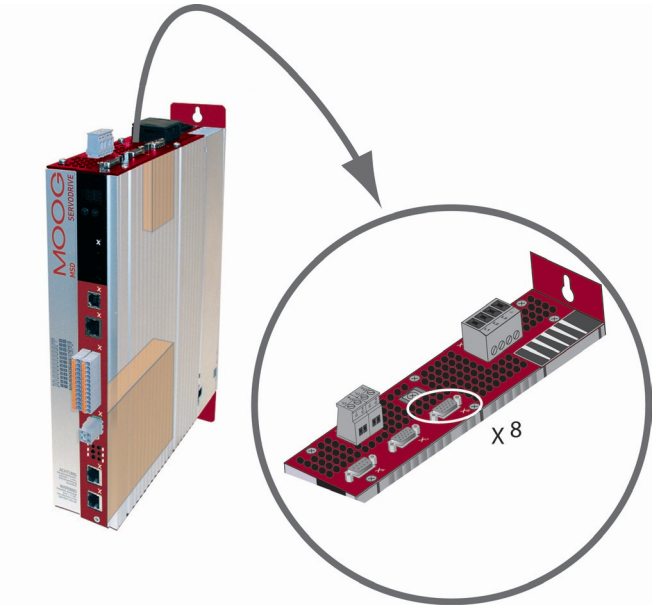
MSD Servo Drive

Specification



Option 2 - Technology

TWINsync option

Specification Option 2 - Technology

TWINsync option

ID no.: CB08759-001 Rev. 1.2

Date: 03/2023

This documentation is applicable to:

Series	Model	Hardware version	Firmware version
MSD Servo Drive Single-Axis System	G392-xxxxx4xxxxx G395-xxx-x4xxxxx	up to ...3.xxxx.0 up to ...3.xxxx.0	up to V2.15 / V201.07 / V230.00
MSD Servo Drive Multi-Axis System	G393-xxx-x4xxxxx G397-xxx-x4xxxxx	up to ...3.xxxx.0	
MSD Servo Drive Compact	G394-xxx-x4xxxxx	up to ...3.xxxx.0	

NOTE

This document is not a substitute for the MSD Servo Drive Operation Manual. Please be certain to observe the information about “Measures for Your Safety”, “Intended Use” and “Responsibilities” which can be found in the operation manual. Information about installation, connections, commissioning and promised technical specifications for the MSD Servo Drive series can be found in the additional documents (Operation Manual, Device Help, etc.).

Legal information

Subject to technical change without notice.

This Specification has been prepared based on DIN EN 82079-1. The content was compiled with the greatest care and attention and reflects the latest information available to us.

We should nevertheless point out that this document cannot always be updated in line with ongoing technical developments in our products.

Information and specifications may be subject to change at any time. For information on the latest version please visit https://www.moogsoftwaredownload.com/msd.html.

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1 General information

The KEBA Industrial Automation Germany GmbH documentation set contains the complete documentation belonging to the respective product series. The documentation of a product series includes Operation Manual (hardware description), Device Help (software description) and other User manuals (e.g. fieldbus description) and Specifications. They are available in PDF format.

1.1 Target group

Dear user,

the documentation is an integral part of the device and contains important information on operation and service. It is aimed at everyone who performs mounting, set-up, commissioning and service tasks on the product.

1.2 Requirements

Requirements for using KEBA Industrial Automation Germany GmbH devices:

- The documentation for the devices must be legible, accessible at all times and kept for the product's entire service life.
- Read and understand the documentation for your device.
- Qualification: To avoid bodily injury and property damage, only qualified personnel with electrical training may work with/on the device.
- Required skills and knowledge:
  - national accident prevention rules (e.g. DGUV V3 in Germany)
  - How to set up, install, commission and operate the device

Work related to other specialised areas, such as transportation, storage and disposal must be performed exclusively by appropriately trained personnel.

1.3 Applicable documentation

All further applicable documents can be found on our website at www.keba.com in the DOCUMENT PORTAL.

1.4 Pictograms

The pictograms used in this document have the following meaning for the user:

NOTE

- Useful information.

- Reference to applicable documents.

1.5 Exclusion of Liability

Observing all the instructions and information in the documentation for KEBA Industrial Automation Germany GmbH devices is a prerequisite:

- for safe operation and
- to attain the performance characteristics and product characteristics described.

KEBA Industrial Automation Germany GmbH accepts no liability for personal injury, material damage or financial losses arising from failing to observe the documentation.

1.6 Support

Our Technical Helpline helps you quickly and expertly if you have any technical questions concerning project planning or commissioning your device.

Address:	KEBA Industrial Automation Germany GmbH Gewerbestraße 5-9 35633 Lahnau Germany

The Technical Helpline can be reached by e-mail or telephone:

Opening hours:	Mon–Fri: 8 am–5 pm (CET)
Email:	Helpline-DE@Keba.com
Telephone:	+49 6441 966-180

NOTE

- For detailed information on our services, please visit our website, www.keba.com, under ►Service.

1 General information

2 The TWINsync technology option

This documentation describes the TWINsync technology option for the MSD Servo Drive. The TWINsync technology option is based on an optional communication interface available for the MSD Servo Drive for option slot 2 (X8) which can be used to connect two MSD Servo Drive devices with one another. The use of the TWINsync option is therefore geared towards applications in which the synchronous operation of two drives is required or in which one drive needs to use the I/O or encoder interfaces of another drive.

Any process data desired can be exchanged between two drives via the TWINsync option. The data exchange is bidirectional and operates together with the sampling time of the speed control. As an alternative, pre-configured telegram types or telegrams that can be configured as desired are available.

The TWINsync communication interface contains a synchronization mechanism. The MSD Servo Drive parametrized as the TWINsync master generates a cyclical signal pulse on the SYNC_OUT line of the interface which is synchronous with its own control cycle. The MSD Servo Drive parametrized as the TWINsync slave receives the synchronization signal on its SYNC_IN line and synchronizes its own control cycle with the TWINsync master.

NOTE:
In the “TWINsync-Slave” TWIN mode, the source for the synchronization must be configured suitably because of the different synchronization mechanisms that exist when a real-time field bus (including EtherCAT, SERCOS II/III, CAN, Profinet IRT, Powerlink) or MSD Servo Drive Safety-Slave is used at the same time. Possible synchronization sources are the TWIN option itself, a real-time field bus or the safety cross-communication.

The process data that are to be exchanged via the TWINsync interface can be defined via the configuration parameters. A setting must be made for both the TWINsync master and the TWINsync slave specifying from which parameters the sent data should be taken and to which parameters the received data should be copied. In addition to a freely definable configuration, there are also pre-set telegrams (TWIN operation modes) for masters and slaves available for selection.

A maximum of up to 30 bytes of usable data can be sent via the TWINsync interface, depending on the baud rate selected (250 kBaud - 4 MBaud) and the TWIN sampling time (dependent on the switching frequency, 250 µs or 125 µs). The default settings are 4 MBaud and 10 bytes of usable data. The following list summarizes the performance characteristics of the TWINsync option in keywords.

Performance characteristics of the TWINsync option:

- Serial data transfer via a twisted pair cable (EIA485) in master-slave operation
- Galvanic isolation of the transmission channel from the control PCB
- Transfer rate: 250 kBaud - 4 MBaud
- Full duplex operation
- Frame size: 6 - 32 bytes; of this, 0 - 30 bytes of usable data with 2 bytes for CRC.
- Frame rate: Data transfer takes place according to the speed control clock (dependent on the switching frequency; at 4 kHz, 250 µs or at 8 kHz, 125 µs, corresponding to the display in **P0305** or **P0304**)
- Monitored synchronization of master and slave
- Mapping as desired of the sent and received data to parameters or scope variables.
- Checksum-monitored data transfer

Technical data	TwinSync communication
Signal level	EIA485, electrically isolated from the servo drive
User data	0-30 byte
Transfer mode	Asynchronous, synchronized via sync pulse
Transfer rate	max. 8 kHz
Cable length	max. 10 m
Wave terminating resistance	120 Ω (integrated)

Table 2.1: Technical data for the TWINsync communication

2.1 Hardware requirements

For TWINsync coupling of two MSD Servo Drives, the TWINsync option for the X8 technology interface of the MSD Servo Drive is required in both drives . The same applies as well for the MSD Servo Drive Compact. The option is detected automatically (control is accomplished via the device type plate in the DRIVEADMINISTRATOR or via **P0053** == TWS(2) for "TWINsync").

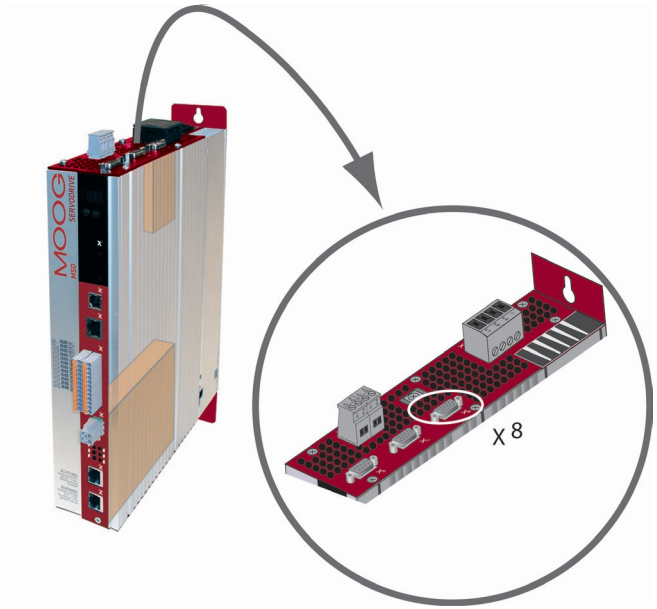

Figure 2.1: The TWINsync option for TWINsync coupling of two MSD Servo Drives

3 Installation

NOTE:

Please be certain to read the MSD Servo Drive Operation Manual before installing the device. It contains fundamental information about safety, device installation and detailed overviews of the connections.

3.1 TWINsync connecting cable pin assignment

The TWINsync option card is located at the MSD Servo Drive option slot 2 (see the Operation Manual) and is equipped with a 9-pin D-Sub socket (X8). The socket has the following pin assignment.

Pin	Signal option card X8	Meaning
1	SYNC IN-	Synchronization interrupt in via EIA485 converter
2	SYNC OUT-	Synchronization interrupt out via EIA485 converter
3	GND	GND from driver
4	RX+	UART via EIA485 converter receive +
5	TX+	UART via EIA485 converter transmit +
6	SYNC IN+	Synchronization interrupt in via EIA485 converter
7	SYNC OUT+	Synchronization interrupt out via EIA485 converter
8	RX-	UART via EIA485 converter receive -
9	TX-	UART via EIA485 converter transmit -

Table 3.1: Pin assignment of the 9-pin D-sub X8 socket on the TWINsync option card

The TWINsync connecting cable execution must be shielded. The pin assignment of the D-sub plugs on the ends of the cable is described in the following table. When a connecting cable with twisted pairs is used, the pairs must consist of the associated wires for the respective connections (+ and -). The signal pairs for SYNC IN and SYNC OUT as well as RX and TX must be crossed over in the cable. The SYNC IN on the one plug end must be connected to the SYNC OUT on the other plug end and vice versa. The same applies for RX and TX. The '+' wire of the one signal must be connected to the '+' wire of the other signal. Analogously, the respective '-' wires must also be connected.

Plug 1 Pin no.	Cable		Plug 2 Pin no.
1	SYNC IN-	SYNC OUT-	2
2	SYNC OUT-	SYNC IN-	1
3	GND	GND	3
4	RX+	TX+	5
5	TX+	RX+	4
6	SYNC IN+	SYNC OUT+	7
7	SYNC OUT+	SYNC IN+	6
8	RX-	TX-	9
9	TX-	RX-	8

Table 3.2: TWINsync connecting cable plug/pin assignment

3.2 TWINsync connecting cable technical data

TWINsync connecting cable	
Article designation	CB36987-xxx-yyy
Cable length	1 m
Connections	2 x SUB-D 9-pin male
Cross-section	4 x 2 x 0.25 + 2 x 0.50

Table 3.3: Connecting cable technical data and article description

4 Description of parameters

The specific parameters of the TWINsync option are described below.

NOTE:

A description of general parameters can be found in the MSD Servo Drive Device Help.

4.1 General parameters of the TWINsync communication interface

The following table shows the configuration parameters for the TWINsync optioncommunication interface.

