh	-	Software position limit	-	-	-	-
	1	Min. position limit	RW	No	Pos Units	DINT
	2	Max. position limit	RW	No	Pos Units	DINT
607Fh	-	Max. profile velocity	RW	No	Vel Units	UDINT

### 5.2.3 Homing

The block diagram below shows the input and output objects of homing mode. Users may specify the speed, acceleration, and method of homing. There is a further object *home offset* which allows user to displace zero in the user's coordinate system from the home position.

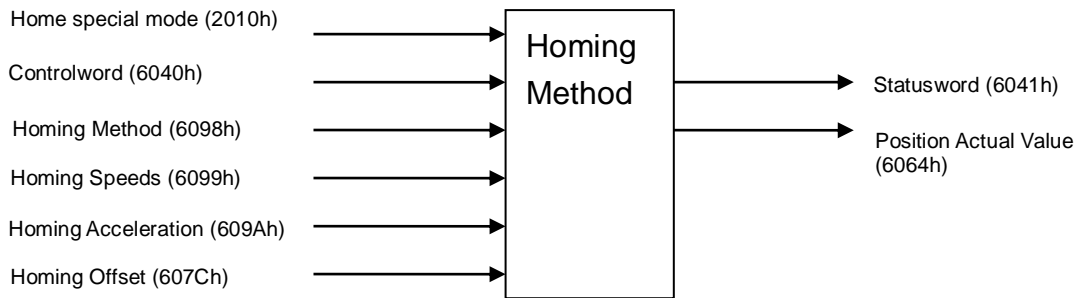


Figure 5.3 Block Diagram of Homing Mode

#### Related Objects

Index	Sub Index	Name	Access	PDO Mapping	Units	Data Type
2010h	-	Home special mode	RW	No	-	UINT
6040h	-	Controlword	RW	Yes	-	UINT
6041h	-	Statusword	RO	Yes	-	UINT
607Ch	-	Home offset	RW	No	Pos Units	DINT
6098h	-	Homing method	RW	No	-	SINT
6099h	-	Homing speeds	-	-	-	-
	1	Speed during search for switch	RW	No	Vel Units	UDINT
	2	Speed during search for zero	RW	No	Vel Units	UDINT
609Ah	-	Homing acceleration	RW	No	Acc Units	UDINT

**Homing Method (6098h)**

**Method 1:** Homing on the negative limit switch and index pulse

Using this method the initial direction of movement is leftward if the negative limit switch is inactive (here shown as low). The home position is at the first index pulse to the right of the position where the negative limit switch becomes inactive.

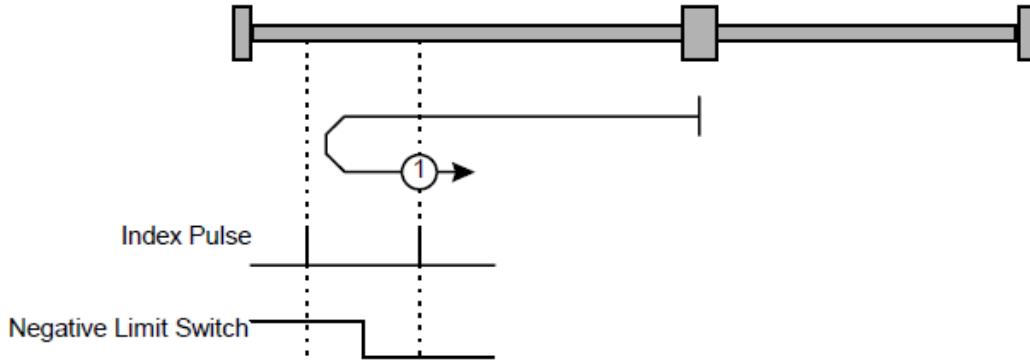


Figure 5.4

**Method 2:** Homing on the positive limit switch and index pulse

Using this method the initial direction of movement is rightward if the positive limit switch is inactive (here shown as low). The home position is at the first index pulse to the left of the position where the positive limit switch becomes inactive.

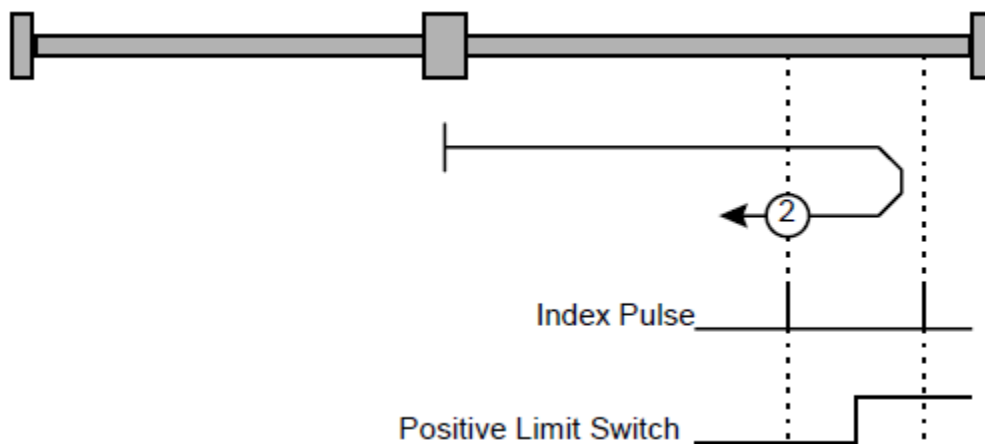


Figure 5.5

**Methods 3 and 4:** Homing on the positive home switch and index pulse

Using methods 3 or 4 the initial direction of movement is dependent on the state of the home switch. The home position is at the index pulse to either to the left or the right of the point where the home changes state. If the initial position is sited so that the direction of movement must reverse during homing, the point at which the reversal takes place is anywhere after a change of state of the home switch.

