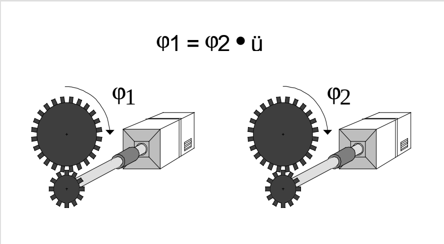
SIEMENS

Standard Software Package

SPA440 Angular Synchronous Control

for the

T400 Technology Module



Manual

Edition 05.01

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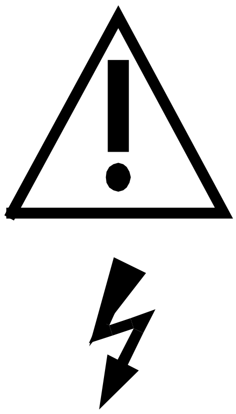
Contents

0 Warning information



WARNING

Electrical equipment has components which are at dangerous voltage levels.

If these instructions are not strictly adhered to, this can result in severe bodily injury and material damage.

Only appropriately qualified personnel may work on/commission this equipment.

This personnel must be completely knowledgable about all the warnings and service measures according to this User Manual.

It is especially important that the warning information in the relevant Operating Instructions (MASTERDRIVES or DC MASTER) is strictly observed.

Definitions

- **Qualified personnel** for the purpose of this Manual and product labels

are personnel who are familiar with the installation, mounting, start-up and operation of the equipment and the hazards involved. He or she must have the following qualifications:

1. Trained and authorized to energize, de-energize, clear, ground and tag circuits and equipment in accordance with established safety procedures.

2. Trained in the proper care and use of protective equipment in accordance with established safety procedures.

3. Trained in rendering first aid.

DANGER

For the purpose of this Manual and product labels, „Danger“ indicates death, severe personal injury and/or substantial property damage will result if proper precautions are not taken.

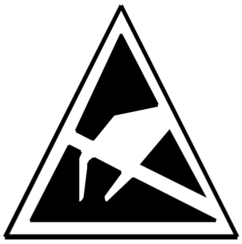
WARNING

For the purpose of this Manual and product labels, „Warning“ indicates death, severe personal injury or property damage can result if proper precautions are not taken

CAUTION

For the purpose of this Manual and product labels, „Caution“ indicates that minor personal injury or material damage can result if proper precautions are not taken.

NOTE For the purpose of this Manual, „Note“ indicates information about the product or the respective part of the Manual which is essential to highlight.



CAUTION

This board contains components which can be destroyed by electrostatic discharge. Prior to touching any electronics board, your body must be electrically discharged. This can be simply done by touching a conductive, grounded object immediately beforehand (e.g. bare metal cabinet components, socket protective conductor contact).

1 Overview

1.1 Validity

This User Manual is valid for the SPA440 angular synchronous control standard software package.

NOTE

This documentation is **not compatible** with the previous MS340 angular synchronous controls!

Contrary to the earlier version, version 2.02 and higher includes so-called BICO technology. This allows connections within the application to be adapted to the actual task by making the appropriate parameter changes. Supplementary functions can be implemented by inserting free blocks.

For compatibility reasons, the multiplexer blocks have been kept, although they are no longer required as a result of the BICO technology. All of the parameters from versions V2.00 and V2.01 which can be changed, have been kept. Changes have been made with respect to the display parameters.

Hardware configuration

The documentation refers to operational standard software package, comprising the T400 technology module and the software which is loaded onto it. Generally, the T400 is operated in the drive converter (SIMOVERT MASTERDRIVES MC or VC; DC Master) with/without communications module (e. g.: PROFIBUS connection).

However, the software package can also be used when the T400 is inserted in the SRT400. In this particular case, data is not transferred to the basic drive converter via a common backplane bus. Presently, it is not possible to parameterize the system using SIMOVIS.

NOTE

The control core (all of the functions) of the SPA440 standard software package is also available for other configurations, e.g. CPU modules PM4 - PM6 with the IT41 expansion module. In this case, the application-specific changes are made using the graphic configuring tool CFC.

1.2 Order Numbers

The sources of the standard software package SPA440 angular synchronous control, are available on CD-ROM (designation SPA440) . When required, the angular synchronous control function can be adapted to specific customer requirements using the graphic configuring interface of SIMADYN D, i.e. CFC (also refer to Table 1-1).

Designation	Explanation	MLFB / Order No.
SPA440	SPA440 angular synchronous control on CD-ROM and the documentation (as file).	6DD1842-0AB0
D7 ES	SIMADYN D configuring software D7-ES. Package comprising STEP7, CFC and D7-SYS on CD-ROM	6DD1801-4DA2

Table 1-1 Components for adapting the software package using CFC

1.3 Introduction

Electrical shaft

The angular synchronous control with synchronization is an application which is frequently used in drive technology. This synchronous operation, which is achieved with the control software, is also known as **”Electrical shaft”**.

Standard software package

Angular synchronous operation is implemented using the SPA440 **standard software package**. This standard software package can run on the T400 technology module, integrated in a drive converter. It is available as CFC source software on CD-ROM or directly on the T400. It can be modified with STEP7, CFC and the supplementary D7-SYS software, to adapt the technology functions to the customer’s precise requirements.

1.4 Terminology

1.4.1 Important terminology

Master slave

The ”angular synchronous” application comprises a master drive and one or several slave drives. The master drive specifies the speed and angular position of the slaves.

Pulses / pulse encoder

Position actual values are sensed by counting the pulses received from the connected pulse encoder. The pulse encoder has two signal lines, which supply pulse series with a 90° offset to one another. The direction of rotation is determined from the phase position of the two pulse series. For these pulse series, both the rising as well as the falling edges are evaluated. Overall, the **pulses are quadrupled**, which means that the resolution is also quadrupled. The position- and speed actual values are retrieved from the quadrupled pulses per software (using the speed sensing function blocks).

Encoder pulse number / synchronizing pulse number

A differentiation must be made between **”Encoder pulse number”** (parameter H011) and **”Synchronizing pulse number”** (parameter H100). **”Encoder pulse number”** specifies the number of encoder pulses per revolution (“Pulse number”). On the other hand, the **”Synchronizing pulse number”** refers to the number of pulse edges between two synchronizing pulses (quadrupled pulses). This means, that for an encoder with an encoder pulse number H011=1024, the synchronizing pulse number is H100=4096, if one synchronizing pulse (e.g. zero pulse) occurs per revolution.

Position actual value

The number of summed pulses since the drive was powered-up, or since it was reset the last time. The position actual value can be reset, e.g. when a zero pulse occurs. In this case, the position actual value corresponds to the number of summed pulses since the last time the drive was reset.

Actual angular value

Rotation of the rotor of a drive with reference to a defined zero position in angular degrees. The definition of the actual angular value is from 0 to 360°. It can only be determined after a synchronizing pulse has been received (zero pulse, BERO proximity switch) with the drive running. The absolute position of the drive is known as a result of the synchronizing pulse. As the drive moves, additional pulses are received, which are summed and the actual position changes. The actual angular value is obtained from the difference of the instantaneous actual position and the actual position at the synchronizing instant. It therefore corresponds to the angle that the rotor has moved through since the last synchronizing pulse was received.

Position actual value

The summed pulses of the incremental encoder represent the actual position value. The actual travel is calculated from the actual position value, which is generated due to the fact that the drive is moving, e.g. the distance that a gantry crane moves when the drives are running (refer to 3.8.1)

Speed synchronism

The master- and slave drive(s) receive the same speed setpoint. The speed setpoint can be weighted for the individual drives using a ratio. For pure synchronous speed control, only the **speeds of the drives** are controlled and the angular position is ignored.

Angular synchronism

The angular synchronous control has a closed-loop speed synchronizing control as subordinate control loop. In addition to the speed synchronism, the differential position actual values (i. e. the difference pulses) between the master- and slave drive(s) are fed to a higher-level closed-loop angular control. Angular synchronous operation of the drives means that while the master- and slave drives are operational, the **relative angular position** between the master and slaves is controlled so that it remains constant. The same as the closed-loop synchronous speed control, the master/slave ratio can be adjusted over a wide range.

Synchronization

In addition to speed- and angular synchronism, the drives can also be synchronized with one another. This means, that the angular- or positions of the drives can be synchronized to a specified offset (displacement) when synchronizing marks are passed (pulse encoder zero pulse or BERO proximity switch). Synchronization is realized, depending on the application, at various intervals. The synchronizing mechanism is explained in more detail in Section 1.5.

1.4.2 Functions and features

- Ratio between the master and slave which can be set over a wide range
- Both drives can be synchronized with one another, also for a flying master
- An offset (displacement) can be entered depending on the direction of rotation
- Speed controller KP adaption for low speeds
- Angular controller KP adaption as a function of the ratio
- Communications coupling is monitored and the angular controller enabled
- From V2.1. onwards for linear axis, angular synchronism can also be implemented using **2 absolute value encoders** by comparing the two position actual values: Delta_Pos = Pos_Master – Pos_Slave.
  When using this version, parameters L098 must be set to 0 and L099 to 1. In this case, the peer-to-peer coupling of the T400 cannot be used.
  If the standard version is used (position differential sensing with incremental encoders), parameter L098 must be set to 1 and L099 to 0 (factory setting).

Functions

The control core consists of the following CFC charts: SYNC01, SYNC02 and CONTR. All of the other charts form the interfaces to the drive converter, communication channels and HMI devices.

Functions in the standard software package	Implemented in CFC chart	Sampl. time	Description
Closed-loop control - reading-in setpoints - sensing actual values - angular controller - determining the displacement - synchronizing - speed controller (optional) - analog outputs - analog inputs • AE1 • AE2 to AE4	SYNC01, SYNC02	 9.6 ms 1.2 ms 1.2 ms 1.2 ms 1.2 ms 1.2 ms 1.2 ms 1.2 ms 9.6 ms	Section 2.2 Section 3
Open-loop control - jogging - enable functions for: • angular controller • synchronization • speed controller • communication interfaces - fault- and alarm handling - monitoring functions • couplings	CONTR	19.2 ms 19.2 ms 19.2 ms 19.2 ms when initial. 153.6 ms 19.2 ms	Section 3
Communications - drive converter (CU), receive PZD - drive converter (CU), send PZD - COMBOARD PZD	 IF_CU (interface to CU) IF_COM (interface to CB1)	 19.2 ms 1.2 ms 9.6 ms	Section 2.1

- peer-to-peer PZD	IF_Peer (interface to peer.)	9.6 ms	
Parameter handling - defining the texts for the technology parameters	PAR_GER (German) PAR_ENG (English)	153.6 ms	Section 4

Table 1-2 Functions and structure at a glance

1.5 A comparison between speed- and angular synchronism

1.5.1 Model

The following sketch of the model is intended to provide a better understanding of the control principles of speed- and angular synchronism.

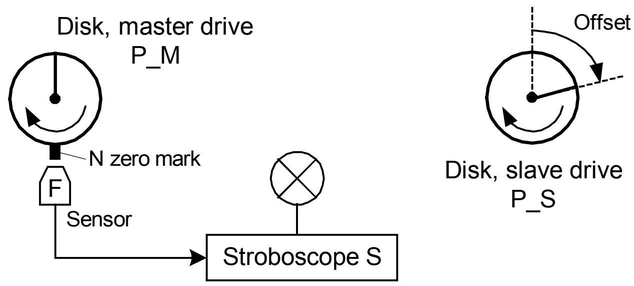


Fig. 1-1 Model to illustrate angular synchronism

S_M and S_S

The lefthand disk is located on the rotor of the master drive. In the following it will be called ”Disk, master drive” (P_M). The righthand disk is connected to the rotor of the slave drive and is called ”Disk, slave drive” (P_S).

Stroboscope S

The slave drive is operated from a closed-loop synchronous speed- or angular synchronous control, where the reference is the master. The master/slave speed ratio is assumed to be 1:1, i.e. the two disks P_M and P_S rotate with the same speed, in the same direction. Stroboscope S is triggered by the rotational motion of the master. It is triggered precisely then, when cam N is located above sensor F, i.e., if the line on the disk P_M points vertically upwards (i.e. to ”12”). This is implemented, e.g. using the zero pulse of a pulse encoder.

NOTE

The situation assumes a master/slave speed ratio of 1:1 (this is easier to depict). The observations also apply for other ratios.

Pulse pattern

In spite of the rotational movement, as a result of the stroboscope, anybody looking at the disk, will see a steady-state pattern of lines on the disks P_M and P_S. The principles behind closed-loop speed- and angular synchronous controls can be made very clear using the position of the lines on the two disks, as will be seen in the following.

1.5.2 Differences between speed- and angular synchronism

For synchronous speed control, the master- and slave drives receive the same speed setpoint, while the angular position is ignored. The closed-loop angular synchronous control has, as subordinate control, a closed-loop synchronous speed control. In addition to speed synchronism, the differential position actual values (i. e. the difference pulses) between the master- and slave drives, are fed to a higher-level closed-loop angular control.