ID	Sub ID	Name	Unit	Description	Data type
P 2613		TOPT_TWIN_ MaxFaultTime	ms	Maximum communication fault time (timeout monitoring)	Float32
P 2614		TOPT_TWIN_Mode	wet	Select Master or Slave Mode 0 = OFF 1 = SLAVE 2 = MASTER	UInt16
P 2615	0-7	TOPT_TWIN_ ProcessSendData		Mapping of process data to be sent (TX data) Sub-ID: 0: Number of mapped process data or 1st mapped object (only extended mapping) 1-7: mapped objects (see standard mapping or extended mapping)	UInt32
P 2616	0-7	TOPT_TWIN_ ProcessReceiveData		Mapping of process data to be sent (RX data) Sub-ID: 0: Number of mapped process data or 1st mapped object (only extended mapping) 1-7: mapped objects (see standard mapping or extended mapping)	UInt32
P 2617		TOPT_TWIN_ Statusword (ro)	bits	Received system status word	UInt16
P 2618		TOPT_TWIN_ SyncTicks		Max. synchronization ticks with 15ns/tick. This means the gain of the synchronization controller.	Int16

Table 4.1: Configuration parameters of the TWINsync technology option card

ID	Sub ID	Name	Unit	Description	Data type
P 2619		TOPT_TWIN_ CommStatus (ro)	bits	Bit status of communication (not used with extended mapping) 0: No error 1: Communication error, communication lost (error frames > P2613) 2: switching-frequency discrepancy 3: master / slave mode conflict 4: - 5: Different DriveCom states between master and slave 6: dSpace mode control error (different mode detected – only dSpace modes) 7-15: -	UInt16
P 2623		TOPT_TWIN_ SystemLoad (ro)	ns	TWINsync system load. Actual load of TWINsync communication (receive and transmit) and handling of protocol data (mapping)	Float32
P2651		TOPT_TWIN_Config	bits	Configuration of TWIN special function (default not necessary). Bit: 0: - 1: Shift TWIN RX/TX handling to next 16kHz control cycle (possibly saves CPU load of the position loop cycle). 2: Disable DriveCom state handling on TWIN master (disable check of slave status). Normally master waits until slave is switched on and is in state 'Operation- Enabled', after this, the master switches on its control. 3-15: -	UInt32
P2701		TOPT_TWIN_ SyncSel	wet	Synchronization selection (TWIN/fieldbus) 0 = SLAVE_SYNC_ISR, TWINslave, sync by TWIN (mode 1) 1 = SLAVE_SYNC_COM, TWINslave, sync by external fieldbus (com opt) 2 = SLAVE_SYNC_ENC, TWINslave, sync by TWIN (mode 2) 3 = MASTER_NO_COM_SYNC, TWINmaster, no sync by	UInt16

Table 4.1: Configuration parameters of the TWINsync technology option card (continued)

ID	Sub ID	Name	Unit	Description	Data type
				external fieldbus (com opt)	
P2709	0…1	TOPT_TWIN_ PhyLinkConfig		physical and link configuration	
P2709	0	Baud rate		baud rate selection 0 = 4 M 1 = 2 M 2 = 1 M 3 = 800 k 4 = 500 k 5 = 400 k 6 = 250 k	UInt16
P2709	1	Frame size		frame size selection (sm) = (standard mapping) (em) = (extended mapping) 0 = 10 byte PDO (sm) or 14 byte EXT_PDO (em) 1 = 8 byte PDO (sm) or 12 byte EXT_PDO (em) 2 = 6 byte PDO (sm) or 10 byte EXT_PDO (em) 3 = 4 byte PDO (sm) or 8 byte EXT_PDO (em) 4 = 2 byte PDO (sm) or 6 byte EXT_PDO (em) 5 = 0 byte PDO (sm) or 4 byte EXT_PDO (em) 6 = 12 byte PDO (sm) or 16 byte EXT_PDO (em) 7 = 14 byte PDO (sm) or 18 byte EXT_PDO (em) 8 = 16 byte PDO (sm) or 20 byte EXT_PDO (em) 9 = 18 byte PDO (sm) or 22 byte EXT_PDO (em) 10 = 20 byte PDO (sm) or 24 byte EXT_PDO (em) 11 = 22 byte PDO (sm) or 26 byte EXT_PDO (em) 12 = 24 byte PDO (sm) or 28 byte EXT_PDO (em) 13 = 26 byte PDO (sm) or 30 byte EXT_PDO (em)	UInt16

Table 4.1: Configuration parameters of the TWINsync technology option card (continued)

wet : Value replacement text
ro : read-only
rw : read/write
(sm) : standard mapping
(em) : extended mapping

4.1.1 Master/Slave Selector (P 2614) TOPT_TWIN_ Mode

The TWINsync slave synchronizes with the TWINsync master via the TWINsync interface. This means that one of the drives must be parametrised as the TWINsync master and one as the TWINsync slave. The parameter (**P2614**) TOPT_TWIN_Mode is for defining the master/slave operation mode.

ID	Selection text	Value	Description
P 2614	OFF	0	The selection OFF disables the TWINsync interface. In the OFF state, no process data are sent and no SYNC OUT signal is generated.
	SLAVE	1	The selection SLAVE puts the MSD Servo Drive into the TWINsync slave mode. The slave drive synchronizes its controller cycle with the incoming SYNC IN signals. If the SYNC IN signal remains absent for a configurable time, a communication error is reported (see the next section).
	MASTER	2	The selection MASTER puts the MSD Servo Drive into the TWINsync master mode. SYNC OUT signals are generated for the slave.

*Table 4.2: Setting options for (**P2614**) TOPT_TWIN_Mode*

NOTE:

It is mandatory for the synchronization that both drives be set for the same switching frequency because this is used for the synchronization. This means that the parameter (**P0302**) CON_SwitchFreq must be set to the same value for both axes.

4.1.2 Timeout monitoring for the communication

A communication interface fault is recognized as follows:

- The MSD Servo Drive receives invalid data (CRC monitoring)
- The TWINsync master synchronization signal is not sent.

If one of these error occurs, it is assumed that the transmission channel is malfunctioning. The parameter (**P2613**) TOPT_TWIN_MaxFaultTime specifies for what time interval (in ms) the channel can be considered to be malfunctioning without an error being reported. This monitoring is not enabled in the extended mapping mode. The monitoring of valid frames can be performed in this use case with the corresponding scope signals, for example in the MSD PLC. If there is a fault, the last correctly received data are frozen. The error messages are documented in the chapter " Monitoring functions / Error messages" on page 41.

For commissioning, it is therefore recommended that master and slave be configured and then an initialization be forced, or a restart of the devices be carried out (**P0149**) MPRO_DRVCOM_Init). It is possible to check for valid or invalid communication by means of scope variables ID-5709 (TWIN_FrameValid) or ID-5710 (TWIN_FrameErrorCounter).

4.1.3 Structure of a TWINsync data telegram

A TWINsync data telegram in the standard-mapping mode is structured as shown in the table below. It consists of 3x2 bytes of fixed data (16-bit CRC, 16-bit TWINsync status word and a control word or status word for changing the slave device state) followed by a variable number of bytes of process data, or PDOs (process data objects). The TWINsync data telegram example in the table is shown with 10 bytes for PDO data for a total frame length of 16 bytes. This is accomplished with the setting parameter Framesize = 0 (== (**P2709**) TOPT_TWIN_PhyLinkConfig[1]).

Checksum (fixed)	TWINsync status word (fixed)	Control or status word (DRIVECOM) (fixed)	PDO1 (configurable)	...	PDOn (configurable)
2 bytes	2 bytes	2 bytes	10 bytes		

Table 4.3: TWINsync data telegram (standard mapping)

The extended-mapping mode can be selected with parameter (**P2580**) MPRO_TWIN_Setting = EXT_MAP_MASTER(31) or EXT_MAP_SLAVE(32). In this case, the TWINsync data telegram is structured as shown in the next table: It consists of 2 bytes of fixed data (16-bit CRC) again followed by a variable number of bytes of process data. The TWINsync data telegram example in the table is shown with 14 bytes for PDO data for a total frame length of 16 bytes. This is accomplished with the setting parameter Framesize = 0 (== (**P2709**) TOPT_TWIN_PhyLinkConfig[1]).

Checksum (fixed)	PDO1 (configurable)	...	PDOn (configurable)
2 bytes	14 bytes		

Table 4.4: TWINsync data telegram (extended mapping)

The checksum is derived using the entire telegram. The structure of the TWINsync status word (**P2617**) TOPT_TWIN_Statusword) is shown in the following table.

Bit No.	Function	Description
0	ProcessData Mode	0 = Initialization mode 1 = cyclical mode
1-3	SwitchingFrequency	000 = 2 kHz 001 = 4 kHz 010 = 6 kHz 011 = 8 kHz 100 = 12 kHz 101 = 16 kHz
4-5	TWINMode	00 = TWINsync off 01 = TWINsync Slave 10 = TWINsync Master
6	not_used	reserved
7-10	DRVCOMstate	current state of DriveCom
11	ChopperState	current chopper state
12	PWM_Period	'pwm is counting down'
13	PWMDisableEv	'pwm disable event'
14	SystemError	Drive in the “error” state
15	TechOptError	A communication error is pending

*Table 4.5: Structure of the received TWINsync status word (parameter **P2617**)*

The definition of the freely configurable data is described below.

3.1.4 Configuration of the process data in the standard-mapping mode

The process data which is to be sent and received by the drive can be configured by means of parameters. For a manual configuration, the parameters (**P2615**) TOPT_TWIN_ProcessSendData (mapping of the sent data) and (**P2616**) TOPT_TWIN_ProcessReceiveData (mapping of the received data) can be modified directly. An automatic configuration for pre-set operation modes is also possible via the operation mode selector (**P2580**) MPTO_TWIN_Setting (see chapter "TWINsync operation modes" on page 19). The parameters **P2615 / P2616** are each field parameters with 8 elements. The first element (SubID: 0) specifies how many parameters are sent/ received by this axis. A maximum of 7 parameters in each direction are supported. The other field elements (SubID:1-7) determine which parameters are sent/received. The entries under SubID 1-7 are coded as described in the following table.

Bit field	Meaning, SubID 1..7 (standard-mapping mode)
PPPPxxxxh	2-byte parameter ID of the parameter that is to be sent as a HEX value
xxxxSSxxh	1-byte parameter Sub-ID of the parameter that is to be sent as a HEX value
xxxxxxWWh	1-byte word width of the parameter which is to be sent as a HEX value 32-bit parameter (Int32,UInt32, Float32): WW = 20h 16-bit parameter (Int16,UInt16): WW = 10h

*Table 4.6: Structure of parameters **P2615 / P2616** (Sub-Id: 1-7) for mapping the process data which is to be sent in the standard-mapping mode*

When configuring the process data, it is essential to be sure that the sequence and the data width of the received data of the one axis match the sequence and the data width of the sent data of the other axis. This matching of the parametrization cannot be monitored by MSD Servo Drive and must therefore be ensured by the user.

4.1.5 Configuration of the process data in the extended-mapping mode

The so-called extended-mapping mode can be selected via the operation mode selector “TWIN_Setting”.

Depending on whether the axis is a TWINmaster or a TWINslave, this operation mode is selected by choosing **P2580** = EXT_MAP_MASTER for the master and **P2580** = EXT_MAP_SLAVE for the slave.

For more on this, see the corresponding chapter on selecting the operation modes (chapter "TWINsync operation modes" on page 19).

4.1.6 Scaling of the process data

In order to be able to transmit the three most commonly used variables, torque, speed and position, via the TWINsync interface simultaneously, a corresponding scaling of the torque and speed variables from the 4-byte floating-point format used internally to a scaled 2-byte integer format has been implemented. The references used for scaling the “local” torque and speed values (sent data) are specified using the parameter (**P2602**) MPRO_TWIN_LocalScaling. The references used for descaling the torque and speed values received from the external drive (“remote”) are specified using the parameter (**P2609**) MPRO_TWIN_RemoteScaling (see the next table).

The first field entry (SubID: 0) in **P2602 / P2609** contains the value of the reference torque in Nm. The second field entry (SubID: 1) contains the value of the reference speed in rpm. The third field entry (Sub-ID: 2) contains the value of the reference current in 100 mA (see **P2697[2]**). The scaling represents the value range between the negative and positive reference value over the numerical range [-32768 ... 32767]. The position data are transferred in the format specified by the units parametrization of the device (factor group) as a 32-bit integer.

NOTE:

Generally speaking, the references **P2602 / P2609** and the factor-group settings in the master and slave drives should be identical.

ID	Sub ID	Name	Unit	Description	Data type
P 2602		MPRO_TWIN_LocalScaling			
	0	MPRO_TWIN_LocalScalingTorque	Nm	Reference torque, local drive	Float32
	1	MPRO_TWIN_LocalScalingSpeed	rpm	Reference speed, local drive	Float32
P 2609		MPRO_TWIN_RemoteScaling			
	0	MPRO_TWIN_RemoteScalingTorque	Nm	Reference torque, external drive	Float32
	1	MPRO_TWIN_RemoteScalingSpeed	rpm	Reference speed, external drive	Float32
	2	MPRO_TWIN_RemoteScaleCurrent	100 mA	Reference current, external drive (see P2697 [2])	Float32

Table 4.7: References for scaling the local and the external torque and speed signals

The following table shows the parameters typically used for the process data which are to be sent. The parameters **P2596 - P2601** describe the “local” setpoint and actual values for torque, speed and position.