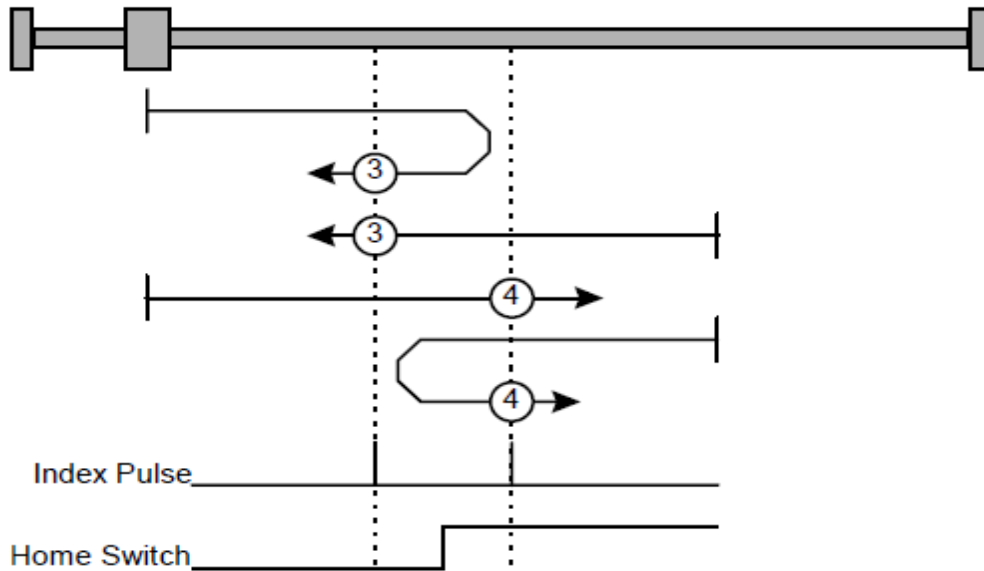


Figure 5.6

**Methods 5 and 6:** Homing on the negative home switch and index pulse

Using methods 5 or 6 the initial direction of movement is dependent on the state of the home switch. The home position is at the index pulse to either to the left or the right of the point where the home changes state. If the initial position is sited so that the direction of movement must reverse during homing, the point at which the reversal takes place is anywhere after a change of state of the home switch.

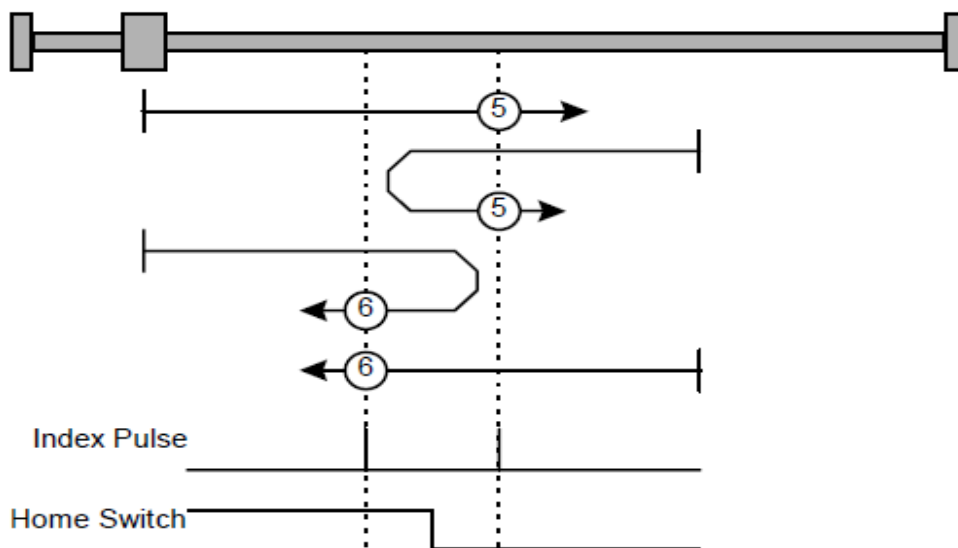


Figure 5.7

**Methods 7 ~ 14: Homing on the home switch and index pulse**

These methods use a home switch which is active over only portion of the travel; in effect the switch has a ‘momentary’ action as the axle’s position sweeps past the switch. Using methods 7 to 10 the initial direction of movement is to the right, and using methods 11 to 14 the initial direction of movement is to the left except if the home switch is active at the start of the motion. I

In this case the initial direction of motion is dependent on the edge being sought. The home position is at the index pulse on either side of the rising or falling edges of the home switch, as shown in the following two diagrams. If the initial direction of movement leads away from the home switch, the drive must reverse on encountering the relevant limit switch.