The differences between the two control types will be clarified using the following example: There are three disks (refer to Fig. 1-2): one master disk (P_M) and two slave (P_S) disks. The master drive rotates with a constant impressed speed. One of the slave drives is controlled from a closed-loop speed control, and the other slave drive, from a closed-loop angular synchronous control; both of them are referred to the master drive. The master/slave ratio is set to 1:1 for both of the slaves, i.e. the three disks rotate in the same direction and with the same speed.

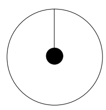
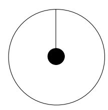
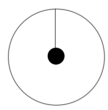
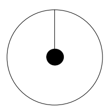
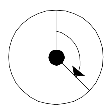
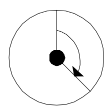
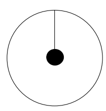
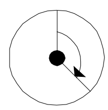
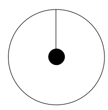
Status	**Master**	**Slave, speed synchronism**	**Slave, angular synchronism**
Instant t Undisturbed, steady-state operation			
Instant t+1 Disturbance quantity injected into the slave			
Instant t+2 Disturbance quantity has been corrected			

Fig. 1-2 Difference between speed- and angular synchronism

Three instants in time are shown in Fig. 1-2 : the disks of the master (P_M) and slave (P_S) at the instants t, t+1 and t+2.

Instant t: Operation without any disturbance quantity. In this operating status, there are no differences between closed-loop speed- and angular synchronous control. However, this particular situation is only of theoretical relevance, as in practical operation, disturbances are always present.

Instant t+1:

A disturbance affects the slave drives. This disturbance **initially** causes the slave drive to lead by a specific offset V_x, both for the closed-loop speed- as well as for the closed-loop angular synchronous control.

Instant t+2:

In steady-state operation, for closed-loop angular synchronous control, this offset V_x is corrected and for the pure closed-loop synchronous speed control, it is not. For the closed-loop angular synchronous control, the slave disk re-assumes its original position, contrary to the pure closed-loop synchronous speed control. The angular controller corrects until the previous pulse difference between the master- and slave drive at instant t has been re-established.

Note

After the disturbance has been corrected, for the closed-loop angular synchronous control, disk P_S assumes its original position, i.e. relative angular position. Contrary to this, for the pure closed-loop speed control, this disturbance is **not** corrected. This means that the additional angular offset, caused by the fault, is kept !

1.6 Displacement and synchronization

When two drives are operated with synchronous control, it may be necessary to also synchronize the drives. This is generally the case after the drives have been powered-up, as the master- and slave drives are not in a defined position. Certain applications make it also necessary to synchronize shorter or longer intervals (also refer to e.g. Section 3.7.1).

The goal is to correct an erroneous differential pulse actual value between the master and slave. In this case, the sensed actual values are referenced to absolute synchronizing marks.

Synchronization

When synchronizing, the displacementat the synchronizing instant is determined and then **this displacement to a specified displacement setpoint is corrected**. Synchronization is required, if the relative position between two drives regarding absolute synchronizing marks must be detected and corrected.

Synchronizing mark

When a synchronizing mark is passed it is detected per hardware using a zero pulse from the pulse encoder or using a BERO proximity switch. The absolute position of the drives with respect to one another is sensed using one synchronizing signal.

Displacement (actual value)

The actual angular values of the two drives is set to defined actual angular values when the fixed synchronizing marks are passed. Only after both drives have passed their synchronizing marks, can the actual **offset (actual value**) be defined as the **number of pulses, which are received from the master- and slave drives between the synchronizing marks**.

Note

The number of synchronizing pulses between the master- and slave drive at the machine part, to which the drive must be synchronized, must be the **same**. This standard software package does not take into account unequal synchronizing pulse rates !

Displacement and synchronization are explained using a rotary movement. This is essentially the same also for linear motion (refer to Section 3.7.1)

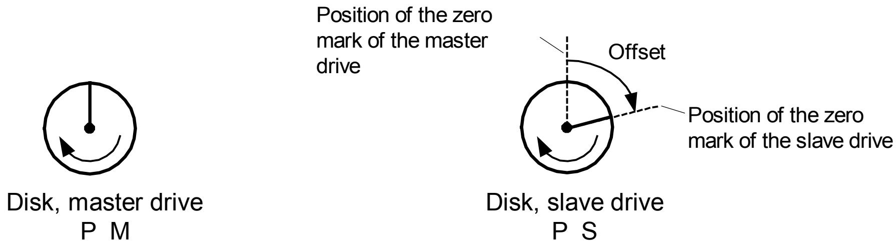


Fig. 1-3 Position displacement between the master- and slave drives

After both drive synchronizing marks have been passed, the correct displacement (actual value) can be determined as master/slave pulse difference. This displacement replaces the previous differential position actual value in the angular synchronous control (which could have been possibly incorrect).

Displacement setpoint

The relative (angular) position of the master and slave are entered using the displacement setpoint so that the master- and slave drives have the required position to one another. If they are not synchronized, the displacement setpoint refers to the angular position of the drives at the instant that the differential position actual value was last set. For example, at the start of the closed-loop control. If synchronized, the displacement setpoint refers to the last synchronized displacement actual value. The displacement is entered as **quadrupled pulses** (refer to Section 1.3.1).

The disks of the master (P_M) and slave (P_S) at instants t, t+1 and t+2 are illustrated in Fig. 1-4 at three instants in time. They are intended to clarify the interaction between displacement setpoint and displacement actual value. These instantaneous states are obtained using a stroboscope and the model as shown in Fig. 1-1.

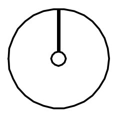
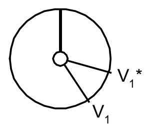
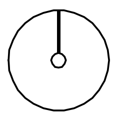
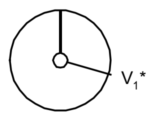
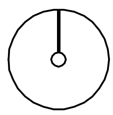
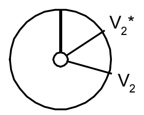
Action, status	Master	Slave
Instant t Displacement actual value V_1 and displacement Setpoint V_1* are present		
Instant t+1 Synchronization has taken place, the displacement actual value has been corrected. Displacement setpoint V_1 is kept, the change is corrected.		
Instant t+2 New displacement setpoint V_2* is entered and kept, actual value V_2 is corrected.		

Fig. 1-4 Synchronizing to an displacement setpoint

Instant t:

The slave drive is operated from the closed-loop angular synchronous control. V_1* is available as displacement setpoint, which should specify the required relative displacement between the master and slave. The displacement setpoint V_1* refers to the angular position of the drive the last time that the differential position actual value was set. If synchronization still has not taken place, this reference instant can extend back to the past until the angular controller has been enabled after power-on. However, if synchronization has already taken place, the displacement setpoint refers to the last synchronized angular position.

However, the actual displacement is V_1. This means that synchronization is necessary (refer to instant t+1). The displacement setpoint V_1* is kept during synchronization.

Instant t+1:

Synchronizing takes place after the synchronizing marks have been passed. An undesirable deviation between the actual displacement V_1 and the displacement setpoint V_1* occurs. The deviation is corrected with unchanged displacement setpoint V_1*. In the closed-loop angular synchronous control, the displacement actual value is set directly to the actual displacement at the synchronizing instant. The angular control then corrects the set displacement actual value to the constant displacement setpoint. Synchronization is completed at instant t+1.

Instant t+2:

A new displacement setpoint V_2* is entered and corrected. The setpoint now refers to the synchronized angular position at instant t+1.

Summary

Synchronization is sub-divided into:

- Determining the displacement, and
- Correcting the deviation, to the differential angular actual value.

The angular synchronous control is a lower-level control to the synchronizing circuit. When synchronizing, the differential position actual value is directly set to the actual displacement at the synchronizing instant (i. e. when at least one synchronizing mark is passed). With a constant displacement setpoint at the angular synchronous controller, deviations which may be present at the synchronizing instant, are corrected.

1.7 Hardware constellation

A typical hardware constellation to implement angular synchronous control on a T400 technology module is shown in Fig. 1-5.

Incremental encoder

The incremental encoder for the master drive is connected at connector X6. For the slave drive, the pulse encoder signals are either received from connector X8 or via the backplane bus of the basic drive (refer to Section 2.2)

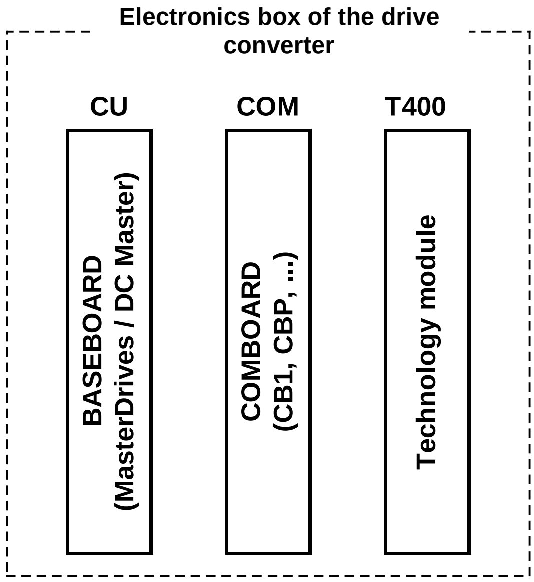


Fig. 1-5: Typical hardware arrangement in the electronics box of a drive converter

Control structure

The basic closed-loop control structure of the angular synchronous control is shown in Fig. 1-6. The master- and slave drive(s) are connected to a common speed master setpoint n*. The speed master setpoint n* is used for pre-control and ensures that the required speed of the slave(s) is achieved. Further, the speed of each slave drive can be set using different master/slave ratios. The higher-level angular controller ensures angular synchronism and corrects steady-state errors in the lower-level speed control loop (also refer to Fig. 3-1, Overview closed-loop control).

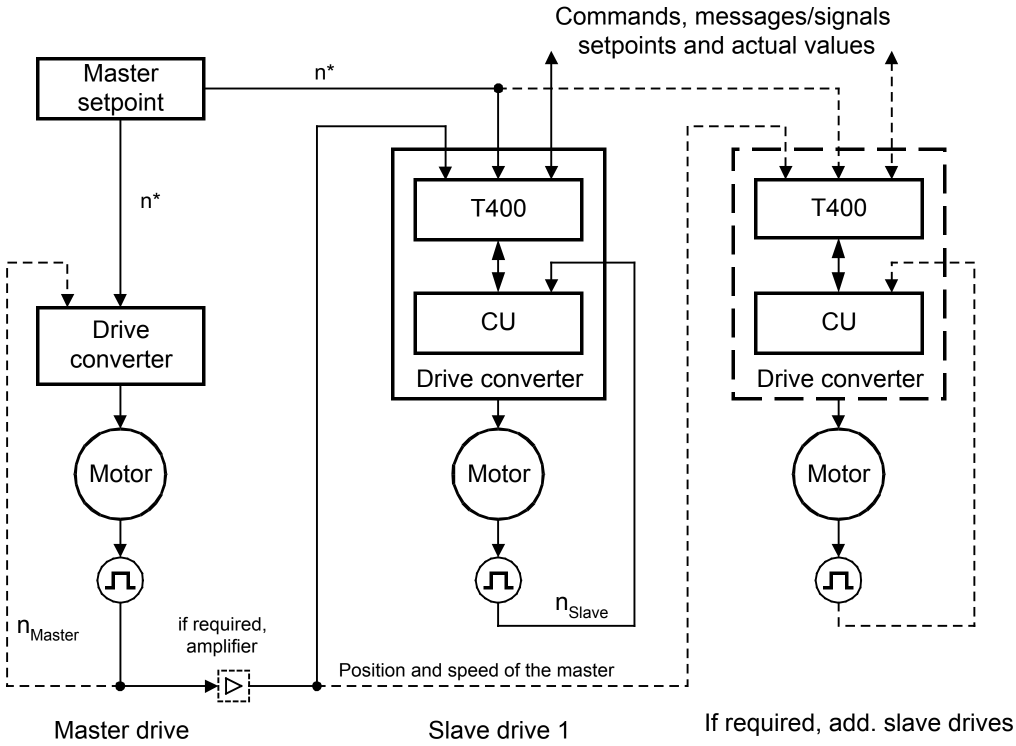


Fig. 1-6 Basic closed-loop control structure of the angular synchronous control (CU: Basic drive module)

Input quantities

The closed-loop control for the slave drive requires the following input quantities:

- Speed master setpoint n* (reference speed for the master and slave)
- Speed- and position actual value of the master (from pulse encoder signals)
- Additional commands and signals, setpoints and actual values (e. g. from the automation)

Synchronization

The closed-loop control structure, illustrated above, is independent of the synchronization. This is because, when synchronizing, only a correction signal for the differential position actual value can be generated from the position of the synchronizing marks (refer to Fig. 3-1).

NOTE

Synchronization is only necessary if the machine requires this.

Angular synchronous control can also be operated without synchronization (without synchronizing pulse/marks).

Several slave drives

If angular synchronism has to be established between several drives, then the drive with the highest output or the longest rise time should be used as the master drive. If this drive runs unsteadily, then it might make more sense to select a smoother running drive, i.e. deviating from this recommendation.