ID	Sub ID	Name	Unit	Description	Data type
P 2596	0	MPRO_TWIN_LocalRefTorque	scaled	scaled torque setpoint (local)	Int16
P 2597	0	MPRO_TWIN_LocalActTorque	scaled	scaled torque actual value (local)	Int16
P 2598	0	MPRO_TWIN_LocalRefSpeed	scaled	scaled speed setpoint (local)	Int16
P 2599	0	MPRO_TWIN_LocalActSpeed	scaled	scaled speed actual value	Int16

Table 4.8: Frequently used parameters for transmitting process data

ID	Sub ID	Name	Unit	Description	Data type
				(local)	
P 2600	0	MPRO_TWIN_LocalRefPos	POS	Position setpoint (local)	Int32
P 2601	0	MPRO_TWIN_LocalActPos	POS	Position actual value (local)	Int32

Table 4.8: Frequently used parameters for transmitting process data (continued)

The following table shows the parameters typically used for the process data which are to be received. The parameters **P2603 - P2608** are provided as data containers for receiving the external (“remote”) setpoint and actual values for torque, speed and position.

ID	Sub ID	Name	Unit	Description	Data type
P 2603		MPRO_TWIN_RemoteRefTorque	scaled	scaled torque setpoint (external)	Int16
P 2604		MPRO_TWIN_RemoteActTorque	scaled	scaled torque actual value (external)	Int16
P 2605		MPRO_TWIN_RemoteRefSpeed	scaled	scaled speed setpoint (external)	Int16
P 2606		MPRO_TWIN_RemoteActSpeed	scaled	scaled speed actual value (external)	Int16
P 2607		MPRO_TWIN_RemoteRefPos	POS	Position setpoint (external)	Int32
P 2608		MPRO_TWIN_RemoteActPos	POS	Position actual value (external)	Int32
P2700		MPRO_TWIN_RemoteAcc	scaled	maximum acceleration (external)	Int16

Table 4.9: Frequently used parameters for receiving process data

The scaled parameters for speed and torque provided on the transmit side also exist on the receiving side. The information needed for descaling of the torque and speed is entered in parameter **P2609**. This is used to convert the 16-bit integer that is received back into the local units system.

4.2 Parametrization of the TWINsync master axis

The master axis contains setpoints in accordance with the parametrised setpoint source (e.g. from a field bus). Aside from the configuration of the data to be sent, the master axis requires no further special parametrisation. However, slave process data can also be received.

4.3 Parametrization of the TWINsync slave axis

The slave axis receives the setpoints from the master axis and uses them in dependence on the TWINsync operation mode set by means of the parameter (**P2580**) MPRO_TWIN_Setting. Depending on the operation mode, the setpoints or actual values for torque, speed or position of the master axis are needed. In order for the slave axis to receive the setpoint via the TWINsync interface, the setpoint source must be parametrised to the value TWIN(11) via the parameter (**P0165**) MPRO_REF_SEL. The setpoints for the control of the slave axis are then derived from the parameters listed in the upper table in dependence on the control mode set by the control mode selector (**P0300**) CON_CfgCon. For the scaled parameters, conversion back to the local units system takes place prior to this in accordance with the field parameter (**P2609**) MPRO_TWIN_RemoteScaling.

5 Control via TWINsync

The slave drive in the TWINsync set-up can be controlled by the TWINsync master via the TWINsync control word or via any other control location (e.g. digital inputs or field bus). The control location can be configured via the control location selector (**P0159**) MPRO_CTRL_SEL. To select the “TWINsync” as the control location, the value TWIN(10) must be set for **P0159**. Control of the drive then takes place via the TWINsync control word (parameter (**P2611**) MPRO_TWIN_SlaveCtrlWord, (see the table for **P2611)** and the drive status is given in parameter (**P2612**) MPRO_TWIN_ SlaveStatus (see the table for **P2612**). The TWINsync master copies its own control word onto the TWINsync control word that is sent from the TWINsync master to the TWINsync slave via the process data channel. This causes the TWINsync slave to obey the same control commands as the TWINsync master. In addition, error acknowledgement and homing can be triggered on the slave via the TWINsync control word. The TWINsync slave also sends its TWINsync status word back to the TWINsync master via the process data channel.

Bit No.	Function	Description
0	Operation_mode_0	reserved
1	Operation_mode_1	reserved
2	Operation_mode_2	reserved
3	Operation_mode_3	reserved
4	Operation_mode_4	reserved
5	EnableOperation	Begin control
6	SwitchOn	Switch on the power stage
7	CoastStop	No torque applied to drive
8	QuickStop	Quick stop
9	StartHoming	Start homing
10	FaultReset	Error reset
11	EnableVoltage	Enable power stage
12	ReSyncPosition	Re-synchronization of the master position
13	FREE2	reserved
14	FREE3	reserved
15	FREE4	reserved

*Table 5.1: Structure of the TWINsync control word (**P2611**) MPRO_TWIN_ SlaveCtrlWord*

*Table 5.1: Structure of the TWINsync control word (**P2611**) MPRO_TWIN_Sla-veCtrlWord (continued)*

Bit No.	Function	Description
0	Operation_mode_0	reserved
1	Operation_mode_1	reserved
2	Operation_mode_2	reserved
3	Operation_mode_3	reserved
4	Operation_mode_4	reserved
5	OperationEnabled	Control is active
6	Fault	Drive is in the error state
7	Free_7	reserved
8	Free_8	reserved
9	HomePositionSet	The drive has been homed
10	Free_10	reserved
11	Free_11	reserved
12	OpInProgress	The slave is busy (is switching to the new DriveCom state)
13	ActDrivecom_0	current DriveCom state bit 0
14	ActDrivecom_1	current DriveCom state bit 1
15	ActDrivecom_2	current DriveCom state bit 2

*Table 5.2: Structure of the TWINsync status word (**P2612**) MPRO_TWIN_ SlaveStatus*

6 TWINsync operation modes

6.1 Virtual encoder

In the operation modes "TWin Drive profile TWD V1" (speed) and "Virtual Encoder VE" (torque), additional raw data from the encoder of the master (SingleTurn without offset and correction) are sent to the slave. This makes it possible to activate a so-called “virtual encoder” on the slave. To do so, the following encoder parameters must be entered:

For "TWin Drive profile TWD V1" (speed):
(P2580) MPRO_TWIN_Setting = (1) + (2)

ID	Parameters	Setting in the master	Setting in the slave
P0520	Encoder for commutation	---	CH3(3)
P0521	Encoder for speed control	---	CH3(3)
P0507	Selector for encoder channel 3	---	TWINSYNC(6)

Table 6.1: TWin Drive profile TWD V1 (speed)

For "virtual encoder VE" (torque):
(P2580) MPRO_TWIN_Setting = (12) + (13)

ID	Parameters	Setting in the master	Setting in the slave
P0520	Encoder for commutation	---	CH3(3)
P0507	Selector for encoder channel 3	---	TWINSYNC(6)

Table 6.2: Virtual encoder VE (torque)

6.2 Selection via parameter (**P2580**) MPRO_TWIN_Setting

Different pre-set TWINsync operation modes can be selected via the parameter (**P2580**) MPRO_TWIN_Setting. The process data configuration is carried out automatically in dependence on the operating mode selected. The operation modes which can be selected are listed below.

ID	SUB	Name	UNIT	Description	Type
P2580		MPRO_TWIN_ Setting	wet	Function selector for automatic master/slave mapping: 0 = USER user-specific mapping	UInt8
P2580		MPRO_TWIN_ Setting	wet	TWin Drive profile "TWD" 1 = TWD_MASTER_V1, Twin drive master profile V1 2 = TWD_SLAVE_V1, Twin drive slave profile V1 3 = TWD_MASTER_V2, Twin drive master profile V2 4 = TWD_SLAVE_V2, Twin drive slave profile V2	UInt8
P2580		MPRO_TWIN_ Setting	wet	5 = SCON_MASTER, master speed control 6 = SCON_SLAVE, slave speed control 7 = PCON_MASTER, master position control 8 = PCON_SLAVE, slave position control	UInt8
P2580		MPRO_TWIN_ Setting	wet	Double Inverter "DI" 9 = DI_MASTER, master double inverter	UInt8
P2580		MPRO_TWIN_ Setting	wet	Rack-and-Pinion Drive Control "RPDC" 10 = RPDC_MASTER, master rack-and-pinion control 11 = RPDC_SLAVE, slave rack-and-pinion control	UInt8
P2580		MPRO_TWIN_ Setting	wet	Virtual Encoder "VE" 12 = VE_TCON_MASTER, master virtual encoder, torque/power control 13 = VE_TCON_SLAVE, slave virtual encoder, torque/power control	UInt8

*Table 6.3: Overview of the TWINsync operation modes using parameter (**P2580**) MPRO_TWIN_Setting*

ID	SUB	Name	UNIT	Description	Type
P2580		MPRO_TWIN_ Setting	wet	dSPACE-TWINsync (rapid-prototyping systems from the dSPACE company) 14 = PWM_SLAVE, slave PWM interface 15 = TCON_SLAVE, slave torque control interface 16 = SCON_SLAVE, slave speed control interface 17 = PCON_1_SLAVE, slave interpolated position control interface 18 = PCON_2_SLAVE, slave profile position control interface	UInt8
P2580		MPRO_TWIN_ Setting	wet	19 = PCON_IP_SLAVE, slave interpolated position control	UInt8
P2580		MPRO_TWIN_ Setting	wet	20 = PLC, iPLC controller	UInt8
P2580		MPRO_TWIN_ Setting	wet	Position setpoint (position reference value) 21 = PCON_REFPOS_MASTER, master position control (position reference value) 22 = PCON_REFPOS_SLAVE, slave position control (position reference value)	UInt8
P2580		MPRO_TWIN_ Setting	wet	Serial Double Inverter "SDI" / Parallel Double Inverter "PDI" 23 = SDI_PWM_MASTER, master serial double inverter (PWM mode) 24 = PDI_PWM_MASTER, master parallel double inverter (PWM mode) 25 = SDI_PDI_PWM_SLAVE, slave serial/parallel double inverter (PWM mode) 26 = SDI_CURR_MASTER, master serial double inverter (current mode) 27 = PDI_CURR_MASTER, master parallel double inverter (current mode) 28 = SDI_PDI_CURR_SLAVE, slave serial/parallel double inverter (current mode)	UInt8

*Table 6.3: Overview of the TWINsync operation modes using parameter (**P2580**) MPRO_TWIN_Setting (continued)*

ID	SUB	Name	UNIT	Description	Type
P2580		MPRO_TWIN_ Setting	wet	Function selector for automatic master/slave mapping Gantry application 29 = PCON_GANTRY_MASTER, master position control (gantry application) 30 = PCON_GANTRY_SLAVE, slave position control (gantry application)	UInt8
P2580		MPRO_TWIN_ Setting	wet	Extended-mapping mode 31 = EXT_MAP_MASTER, extended mapping (master) 32 = EXT_MAP_SLAVE, extended mapping (slave)	UInt8
P2580		MPRO_TWIN_ Setting	wet	Dual stator winding motor "DSW" 33 = DSW_MASTER, dual stator winding motor (master) 34 = DSW_SLAVE, dual stator winding motor (slave)	UInt8

*Table 6.3: Overview of the TWINsync operation modes using parameter (**P2580**) MPRO_TWIN_Setting (continued)*

6.2.1 User-specific mapping

6.2.1.1 Operation mode USER, 0

When this operation mode is selected, the user can assign the process data channel of the TWINsync bus as desired. To do so, the field parameters (**2615**) TOPT_TWIN_ ProcessSendData and (**2616**) TOPT_TWIN_-ProcessReceiveData can be used to set how many and which objects should be sent and received (see the chapter Description of Parameters, section “Configuration of the process data in the standard mapping mode”).