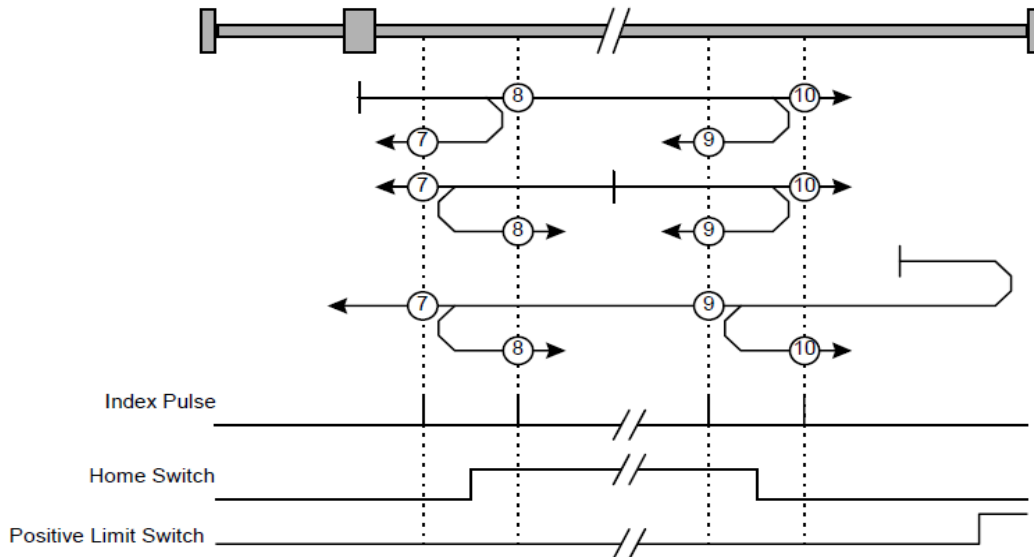


Figure 5.8

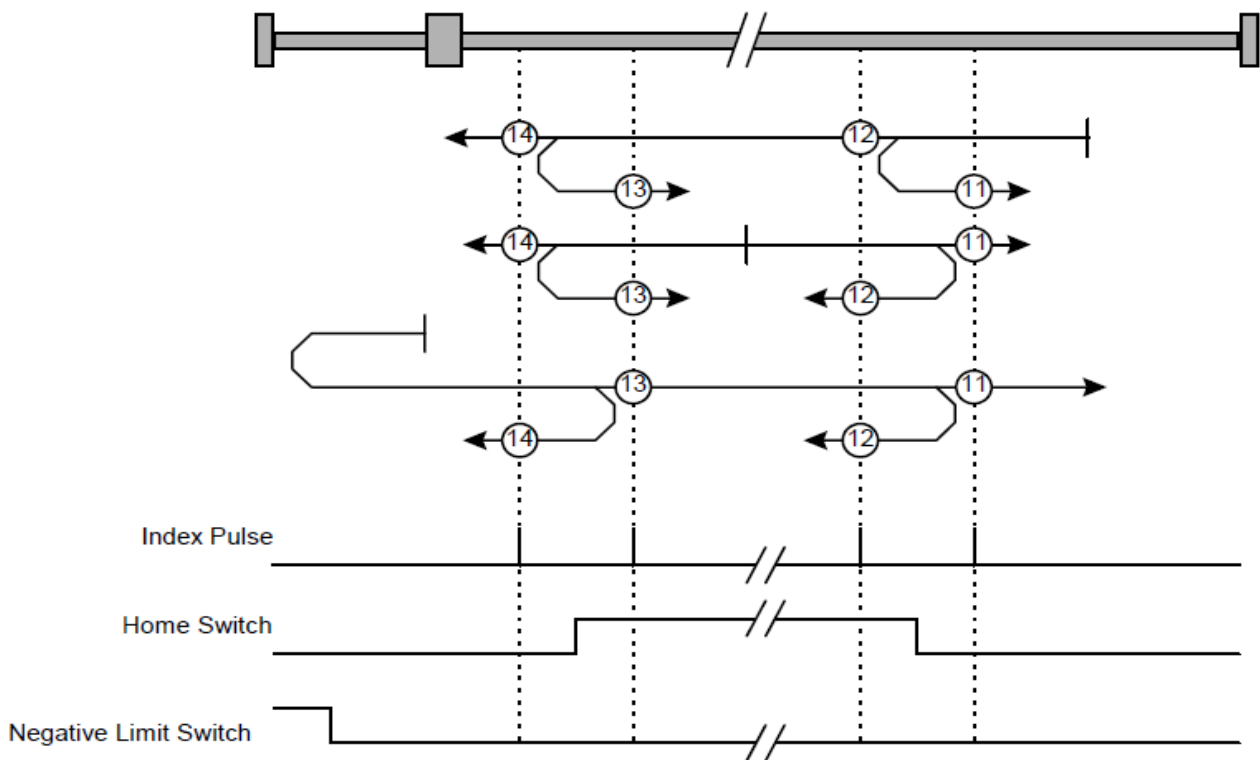


Figure 5.9

**Methods 15 and 16:** Reserved

These methods are reserved for future expiation application of the homing mode.

**Methods 17 ~ 30:** Homing without an index pulse

These methods are similar to methods 1 to 14 except that the home position is not dependent on the index pulse but only dependent on the relevant home or limit switch transitions. For example, methods 19 and 20 are similar to methods 3 and 4 as shown in Figure 5.10.

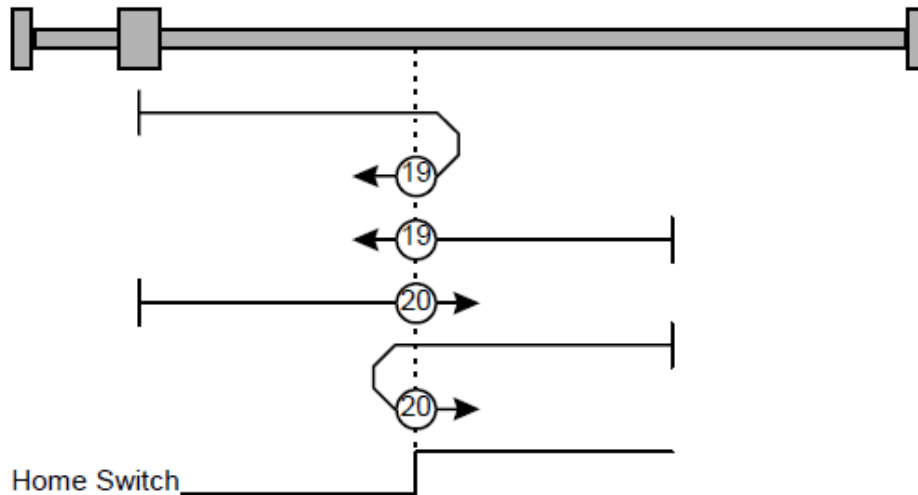


Figure 5.10

**Methods 31 and 32:** Reserved

These methods are reserved for future expansion application of the homing mode.