NOTES

The pulse encoder of the master drive must be simultaneously connected to the appropriate inputs of the slave drives. It is not permissible to overload the pulse encoder of the master drive!

1.8 Information and instructions when using angular synchronous control

NOTE **Applications**

Angular synchronous control means that **the machine runs in true angular synchronism** which for instance can be realized using mechanical linkages and couplings (e. g. shafts or gearboxes).

NOTE **Applications, which under certain circumstances, are not practical:**

Applications, which can be implemented using a pure closed-loop speed control. Closed-loop speed control is preferable to angular synchronism due to the simpler controller optimization, if the task in hand permits this. Generally, angular synchronous control does not further improve the control dynamic performance.

Applications, which require **load equalization** or **closed-loop tension control**.

2 T400 technology module

The interfaces between the standard software package and the system environment are explained in this Section. In addition to the local interfaces of the T400 technology module (terminals and backplane bus to the basic drive), the three configured communication interfaces are also involved.

2.1 Communication interfaces

The approximate structure of the standard software package is shown in Fig. 2-1. It is sub-divided into:

- Communication interfaces: COMBOARD (e. g. PROFIBUS slave), peer-to-peer and USS slave (USS is only required if the T400 is used in standalone applications, i.e. is not used with a basic drive. In this case, only restricted parameterization capability is possible via the USS-slave interface.)
- Interface to the basic drive (process data PZD, parameterization, fault- and alarm messages)
- Analog and digital I/O
- Control core (the speed controller can be alternatively located on the T400 or in the basic drive).

The functions of the control core are explained in detail in Section 0. The interfaces, via which process- and parameter data are transferred/exchanged with the T400, are described in the following Sections.

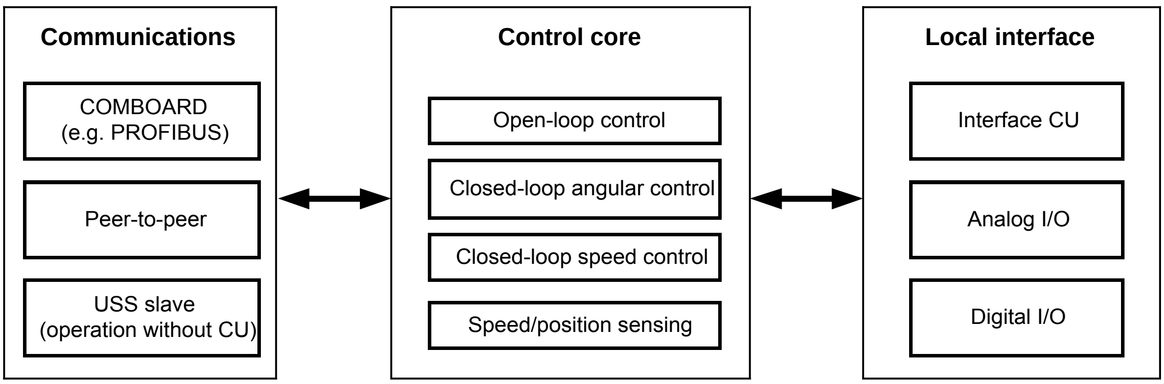


Fig. 2-1 Structure of the standard software package (CU is the processor module of the basic drive)

2.1.1 Interface to the basic drive (CU)

Communications with CU

Data, including fast process data and parameters, as well as faults/alarms, is exchanged between the T400 technology module and the basic drive converter (abbreviated: ”Basic drive”) using the backplane bus LBA (Local Bus Adapter) via a parallel DUAL-PORT RAM interface.

Basic drive setting

The basic drive must be commissioned. For instance, for SIMOVERT MasterDrives this is realized according to the ”Expert application” mode in the Operating Instructions[1]. In order to operate the SPA440 standard software package, the following pre-set basic drive parameters must be set, refer to Table 2-1 and Table 2-2.

NOTE

The T400 supplies the basic drive with the following control words; however, they are only effective in the drive converter after the basic drive has been appropriately parameterized.

Variable	Word	VC (CU2)		CUMC		DC-Master	
	Bit	Param.	Value	Param.	Value	Param.	Value
On command (main contactor)	W1.0	P554	3001	P554	3100	P654	3100
Off2	W1.1	P555..557	3001	P555	3101	P655	3101
Off3	W1.2	P558..560	3001	P558	3102	P658	3102
Setpoint enable	W1.6	P564	3001	P564	3106	P664	3106
Fault acknowledgement	W1.7	P565-567	3001	P565	3107	P665	3107
Jogging 1	W1.8	P568	3001	P568	3108	P668	3108
Jogging 2	W1.9	P569	3001	P569	3109	P669	3109
External fault 1	W1.15	P575	3001	P575	3115	P675	3115
Speed controller enable	W4.9	P585	3004	P585	3409	P685	3409
Speed setpoint (if H140 = 0)	W2	P443	3002	P443	3002	P644	3002
Suppl. speed setpoint from the angular controller	W5	P433	3005	P224	3005	P634	3005
Pre-control value for the speed controller	W8	P506	3008	P262	3008	P501	3008

Table 2-1 Control word- and setpoint channel

Variable	Word /	VC		CUMC		DC-Master	
	Bit	Param.	Value	Param.	Value	Param.	Value
Status word 1	W1	P694.01	968 552	P734.01	0032	U734.01	0032
Speed actual value	W2	P694.02	219	P734.02	0091	U734.02	0040
Torque	W3	P694.03	7	P734.03	0182	U734.03	0142
Status word 2	W4	P694.04	553	P734.04	0033	U734.04	0033
Drive converter output current	W5	P694.05	4	P734.05		U734.05	0116

Table 2-2 Status word- and actual value channel

2.1.2 Interface to COMBOARD

Communications module

Communication modules (COMBOARDs; abbreviated: CB) form the interface between the T400 and a communication's network. The type of COMBOARD depends on the network protocol. For example, CB1,CBP or CBP2 are available for PROFIBUS applications. For the T400, the COMBOARD is an interface, which can be used to transfer process data (PZD) and parameters (PKW).

The COMBOARD is parameterized from the basic drive (protocol, baud rate, telegram length, monitoring,...). The number of pieces of net (useful) data can extend up to 10 PZD (each 16 bits).

T400 in the SRT400

The parameterization is only made from the T400, if the T400 is used as standalone solution in the SRT400 with COMBOARD at slot 2. Parameters H480 - H496 are provided for this special case.

Example

Fixed protocol versions are available for PROFIBUS (parameter process data objects PPO [2, 4]). The required PPO type of the slave is generally saved in the master. It defines the number of PZD which are transferred. If, for example, PPO type 4 (6 PZD) is used, PZD7 to PZD10 are undefined.

Enable

COMBOARD communications can be activated or de-activated using parameter H409.

Receive data

The first 6 of the process data received from the communications module are assigned as follows in the factory setting (refer to Chart 410):

PZD	Receive words (factory setting)	Normalization	Display
1	Control word1 (e. g. On)	None	d460
2	Master setpoint	H451	d450
3	Setpoint, displacement setpoint	H453	d452
4	Control word2	None	d461
5	Setpoint, ratio	H455	d454
6	Setpoint, inertia compensation	H457	d456

Table 2-3 COMBOARD receive channels (sampling time 9.6 ms; free PZD, refer to Chart 410)

Send data

The send data are selected via multiplexer (H442 to H449), or using BICO re-connections. Refer to Chart 440 to normalize the send data.

Monitoring

Telegram reception can be monitored from a time perspective (watchdog). Two time limits are available. After power-on there is a delay of H462 ms, and during operation H463 ms for a valid receive telegram. The error- and alarm messages are transferred to the CU where they are displayed if the messages were not suppressed (H003 and H004).

2.1.3 Peer-to-peer interface

Communications via peer-to-peer

The standard software package contains a peer-to-peer interface for fast data transfer between two modules, e.g. to an additional T400. This interface has the following factory setting:

Baud rate	H363	19200 baud
Monitoring time limit after power-on	H360	20 s
Monitoring time limit in operation	H361	100 ms
Telegram structure (cannot be changed)		1 control word 2 floating-point values

Table 2-4 Factory setting, peer-to-peer interface

NOTE

The peer-to-peer telegram always includes 5 PZD. (PZD2 and PZD3) or (PZD4 and PZD 5) can, alternatively, be used as single words, double word or floating-point value (refer to Chart 300). For the factory setting, floating-point values are transferred.

Caution

In order to eliminate data transfer disturbances, the interface terminating resistors must be switched-in (switches S1/3 to S1/6; refer to [4]).

Enable

Parameter H309 is used to enable or inhibit peer-to-peer communications.

Monitoring

Telegram reception can be monitored from a time perspective. There are two time limits. After power-on, there is a delay of H360 ms and during operation H361 ms for a valid receive telegram. The error- and alarm messages are transferred to the CU where they are displayed if the messages were not suppressed (refer to H003 and H004).

For absolute value encoders

If the position sensing of the 2 absolute value encoders of the T400 are used, the peer-to-peer interface **cannot be used,** as absolute value encoder 2 uses the same terminals!

2.1.4 Diagnostics interface

A PC can be connected to serial interface 1 (RS232). The interface can be used with the Service-IBS/ TELEMASTER or with the CFC in the test mode. Thus, values and connections can be changed.

The baud rate **19200 baud**.

T400		**PC**	
Terminal	Function	9-pin	25-pin
67	RxD	3	3
68	TxD	2	2
69	Ground	5	7

Table 2-5 Terminals of interface X01 on T400 (RS232)

2.1.5 USS-slave interface

Serial interface 1 (RS232 / RS485) can be alternatively used for parameterization. This is intended for the special case, where the T400 is used in the SRT400. When used in the basic drive, parameterization is realized via the basic drive. The following settings are required for this particular case:

Involves	Value	Factory	Significance
H700	1	1	Enable USS slave
H701		9600	Baud rate (OP1S : 9600 or 19200)
H703		0	Slave address at the USS bus
H704		0	0: RS485 (OP1S) 1: RS232 (SIMOVIS)
S1/8 on T400	ON	OFF	Changeover from online operation (CFC, basic start-up) on USS. This only becomes effective after power-down / when the T400 is reset

Table 2-6 Settings for USS-slave operation (factory = factory setting)

Caution: It is not possible to simultaneously use USS and CFC online! USS operation is not possible if the parameterization is incorrect. This means, that the error can only be resolved if online operation is selected, and then the error is, for example, resolved using the basic-IBS (basic start-up tool). OP1S can only be used from version V2.3 onwards.

2.2 Terminal assignment

Setpoints and control signals can be read-in and actual values and status signals output via digital and analog signals. For the T400, the system/plant signals are connected directly at the appropriate terminals, which are accessible from the front. Fig. 2-2 shows an overview of the T400 connections. The following description refers to the terminal assignment.

2.2.1 Digital I/O

Supply voltage

The digital inputs and outputs of the T400 Technology Module have a 24 V signal level. The **24 V** power supply for the digital outputs must be **externally connected**.

The SPA440 control core uses 5 control signals, which, when required can be entered via digital inputs (refer Table 2-7) .

Terminal	Recommended assignment (control signals)
53	*Angular controller enable*
54	*Synchronizing command*
55	*Reset position*
56	*Displacement reset*
57	*Jog enable*

Table 2-7 Recommended terminal assignment for the digital inputs, T400 module

Digital outputs

The digital outputs are pre-assigned for status messages, refer to Table 2-8.

Properties

When the unit is powered-up, all of the outputs are initially open-circuit (high ohmic state). After the initialization phase, they are driven with the values which are present. All of the outputs are connected to ground when the drive converter is powered-down or when a fault develops.

NOTE

Logical ”0”: Output open-circuit or connected to ground
Logical ”1”: Output is closed, i. e. the terminal is at the connected supply voltage of approx. - 2.5 V.

The max. output load is 50 mA, short-circuit proof

Term.	Factory setting	BICO param.	Enable
46	Synchronism reached	H631	H637
47	Angular controller at its limit	H632	H638
48	Enable status of the ang. controller	H633	H639
49	Fault	H634	H640
51	Alarm	H635	Not relev.