ID	Parameters	Setting in the master		Setting in the slave	
P2614	TWINdrive mode	MASTER (2)		SLAVE (1)	
P2580	TWIN_Setting	USER(0)		USER(0)	
P0300	Control mode	---		---	
P0159	Control selector	---		---	
P0165	Setpoint selector	---		---	
P0301	Setpoint mode	---		---	
P2584	Speed-up	---		---	
P2602	Local scaling	---		---	
P2609	Remote scaling	---		---	
P2615	Mapping of the sent data	Parameter value (hex)	Meaning	Parameter value (hex)	Meaning
	Sub-ID 0	0000.000x	x objects (x = 0..7)	0000.000x	x objects (x = 0..7)
	Sub-ID 1	pppp.SSww	1. Object	pppp.SSww	1. Object
	Sub-ID 2	pppp.SSww	2. Object	pppp.SSww	2. Object
	Sub-ID 3	pppp.SSww	3. Object	pppp.SSww	3. Object
	Sub-ID 4	pppp.SSww	4. Object	pppp.SSww	4. Object
	Sub-ID 5	pppp.SSww	5. Object	pppp.SSww	5. Object
	Sub-ID 6	pppp.SSww	6. Object	pppp.SSww	6. Object
	Sub-ID 7	pppp.SSww	7. Object	pppp.SSww	7. Object
P2616	Mapping of the received data	Parameter value (hex)	Meaning	Parameter value (hex)	Meaning
	Sub-ID 0	0000.000x	x objects (x = 0..7)	0000.000x	x objects (x = 0..7)
	Sub-ID 1	pppp.SSww	1. Object	pppp.SSww	1. Object
	Sub-ID 2	pppp.SSww	2. Object	pppp.SSww	2. Object
	Sub-ID 3	pppp.SSww	3. Object	pppp.SSww	3. Object
	Sub-ID 4	pppp.SSww	4. Object	pppp.SSww	4. Object
	Sub-ID 5	pppp.SSww	5. Object	pppp.SSww	5. Object
	Sub-ID 6	pppp.SSww	6. Object	pppp.SSww	6. Object
	Sub-ID 7	pppp.SSww	7. Object	pppp.SSww	7. Object

Table 6.4: Parameters for the master and slave drives of the pre-set TWINsync operation mode: User-specific mapping

pppp: Parameter ID in hex
SS: Parameter Sub-ID in hex
ww: 10 hex for 16 bit, 20 hex for 32 bit

6.2.2 TWin Drive profile “TWD” (speed)

... with virtual encoder!

The "TWin Drive profile TWD" (speed) operation mode is suitable for speed synchronization of mechanically coupled axes, for example, of travel or lift drives with a double drive. The master sends its actual speed value and its actual torque value to the TWINsync slave via the TWINsync interface. The TWINsync slave then processes these two variables and passes them on to its internal control structure.

6.2.2.1 TWD_MASTER_V1 / TWD_SLAVE_V1, 1+2

This operation mode is selected by choosing **P2580** = TWD_MASTER_V1 for the master and **P2580** = TWD_SLAVE_V1 for the slave. In this operating mode, the master sends its torque actual value (**P2597**) and its speed actual value (**P2599**) to the slave. The received data, which the master expects via TWINsync, are interpreted as current error number (**P2650[0]**) and current error location (**P2650[1]**) of the slave drive.

In this operating mode, the speed actual value of the master drive is used as the main speed setpoint (main setpoint) of the slave drive. An additional setpoint value is added to the main setpoint value which is proportional to the main setpoint value and which is specified as a percentage of parameter **P2584**. If the additional setpoint value calculated in this way goes below the threshold value specified in parameter **P2585** (speed-up minimum), then this threshold value is used as the additional setpoint value. The sign of the additional setpoint value corresponds to the sign of the torque actual value of the master drive.

ID	Parameters	Setting in the master		Setting in the slave	
P2614	TWINdrive mode	MASTER (2)		SLAVE (1)	
P2580	TWIN_Setting	TWD_MASTER_V1(1)		TWD_SLAVE_V1(2)	
P0300	Control mode	any		SCON(2)	
P0159	Control selector	any		TWINSYNC(10)	
P0165	Setpoint selector	any		TWINSYNC(11)	
P0301	Setpoint mode	any		IP-Mode(1)	
P2584	Speed-up	---		any	
P2602	Local scaling	any		---	
P2609	Remote scaling	---		same as P2602 from master	
P2615	Mapping of the sent data	Parameter value (hex)	Meaning	Parameter value (hex)	Meaning
	Sub-ID 0	0000.0003	3 objects	0000.0002	2 objects
	Sub-ID 1	0A25.0010	local torque actual value P2597 (16-bit)	0A5A.0010	current error number P2650[0] (16-bit)
	Sub-ID 2	0A27.0010	local speed actual value P2599 (16-bit)	0A5A.0110	current error location P2650[1] (16-bit)
	Sub-ID 3	107C.0010	local position actual value P4220 (16-bit)		
	Sub-ID 4				
	Sub-ID 5				
	Sub-ID 6				
	Sub-ID 7				
P2616	Mapping of the received data	Parameter value (hex)	Meaning	Parameter value (hex)	Meaning
	Sub-ID 0	0000.0002	2 objects	0000.0003	3 objects
	Sub-ID 1	0A5A.0010	current error number P2650[0] (16-bit)	0A2C.0010	RemoteActTorque P2604 (16-bit)
	Sub-ID 2	0A5A.0110	current error location P2650[1] (16-bit)	0A2E.0010	RemoteActSpeed P2606 (16-bit)

Table 6.5: Parameters for the master and slave drives of the pre-set TWINsync operation mode: "TWin-Drive-Profile TWD" (speed) Version 1

ID	Parameters	Setting in the master		Setting in the slave	
	Sub-ID 3			107D.0010	RemoteActEps P4221 (16-bit)
	Sub-ID 4				
	Sub-ID 5				
	Sub-ID 6				
	Sub-ID 7				

Table 6.5: Parameters for the master and slave drives of the pre-set TWINsync operation mode: "TWin-Drive-Profile TWD" (speed) Version 1 (continued)

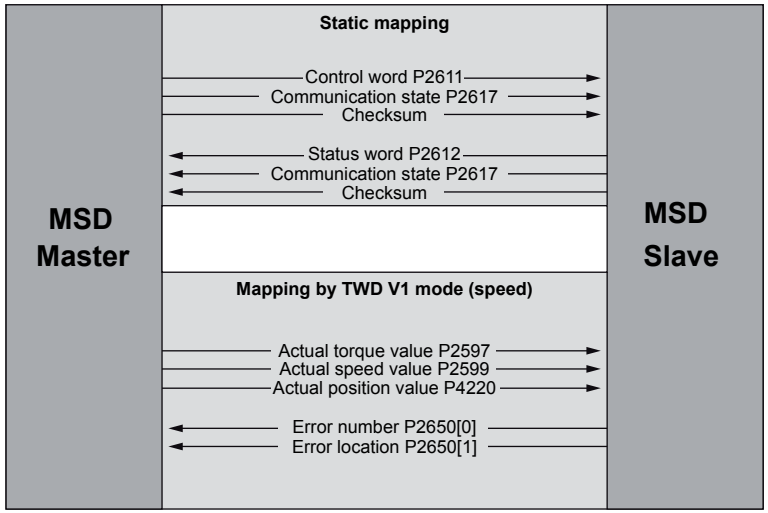

Figure 6.1: Process data interface between the master and slave drives in the operation mode: "TWin-Drive-Profile TWD" (speed) Version 1

The following figure shows the control structure of the slave drive.

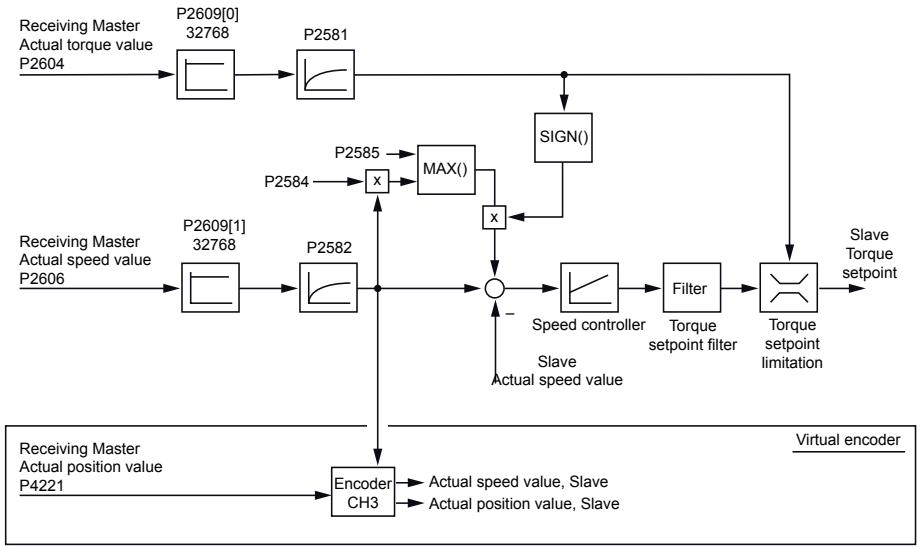

Figure 5.2: Control structure for "TWin-Drive-Profile TWD" (speed) Version 1

5.2.2.2 TWD_MASTER_V2 / TWD_SLAVE_V2, 3+4

This operation mode is selected by choosing **P2580** = TWD_MASTER_V2 for the master and **P2580** = TWD_SLAVE_V2 for the slave. This operating mode is another variation for synchronizing mechanically coupled drive axes. The master sends its current speed actual value as well as the current torque actual value to the slave via the TWINsync interface. The slave uses the current master torque actual value as a torque pre-control signal at the speed controller output. The speed actual value received from the master is used as the speed setpoint for the speed control circuit of the slave. As an option, the speed actual value can be filtered via a PT1 element. The speed controller on the slave side must be configured as a weak P-controller for this operating mode.

The mapping of the process data channel on the master and slave side is the same as that of the TWINspeed mode 1 operation mode (see previous table).

ID	Parameters	Setting in the master		Setting in the slave	
P2614	TWINdrive mode	MASTER (2)		SLAVE (1)	
P2580	TWIN_Setting	TWD_MASTER_V2(3)		TWD_SLAVE_V2(4)	
P0300	Control mode	any		SCON(2)	
P0159	Control selector	any		TWINSYNC(10)	
P0165	Setpoint selector	any		TWINSYNC(11)	
P0301	Setpoint mode	any		IP-Mode(1)	
P2584	Speed-up	---		any	
P2602	Local scaling	any		---	
P2609	Remote scaling	---		same as P2602 from master	
P2615	Mapping of the sent data	Parameter value (hex)	Meaning	Parameter value (hex)	Meaning
	Sub-ID 0	0000.0003	3 objects	0000.0002	2 objects
	Sub-ID 1	0A25.0010	local torque actual value P2597 (16-bit)	0A5A.0010	current error number P2650[0] (16-bit)
	Sub-ID 2	0A27.0010	local speed actual value P2599 (16-bit)	0A5A.0110	current error location P2650[1] (16-bit)
	Sub-ID 3	107C.0010	local position actual value P4220 (16-bit)		
	Sub-ID 4				
	Sub-ID 5				
	Sub-ID 6				
	Sub-ID 7				
P2616	Mapping of the received data	Parameter value (hex)	Meaning	Parameter value (hex)	Meaning

Table 6.6: Parameters for the master and slave drives of the pre-set TWINsync operation mode: "TWin-Drive-Profile TWD" (speed) Version 2

ID	Parameters	Setting in the master		Setting in the slave	
	Sub-ID 0	0000.0002	2 objects	0000.0003	3 objects
	Sub-ID 1	0A5A.0010	current error number P2650[0] (16-bit)	0A2C.0010	RemoteActTorque P2604 (16-bit)
	Sub-ID 2	0A5A.0110	current error location P2650[1] (16-bit)	0A2E.0010	RemoteActSpeed P2606 (16-bit)
	Sub-ID 3			107D.0010	RemoteActEps P4221 (16-bit)
	Sub-ID 4				
	Sub-ID 5				
	Sub-ID 6				
	Sub-ID 7				

Table 6.6: Parameters for the master and slave drives of the pre-set TWINsync operation mode: "TWin-Drive-Profile TWD" (speed) Version 2 (continued)

The following figure shows the process data interface between the master and slave drives in the operation mode: "TWin-Drive-Profile TWD" (speed) Version 2.

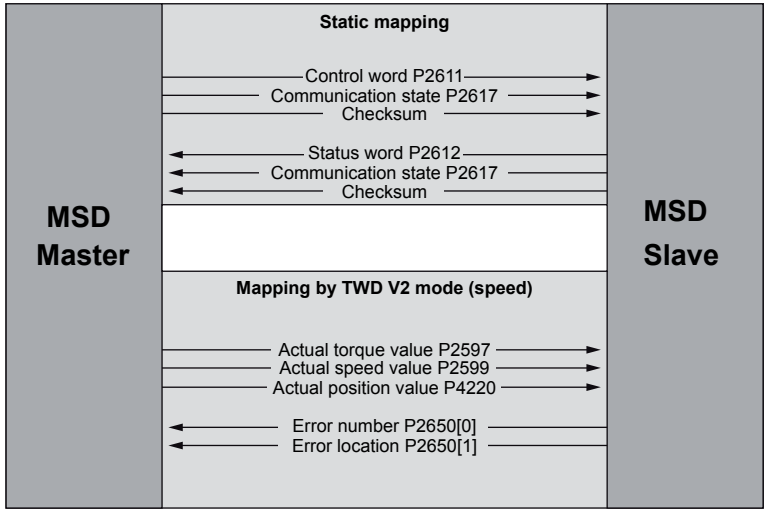

Figure 6.3: Process data interface between the master and slave drives in the operation mode: "TWin-Drive-Profile TWD" (speed) Version 2

The following figure shows the control structure of the slave drive.