**Methods 33 and 34:** Homing on the index pulse

Using methods 33 or 34 the direction of homing is negative or positive respectively. The home position is at the index pulse found in the selected direction.

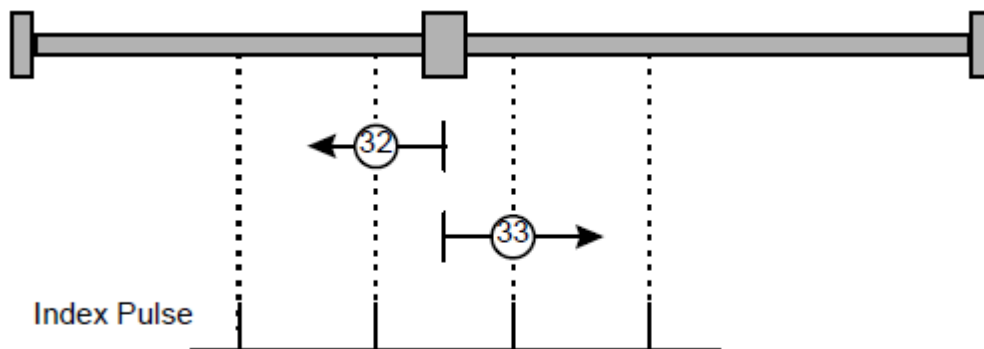


Figure 5.11

**Method 35:** Homing on current position

Method 35 the current position is taken to be the home position.



### 5.3 Touch Probe Function

The feedback position can be latched with the following trigger events :

- ORG signal trigger
- QZ signal trigger

Supporting one set of Touch Probe Function.

- Latch Control: 60B8h (Bit 0 to 7)
- Latch Status: 60B9h (Bit 0 to 7)
- Latch position is always stored to the Touch Probe1 Position Value (60BAh).
- Trigger Signal: ORG signal / QZ signal

#### Related Objects

Index	Sub Index	Name	Access	PDO Mapping	Units	Type
60B8h	-	Touch probe function	RW	No	-	UINT
60B9h	-	Touch probe status	RO	No	-	UINT
60BAh	-	Touch probe 1 position value	RO	No	-	DINT

The figure below shows the operation of Touch probe function.

- Single Trigger Mode (60B8h bit1 = 0)

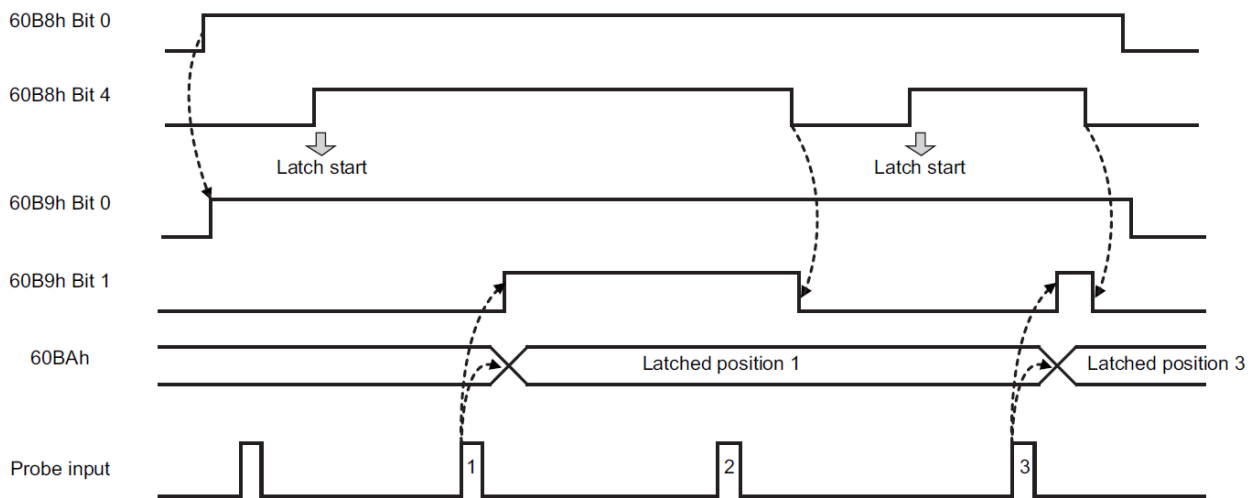


Figure 5.12

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# Chapter 6 Object Dictionary