Table 2-8 Terminal assignment of the digital outputs of the T400

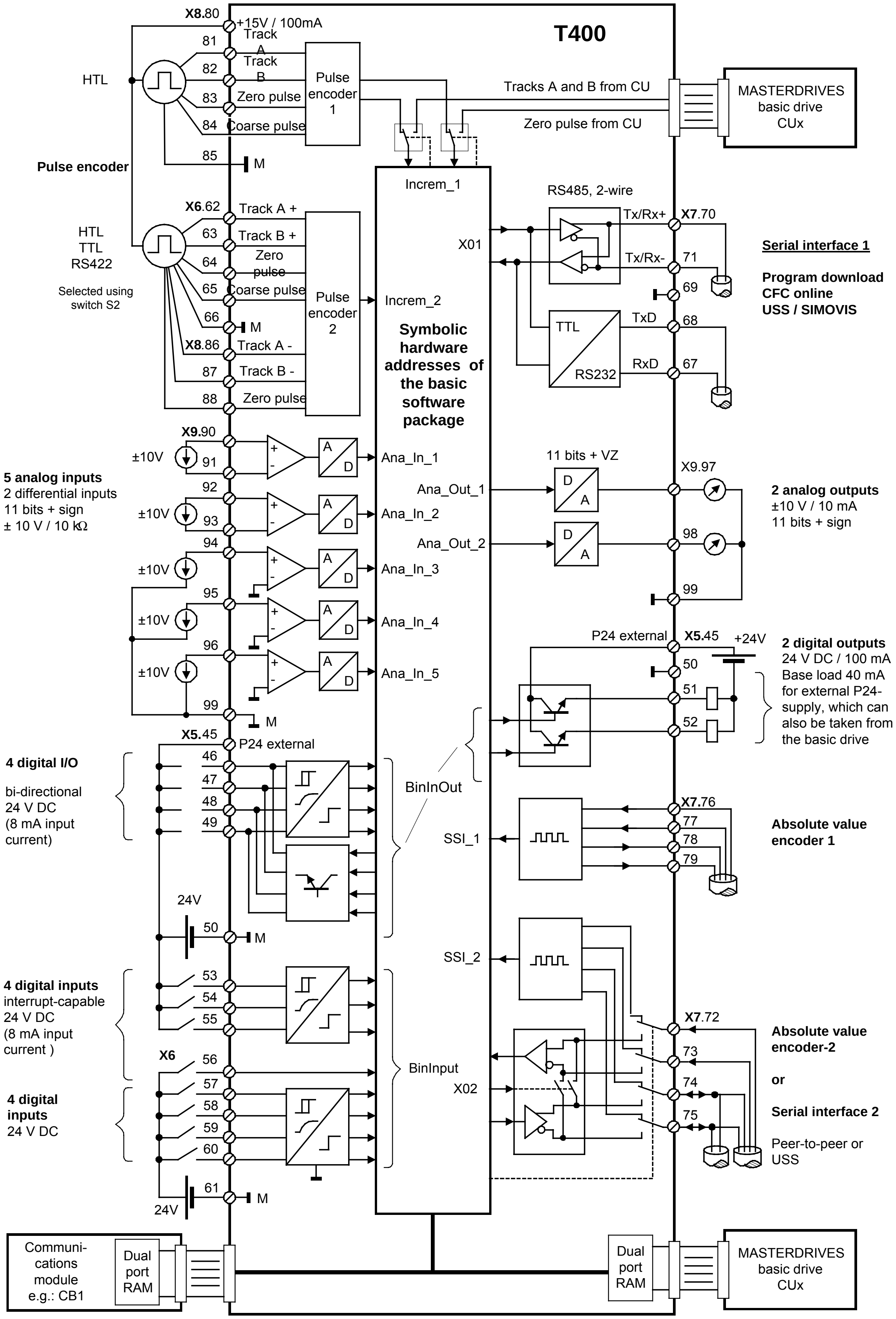


Fig. 2-2 Layout of the terminals of the T400 Technology Module

2.2.2 Analog I/O

Scaling

An output- and input voltage of **5 V** corresponds, in the factory setting to an internal value of 1.0 (100 %). This pre-setting can be changed using scaling factors and offsets. The following is valid for analog inputs:

Analog value = terminal voltage · scaling factor / 5 V - offset

Generally, the analog inputs have a smoothing element connected in series. The smoothing can be de-activated by setting the filter time constant to 0.

Term-inal	Recommended assignment	Sampling time	Scaling	Offset	Filter time constant	Value, smoothed
90 / 91	Inertia compensation	1.2 ms	H210	H211	H222	d223
92 / 93	Ratio	9.6 ms	H213	H214	H224	d225
94 / 99	Speed master setpoint	9.6 ms	H216	H217	H226	d227
95 / 99	Offset setpoint	9.6 ms	H219	H220	H228	d229

Table 2-9 Terminal assignment of the analog inputs, T400 module

Analog outputs

T400 has two analog outputs which are processed in the fastest sampling time (1.2 ms). The output quantity is selected per multiplexer or the BICO connection. During operation, every output can be inhibited by a control signal (output = 0V).

The outputs can be scaled. For the factory setting, 1.0 is output for 5 V. The output voltage V is obtained as follows:

V = (value + offset) · scaling factor · 5 V

Terminal	Multiplexer	BICO input	Inhibit input	Scaling factor	Offset
97 / 99	H618	H620	H621	H161	H160
98 / 99	H619	H622	H623	H163	H162

Table 2-10 Analog outputs and associated parameters

2.2.3 Pulse encoders

Pulse encoder type

Pulse encoders with **two tracks, offset through 90 degrees** must be used. If the synchronizing function is used, the zero pulse or a comparable synchronizing signal (e. g. BERO switch) must be connected.

Encoder power supply
Shielding

The T400 module provides 15 V (max. 100 mA) as encoder power supply.

Encoders with a 15 - 24 V supply voltage, especially: SIEMENS rotary pulse encoders **1XP8001-1** (for 1LA5 motors, frame sizes 100K to 200L);

The pulse encoder cable and the cables used to conduct the synchronizing pulses must be shielded. The cable shield must be connected at both ends, if possible through clamps, to ground potential through the lowest impedance connection. This is especially important for signals from proximity- or switches using contacts.

15 V power supply units

If the 100 mA of the internal 15 V supply is not adequate, we recommend the following 15V power supplies:

- Type CM62-PS-220 AC/ 15 DC/ 1
  220 V AC to 15V DC, load capacity 1 A
  Manufacturer, Phoenix
- Type FMP 15S 500 "with fast mounting"
  110/220 V AC to 15V DC, load capacity 0.5 A
  Manufacturer, Block

Encoder pulse numbers

When selecting the encoder pulse number, the following issues must be taken into account:

1. Maximum pulse frequency, 1.5 MHz
2. The *ratio* should be approx. *1:1* as in this case, the best dynamic performance is obtained. A *ratio* in the range from 1:4 to 4:1 is acceptable (definitions, refer to the following sections).
3. The encoder pulse numbers of the master- and slave drives should be same; however, criteria 1) and 2) have priority.

The master drive pulse encoders are directly connected to the T400. The slave drive can use the incremental encoder signals from the basic drive (CU) from the backplane bus.

The operating mode can be parameterized using parameters H018 and H019. The following should be set:

- Encoder type
- Filter parameterization and filter time constant of the digital filter for the signals of the two pulse tracks / zero pulse track
- Source of the encoder tracks

The recommended values for H018 and H019 are specified in the parameter table in Section 4.2. For additional information, refer to Lit.[5] block NAVS, connector MOD.

	Encoder 1	Encoder 2			
	HTL	RS422	HTL	TTL	HTL ±3V
Track A+ and track A	81	62	62	62	62
Track A-	-	86	-	-	-
Track B+ and track B	82	63	63	63	63
Track B-	-	87	-	-	-
Synchronizing pulse N+	83	64	64	64	64
Synchronizing pulse N -	66	88	-	-	-
Coarse pulse inputs	84	65	65	65	65
P15 output for the 15 V encoder power supply	80	80	80	80	80
Ground	85	66	66	66	66
Switch S2.1		ON	OFF	ON	OFF
Switch S2.2		ON	OFF	ON	OFF
Switch S2.3		ON	OFF	OFF	ON
Switch S2.4		ON	OFF	ON	OFF
Switch S2.5		ON	OFF	OFF	ON

Table 2-11 Incremental encoder inputs of the T400: Terminal assignment and switch settings for various encoder types

Coarse pulse evaluation

Coarse pulses are used to suppress undesirable synchronizing signals. For example, by combining coarse- and fine pulses, disturbances can be suppressed, or just specific synchronizing pulses evaluated.

5 different cases are investigated. The default setting is for synchronizing pulses which are used independently of the associated coarse pulses (mode 1). The coarse pulse mode is selected using H022 and H023.

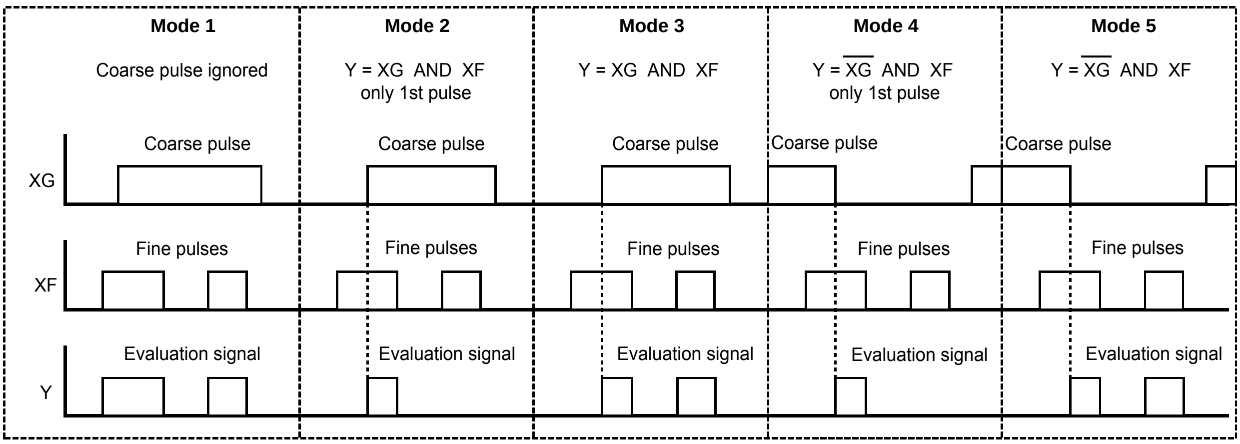


Fig. 2-3 Operating modes for coarse pulse evaluation (the synchronizing pulses correspond to the fine pulses)

Absolute value encoder

When using the absolute value encoder for differential position sensing, two absolute encoders with SSI or EnDat interface are connected.
We recommend a multi-turn encoder with e.g. 4096 steps per revolution and 4096 revolutions which can be differentiated between. The encoder should be a coded rotary encoder.
(function block type to evaluate an absolute value encoder: AENC)

T400 terminal	**Significance**	**Drive to be connected**
72	Absolute encoder 2, data +	Master drive
73	Absolute encoder 2, data -	
74	Absolute encoder 2, clock +	
75	Absolute encoder 2, clock -	
76	Absolute encoder 1, data +	Slave drive with T400
77	Absolute encoder 1, data -	
78	Absolute encoder 1, clock +	
79	Absolute encoder 1, clock -	

Table 2-12: T400 terminals for absolute value encoder

3 Function description

A control-related block diagram of the standard angular synchronism software package is illustrated in Fig. 3-1.

The **closed-loop angular control** is implemented on the technology module. The **closed-loop speed control** is either realized on the connected drive converter or is internally computed on the T400 (refer to parameter H140).

The setpoints are either received from the basic drive (CU), COMBOARD, peer-to-peer or analog input or can be entered as fixed value.

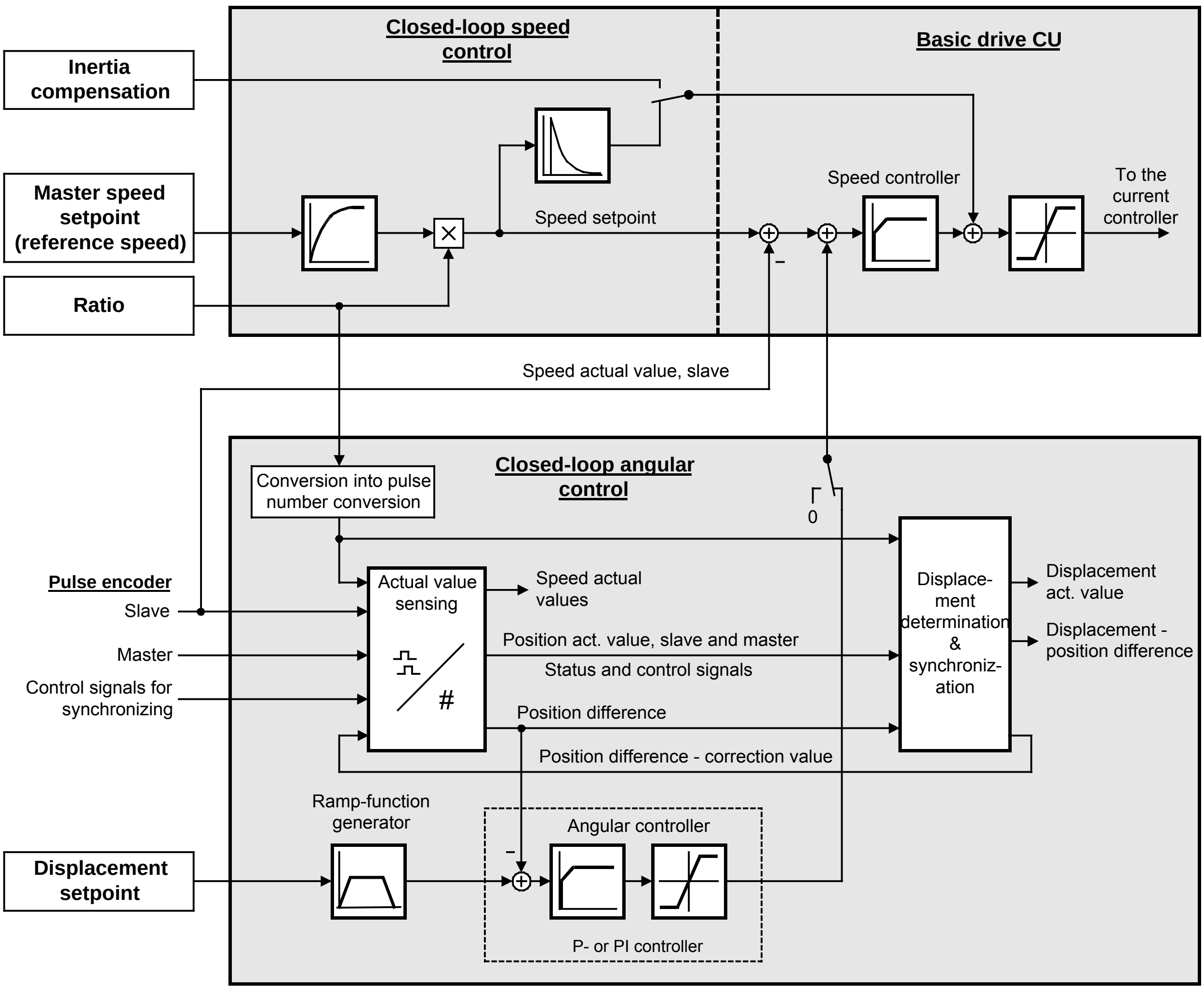


Fig. 3-1 Overview of the SPA440 standard software package

3.1 Ratio

3.1.1 Speed ratio

The master- and slave drives receive the same speed setpoint, whereby this setpoint is weighted by the (master/slave) speed ratio ü.