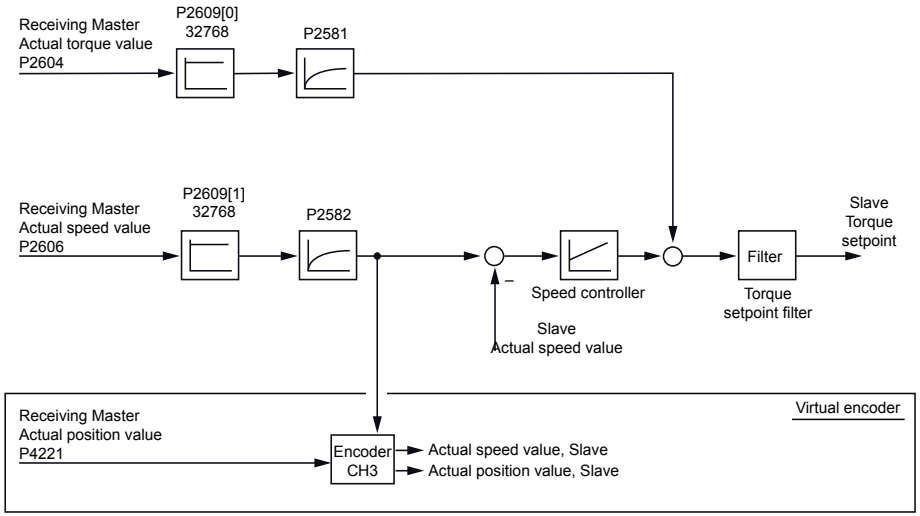

Figure 6.4: Control structure for "TWin-Drive-Profile TWD" (speed) Version 2

6.2.3 Speed and position control

6.2.3.1 SCON_MASTER / SCON_SLAVE, 5+6

This operation mode is selected by choosing **P2580** = SCON_MASTER for the master and **P2580** = SCON_SLAVE for the slave. This operation mode is suitable for speed synchronization between a master and a slave drive.

ID	Parameters	Setting in the master		Setting in the slave	
P2614	TWINdrive mode	MASTER (2)		SLAVE (1)	
P2580	TWIN_Setting	SCON_MASTER(5)		SCON_SLAVE(6)	
P0300	Control mode	any		SCON(2)	
P0159	Control selector	any		TWINSYNC(10)	
P0165	Setpoint selector	any		TWINSYNC(11)	
P0301	Setpoint mode	any		IP-Mode(1)	
P2584	Speed-up	---		---	
P2602	Local scaling	any		---	
P2609	Remote scaling	---		same as P2602 from master	
P2615	Mapping of the sent data	Parameter value (hex)	Meaning	Parameter value (hex)	Meaning
	Sub-ID 0	0000.0003	3 objects	0000.0002	2 objects
	Sub-ID 1	0A25.0010	local torque actual value P2597 (16-bit)	0A5A.0010	current error number P2650[0] (16-bit)
	Sub-ID 2	0A27.0010	local speed actual value P2599 (16-bit)	0A5A.0110	current error location P2650[1] (16-bit)
	Sub-ID 3	107C.0010	local position actual value P4220 (16-bit)		
	Sub-ID 4				
	Sub-ID 5				
	Sub-ID 6				
	Sub-ID 7				
P2616	Mapping of the received data	Parameter value (hex)	Meaning	Parameter value (hex)	Meaning
	Sub-ID 0	0000.0002	2 objects	0000.0003	3 objects
	Sub-ID 1	0A5A.0010	current error number P2650[0] (16-bit)	0A2C.0010	RemoteActTorque P2604 (16-bit)
	Sub-ID 2	0A5A.0110	current error location P2650[1] (16-bit)	0A2E.0010	RemoteActSpeed P2606 (16-bit)

Table 6.7: Parameters for the master and slave drives of the pre-set TWINsync operation mode: Speed control (TWINspeed)

ID	Parameters	Setting in the master		Setting in the slave	
	Sub-ID 3			107D.0010	RemoteActEps P4221 (16-bit)
	Sub-ID 4				
	Sub-ID 5				
	Sub-ID 6				
	Sub-ID 7				

Table 6.7: Parameters for the master and slave drives of the pre-set TWINsync operation mode: Speed control (TWINspeed) (continued)

The following figure shows the process data interface between the master and slave drives in the operation mode: Speed control (TWINspeed)

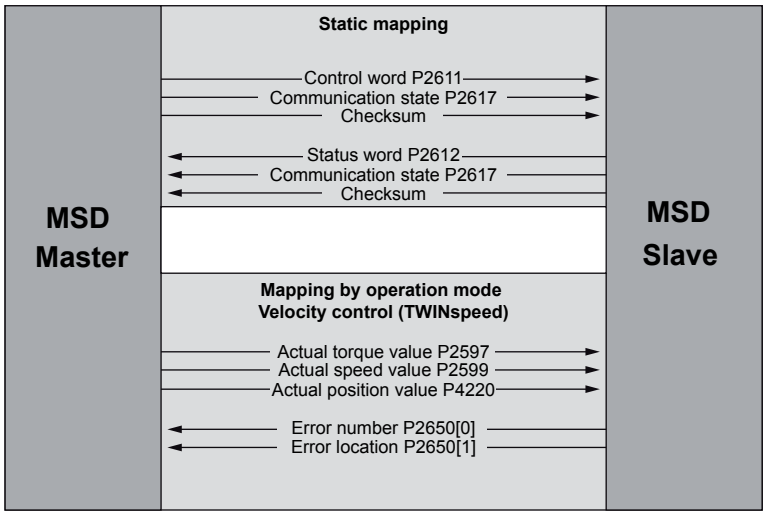

Figure 6.5: Process data interface between the master and slave drives in the operation mode: Speed control (TWINspeed)

5.2.3.2 PCON_MASTER / PCON_SLAVE, 7+8

This operation mode is selected by choosing **P2580** = PCON_MASTER for the master and **P2580** = PCON_SLAVE for the slave. This operation mode is suitable for position synchronization between a master and a slave drive. In addition, an electronic gear unit can be used on the slave axis.

ID	Parameters	Setting in the master		Setting in the slave	
P2614	TWINdrive mode	MASTER (2)		SLAVE (1)	
P2580	TWIN_Setting	PCON_MASTER(7)		PCON_SLAVE(8)	
P0300	Control mode	any		PCON(3)	
P0159	Control selector	any		TWINSYNC(10)	
P0165	Setpoint selector	any		TWINSYNC(11)	
P0301	Setpoint mode	any		IP-Mode(1)	
P2584	Speed-up	---		---	
P2602	Local scaling	any		---	
P2609	Remote scaling	---		same as P2602 from master	
P2615	Mapping of the sent data	Parameter value (hex)	Meaning	Parameter value (hex)	Meaning
	Sub-ID 0	0000.0002	2 objects	0000.0002	2 objects
	Sub-ID 1	019C.0020	Position actual value P0412 (32-bit)	0A5A.0010	current error number P2650[0] (16-bit)
	Sub-ID 2	0A27.0010	local speed actual value P2599 (16-bit)	0A5A.0110	current error location P2650[1] (16-bit)
	Sub-ID 3				
	Sub-ID 4				
	Sub-ID 5				
	Sub-ID 6				
	Sub-ID 7				
P2616	Mapping of the received data	Parameter value (hex)	Meaning	Parameter value (hex)	Meaning
	Sub-ID 0	0000.0002	2 objects	0000.0002	2 objects

Table 6.8: Parameters for the master and slave drives of the pre-set TWINsync operation mode: Position control (TWINpos)

ID	Parameters	Setting in the master		Setting in the slave	
	Sub-ID 1	0A5A.0010	current error number P2650[0] (16-bit)	0A30.0020	RemoteActPos P2608 (32-bit)
	Sub-ID 2	0A5A.0110	current error location P2650[1] (16-bit)	0A2E.0010	RemoteActSpeed P2606 (16-bit)
	Sub-ID 3				
	Sub-ID 4				
	Sub-ID 5				
	Sub-ID 6				
	Sub-ID 7				

Table 6.8: Parameters for the master and slave drives of the pre-set TWINsync operation mode: Position control (TWINpos) (continued)

The following figure shows the process data interface between the master and slave drives in the operation mode: Position control (TWINpos)

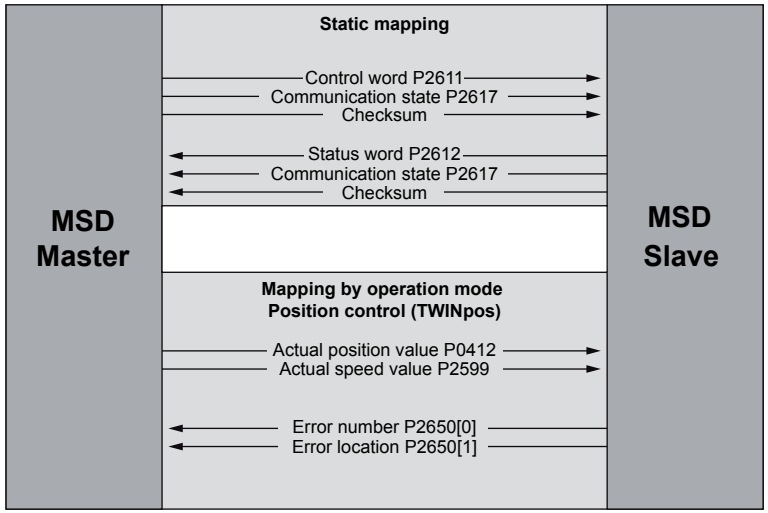

Figure 6.6: Process data interface between the master and slave drives in the operation mode: Position control (TWINpos)

The MASTER sends its position actual value (**P0412**) and its speed actual value (**P2599**).

The SLAVE uses the position actual value from the master drive (**P2608**) to generate the position control setpoint and the current speed actual value (**P2606**) to generate the external speed pre-control value.

The following figure shows the control structure of the slave drive.

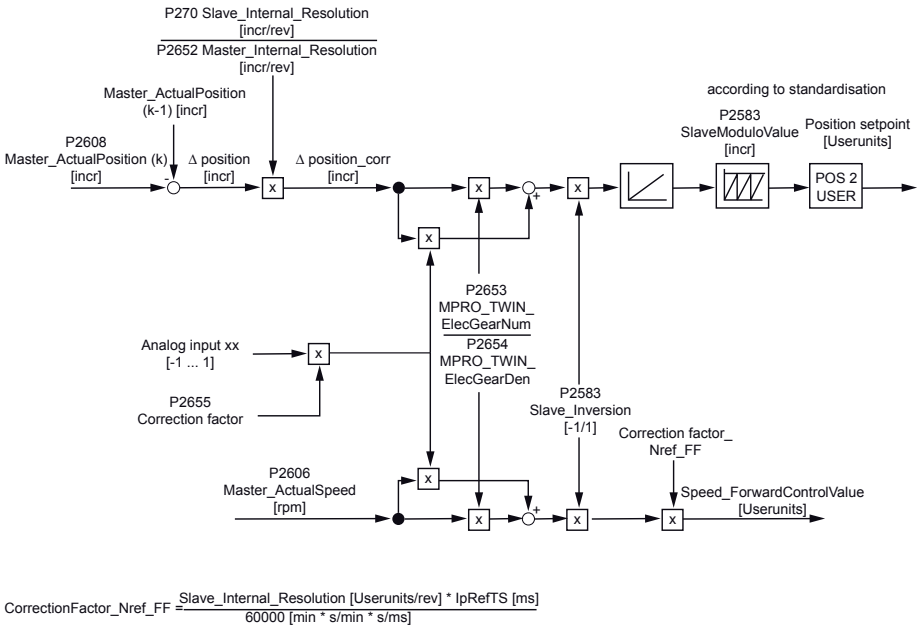

Figure 6.7: Control structure for position control (TWINpos)

About the position setpoint: Working from the incremental master actual position **P2608**, delta increments are derived for each scanning step. If there is a difference in the resolution factors between the master and slave, the delta increments are corrected by the factor **P0270 / P2652**. Subsequently, the corrected delta increments are multiplied first by the gear ratio of the electronic gear unit (**P2653 / P2654**) and second by the analogue correction factor, and the results are added. Moreover, the parameter **P2583** can be used to realize a directional reversal between the master and slave. Afterwards, the corrected delta increments are integrated to the modulo value of the slave.

The current speed actual value of the master in rpm is used for the external **speed pre-control**. Just as for the position processing, this actual value is multiplied by the factor of the electronic gear unit (**P0270 / P2652**) as well as by the same analogue correction factor.

6.2.4 Double inverter "DI"

The function “double inverter DI” includes operation modes 23 … 28, which are described separately in a document.