## 6.1 Object List

	Object Dictionaries	Refer to
General Objects	Device type (1000h)	6.2.1
	Error register (1001h)	6.2.2
	Manufacturer device name (1008h)	6.2.3
	Manufacturer software version (100Ah)	6.2.4
	Identity object (1018h)	6.2.5
PDO Mapping Objects	Receive PDO mapping (1601h)	6.3.1
	Transmit PDO mapping (1A00h)	6.3.2
Sync Manager Communication Objects	Sync manager communication type (1C00h)	6.4.1
	Sync manager PDO assignment (1C12h to 1C13h)	6.4.2
	Sync manager synchronization (1C32h, 1C33h)	6.4.3
Manufacturer Specific Objects	DDA output mode (2000h)	6.5.1
	DDA input mode (2001h)	6.5.2
	ORG inverse (2002h)	6.5.3
	QZ inverse (2003h)	6.5.4
	Home special mode (2010h)	6.5.5
Device Control	Error code (603Fh)	6.6.1
	Controlword (6040h)	6.6.2
	Statusword (6041h)	6.6.3
	Shutdown option code (605Bh)	6.6.4
	Disable operation option code (605Ch)	6.6.5
	Modes of operation (6060h)	6.6.6
	Modes of operation display (6061h)	6.6.7
	Supported drive modes (6502h)	6.6.8
Profile Position Mode	Target position (607Ah)	6.7.1
	Software position limit (607Dh)	6.7.2
	Max. profile velocity (607Fh)	6.7.3
	Profile velocity (6081h)	6.7.4
	Profile acceleration (6083h)	6.7.5
	Profile deceleration (6084h)	6.7.6
	Quick stop deceleration (6085h)	6.7.7
	Motion profile type (6086h)	6.7.8
Homing Mode	Home offset (607Ch)	6.8.1
	Homing method (6098h)	6.8.2
	Homing speeds (6099h)	6.8.3
	Homing acceleration (609Ah)	6.8.4
Position Control Function	Position demand value (6062h)	6.9.1
	Position actual value (6064h)	6.9.2
Profile Velocity Mode	Velocity actual value (606Ch)	6.10.1
	Target velocity(60FFh)	6.10.2
Touch Probe Function	Touch probe function (60B8h)	6.11.1
	Touch probe status (60B9h)	6.11.2
	Touch probe 1 position value (60BAh)	6.11.3

## 6.2 General Objects

### 6.2.1 Device Type (1000h)

This object shall indicate the type of device and its functionality.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEPROM
1000h	0	Device type	UDINT	RO	No	0x00040192	No

Additional information (bit0~15): 0004 (stepping motor)

General Information (bit16~31): 0192 (DS402)

### 6.2.2 Error Register (1001h)

This object is an error register for the device. The value of this object is stored in the Emergency message.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEPROM
1001h	0	Error register	USINT	RO	No	0x00	No

### 6.2.3 Manufacturer Device Name (1008h)

This object shall acquire the device name of R1-EC5621.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEPROM
1008h	0	Manufacturer device name	STRING	RO	No	-	No

### 6.2.4 Manufacturer Software Version (100Ah)

This object shall acquire information about the software version of R1-EC8124.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEPROM
100Ah	0	Manufacturer software version	STRING	RO	No	-	No

The current version is 1.10.

### 6.2.5 Identity Object (1018h)

This object shall acquire basic information about the device.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEPROM
1018h	0	Number of entries	USINT	RO	No	4	No
	1	Vendor ID	UDINT	RO	No	0x00001A05	Yes
	2	Product code	UDINT	RO	No	0x00005621	Yes
	3	Revision number	UDINT	RO	No	0x00100000	Yes
	4	Serial number	UDINT	RO	No	0x00000000	Yes

## 6.3 PDO Mapping Objects

EtherCAT in CANopen protocol allows users to map objects to process data objects (PDO) and use these PDOs to conduct data transmission.

### 6.3.1 Receive PDO Mapping (1601h)

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEPROM
1601h	0	Number of objects in this PDO	USINT	RO	No	2	No
	1	Mapping entry 1	UDINT	RW	No	0 to 0xFFFFFFFF (Default:0x60400010)	No
	2	Mapping entry 2	UDINT	RW	No	0 to 0xFFFFFFFF (Default:0x607A0020)	No

### 6.3.2 Transmit PDO Mapping (1A00h)

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEPROM
1A00h	0	Number of objects in this PDO	USINT	RO	No	2	No
	1	Mapping entry 1	UDINT	RW	No	0 to 0xFFFFFFFF (Default:0x60410010)	No
	2	Mapping entry 2	UDINT	RW	No	0 to 0xFFFFFFFF (Default:0x60640020)	No

## 6.4 Sync Manager Communication Objects

### 6.4.1 Sync Manager Communication Type (1C00h)

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEP-ROM
1C00h	0	Number of used sync manager channels	USINT	RO	No	4	No
	1	Communication type sync manager 0	USINT	RO	No	1: mailbox receive (Master to slave)	No
	2	Communication type sync manager 1	USINT	RO	No	2: mailbox send (Slave to master)	No
	3	Communication type sync manager 2	USINT	RO	No	3: process data output (Master to slave)	No
	4	Communication type sync manager 3	USINT	RO	No	4: process data input (Slave to master)	No

### 6.4.2 Sync Manager PDO Assignment (1C12h to 1C13h)

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEP-ROM
1C12h	0	Number of assigned PDOs	USINT	RW	No	1	Yes
	1	PDO mapping object index of assigned RxPDO 1	UINT	RW	No	1601h	Yes
1C13h	0	Number of assigned PDOs	USINT	RW	No	1	Yes
	1	PDO mapping object index of assigned TxPDO 1	UINT	RW	No	1A00h	Yes

## 6.5 Manufacturer Specific Objects

### 6.5.1 DDA Output Mode (2000h)

This object shall indicate the configured DDA output mode.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEPROM
2000h	0	DDA output mode	UINT	RW	No	0 to 2	No

#### Data Description

Data	Data Meaning
0	A/B Phase
1	CW/CCW
2	PLS/DIR

### 6.5.2 DDA Input Mode (2001h)

This object shall configure DDA Input mode.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEPROM
2001h	0	DDA input mode	UINT	RW	No	0 to 1	No

#### Data Description

Data	Data Meaning
0	A/B phase
1	CW/CCW
2	Command pulse

### 6.5.3 ORG Inverse (2002h)

This object shall be used to indicate the signal of QZ inverse.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEPROM
2002h	0	ORG inverse	UINT	RW	No	0 to 1	No