The speed ratio ü between the master and slave drive is defined as follows:

$$\text{Speed ratio} \quad ü = \frac{\text{Speed, master drive}}{\text{Speed, slave drive}}$$

Example:

Speed, master drive: n_M = 1710 RPM
Ratio ü = 1.5
Speed, slave drive: $n_S = n_M$ / ü = 1710 RPM / 1.5 = 1140 RPM

NOTE Contrary to the older versions of the angular synchronous control, the ratio, as floating-point value, can be practically set without any limitations.

Parameter	Use
H040	Multiplexer selection of the source for the ratio
H041	Source for the supplementary ratio
H043	Fixed value, ratio
d044	Actual ratio
d045	Ratio, numerator
d046	Ratio, denominator
H047	Fixed value, supplementary ratio
H048	Multiplexer selection for the relative ratio
H067	Source for the ratio
H068	Source for the relative ratio
H086	Fixed value, fine ratio, numerator
H087	Fixed value, fine ratio, denominator
H088	Enable fine ratio
H155	Resolution for calculating numerator and denominator

Table 3-1 Parameters to define and display the ratio

3.1.2 Fine ratio

The ratio is generally entered as a floating-point value. The integer value for numerator and denominator DN and NM are automatically calculated from the selected ratio (refer to Chart 80). The calculated ratio exhibits a maximum error of 0.0001 with respect to the floating-point input (this can be influenced using the resolution of the ratio H155).

Nominator and denominator can be separately entered as integer value (”fine ratio”) (refer to Table 3-1). (For example, this may be required if the ratio is entered with OP1S, whereby only 3 decimal points are possible).

Example:

- Ratio: $^{2}/_{3}$ (master speed/slave speed)
- Pulses, slave/revolution: 1024
- Pulses, master/revolution: 2048
- Displacement correction should be made

Settings:

Parameter	Value	Explanation
H077 H078	5001	Source for fixed value 1st ratio of the displacement calculation = 1, as the number of pulses between 2 synchronizing operations has been taken into account (refer to H100, H102, H105, H107)
H086	2	Fine ratio, numerator
H087	3	Fine ratio, denominator
H088	1	Activates the fine ratio
H100	16384	(2·4·2048) number of edges between 2 synchronizing signals of the master (2 revolutions)
H102	12288	(3·4·1024) number of edges between 2 synchronizing signals of the slave (3 revolutions)
H105	10993	Suppresses the first synchronizing pulse from the master (synchronizing is only enabled after 1.5 revolutions)
H107	10240	Suppresses the first two synchronizing pulses from the slave (synchronizing is only enabled after 2.5 revolutions)

3.2 Setpoints and actual values

3.2.1 Setpoints

Setpoints can be entered from any interface. A connection must be established from the required source to the appropriate setpoint input using BICO technology. When making a selection with the multiplexer, a selection can be made between the following sources. Also refer to function chart 500 and the tables specified below.

Setpoint	Selection	Pre-assigned with ...
Displacement	H050	Fixed value (by H066)
Ratio	H040	Fixed value (by H043)
Relative ratio	H048	Fixed value (by H049)
Master speed setpoint	H070	Speed actual value, master
Inertia compensation	H080	Differentiation of the speed setpoint

Table 3-2 Multiplexer to select the setpoint channel

Selection	Normalization	Setpoint sources
0	-	Fixed value 0.0
1	-	Fixed value (a separate fixed value for each setpoint channel)
2	H210	Analog input 1, smoothed
3	H213	Analog input 2, smoothed
4	H216	Analog input 3, smoothed
5	H219	Analog input 4, smoothed
6	H550	Basic drive, word 2
7	H552	Basic drive, word 3
8	H554	Basic drive, word 5
9	H451	COMBOARD word 2
10	H453	COMBOARD word 3
11	H455	COMBOARD word 5
12	H457	COMBOARD word 6
13	-	Peer-to-peer, words 2 + 3
14	-	Peer-to-peer, words 4 + 5
15		Speed actual value, master (channel 15 is only available to select the master setpoint)

Table 3-3 Setpoint sources

3.2.2 Actual value sensing

Principle

The actual **speed, position and position difference** are sensed by counting the **pulses** from the two pulse encoders from the master- and slave drives.

The speed actual value sensing is calibrated using parameters H010 to H013. The speed actual value is referred to the configured rated speed, i.e. the rated speed has a speed actual value of 1.0.

$$\text{Speed} \quad \frac{\text{Pulses}}{\text{Measuring time}} \bullet \frac{\text{Normalization factor}}{\text{Encoder pulse No.} \cdot \text{Rated speed}}$$

All of the parameters which have to be set for the actual value sensing are listed in Table 3-4:

Param.	Significance	Explanation
H010	Encoder pulse number, slave	Number of pulses (single) per revolution
H011	Encoder pulse number, master	Number of pulses (single) per revolution
H012	Rated speed, slave	Speed actual value, which is simulated for 1.0
H013	Rated speed, master	Speed actual value, which is simulated for 1.0
d014	Speed actual value, slave	Display parameter
d015	Speed actual value, master	Display parameter
d016	Position actual value, slave	Display parameter
d017	Position actual value, master	Display parameter
H018	Slave sensing mode	Encoder type (always type 1); filter time; behavior for zero pulse; source of the tracked signals and zero pulse
H019	Master sensing mode	Encoder type (always type 1); filter time; behavior for zero pulse
d020	Error code, slave sensing	Refer to Section 4.2
d021	Error code, master sensing	Refer to Section 4.2
H022	Coarse pulse evaluation, slave	Refer to Section 4.2 and 2.2.3
H023	Coarse pulse evaluation, master	Refer to Section 4.2 and 2.2.3

Table 3-4 Parameters for the speed actual value sensing

NOTE

The explanations in this Manual only assume encoders with 2 tracks A and B, offset through 90° and possibly with zero pulse! However, the information is also valid for encoders with separate forwards- and reverse tracks.

Rated speed, master (H013) and rated system frequency:
If the master setpoint for the slave is referred to the encoder pulses of the master (H070 = 15), the rated speed of the master (H013) and the rated system frequency (or the speed for a drive converter) must be parameterized so that they are identical.

The **rated speeds** of the master and slave are required to generate the master setpoint and to display the speed actual value (d014, d015). These are used when calculating the pos. and pos. difference.

Position actual value sensing

The master and slave position actual values are required to **determine the displacement**. To sense the position actual value, the encoder pulse edges from the master- and slave drives are counted which have been received since the last time the system was reset with the drives operational.

The position actual values are reset as follows:

- the control signal *reset position* (refer to Chart 90)
- when enabling the angular controller
- using the **synchronizing pulse** (e. g. zero pulse) at the pulse encoder input. When the synchronizing marks are passed, the position actual value is set to 0 and runs-up to four times the encoder pulse number in one revolution.

The position difference is sensed per software using a 32-bit counter. This means that a maximum pulse number of

$\pm 2^{31} = \pm 2147483648$ quadrupled pulses is possible.

NOTE In order that the position actual values do not **overflow** (e. g. from $2^{31} \Rightarrow -2^{31}$), a synchronizing pulse must be generated, at the latest after 2^{31} quadrupled pulses, which then resets the position!

Param.	Significance	Explanation
d017	Position actual value, master	Calculated in quadrupled pulses
d016	Position actual value, slave	Calculated in quadrupled pulses
H105	Synchronizing threshold, slave	A synchronizing pulse is only evaluated if the position actual value exceeds threshold H105
H107	Synchronizing threshold, master	As for H105, however for the master position
d109	Status of the angular controller enable	At d109=0, the position is reset
H173	Multiplexer for *reset position*	Selects the source for this control signal
H097 H167	Inputs for the reset position function	BICO inputs
H181	Input, reset slave position	“
H189	Input, reset master position	“

Table 3-5 Parameters for position actual value sensing

Position difference sensing

The position difference actual value is defined as the position actual value through which the slave must be moved, so that the position actual value of the slave and the position actual value of the master, referred to the slave, are the same.

The position pulse number of the master drive is re-normalized to the slave. This means it can be directly compared with the position pulse number of the slave, i.e. the angle through which the master drive moves, is represented as a pulse number of the slave. The following algorithm for the position difference is obtained, taking into account different encoder pulse numbers for the master- and slave drives. ”Master- and encoder pulses” refer to the quadrupled position pulses generated by the pulse encoder. ”Rated pulses” represents the number of position pulses, where the position actual value should be 1.0.

Calculation

$$\text{Pos. difference} = \frac{\text{Pulse}_{\text{Master}} \cdot \frac{\text{DN}}{\text{NM}} \cdot \frac{\text{Slave encoder pulse No.}}{\text{Master encoder pulse No.}} - \text{Pulse}_{\text{Slave}}}{\text{Rated pulses}}$$

The quotient of NM / DN corresponds to **ratio ü** (refer to Section 3.1.2).

Correction pulse number

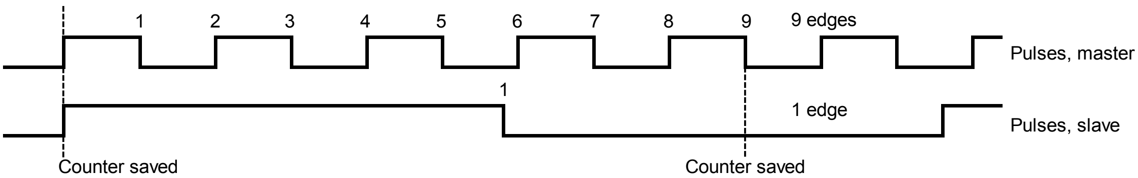
A so-called correction pulse number (H093), calculated from the displacement calculation, is added to the position difference for synchronization. This means that the angular controller is forced to correct the position difference which is entered. This correction value is zero if synchronization is not applied or when in the synchronous condition

Par.	Significance	Explanation
H093	Correction pulse number	Number of pulses which, when the displacement is being corrected are input per sampling time into the angular controller to correct the displacement
H117	Filter time, position difference	
d124	Differential position actual value, smoothed	Number of pulse edges (pulses · 4) which represents the offset between the master and slave; this is zero when the system is synchronized.

Table 3-6 Parameters for the differential position sensing

Inaccuracy

The pulse number ratio should be approximately 1:1. An inaccuracy of several pulses can occur, especially for a pulse number ratio ≠ 1. The highest accuracy is achieved for a pulse number ratio of 1:1, refer to the example in Fig. 3.5.



Ratio = 1

Determined position difference:	9 edges - 1 edge	= 8 edges
Actual position difference:	4.5 pulses - 0.75 pulses	= 3.75 pulses

Ratio = 6

Determined position difference:	9 edges - 6 • 1 edge	= 3 edges
Actual position difference:	4.5 pulses - 6 • 0.75 pulses	= 0 pulse

Fig. 3-2 Example of inaccuracies when determining the position difference

The settings when using absolute value encoders are described in the next section.

3.2.3 Position actual value sensing with absolute value encoders

Parameter	Description	Factory setting	Connector
L098	Enables position sensing using a pulse encoder (NAVS). It is necessary to reset after a value is changed!	1	---
L099	Enables position sensing using an absolute value encoder (AENC). It is necessary to reset after a value is changed!	0	---

Table 3-7: Activating the absolute value encoder

Settings

The absolute value encoder is set using the following parameters. The required data can be taken from the manufacturers Operating Instructions for the particular absolute value encoder.