6.2.4.1 DI_MASTER, 9

The master operation mode 9 for the function “Double inverter DI” is no longer used and is replaced by the corresponding master operation modes for serial and parallel double inverters mentioned above.

6.2.5 Rack-and-Pinion Drive Control "RPDC"

Rack and **P**inion **D**rive **C**ontrol (RPDC) describes a method for controlling a gear rack drive or planetary gear unit drive with two motors. The objective here is, on the one hand, to create a tension between the two motors so that backlash present between the gear wheels is compensated. On the other hand, the control is

designed to consist of a master/slave combination so that the slave assists the master in positioning when the torque requirement is greater than the moment of tension.

In this case, the slave drive travels through the previously compensated backlash in order to assist the master in a positioning operation.

6.2.5.1 RPDC_MASTER / RPDC_SLAVE, 10+11

This operation mode is selected by choosing **P2580** = RPDC_MASTER for the master and **P2580** = RPDC_SLAVE for the slave.

ID	Parameters	Setting in the master	Setting in the slave
P2614	TWINdrive mode	MASTER (2)	SLAVE (1)
P 2580	TWIN_Setting	RPDC_MASTER(10)	RPDC_SLAVE(11)
P0300	Control mode	any	SCON(2)
P0159	Control selector	any	TWINSYNC(10)
P0165	Setpoint selector	any	TWINSYNC(11)
P0301	Setpoint mode	any	IP-Mode(1)
P2584	Speed-up	---	---
P2602	Local scaling	any	any
P2609	Remote scaling	same as P2602 from slave	same as P2602 from master
P2583	SlaveInverted	1 / -1	1 / -1
P4200	TwinRPDC_Sel	1	1
P4201	Current offset	any	any
P2659	CON_PRC_Kp	---	any
P2661	CON_PRC_Tn	---	any
P2663	CON_PRC_ LIMPOS	---	+ LIM
P2664	CON_PRC_ LIMNEG	---	- LIM

Table 6.9: Parameters for the master and slave drives of the pre-set TWINsync operation mode: "Rack and Pinion Drive Control RPDC"

ID	Parameters	Setting in the master		Setting in the slave	
P2683	CON_PRC_ REFSEL	---		RPDC(1)	
P2668	CON_PRC_ ACTSEL	---		ISQREF_SCON(5)	
P2672	CON_PRC_ OUTSEL	---		REFSPEED(2)	
P2615	Mapping of the sent data	Parameter value (hex)	Meaning	Parameter value (hex)	Meaning
	Sub-ID 0	0000.0002	2 objects	0000.0001	1 object
	Sub-ID 1	106A.0010	local current setpoint tx P4202 (16-bit)	106A.0010	local current setpoint tx P4202 (16-bit)
	Sub-ID 2	106C.0010	local speed setpoint P4204 (16-bit)		
	Sub-ID 3				
	Sub-ID 4				
	Sub-ID 5				
	Sub-ID 6				
	Sub-ID 7				
P2616	Mapping of the received data	Parameter value (hex)	Meaning	Parameter value (hex)	Meaning
	Sub-ID 0	0000.0001	1 object	0000.0002	2 objects
	Sub-ID 1	106B.0010	local current setpoint rx P4203 (16-bit)	106B.0010	local current setpoint rx P4203 (16-bit)
	Sub-ID 2			0A2D.0010	RemoteRefSpeed P2605 (16-bit)
	Sub-ID 3				
	Sub-ID 4				
	Sub-ID 5				
	Sub-ID 6				
	Sub-ID 7				

Table 6.9: Parameters for the master and slave drives of the pre-set TWINsync operation mode: "Rack and Pinion Drive Control RPDC" (continued)

The following figure shows the process data interface between the master and slave drives and the process controller in the operation mode: "Rack and Pinion Drive Control RPDC"

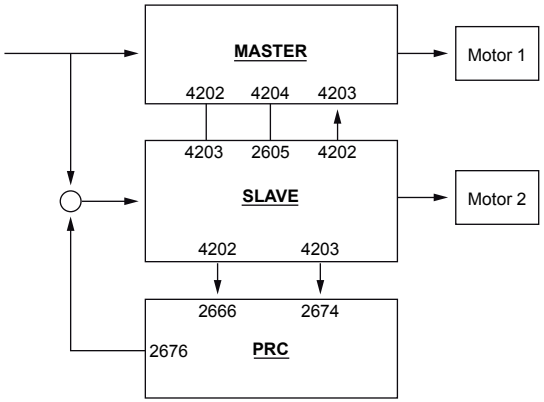

Figure 6.8: Process data interface and process controller "Rack and pinion drive control RPDC"

The transfer of the sent and received parameters is shown in the previous figure. The communication between the master and slave is accomplished via the TWINsync module. Here, the required current values and the speed setpoint are transferred to the speed controller. The process controller (PRC) must be parametrized for the slave unit. The transferred speed controller output from the master unit serves as the specified setpoint. The slave unit delivers the current speed controller output. The output of the process controller is a speed which is added to the setpoint.

The following figure shows the control structure of the master and slave drives.

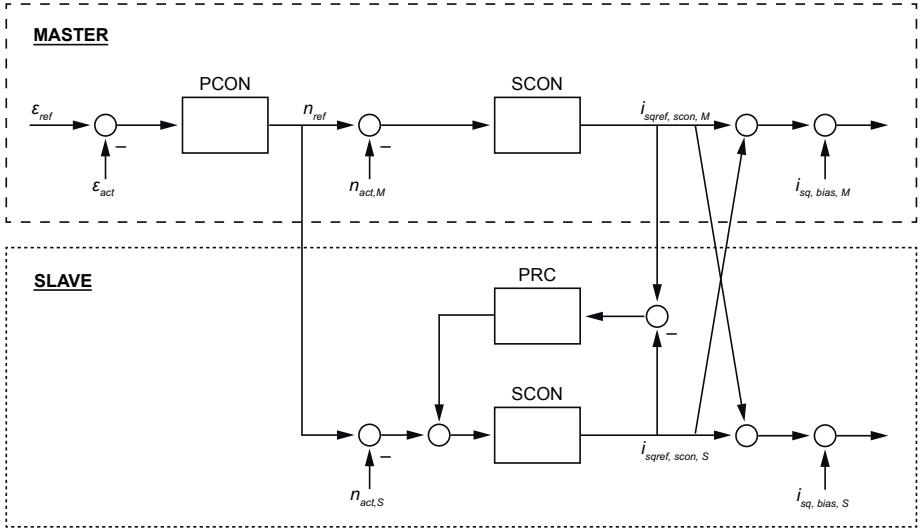

Figure 6.9: "Rack and pinion drive control RPDC" control structure

The structure diagram of the RPDC is shown in the previous figure. It can be seen here that the master operates with position control and the slave with speed control. The process controller operates on the slave drive and ensures that both speed controller outputs specify an identical current setpoint. Adding the two current setpoints (master/slave) ensures that the same current is specified for both machines. In order to now create a tension between the two drives, a current offset must now be added to the machines. This offset ensures that the slave unit only assists the master when the current setpoint exceeds the offset.

6.2.6 Virtual encoder “VE” (torque)

6.2.6.1 VE_TCON_MASTER / VE_TCON_SLAVE, 12+13

This operation mode is selected by choosing **P2580** = VE_TCON_MASTER for the master and **P2580** = VE_TCON_SLAVE for the slave. The master sends its torque setpoint, the current speed and the current position angle to the slave. To do so, the torque and speed values are first converted to a value between "-1" and "1" through “LocalScaling” and are then sent to the slave. Once they have arrived there, the values are converted back to the original variables through “RemoteScaling”.

The slave sends its error number and its error location to the master.

Mapping of the sent and received data takes place automatically by setting **P2580**. The tables must not be modified manually!

ID	Parameters	Setting in the master		Setting in the slave	
P2614	TWINdrive mode	MASTER (2)		SLAVE (1)	
P2580	TWIN_Setting	VE_TCON_MASTER(12)		VE_TCON_SLAVE(13)	
P0300	Control mode	any		TCON(1)	
P0159	Control selector	any		TWINSYNC(10)	
P0165	Setpoint selector	any		TWINSYNC(11)	
P0301	Setpoint mode	any		IP-Mode(1)	
P2581	MasterTorqueTF	---		any	
P2602	Local scaling	maximum torque and maximum speed		---	
P2609	Remote scaling	---		same as P2602 from master	
P2615	Mapping of the sent data	Parameter value (hex)	Meaning	Parameter value (hex)	Meaning
	Sub-ID 0	0000.0003	3 objects	0000.0002	2 objects
	Sub-ID 1	0A24.0010	local torque setpoint P2596 (16-bit)	0A5A.0010	current error number P2650[0] (16-bit)
	Sub-ID 2	0A27.0010	local speed actual value P2599 (16-bit)	0A5A.0110	current error location P2650[1] (16-bit)
	Sub-ID 3	107C.0010	local position actual value P4220 (16-bit)		
	Sub-ID 4				
	Sub-ID 5				
	Sub-ID 6				
	Sub-ID 7				
P2616	Mapping of the received data	Parameter value (hex)	Meaning	Parameter value (hex)	Meaning
	Sub-ID 0	0000.0002	2 objects	0000.0003	3 objects
	Sub-ID 1	0A5A.0010	current error number P2650[0] (16-bit)	0A2B.0010	RemoteRefTorque P2603 (16-bit)
	Sub-ID 2	0A5A.0110	current error location P2650[1] (16-bit)	0A2E.0010	RemoteActSpeed P2606 (16-bit)
	Sub-ID 3			107D.0010	RemoteActEps P4221 (16-bit)
	Sub-ID 4				
	Sub-ID 5				
	Sub-ID 6				
	Sub-ID 7				

Table 6.10: Parameters for the master and slave drives of the pre-set TWINsync operation mode: "Virtual Encoder VE" (torque)

Table 6.10: Parameters for the master and slave drives of the pre-set TWINsync operation mode: "Virtual Encoder VE" (torque) (continued)

The following figure shows the process data interface between the master and slave drives in the operation mode: "Virtual Encoder VE" (torque)

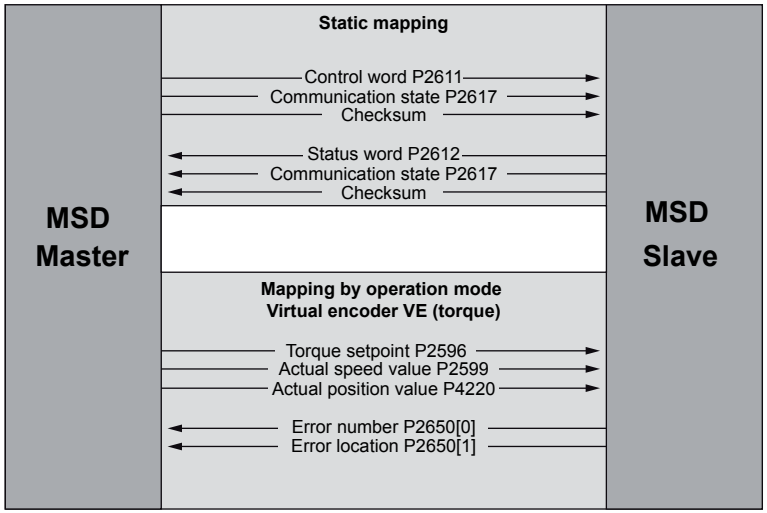

Figure 6.10: Process data interface between the master and slave drives in the operation mode: "Virtual Encoder VE" (torque)

The following figure shows the control structure of the slave drive.

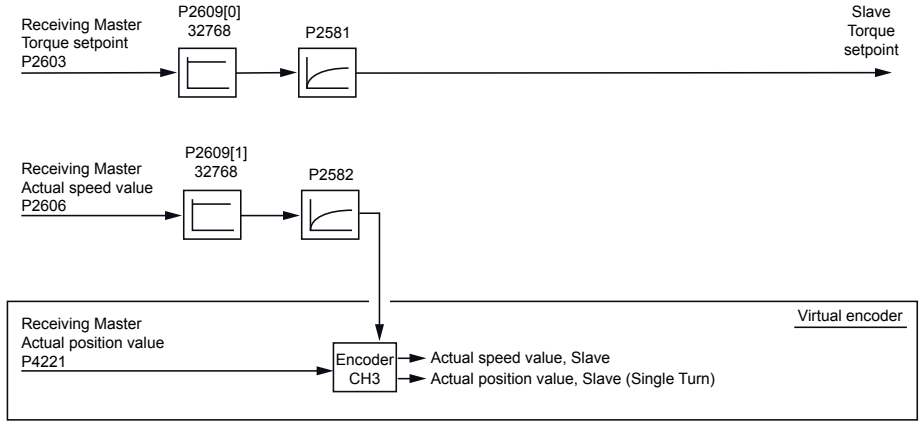

Figure 6.11: Virtual encoder VE (torque) control structure

6.2.7 dSPACE TWINsync (rapid-prototyping systems from the Fa. dSPACE company)

NOTE

The five operation modes
- PWM_SLAVE, 14
- TCON_SLAVE, 15
- SCON_SLAVE, 16
- PCON_1_SLAVE, 17
- PCON_2_SLAVE, 18

are described separately in the document: "TwinSync dSPACETwinSync dSPACE - MSD Servo Drive"

6.2.8 Interpolating positioning “IP”

For the interpolating operation modes, the master positions that are sent are not evaluated differentially and added to the internal position, but are instead used directly as the setpoint. This has the advantage that no tracking errors or differences between the master and slave can accumulate. This method has one disadvantage when there are jumps in the master position (after errors, homing, etc.) because these are implemented by the slave directly (possibly also when not desired). The use of multiturn encoders and independent homing of the master and slave drives is recommended.