#### Data Description

Data	Data Meaning
0	Normal
1	Inverse

### 6.5.4 QZ Inverse (2003h)

This object shall indicate the configured the inverse of QZ signal inverse.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEPROM
2003h	0	QZ inverse	UINT	RW	No	0 to 1	No

#### Data Description

Data	Data Meaning
0	Normal
1	Inverse

### 6.5.5 Home Special Mode (2010h)

This object shall indicate the configured special mode of homing, which will slow down the speed of homing but making it stop at the edge signal (limit) with higher precision.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEPROM
2010h	0	Home special mode	UINT	RW	No	0 to 1	No

#### Data Description

Data	Data Meaning
0	Mode 0 (normal)
1	Mode 1



## 6.6 Device Control

### 6.6.1 Error Code (603Fh)

This object shall provide the error code of the last alarm or warning, which occurred in R1-EC5621.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEPROM
603Fh	0	Error code	UINT	RO	No	0	No

### 6.6.2 Controlword (6040h)

This object shall indicate the module status, including control of operating modes and manufacturer-defined operation.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEPROM
6040h	0	Controlword	UINT	RW	Yes	0 to 0xFFFF(Default: 0)	No

#### Controlword Bits

Bit No	Function	Description
0	Switch on	See <Details on Bits 0 to 3>.
1	Enable voltage	
2	Quick stop	
3	Enable operation	
4 to 6	– (Reserved)	See <Details on Bits 4 to 9>.
7	Fault reset	
8	Halt	
9 to 15	– (Reserved)	

#### <Details on Bits 0 to 3>

- Bit 0 to 3: Control commands of the module status

Command	Bits of the Controlword				
	Bit7	Bit3	Bit2	Bit1	Bit0
Shutdown	0	-	1	1	0
Switch on	0	0	1	1	1
Switch on + Enable operation	0	1	1	1	1
Quick stop	0	-	0	1	-
Disable operation	0	0	1	1	1
Enable operation	0	1	1	1	1
Fault reset	0→1	-	-	-	-

<Details on Bits 4 to 8>

- Bit 4: PP mode control bits

Bit4	Definition
0→1	Start the next positioning after the current positioning completes (target reached)

- Bit 6 and 8: PP mode Control bits

Bit	Function	Value	Definition
6	Abs/rel	0	Target position is an absolute value.
		1	Target position is a relative value.
8	Halt	0	Positioning is executed or continued.
		1	Stop axis with profile deceleration

- Bit 4 and 8: Homing mode Control bits

Bit	Function	Value	Definition
4	Homing operation start	0	Do not start homing procedure
		1	Start or continue homing procedure
8	Halt	0	Execute the instruction of bit 4
		1	Stop axis with homing deceleration

### 6.6.3 Statusword (6041h)

Statusword indicates the current status of the module.

Statusword bits include current module status and status of current operation mode.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEPROM
6041h	0	Statusword	UINT	RO	Yes	0	No

#### Statusword Bits

Bit	Status	Description
0	Ready to Switch On	See <Details on Bits 0 to 6>.
1	Switched On	
2	Operation Enabled	
3	Fault	
4	Voltage Enabled	
5	Quick Stop	
6	Switch on Disabled	
7	Reserved	-
8	Accelerate and Decelerate	See <Details on Bits 8 and 10>.
9	Remote	Controlword (6040h) is processed
10	Target Reached	See <Details on Bits 8 and 10>.
11	Internal Limit Active	-
12	Reserved	-
13	Reserved	-
14	+EL	See <Details on Bits 14.15>.
15	-EL	

#### <Details on Bits 0 to 7>

- Bit 0 to 7: Current status of the module

Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Drive State
0	-	-	0	0	0	0	Not Ready to Switch On
1	-	-	0	0	0	0	Switch on Disabled
0	1	-	0	0	0	1	Ready to Switch On
0	1	-	0	0	1	1	Switched On
0	1	-	0	1	1	1	Operation Enabled
0	0	-	0	1	1	1	Quick Stop Active
0	-	-	1	1	1	1	Fault Reaction Active
0	-	-	1	0	0	0	Fault
-	-	1	-	-	-	-	Main Power On

## &lt;Details on Bit 11&gt;

- Bit11: Internal limit active

Internal limit is active under the following condition:

- +EL/-EL signals are activated

## &lt;Details on Bits 8 and 10&gt;

- Bit 8 and10: PP Mode

Bit No	Description	Value	Definition
8	Accelerate and Decelerate	0	Acceleration or Deceleration Phase
		1	Stage at Constant Speed
10	Target reached	0	Halt (Bit 8 in Controlword) = 0: Target Position Not Reached Halt (Bit 8 in Controlword) = 1: Axis Decelerates
		1	Halt (Bit 8 in Controlword) = 0: Target Position Reached Halt (Bit 8 in Controlword) = 1: Velocity of Axis is 0

- Bit 8 and 10: Homing Mode

Bit No	Description	Value	Definition
8	Accelerate and Decelerate	0	Acceleration or Deceleration Phase
		1	Stage at Constant Speed
10	Target reached	0	Halt (Bit 8 in Controlword) = 0: Target Position Not Reached Halt (Bit 8 in Controlword) = 1: Axis Decelerates
		1	Halt (Bit 8 in Controlword) = 0: Target Position Reached Halt (Bit 8 in Controlword) = 1: Velocity of Axis is 0

## &lt;Details on Bit 14.15&gt;

Bit No	Description	Value	Definition
14	Positive Limit Switch	0	Positive Limit Switch is OFF
		1	Positive Limit Switch is ON
15	Negative Limit Switch	0	Negative Limit Switch is OFF
		1	Negative Limit Switch is ON

### 6.6.4 Shutdown Option Code (605Bh)

This object shall indicate what action is performed if there is a transition from Operation Enabled state to Ready to Switch on state.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEPROM
605Bh	0	Statusword	INT	RW	No	0	No

#### Data Description

Value	Data Description
0	Disable drive function (transit into Switch On Disabled).