Absolute encoder 1	Absolute encoder 2	Description
L100	L200	**Resolution per turn (RPT)** Example: L100 = 4096 (Operating Instructions, absolute encoder)
L101	L201	**Number of turns (NOT)** only for multi-turn encoders. For single-turn encoders = 0. Example: A multi-turn encoder is used. L101 = 4096 (Operating Instructions, absolute encoder)
L102	L202	**Preceding zero bits (PZB)** Number of non-relevant bits at the start of the position value transfer. This is valid for SSI encoders, with which the various protocol versions are specified. Example: L102 = 0 (Operating Instructions, absolute encoder)
L103	L203	**Alarm bit position (ABP)** Position of the interrupt bit within the data transfer protocol of an SSI encoder. If there is no interrupt bit, then ABP = 0 applies. Example: L103 = 0 (Operating Instructions, absolute encoder)
L104	L204	**Clock frequency (MDF)** There are four possible clock frequencies for data transfer. 0 : Clock frequency = 100 kHz, period = 10 µs 1 : Clock frequency = 500 kHz, period = 2 µs 2 : Clock frequency = 1 MHz, period = 1 µs 3 : Clock frequency = 2 MHz, period = 0.5 µs Example: L104 = 0 (Operating Instructions, absolute encoder)

L105	L205	**Encoder type (MDT)** Specification of the encoder type. The differentiation between coded rotary encoders and length measuring systems has an influence on the velocity output (parameter c114 or c214). 0 : SSI (coded rotary encoder) 1 : SSI (coded length measuring system) 2 : EnDat (coded rotary encoder) 3 : EnDat (coded length measuring system) 4 : SSI (coded length measuring system with range correction) 5 : EnDat (coded length measuring system with range correction) Example: L105 = 0 (Operating Instructions, absolute encoder)
L106	L206	**Data coding (MDC)** 0 : Binary code (permissible for EnDat and SSI) 1 : Gray code (permissible for SSI) 2 : Gray Excess code (permissible for SSI single-turn encoders) Example: L106 = 1 (Operating Instructions, absolute encoder)
L107	L207	**Control word (CW)** Bit 0 : Enables the parity monitoring for an SSI encoder. A check is made for even parity. The parity bit is directly transferred after the position value, i.e. as 14th bit or as 26th bit. 0 = No parity monitoring (permissible for SSI, EnDat) 1 = Parity monitoring, even parity (permissible for SSI). Bit 1 : Resets the AENC block and deletes the fault messages and alarms as well as individual bits of the fault word. When using an EnDat encoder, its alarms and alarm bits are reset. For SSI encoders, after connecting-up and powering-up the encoder, it is necessary to reset. A 0 to 1 signal edge is required to reset. Example: L107 = 0000h (hexadecimal value, with all bits = 0, setting, bit 0 from the Operating Instructions, absolute encoder)
L108	L208	**Gearbox ratio (NFG)** Takes into account a gear ratio between the coded rotary encoder and the drive system. The position values and the speed are converted over to the drive system. For a length measuring system, the gear ratio is not taken into account. The following applies: Position(drive) = gear ratio * position(encoder). Example: L208 = 1.0 (recommended setting)
L109	L209	**Normalization, position (NFP)** Normalization basis for the offset input (OFF). Example: L109 = 1.0 (recommended setting)
L110	L210	**Normalization, speed (NFY)** This value influences the output value Y of the speed: Y = NFY * revolutions/min. Factory setting: 0.0 Example: L110 = 1.0 (i.e. for 100 revolutions/min, c114 = 100.0 is displayed at the output)

L111	L211	**Position offset (OFF)** When entering an offsets ≠ 0 the encoder zero position is shifted. The offset value has the same normalization as the position outputs. It is subtracted from the encoder position actual value. Example: L111 = ... (must be determined from the position normalization, refer to Section 4)
L112	L212	**Upper speed limit (LU)** Maximum operating speed of the encoder where valid position values can still be determined. The data is a value normalized to the speed output (parameter c114 and c214). Example: L112 = 6000.0 (i.e. 6000 revolutions/min, must, if required, be adapted)
[23]L120	L220	**Offset, number of rotations** This is used to enter an offset for the number of revolutions (parameter c116 or c216). This determines the scaled position actual value. Example: L120 = ... (must be determined from the position normalization, refer to Section 6.2.6)
L121	L221	**Scaling, position actual value** This normalizes the scaled position actual value (c125 or c225). Example: L121 = ... (must be determined from the position normalization, refer to Section 4)
L122	L222	**Selection, MUL/DIV:** 0: The scaling factor L121 (or L221) is multiplied by the value supplied from AENC. 1: The value supplied from AENC is divided by the scaling factor L121 (or L221). The scaling factor must be assigned its inverse value: L121 = 1.0 / L121. The selection must be made if the scaling factor < 0.1 and otherwise the multiplication would be too inaccurate. Example: 1: L122 = 0 (the scaling factor L121 = 3.431 determined from the position normalization and can therefore be multiplied) Example: 2: L122 = 1 (the original scaling factor $L121_U$ = 0.01234 originally determined from the position normalization, is less than 0.1. The scaling factor to be entered, L121 = 1.0 / $L121_U$ = 81.037.
L123	L223	**Offset, position actual value:** The position can only be normalized if a defined point has the position actual value 0.0. However, if this point is not at 0.0, then it can be shifted to 0.0 using the offset. The following applies for AENC 1: if L122 = 0 : c125 = (c115 + c116 – L120) * L121 + L123. if L122 = 1 : c125 = (c115 + c116 – L120) / L121 + L123. The corresponding is true for AENC 2. Example: H123 = 10000.0 (reference point 1 for the position normalization is at 10000.0 mm, however, it must be 0.0 and is therefore shifted via L123 (offset).

Table 3-8: Settings for absolute value encoders (examples only for AENC1)

INIT parameters

Parameters L100 – L106 (or L200 – L206) are INIT parameters, i.e. after a value has been changed, a reset is required (e.g. power off/on).

Diagnostics

c114	Speed actual value AENC1, slave	only display	KR4114
c115	Position counter AENC1, slave	only display	KR4115
c116	Revolution counter AENC1, slave	only display	KR4116
c118	Error code AENC1, slave (refer below)	only display	---
c119	Error word AENC1, slave (refer below)	only display	---
c125	Position actual value AENC1, slave [length units]	only display	KR4125
c214	Speed actual value AENC2, master	only display	KR4214
c215	Position counter AENC2, master	only display	KR4215
c216	Revolution counter AENC2, master	only display	KR4216
c218	Error code AENC2, master (refer below)	only display	---
c219	Error word AENC2, master (refer below)	only display	---
c225	Position actual value AENC2, master [length units]	only display	KR4225
c300	Differential position, master – slave [length units]	only display	KR4300

Table 3-9: Diagnostic parameters for absolute value encoders

Normalization of the position actual values

L301	Adaptation, division differential position (Y1 = c300/L301)	1.0	---
L302	Adaptation, multiplication differential position Y2 = Y1 * L302. This value is saved in connector KR3124 via the filter smoothed with H117 and transferred to the angular controller.	1.0	---

Table 3-10: Parameter and connectors for absolute value encoders

The position actual values can be represented in length units. A length unit can be freely selected, e.g. 1 length unit = 1 mm or 1 length unit = 1 m.

Position normalization

Procedure when normalizing the position (as an example, AENC1). Parameters L111, L120, L121, L122 and L123 must be defined using the position normalization.

1. **Prerequisites:**
   L111 = 0.0 (Offset zero position).
   L120 = 0.0 (Offset, number of revolutions)
   L121 = 1.0 (Scaling factor).
   L122 = 0 (Multiplication of the scaling factor).
   The defined first position should be, e.g. 10000 mm: L123 = 10000.
   These values should first be entered.
   The angular synchronism may still not be activated (H172=0), as the values from the absolute value encoder block have still not been normalized in this phase and therefore are not correct.

2. **Move to the first position** (in this case 10,000 mm). The first position is now used as a virtual zero point.

Read-off c115 and enter in L111.
Read-off c116 and enter in L120.
A value of 10000 must now be in c125.

3. **Traverse to a second position**. The distance l_{Diff} to the first position must be known.
   l_{Diff} = 15014.3 mm; i.e. the second position is 25014.3 mm, as the first position = 10000 mm.
   Read-off parameter c125.

   Example 1: If c125 = 26023.5, a scaling factor is obtained
   L121 = 15014.3 / (26023.5 – 10000) = 0.937
   This value is greater than 0.1, which means that L122 can be kept at 0.

   Example 2: If c125 = 1234567.8, then this results in a scaling factor
   L121 = 15014.3 / (1234567.8 – 10000) = 0.0123
   This value is less than 0.1, a correction must be made:
   L122 = 1 (it is divided by the scaling factor).
   L121 = (1234567.8 – 10000) / 15014.3 = 81.560

4. **Check:**
   Move to the "second position" position and read-off c125 (in this case, c125 = 25014.3).
   Then move to the "first position" and ready-off c125 (in this case, c125 = 10000).

5. Proceed in the same way for the master drive (AENC2).

6. After position normalization, the **synchronous operation function can be activated**. The slave will now always control itself to track the master position.
   If the position is to shift, then this can be corrected via the offset slave L123 or offset master L223.

   Example:
   Actual slave position = 12000.0 mm, display c125 = 12000.5 mm.
   Then
   L123 = $L123_{old}$ + real position – c125 = 10000.0 + 12000.0 – 12000.5 = 9999.5
   This means that the display is c125 = 12000.0

The position actual value must be re-normalized if the **encoder type is changed**.

When using the **plausibility check** (function chart 75 of the SPA440 Operating Instructions) the dn enable (H118 and H119) must be set to a higher value (e.g. 1.2), if the speed actual value source (parameter H192 or H195) was <u>not</u> configured.

A higher value is not required for the dn enable if the speed actual values from the master and slave from the absolute value encoder blocks are

used. In this particular case, the source parameters should be set as follows:
H192 = 4114 (speed actual value AENC1, observe the normalization L110!)
H195 = 4214 (speed actual value AENC2, observe the normalization L210!)

Error codes for the absolute value encoders

Parameters c118 and c218
This involves erroneous input parameters (configuring error) communication errors (possibly erroneous encoder specification) or operating errors.

Bit 0 - 1	Not specified
Bit 2	Timeout
Bit 3	Communications error: The component of messages (telegrams) with parity/CRC errors is, on the average, 10% and more. If the error rate decreases the error bit is automatically reset.
Bit 4	Communication errors: On the average, a parity or CFC error occurs at each second position transfer (or more frequently). The error bit is automatically reset if the error rate decreases.
Bit 5	Not specified
Bit 6	Parity check only possible in the SSI mode
Bit 7	Illegal data coding
Bit 8	Illegal encoder type
Bit 9	Illegal clock cycle frequency
Bit 10	Format error: Contradictory or illegal data
Bit 11	Hardware address illegal or already assigned
Bit 12-15	Not specified

Table 3-11: Error codes for absolute value encoders

Errors words of the absolute encoder

Monitoring parameters c119 and c219

Error status word of an EnDat encoder. The significance of the error bits can be taken from the manufacturers data sheets.

Fault word = 0000Hex, as long as no fault is present.
Fault word = FFFFHex, as long as an SSI encoder sends a set interrupt bit.

Faults, alarms via CU

Faults and alarms can also be sent to the basic unit (CU):

Fault	Significance	Alarm	Binector
F125	Fault AENC2 master	A106	B0212
F126	Fault AENC1 slave	A107	B0211

3.3 Determining the displacement and synchronization

3.3.1 Synchronization

The differential position actual value is determined as a result of the difference between the pulses which have occurred since the position difference was reset. This does not indicate the relative position of the drives to one another! The **displacement is determined** if the **position of two drives with respect to one another regarding their synchronizing pulses** (e.g. zero pulses) must be identified and corrected.

Synchronization involves determining and correcting the displacement, which isn't clear from the position difference, e.g. after the drives have been rotated with the drive converter powered-down. For instance, it makes sense to first synchronize the drives after they have been powered-up, as they are still not in defined positions at the instant of power-on. Initial synchronization can be automatically initiated (refer to H168, H169). After this initial synchronization, additional synchronized operations are required, if errors occur in the position actual value sensing of the drives, as a result of disturbances for example, wheel slip (also refer to Section 3.8.1)

NOTE For angular synchronous control, synchronization and therefore the availability of synchronizing marks is **not** a prerequisite (if the displacement is not specified)!

Task

Synchronization is sub-divided into:

1. Determining the displacement from the position of the synchronizing marks, whereby a correction value for the differential position actual value is generated,

2. Correcting the differential position actual value by correcting the displacement.

In principle, it is adequate to synchronize just once. Continuous synchronization is mandatory under the following conditions:

- The (pulse number) ratio cannot be precisely entered. While fractions can be precisely set, **irrational ratios (e.g. π) cannot be precisely entered** !
- Encoder pulses can be lost
- Closed-loop position control of a traversing gear (refer to Section3.8.1) should be executed. As the pulse encoders are mounted on the motor, they do not emulate the actual position of the crane (position actual values). For wheel slip, position actual value sensing drive errors occur, which can only be corrected by synchronizing.