6.2.8.1 PCON_IP_SLAVE, 19

Direct specification of the transferred position setpoint as an absolute position. The appropriate corresponding master operation mode would be operation mode 7.

The same functionality can also be achieved more conveniently using operation modes 21, 22 or 29, 30 which were developed for gantry applications.

6.2.9 MSD PLC control "PLC"

In the iPLC operation mode, data packets which are configured within the MSD PLC are exchanged cyclically. Configuration and access are accomplished based on MSD PLC function calls (MCB_TWIN_...). The functions are described in the MSD PLC documentation or via the CoDeSys library manager.

Three data buffers with 24 double words each are available. Two of these are exchanged cyclically. The third buffer can be modified and enabled as needed for sending or receiving. A total of 2*24 double words can be exchanged cyclically.

6.2.9.1 PLC, 20

Set this operation mode for the master and the slave and write a corresponding MSD PLC program.

6.2.10 Position setpoint (position reference value)

This operation mode is suitable for synchronizing two axes. The axes move with positional synchronization. The homing is controlled via the master and is also synchronized with the slave. The synchronization of the slave with the position of the master is absolute. If the master control mode is PCON, the setpoint position is transferred, otherwise, the actual position.

6.2.10.1 PCON_REFPOS_MASTER / PCON_REFPOS_ SLAVE, 21+22

This operation mode is selected by choosing **P2580** = PCON_REFPOS_MASTER for the master and **P2580** = PCON_REFPOS_SLAVE for the slave.

ID	Parameters	Setting in the master	Setting in the slave
P2614	TWINdrive mode	MASTER (2)	SLAVE (1)
P2580	TWIN_Setting	PCON_REFPOS_MASTER(21)	PCON_REFPOS_SLAVE(22)
P0300	Control mode	any (actual / setpoint position is transferred)	PCON(3)
P0159	Control selector	any	TWINSYNC(10)
P0165	Setpoint selector	any	TWINSYNC(11)
P0301	Setpoint mode	any	IP-Mode(1) (optionally with ext. feed forward control via TWIN)
P2584	Speed-up	---	---
P2602	Local scaling	any (for speed)	---

Table 6.11: Parameters for the master and slave drives of the pre-set TWINsync operation mode: Position setpoint (position reference value)

ID	Parameters	Setting in the master		Setting in the slave	
P2609	Remote scaling	---		same as P2602 from master (for speed)	
P2615	Mapping of the sent data	Parameter value (hex)	Meaning	Parameter value (hex)	Meaning
	Sub-ID 0	0000.0002	2 objects	0000.0001	1 object
	Sub-ID 1	0A28.0020	local position setpoint P2600 (32-bit)	0A29.0020	local position actual value P2601 (32-bit)
	Sub-ID 2	0A8E.0010	local speed setpoint (LocalRefFFISpeed) P2702 (16-bit)		
	Sub-ID 3				
	Sub-ID 4				
	Sub-ID 5				
	Sub-ID 6				
	Sub-ID 7				
P2616	Mapping of the received data	Parameter value (hex)	Meaning	Parameter value (hex)	Meaning
	Sub-ID 0	0000.0001	1 object	0000.0002	2 objects
	Sub-ID 1	0A30.0010	RemoteActPos P2608 (32-bit)	0A2F.0020	RemoteRefPos P2607 (32-bit)
	Sub-ID 2			0A2D.0010	RemoteRefSpeed P2605 (16-bit)
	Sub-ID 3				
	Sub-ID 4				
	Sub-ID 5				
	Sub-ID 6				
	Sub-ID 7				

Table 6.11: Parameters for the master and slave drives of the pre-set TWINsync operation mode: Position setpoint (position reference value) (continued)

The following figure shows the process data interface between the master and slave drives in the operation mode: Position setpoint (position reference value)

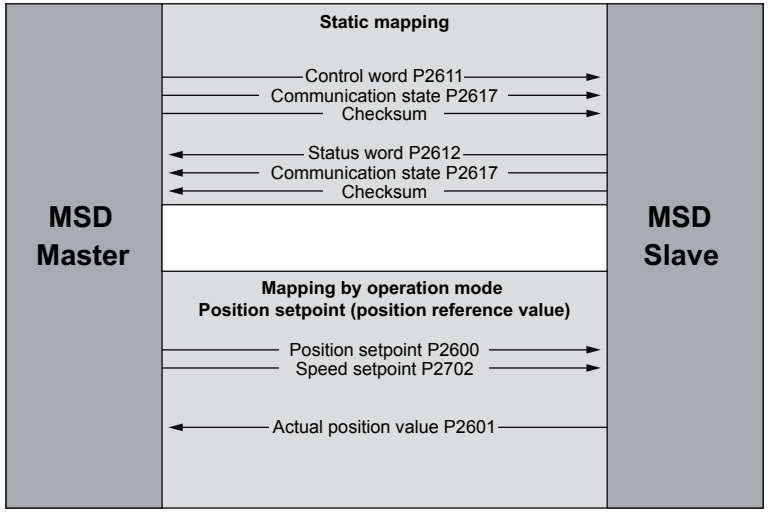

Figure 6.12: Process data interface, position setpoint (position reference value)

6.2.11 Serial Double Inverter "SDI" / Parallel Double inverter "PDI"

This chapter describes a solution with which a combined operation of two servo drives of the type G395-450/G397-450 on a single, common motor winding is possible. This solution is intended for applications in which the maximum output current or the maximum output power of one servo drives of the type G395-450/G397-450 is inadequate.

The solution assumes the presence of a TWINsync communication connection between the two inverters. One inverter is operated in master mode and is parametrized in accordance with the application. The second inverter is operated in slave mode and receives its control commands and setpoints from the master via the

TWINsync interface. The slave sends actual values and status information to the master via the TWINsync interface. The slave is operated either with direct specification of the PWM duty cycles or in current-controlled mode.

6.2.11.1 TWINsync dual inverter operation modes

In the dual inverter operation mode, two inverters operate in master-slave mode. Both inverters are connected to a common motor winding on the output side. In this case, for the slave inverter, a distinction is made between the control modes “PWM mode” and “ICON mode”. In the PWM mode, the master sends the PWM switching times directly to the slave. In the ICON mode, the d and q current setpoints as well as the commutation angle measured by the master are sent from the master to the slave. The slave the operates with a field-oriented current control without its own encoder evaluation. The outputs of the master and slave can be connected in parallel or in series in this case.

The following table describes the new TWINsync operation modes which can be set via the parameter **P2580** (MPRO_TWIN_Setting).

ID	Value	Selection text	Description
P2580	23	MPRO_TWIN_SDI_ Master_PWM	Serial dual inverter master (slave in PWM mode)
	24	MPRO_TWIN_PDI_ Master_PWM	Parallel dual inverter master (slave in PWM mode)
	25	MPRO_TWIN_SPDI_ Slave_PWM	Serial/parallel dual inverter slave (slave in PWM mode)
	26	MPRO_TWIN_SDI_ Master_ICON	Serial dual inverter master (slave in ICON mode) (not yet selectable)
	27	MPRO_TWIN_PDI_ Master_ICON	Parallel dual inverter master (slave in ICON mode) (not yet selectable)
	28	MPRO_TWIN_SPDI_ Slave_ICON	Serial/parallel dual inverter slave (slave in ICON mode) (not yet selectable)

Table 6.12: TWINsync operation modes for dual inverter operation

No.	Operation mode combinations		Wiring
	P2580 (master)	P2580 (slave)	
1	MPRO_TWIN_SDI_ Master_ICON	MPRO_TWIN_SPDI_Slave_ ICON	Inverters wired in series to a motor winding open on both sides
2	MPRO_TWIN_SDI_ Master_PWM	MPRO_TWIN_SPDI_Slave_ PWM	
3	MPRO_TWIN_PDI_ Master_ICON	MPRO_TWIN_SPDI_Slave_ ICON	Inverters wired in parallel to a standard motor winding with balance coils to provide isolation
4	MPRO_TWIN_PDI_ Master_PWM	MPRO_TWIN_SPDI_Slave_ PWM	

Table 6.13: Useful combinations of TWINsync operation modes in dual-inverter operation

Because this concerns rather “exotic” applications, the responsible field or global application engineer should be consulted, possibly also with assistance from the development department.

6.2.11.2 Operation modes 23, 24, 25, 26, 27 and 28

The operation modes

- SDI_PWM_MASTER (pwm mode), 23
- PDI_PWM_MASTER (pwm mode), 24
- SDI_PDI_PWM_SLAVE (pwm mode), 25
- SDI_CURR_MASTER (current mode), 26
- PDI_CURR_MASTER (current mode), 27
- SDI_PDI_CURR_SLAVE (current mode), 28

are described again separately with wiring diagrams, start-up information and related documentation in a seperate document.

6.2.12 Gantry application

Operation mode for gantry applications with position and speed tacking error monitoring. Suitable for all control modes.

In contrast to operation modes 21 and 22, the actual position is always sent. The speed and torque sent are determined directly from the feed forward control values of the master and could also be used in the slave as feed forward control values (minimization of the tracking error).

Operation modes 29 and 30 also differ from 21 and 22 in the monitoring of the slave position and speed. The master monitors these values in operation mode 29 (position tracking error from **P-744** and speed tracking error from **P-2595**). If there is a deviation, ERR-39 is generated.

6.2.12.1 PCON_GANTRY_MASTER / PCON_GANTRY_ SLAVE, 29+30

This operation mode is selected by choosing **P2580** = PCON_GANTRY_MASTER for the master and **P2580** = PCON_GANTRY_SLAVE for the slave.

ID	Parameters	Setting in the master	Setting in the slave
P2614	TWINdrive mode	MASTER (2)	SLAVE (1)
P2580	TWIN_Setting	PCON_GANTRY_MASTER(29)	PCON_GANTRY_SLAVE(30)
P0300	Control mode	same as P0300 from slave	same as P0300 from master
P2701	Slave synchronization	- - -	0 = SLAVE_SYNC_ISR, TwinSlave: Synchronization via TWIN (Mode 1) 1 = SLAVE_SYNC_COM, TwinSlave: Synchronization via field bus 2 = SLAVE_SYNC_ENC, TwinSlave: Synchronization via TWIN (Mode2)
P0159	Control selector	any	TWINSYNC(10)

Table 6.14: Parameters for the master and slave drives of the pre-set TWINsync operation mode: Gantry application

ID	Parameters	Setting in the master		Setting in the slave	
P0165	Setpoint selector	any		TWINSYNC(11)	
P0301	Setpoint mode	any		IP-Mode(1)	
P2584	Speed-up	- - -		- - -	
P2602	Local scaling	any		any	
P2609	Remote scaling	same as P2602 from slave		same as P2602 from master	
P2583	SlaveInverted	1 / -1		1 / -1	
P2615	Mapping of the sent data	Parameter value (hex)	Meaning	Parameter value (hex)	Meaning
	Sub-ID 0	0000.0003	3 objects	0000.0002	2 objects
	Sub-ID 1	0A28.0020	local position setpoint P2600 (32-bit)	0A29.0020	local position actual value P2601 (32-bit)
	Sub-ID 2	02FC.0020	spec. speed setpoint P0764 (32-bit)	0119.0020	spec. speed actual value P0281 (32-bit)
	Sub-ID 3	08E0.0010	spec. torque actual value P2272 (16-bit)		
	Sub-ID 4				
	Sub-ID 5				
	Sub-ID 6				
	Sub-ID 7				
P2616	Mapping of the received data	Parameter value (hex)	Meaning	Parameter value (hex)	Meaning
	Sub-ID 0	0000.0002	2 objects	0000.0003	3 objects
	Sub-ID 1	0A30.0020	RemoteActPos P2608 (32-bit)	0A2F.0020	RemoteRefPos P2607 (32-bit)
	Sub-ID 2	0A1B.0020	ActSpeedMaster P2587 (32 bit)	0A1B.0020	ActSpeedMaster P2587 (32 bit)
	Sub-ID 3			0A2C.0010	RemoteActTorque P2604 (16-bit)
	Sub-ID 4				
	Sub-ID 5				
	Sub-ID 6				
	Sub-ID 7				