### 6.6.5 Disable Operation Option Code (605Ch)

This object shall indicate what action is performed if there is a transition from Operation Enable state to Switched on state.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEPROM
605Ch	0	Disable operation option code	INT	RW	No	0	No

#### Data Description

Value	Data Description
0	Disable drive function (transit into Switch On Disabled).

### 6.6.6 Modes of Operation (6060h)

This object shall indicate the requested operation mode.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEPROM
6060h	0	Modes of operation	SINT	RW	No	0 to 10	No

#### Data Description

Value	Data Description
0	No mode change / No mode assigned
1	Profile Position mode
6	Homing mode
8	Cyclic Sync Position mode

### 6.6.7 Modes of Operation Display (6061h)

This object shall provide the actual operation mode. The operation mode that corresponds to the feedback value is identical to 6060h

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEPROM
6061h	0	Modes of operation display	SINT	RO	No	0	No

### 6.6.8 Supported Drive Modes (6502h)

This object shall provide information about the supported operation modes on this device.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEPROM
6502h	0	Supported drive modes	UDINT	RO	No	00A1	No

#### Data Description

Bit	Supported Modes	Definition
0	Pp (Profile Position mode)	1: Supported
1	VI (Velocity mode)	0: Not Supported
2	Pv (Profile Velocity mode)	0: Not Supported
3	Tq (Torque Profile mode)	0: Not Supported
4	Reserved	0
5	Hm (Homing mode)	1: Supported
6	Ip (Interpolated Position mode)	0: Not Supported
7	Csp (Cyclic Sync Position mode)	1: Supported
8	Csv (Cyclic Sync Velocity mode)	0: Not Supported
9	Cst (Cyclic Sync Torque mode)	0: Not Supported
10 to 31	Reserved	

## 6.7 Profile Position Mode

### 6.7.1 Target Position (607Ah)

This object shall indicate the target position of PP mode and CSP mode. In PP mode, the value of this object shall be interpreted as absolute or relative depending on the abs/rel flag in the controlword. In addition, in CSP mode, the value of this object will be absolute only.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEPROM
607Ah	0	Target position	DINT	RW	Yes	-2147483648 to +2147483647 (Default: 0) [Pos. unit]	No

### 6.7.2 Software Position Limit (607Dh)

This object shall indicate the configured maximal and minimal software position limits. These parameters shall define the absolute position limits for the position demand value and the position actual value. Every new target position shall be checked against these limits. The limit positions shall be always relative to the machine home position. Software position limit will be abled in the condition below:

- Homing completed

Software position limit will be disabled in the condition below:

- Min. position limit  $\geq$  Max. position limit

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEPROM
607Dh	0	Number of entries	USINT	RO	No	2	No
	1	Min. position limit	DINT	RW	No	-536870912 to 536870911 (Default: 0) [Pos. unit]	No
	2	Max. position limit	DINT	RW	No	-536870912 to 536870911 (Default: 0) [Pos. unit]	No

### 6.7.3 Max Profile Velocity (607Fh)

This object shall indicate the configured maximal allowed velocity in forward/reverse direction.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEPROM
607Fh	0	Max. profile velocity	UDINT	RW	No	0 to 4000000 (Default: 4000000) [Vel. unit]	No

### 6.7.4 Profile Velocity (6081h)

This object shall indicate the configured velocity normally attained at the end of the acceleration ramp.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEP-ROM
6081h	0	Profile velocity	UDINT	RW	No	0 to 4294967295 (Default: 0) [Vel. unit]	No

### 6.7.5 Profile Acceleration (6083h)

This object shall indicate the configured acceleration of Profile Modes

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEP-ROM
6083h	0	Profile acceleration	UDINT	RW	No	0 to 4294967295 (Default: 3000) [Acc. unit]	No

### 6.7.6 Profile Deceleration (6084h)

This object shall indicate the configured deceleration of Profile Modes.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEP-ROM
6084h	0	Profile deceleration	UDINT	RW	No	0 to 4294967295 (Default: 3000) [Acc. unit]	No

### 6.7.7 Quick Stop Deceleration (6085h)

This object shall indicate the configured deceleration used to stop the motor when the quick stop function is activated.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEP-ROM
6085h	0	Quick stop deceleration	UDINT	RW	No	0 to 4294967295 (Default: 3000) [Acc. unit]	No

### 6.7.8 Motion profile type (6086h)

This object shall indicate the configured type of motion profile used to perform a profiled motion.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEPROM
6086h	0	Motion profile type	INT	RW	No	0 to 1 (Default: 0)	No

#### Data Description

Data	Data Meaning
0	T-Curve
1	S-Curve



## 6.8 Homing Mode

### 6.8.1 Home Offset (607Ch)

This object shall indicate the configured difference between the zero position for the application and the machine home position (found during homing). During homing, the machine home position is found and once the homing is completed, the zero position is offset from the home position by adding the home offset to the home position.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEP-ROM
607Ch	0	Home offset	DINT	RW	No	-536870912 to +536870911 (Default: 0) [Pos. unit]	No

### 6.8.2 Homing Method (6098h)

This object shall indicate the configured homing method that shall be used. Please refer to Chapter 5.2.3 Homing.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEPROM
6098h	0	Homing method	SINT	RW	No	0 to 35 (Default: 35)	No