Enable

Synchronization, i. e. correcting an displacement which may have been identified, is realized by activating a *synchronizing command* (H174). The *synchronizing command* must be inhibited for applications which do not require synchronization.

Synchronization sequence

The differential position actual value can be corrected using the calculated displacement, either once within a sampling time, or distributed over several sampling times.

- **Directly setting the displacement**

The differential position actual value is set directly to a correction value, which is retrieved from the position of the synchronizing marks, if a *synchronizing command* is present, and after at least one synchronizing pulse has been received.

Thus, the angular controller receives a system deviation, generated from the displacement calculation, which must be corrected. As there is a time delay between the instant that the displacement is determined, and the instant that the displacement is set per software, then the difference pulses, which are received during this time, must be taken into account. This is possible when configuring the speed sensing blocks by appropriately connecting-up the setting inputs and selecting specific setting modes. The differential position actual value is corrected, so that no pulses are lost between determining the displacement and correcting the differential position actual value.

- **Successively setting the displacement in n sampling times**

When the displacement is set once, this can result in large steps in the differential position actual value at the angular synchronous controller and can even result in overshoot. Steps such as these can be avoided by successively setting the displacement. Correction is then step-by-step, i.e. in n sampling times by the correction pulse number (H093):

n = displacement/H093.

Correction pulse number

H093 is used to define how many pulses of the defined displacement per sampling time should be corrected. If the angular controller is inactive, then the differential position value would assume the displacement setpoint after n sampling cycles. In order that the displacement correction isn’t too high, the correction pulse number H093 should be set to extremely low values (typically =1). The value of the correction pulse number is subtracted from the differential position actual value in each sampling time until synchronism is achieved.

NOTE

A synchronizing operation, started once is executed until synchronism is achieved (correction value is 0); this can no longer be interrupted !

3.3.2 Determining the displacement

Synchronizing pulse number

The number of encoder pulses between two synchronizing pulses, the so-called synchronizing pulse number, must be entered in order to determine the displacement actual value (refer to Fig. 3-3). The **synchronizing pulse numbers** from the master- and slave drives are entered using parameters **H100** and **H102**.

If a small deviation occurs between the entered and actual pulse number, e.g. as a result of an encoder error, then this is corrected by the synchronization.

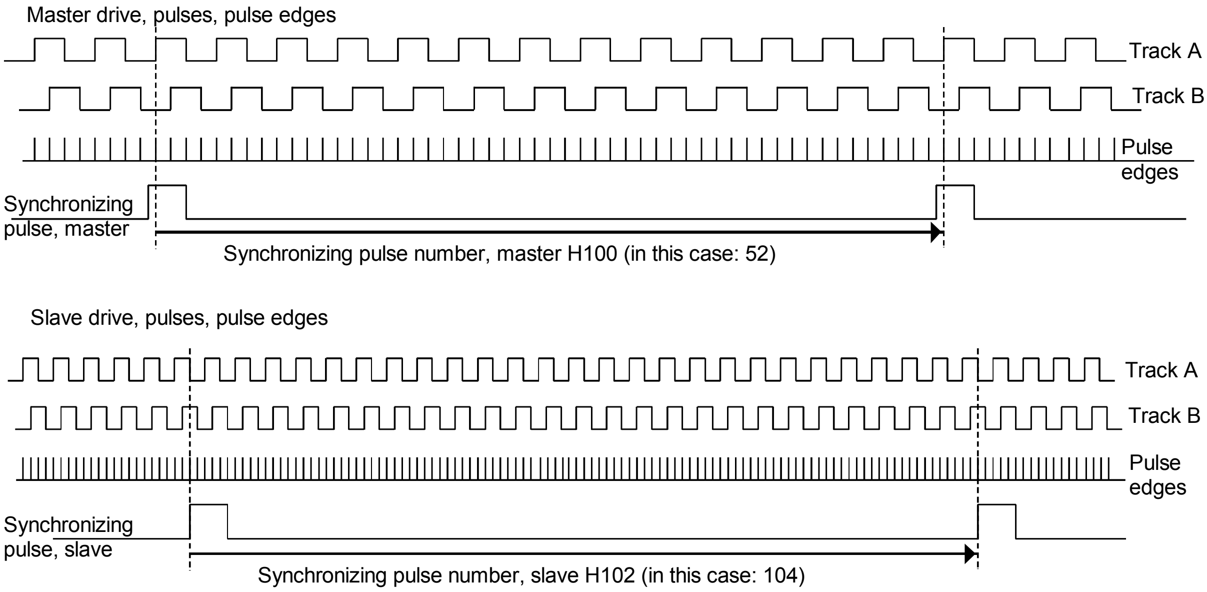


Fig. 3-3 Explanation of the synchronizing pulse number

Operating mode

The displacement actual value can be determined once if the master- and slave drives pass over the two synchronizing marks **at least once**. This can be determined in two ways:

- "continuous” (H091=0) displacement determination:

As soon as the displacement actual value has been determined once, i. e. both synchronizing marks have been passed once, then an displacement actual value (d094, d095) is calculated each time a synchronizing mark is passed. The number of synchronizing pulses passed is counted and is evaluated with the synchronizing pulse numbers (H100 and H102). This allows the actual displacement to be determined, even if the associated synchronizing pulse of the other drive is missing. Several revolutions of the machine parts to be synchronized may be included in the displacement actual value. For a synchronizing operation, **several synchronizing pulses which are passed are corrected** (”revolutions”). This is the default mode.

- ”Retrigger” displacement calculation (H091=1):

When synchronizing, correction is only made **within a synchronizing pulse period**. This corresponds, for example, for a zero pulse during one encoder revolution.

The **“Retrigger”** operating mode should be used, if

1. if, for technology reasons it is sufficient or it makes more sense to only synchronize within one “revolution”, or
2. if the synchronizing pulse number can only be determined with insufficient accuracy. In this case, both synchronizing pulses are required in order to determine the precise displacement.

In order to determine a new displacement, **both** synchronizing marks must be again passed. The number of synchronizing marks which are passed is not counted. If an displacement of several revolutions is to be obtained, then this is lost the next time the displacement is calculated.

NOTE

In the **“Retrigger”** mode, the danger exists, that the angular control loop becomes **unstable** if the dynamic performance is set too high and for low-frequency synchronizing pulses. This is because if the two synchronizing pulses occur one after the another, alternating positive and negative displacement actual values could be determined, which the angular controller would attempt to correct

Example: +10° would be obtained from an displacement of -370°

Edge evaluation

The **displacement is determined** when the synchronizing pulse **edges** are received using the position actual values from the master- and slave drives. Using the example of the switching cam in Fig. 3-4, this corresponds to edge a for clockwise direction of rotation or edge b for counter-clockwise direction of rotation.

The synchronizing circuit has a so-called **direction of rotation-dependent edge evaluation,** i.e. synchronization is realized for both directions of rotations ***at the same edge of the switching cam*** and more precisely, at the front (positive) edge of the synchronizing pulse when rotating clockwise (in Fig. 3-4, edge a). When rotating counter-clockwise, synchronization is realized at the falling edge of the synchronizing pulse (i. e. at edge a).

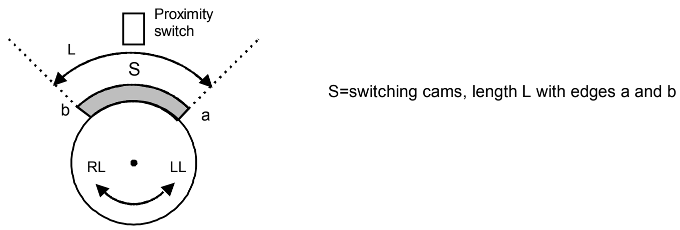


Fig. 3-4 Determining the displacement and synchronizing for clockwise- and counter-clockwise directions of rotation

Command type

The *synchronizing command* can be parameterized for either signal level- or edge control using parameter H092. The *synchronizing command* must be 1 for at least the time it takes to determine the displacement. For signal level control, the displacement is corrected as long as the signal is active (logical 1); for edge control, correction is only executed once after a positive (0→1) edge. The displacement isn’t suddenly corrected, but it is corrected with a pulse number, which can be set using parameter H093, at each sampling time.

Resetting displacement calculation

Resetting the displacement calculation is realized by

- using the *reset position* control signal (refer to Chart 90)
- by enabling the angular controller

NOTE

The displacement calculation should **only** be reset briefly when required, for example, when the drive starts. After this, it is automatically controlled by the internal monitoring function

Displacement calculation

The **displacement** at the instant that at least one synchronizing pulse is received, is calculated using the function block *Displace* in the CFC Chart *SYNC02*.

NOTES

- The distance between two synchronizing operations may not exceed 2^{31} quadrupled pulses.
- The time between two synchronizing operations must be greater than 4.8 ms (for safety reasons, 4x sampling time for a basic sampling time of 1.2 ms)
- The synchronizing pulse must be inactive for T > 1.6 ms, i. e. low (for safety, 2x sampling time for a basic sampling time of 1.2 ms).

Synchronizing example

Master- and slave drive with pulse encoders mounted on the motor shaft. The pulse encoders generate two pulse series, displacement through 90° and zero pulses.

The drives should be synchronized, so that the zero pulses (synchronizing pulses) are always simultaneously received. The pulse trains would look like this on a suitable plotter or oscilloscope:

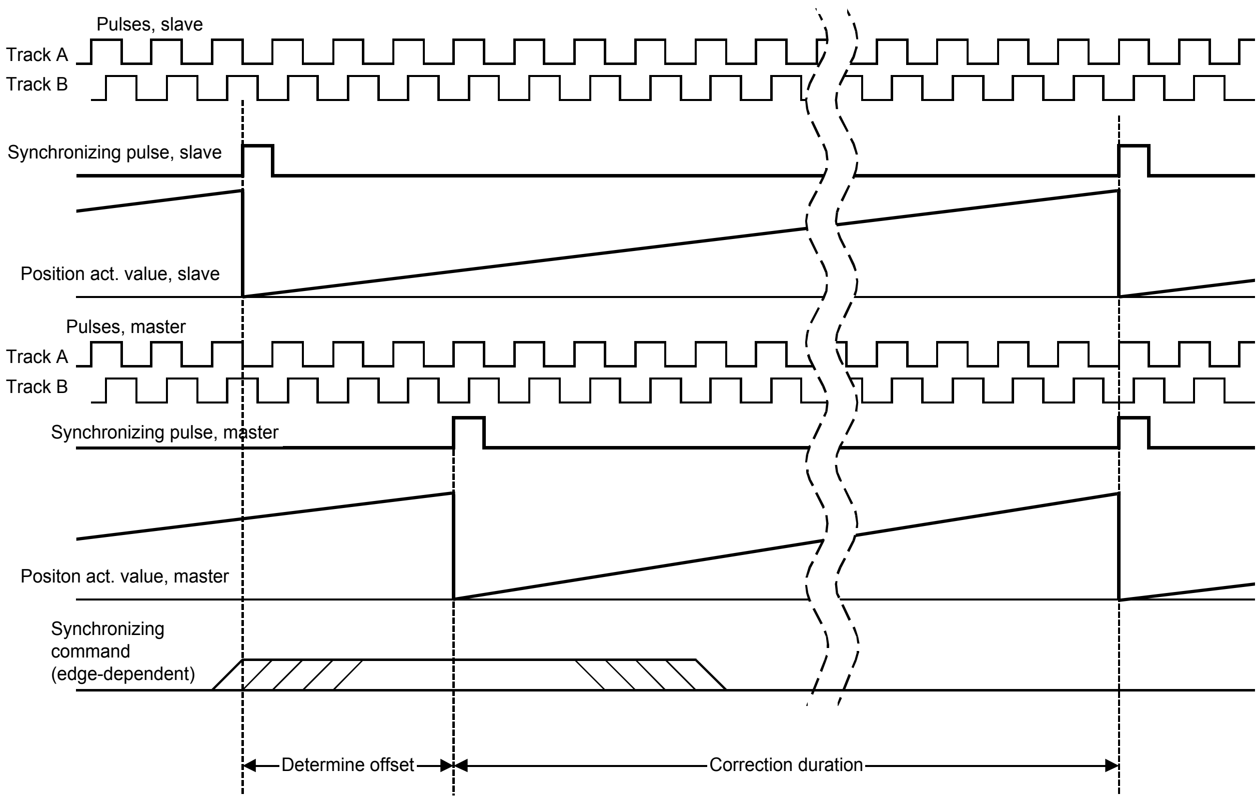


Fig. 3-5 Calculating the displacement and synchronization

3.3.3 Noise-immune synchronization

An adjustable enable threshold is used to suppress multiple edges (switch bounce) and suppress disturbances on the synchronizing pulse cable.

Erroneous synchronizing pulses, caused by **switch bounce** or disturbances, can have, among others, the following results:

- inaccuracy in the angular position,
- the synchronizing control sense could be reversed, as the rigid sequence of synchronizing pulses is interrupted (e.g. master-, slave-, master drive),
- the slave drive could run without any closed-loop control.