Table 6.14: Parameters for the master and slave drives of the pre-set TWINsync operation mode: Gantry application (continued)

The following figure shows the process data interface between the master and slave drives in the operation mode: Gantry application

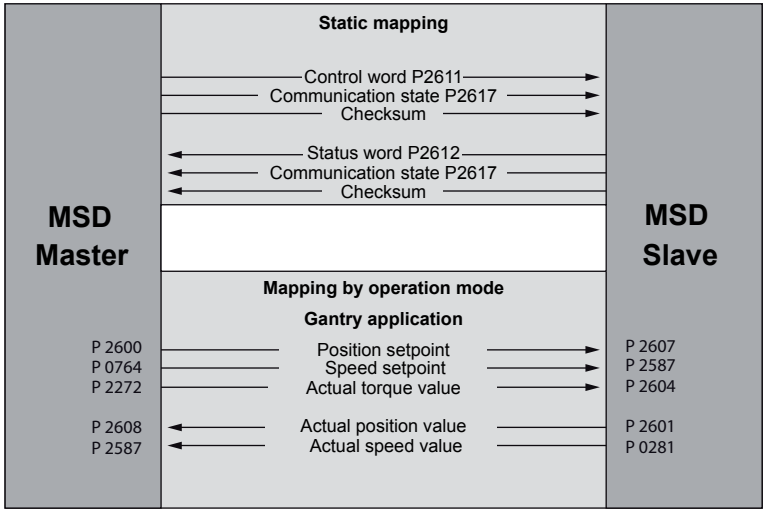

Figure 6.13: Process data interface, gantry application

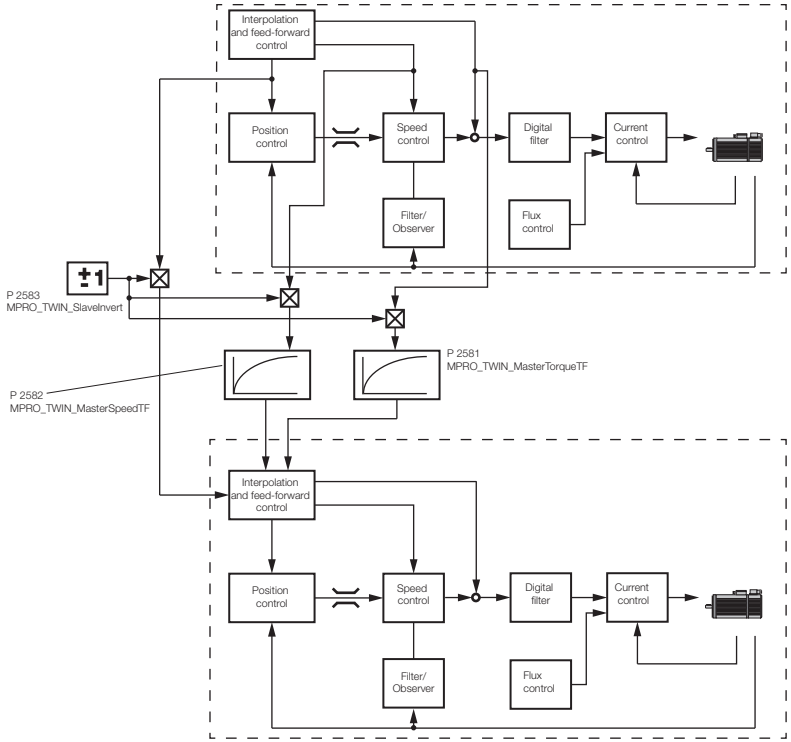

Figure 6.14: Gantry application control structure

6.2.13 Extended Mapping Mode

Extended mapping was introduced for general synchronization tasks. It allows any transfer of scope data or mappable parameter data (in summary: so-called “ParaScope objects”). Ideally, in combination with iPLC applications on master and slave. It is theoretically possible to write to scope data: the application must be created with corresponding foresight.

6.2.13.1 EXT_MAP_MASTER / EXT_MAP_SLAVE, 31+32

This operation mode is selected by choosing **P2580** = EXT_MAP_MASTER for the master and **P2580** = EXT_MAP_SLAVE for the slave.

ID	Parameters	Setting in the master	Setting in the slave
P2614	TWINdrive mode	MASTER (2)	SLAVE (1)
P2580	TWIN_Setting	EXT_MAP_MASTER(31)	EXT_MAP_SLAVE(32)
P0300	Control mode	any	any
P2701	Slave synchronization	---	0 = SLAVE_SYNC_ISR, TwinSlave: Synchronization via TWIN (Mode 1) 1 = SLAVE_SYNC_COM, TwinSlave: Synchronization via field bus 2 = SLAVE_SYNC_ENC, TwinSlave: Synchronization via TWIN (Mode2)
P0159	Control selector	any	any
P0165	Setpoint selector	any	any
P0301	Setpoint mode	any	any
P2584	Speed-up	---	---
P2602	Local scaling	---	---
P2609	Remote scaling	---	---
P2709[0]	PhysicalLink[0]: Baud rate	Baud rate selection 0 = 4 M 1 = 2 M 2 = 1 M 3 = 800 k 4 = 500 k 5 = 400 k 6 = 250 k	same as P2709[0] from master
P2709[1]	PhysicalLink[1]: Frame size	Frame size selection EXT_PDO = extended mapping PDO 0 = 14 byte EXT_PDO 1 = 12 byte EXT_PDO 2 = 10 byte EXT_PDO 3 = 8 byte EXT_PDO	same as P2709[1] from master

Table 6.15: Parameters for the master and slave drives of the pre-set TWINsync operation mode: Extended Mapping Mode

ID	Parameters	Setting in the master		Setting in the slave	
		4 = 6 byte EXT_PDO 5 = 4 byte EXT_PDO 6 = 16 byte EXT_PDO 7 = 18 byte EXT_PDO 8 = 20 byte EXT_PDO 9 = 22 byte EXT_PDO 10 = 24 byte EXT_PDO 11 = 26 byte EXT_PDO 12 = 28 byte EXT_PDO 13 = 30 byte EXT_PDO			
P2615	Mapping of the sent data	Parameter value (hex)	Meaning	Parameter value (hex)	Meaning
	Sub-ID 0	pppp.SS.tt	Tx ParaScope object 0	pppp.SS.tt	Tx ParaScope object 0
	Sub-ID 1	pppp.SS.tt	Tx ParaScope object 1	pppp.SS.tt	Tx ParaScope object 1
	Sub-ID 2	pppp.SS.tt	Tx ParaScope object 2	pppp.SS.tt	Tx ParaScope object 2
	Sub-ID 3	pppp.SS.tt	Tx ParaScope object 3	pppp.SS.tt	Tx ParaScope object 3
	Sub-ID 4	pppp.SS.tt	Tx ParaScope object 4	pppp.SS.tt	Tx ParaScope object 4
	Sub-ID 5	pppp.SS.tt	Tx ParaScope object 5	pppp.SS.tt	Tx ParaScope object 5
	Sub-ID 6	pppp.SS.tt	Tx ParaScope object 6	pppp.SS.tt	Tx ParaScope object 6
	Sub-ID 7	pppp.SS.tt	Tx ParaScope object 7	pppp.SS.tt	Tx ParaScope object 7
P2616	Mapping of the received data	Parameter value (hex)	Meaning	Parameter value (hex)	Meaning
	Sub-ID 0	pppp.SS.tt	Rx ParaScope object 0	pppp.SS.tt	Rx ParaScope object 0
	Sub-ID 1	pppp.SS.tt	Rx ParaScope object 1	pppp.SS.tt	Rx ParaScope object 1
	Sub-ID 2	pppp.SS.tt	Rx ParaScope object 2	pppp.SS.tt	Rx ParaScope object 2
	Sub-ID 3	pppp.SS.tt	Rx ParaScope object 3	pppp.SS.tt	Rx ParaScope object 3
	Sub-ID 4	pppp.SS.tt	Rx ParaScope object 4	pppp.SS.tt	Rx ParaScope object 4
	Sub-ID 5	pppp.SS.tt	Rx ParaScope object 5	pppp.SS.tt	Rx ParaScope object 5
	Sub-ID 6	pppp.SS.tt	Rx ParaScope object 6	pppp.SS.tt	Rx ParaScope object 6
	Sub-ID 7	pppp.SS.tt	Rx ParaScope object 7	pppp.SS.tt	Rx ParaScope object 7

Table 6.15: Parameters for the master and slave drives of the pre-set TWINsync operation mode: Extended Mapping Mode (continued)

pppp : in hex: Parameter ID or scope ID
SS : in hex: Parameter SubID in hex or "0" (if ScopeData)
tt : in hex: Type selection: 0 = ParameterData, 1 = ScopeData

Configuration of the process data in the extended-mapping mode

The process data to be sent and to be received by the drive are configured here manually using the parameters (**P2615**) TOPT_TWIN_ProcessSendData (mapping of the sent data) and (**P2616**) TOPT_TWIN_ProcessReceiveData (mapping of the received data). The parameters **P2615 / P2616** are each field parameters with 8 elements. A maximum of 8 ParaScope objects in each direction are supported. The entries under SubID 0-7 are coded as described in the following table.

Bit field	Meaning of SubID 0...7 (extended-mapping mode)
PPPPxxxxh	2-byte parameter ID or scope ID of the object that is to be sent as a HEX value
xxxxSSxxh	1-byte parameter SubID of the parameter that is to be sent as a HEX value or “0” if the type “ScopeData object” is selected
xxxxxxTTh	1-byte type selection of the object that is to be sent as a HEX value TT = 00h : Type selection “ParameterData object" TT = 01h : Type selection “ScopeData object"

*Table 6.16: Structure of parameters **P2615 / P2616** (SubID: 0-7) for mapping the process data which is to be sent in the extended-mapping mode*

When configuring the process data, it is essential to be sure that the sequence and the data width of the received data of the one axis match the sequence and the data width of the sent data of the other axis. This matching of the parametrization cannot be monitored by MSD Servo Drive and must therefore be ensured by the user.

6.2.13.2 Example: Electronic gear unit / E-CAM synchronization

ID	Parameters	Setting in the master	Setting in the slave
P1319	Camming Mater AxisType	any	9 = encoder TWIN (the position is calculated from P2607 TWIN_RemoteRefPos)
P2615	TX mapping	4-byte encoder single-turn position (Scope ID 1011, 1021, 1031) 4-byte PLC DINT 4-byte PLC FLOAT 2-byte PLC INT	4 byte PLC DINT 4 byte PLC DINT 4 byte PLC FLOAT 2 byte PLC INT
P2616	RX mapping	4 byte PLC DINT 4 byte PLC DINT 4 byte PLC FLOAT 2 byte PLC INT	4 byte P2607 TWIN_RemoteRefPos 4 byte PLC DINT 4 byte PLC FLOAT 2 byte PLC INT
P0159	Control selector	any	iPLC
P0165	Setpoint selector	any	any (with CAM superimposed)

Table 6.17: Example: Electronic gear unit / E-CAM synchronization

6.2.14 Dual Stator Winding motor "DSW"

Operation modes 33 and 34 are intended for the operation of double-wound motors (analogous to the “Double inverter DI” operation modes). The start-up procedure is for the most part identical.

6.2.14.1 DSW_MASTER / DSW_SLAVE, 33+34

Because the topic of double-wound motors is a rather “exotic” application, the responsible field or global application engineer should be consulted, possibly also with assistance from the development department.

7 Monitoring functions / Error messages

The data transfer of the master/slave link is monitored continuously. Errors can occur either if there is faulty parametrization or when the communication channel is malfunctioning. Errors are only reported when the MSD Servo Drive is in the “Control” state (display shows State 5). The master/slave link has the primary error group “40” (ErrorID). A list of the possible errors can be found in the following tables.

Error ID		Cause of error	Remedy for error
40	00	Faulty data transfer. This can occur if the channel malfunctions for longer than the time which can be set in P2613. The error is also reported if the slave has lost synchronization.	Check plug-in connection Check cable Check MSD Servo Drive
40	01	Master and slave have differently parametrized switching frequencies.	Correct parametrization
40	02	The axes are either both parametrized as the master or as the slave.	Correct parametrization
40	04	Master and slave have different DriveCom states (the states through state 5 are monitored. The monitoring is inactive for a quick stop or an error reaction.)	Restart the control, acknowledge the error

Table 7.1: Group “40” error messages in master/slave operation

Error ID		Cause of error	Remedy for error
39	00	Speed difference between master and slave is too great	Check encoder
39	01	Torque difference between master and slave is too great	Correct parametrization
39	02	Error detected on the other axis (master or slave)	Restart master/slave

Table 7.2: Group “39” error messages in master/slave operation

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Moog GmbH
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Telefon +49 7031 622 0

www.moog.com/industrial
drives-support@moog.com

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