#### Data Description

Value (Method)	Data Description
0	No homing operation required
1	Homing on the negative limit switch and index pulse
2	Homing on the positive limit switch and index pulse
3 to 4	Homing on the positive home switch and index pulse
5 to 6	Homing on the negative home switch and index pulse
7 to 14	Homing on the home switch and index pulse
17	Homing on the negative limit switch and index pulse Same homing as Method 1 (without an index pulse)
18	Homing on the positive limit switch and index pulse Same homing as Method 2 (without an index pulse)
19 to 20	Homing on the positive home switch and index pulse Same homing as Method 3.4 (without an index pulse)
21 to 22	Homing on the negative home switch and index pulse Same homing as Method 5.6 (without an index pulse)
23 to 30	Homing on the home switch and index pulse Same homing as Method 7~14 (without an index pulse)
33, 34	Homing on index pulse
35	Homing on the current position

### 6.8.3 Homing Speeds (6099h)

This object shall indicate the configured speed used during homing procedure.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEP-ROM
6099h	0	Number of entries	USINT	RO	No	2	No
	1	Speed during search for switch	UDINT	RW	No	0 to 4294967295 (Default: 500000) [Vel. unit]	No
	2	Speed during search for zero	UDINT	RW	No	0 to 4294967295 (Default: 100000) [Vel. unit]	No

### 6.8.4 Homing Acceleration (609Ah)

This object shall indicate the configured acceleration and deceleration to be used during homing operation.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEP-ROM
609Ah	0	Homing acceleration	UDINT	RW	No	0 to 4294967295 (Default: 1000) [Acc. unit]	No

## 6.9 Position Control Function

### 6.9.1 Position Demand Value (6062h)

This object shall provide the demanded position value.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEP-ROM
6062h	0	Position demand value	DINT	RO	No	– [Pos. unit]	No

### 6.9.2 Position Actual Value (6064h)

This object shall provide actual value of position measurement of the module.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEP-ROM
6064h	0	Position actual value	DINT	RO	No	– [Pos. unit]	No

## 6.10 Profile Velocity Mode

### 6.10.1 Velocity Actual Value (606Ch)

This object shall provide the actual value of velocity.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEPROM
606Ch	0	Velocity actual value	DINT	RO	No	– [Vel. unit]	No

### 6.10.2 Target Velocity (60FFh)

This object shall indicate the configured target velocity in Profile Velocity and Cyclic Synchronous Velocity according to the user-defined value

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEPROM
60FFh	0	Target velocity	DINT	RW	No	–2147483648 to +2147483647 (Default: 0) [Vel. unit]	No

## 6.11 Touch Probe Function

### 6.11.1 Touch Probe Function (60B8h)

This object shall indicate the configured function of the touch probe.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEP-ROM
60B8h	0	Touch probe function	UINT	RW	No	0 to 0xFFFF	No

#### Data Description

Bit	Value	Data Description
0	0	Switch off touch probe
	1	Enable touch probe
1	0	Single trigger mode
	1	Continuous trigger mode
2	0	Triggers with the ORG signal
	1	Triggers with the QZ signal
3	–	Reserved
4	0	Switch off sampling at touch probe
	1	Enable sampling at touch probe
5 to 15	–	Reserved

In homing mode, touch probe function is disabled; if touch probe function is enabled, touch probe will be prohibited.

### 6.11.2 Touch Probe Status (60B9h)

This object shall provide the status of touch probe

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEPROM
60B9h	0	Touch probe status	UINT	RO	No	-	No

#### Data Description

Bit	Value	Data Description
0	0	Touch probe 1 is switched off
	1	Touch probe 1 is enabled
1	0	Touch probe 1 no value stored
	1	Touch probe 1 value stored
2 to 15	0	Reserved

### 6.11.3 Touch Probe 1 Position Value (60BAh)

This object shall be used to store the position value acquired after latching.

Index	Sub Index	Name	Data Type	Access	PDO Mapping	Value	EEPROM
60BAh	0	Touch probe 1 position value	DINT	RO	No	-	No

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# Chapter 7 SDO Error Message Abort Codes

## 7.1 SDO Error Message Abort Codes

The following table lists the SDO error message abort codes.

Abort Code	Description
0x05 03 00 00	Toggle bit not alternated.
0x05 04 00 00	SDO protocol timeout.
0x05 04 00 01	Client/server command specifier not valid or unknown.
0x05 04 00 05	Out of memory.
0x06 01 00 05	Unsupported access to an object.
0x06 01 00 00	Attempt to read an object.
0x06 03 00 02	Attempt to write a read-only object.
0x06 02 00 00	Object does not exist in the object dictionary.
0x06 04 00 41	Object cannot be mapped to the PDO.
0x06 04 00 42	The number and length of the objects to be mapped would exceed PDO length.
0x06 04 00 43	General parameter incompatibility.
0x06 04 00 47	General internal error in device.
0x06 06 00 00	Access failed due to a hardware error.
0x06 07 00 10	Data type does not match; length of service parameter does not match.
0x06 07 00 12	Data type does not match; length of service parameter too high.
0x06 07 00 13	Data type does not match; length of service parameter too low.
0x06 09 00 11	Sub-index does not exist.
0x06 09 00 30	Value range of parameter exceeded (only for write access).
0x06 09 00 31	Value of parameter written too high.
0x06 09 00 32	Value of parameter written too low.
0x06 09 00 36	Maximum value is less than minimum value.
0x08 00 00 00	General error.
0x08 00 00 20	Data cannot be transferred or stored in the application.
0x08 00 00 21	Data cannot be transferred or stored in the application because of local control.
0x08 00 00 22	Data cannot be transferred or stored in the application because of present device state.
0x08 00 00 23	Object dictionary dynamic generation fails or no object dictionary is present.

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