Thus, the synchronizing pulse cables must be especially carefully routed and shielded.

The following diagrams should show the behavior at contact-bounce and the resulting evaluation.

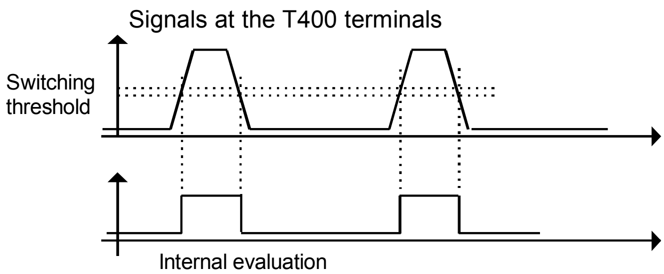


Fig. 3-6 Signal characteristic with clear pulse edges, e.g. for zero pulses from pulse encoders

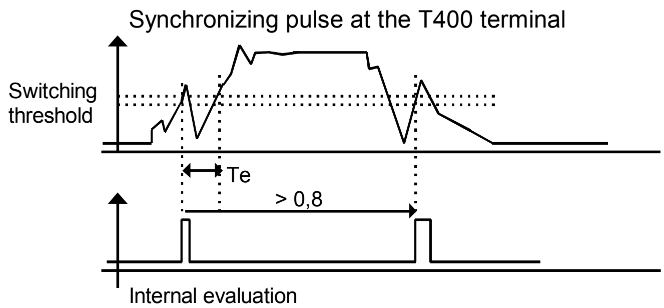


Fig. 3-7 Noisy signal characteristics, e.g. for proximity switches.

NOTE Disturbances and noise which occur in the sampling time are automatically suppressed when processed in the sampling time !

Faults which occur between two leading edges of the synchronizing pulses can be suppressed by entering an **enable threshold** when a specific position actual value is reached. The synchronizing pulses are only evaluated again after the position actual value exceeds the threshold for the master- (H107) or slave drive (H105) (refer to Fig. 3-8).

Calculating the limit value of the enable thresholds (H105, H107):

1.) If the situation is non-critical, the enable threshold can be set to approx. 95% of the synchronizing pulse numbers (parameters H100 and H102).

If the synchronizing pulses are noisy or there is the danger, that at high speeds, an enable threshold for the enable minimum duration tmin (refer to Fig. 3-8) is not maintained, then enable threshold d can be calculated using the following formula:

$$d = SS \times (1 - \frac{t\min + SF \times TS}{TS}) \; ; \qquad d > 0$$

Whereby:

SS	Number of pulse edges between 2 synchronizing pulses
TS	Time between 2 synchronizing pulses at the maximum speed
tmin	Minimum enable time. Time period where synchronization is permitted; calculation: e.g.: 4 • T1 (4 • base sampling time = 4.8 ms)
SF	Safety factor (0.05 to 0.1) if the synchronizing pulse comes earlier due to mechanical inaccuracy.

Limit value d designates the enable threshold for the synchronizing pulse. It defines, how many edges (pulses • 4) must be counted after synchronization (i. e. how high the position actual value must be) before the next synchronizing operation is enabled. Limit value d must be separately calculated for master- and slave drive.

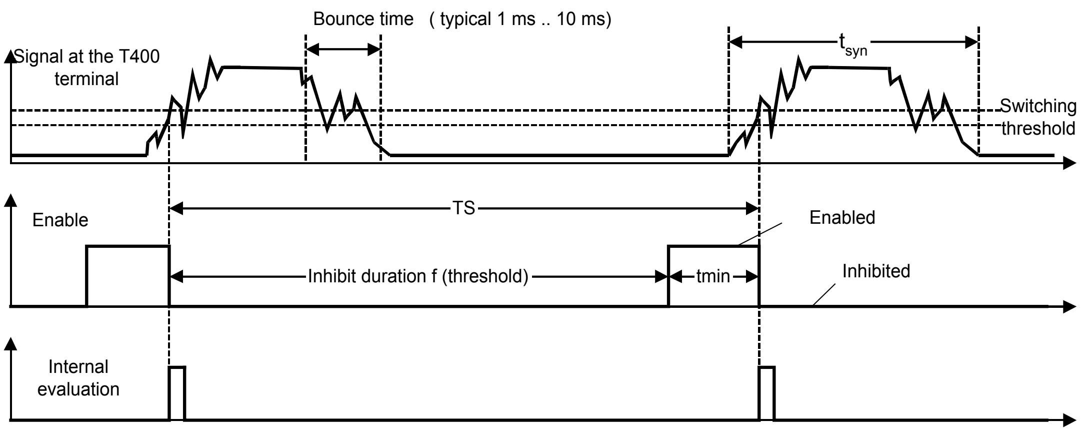


Fig. 3-8: Effect of the enable control (only one drive is shown)

3.3.4 Synchronism achieved

The threshold for the **“Synchronism reached”** signal can be set using parameter H103. A high signal is output at digital output terminal 46 when synchronism is reached.

Conditioned actual displacement

Dynamic fluctuations in the angular difference, which are mirrored in the actual displacement, are taken into account by correcting the displacement actual value by the differential angular actual value. This corrected actual displacement is known as the conditioned actual displacement. Synchronism is reached, if the conditioned actual displacement has been determined and this is zero or is a selected displacement setpoint (including a possible synchronizing displacement setpoint which is dependent on the direction of rotation), i. e.

conditioned actual displacement = displacement setpoint ± H103.

Par.	Significance	Explanation
d056	Actual displacement setpoint	Display parameter
H091	Trigger condition, actual displacement sensing	0 = continuous 1 = retrigger
H092	Edge evaluation, *synchronizing command*	0 = level controlled (continuous) 1 = edge-controlled (once)
H093	Correction pulse number	Select the lowest possible value (preferably 1); this should be **increased**, if the displacement, in spite of low-frequency synchronizing pulses, must be quickly corrected, or if required, for the **“Retrigger”** operating mode
d094	Displacement actual value	Display parameter; also includes, if relevant, a set displacement setpoint
d095	Actual displacement - differential position act. value	Display parameter
d096	Actual displacement sensing, error identification: Bit 0 = Overflow SS_{slave} Bit 1 = Overflow SS_{master} Bit 2 = Overflow $SS_{slave} \cdot$ (H102) Bit 3 = Overflow $SS_{master} \cdot$ (H100) Bit 8 = Overflow displacement- diff. pos. actual value	Display parameter SS = Sum of the synchronizing pulses
H100	Synchronizing pulse number, master	Pulse edges (pulses *4) of the master drive, which are received between 2 synchronizing pulses
H102	Synchronizing pulse number, slave	Pulse edges (pulses *4) of the slave drive, which are received between 2 synchronizing pulses
H103	Response threshold, synchronism reached	If the actual displacement = displacement setpoint ± H103, synchronism has been reached.
H105	Enable threshold, slave synchronization	To suppress the effects of contact bounce and suppressing disturbances on the zero pulse cable.
H107	Enable threshold, master synchronization	Same as H105

Table 3-12 Parameters for displacement sensing/synchronization

3.4 Closed-loop angular control

Principle

Closed-loop angular synchronous control refers to a cascading speed control loop with a higher-level angular control. The angular controller has the task to control the relative angular position between the master- and slave drive to zero or to an displacement setpoint. Angular differences, which can be obtained due to different load levels and speed fluctuations are corrected. The implementation of an angular controller is shown in Function Chart 110 (Appendix).

3.4.1 Enable signals

Principle

The angular controller is enabled as a result of the following **two** conditions

- External enable, *angular controller enable* (H173, H131,H139), and
- Enable threshold of the angular controller (H118)

The *angular controller* is first *enabled*. The angular control (d109) is actually enabled by automatically monitoring the speed actual value of the slave. An enable threshold defines the margin between the speed setpoint of the slave and speed actual value of the slave. As soon as the enable threshold is reached, the angular controller is automatically switched-in. The displacement calculation is simultaneously reset together with the position actual values of the slave/master. This avoids unnecessary overshoot and non-stable rotary motion of the closed-loop angular synchronous control if there is a considerable speed difference between the master and slave (e. g: when powering-up or powering-down a slave while the master is running).

Flying synchronization

The SPA440 standard software package permits this automatic monitoring function to also synchronize a stationary slave with a flying master, and to establish angular synchronism. Before the slave speed actual value approaches its setpoint, or an enable threshold is reached, the angular controller becomes inactive. The displacement calculation and slave/master position are simultaneously reset. **Only** the speed control operates during this time. Synchronization is only executed after the angular controller has been actually enabled.

3.4.2 Displacement setpoint

A shift between the relative angular position of the master- and slave drives can be set using the displacement setpoint. If synchronization was not realized, the displacement setpoint refers to the angular drive position at the instant that the differential position actual value was last set, e.g. that the angular controller was enabled. If synchronization was realized, the displacement setpoint refers to the synchronized angular position.

The displacement setpoint is defined as the number of slave-encoder pulse edges (pulses · 4), which the slave drive leads with respect to the master drive. The limits can be set using parameters H054, H055.

Examples:

Encoder pulse number, slave = 1000 (H010)

The slave drive should lead the master drive by 0.5 revolutions
→ displacement setpoint = 0.5 * (1000 * 4) = 2000 pulses

The displacement setpoint is fed to the angular controller via a ramp-function generator. The ramp-up time should be selected to be as high as possible (recommended: 5 s to 10 s).

NOTE The displacement setpoint, in the **displacement calculation = retrigger (H091=1)** mode, should be a maximum of half of a revolution of the parts which are to be synchronized (safety-/control margin, refer to Section 3.3.1)

Direction of rotation-dependent synchronous displacement

It is possible to provide an displacement setpoint depending on the direction of rotation. Generally, independent of the direction of rotation, the same edge of the synchronizing signal is always used (i. e. the same encoder position). Various displacements can be added to the speed setpoint using parameters H062 to H064 depending on the direction of rotation of the master and slave.

Param.	Master speed	Slave speed	Displacement for positive value
H062	Positive	Positive	Slave lags
H063	Negative	Positive	Slave lags
H064	Positive	Negative	Slave leads
H065	Negative	Negative	Slave leads

Table 3-13 Direction of rotation-dependent synchronizing displacement setpoint

3.4.3 Angular controller

The angular controller can be operated as P- or PI controller (H110). Optionally, the P gain can be adapted as a function of ratio ü.

Smoothing, differential position actual value

The differential position actual value is smoothed using a PT1 element. The smoothing time is set using parameter H117. The smoothed differential position actual value is used as actual value for the angular controller.

Adapting the P gain

The angular controller provides a supplementary speed setpoint for the speed controller at its output. For high speed ratios ü, an over-proportional high supplementary speed setpoint is demanded and at low speeds, an appropriately below-proportional low supplementary speed setpoint. This non-linear interdependency is simulated using a polygon characteristic (refer to Fig. 3-9),

The polygon characteristic sets the P gain, dependent on the ratio. The characteristic linearly interpolated between transition points A and B.

The P gain should be adapted if the ratio is changed in operation by factors of approximately > 1.5 or < 0.75.

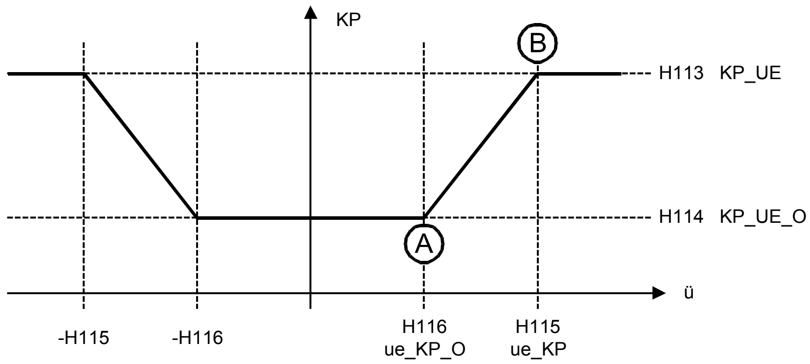


Fig. 3-9 Adapting the P gain for the angular controller

The adaption values are determined empirically using the usual techniques:

1. Starting from the standard setting (no adaption), the highest ratio is selected. This is entered for ue_KP, and the control should be optimized for this value (KP_UE).

2. The lowest ratio is then selected. This is entered at ue_KP_0, and the control should be optimized for this value (KP_UE_0).

Example:

Ratio range: 0.2 to 4.0

H116	=	ue_KP_0	=	0.2
H114	=	KP_UE_0	=	3
H115	=	ue_KP	=	4.0
H113	=	KP_UE	=	5

Parameter list

Table 3-14 lists the parameters used in the angular controller. The structure is illustrated in Chart 110.

Parameter	Significance	Explanation
H052	Ramp-up time, displacement setpoint	
H053	Ramp-down time, displacement setpoint	
H054	Setpoint limiting, positive	Displacement setpoint limiting
H055	Setpoint limiting, negative	Displacement setpoint limiting
d056	Actual displacement setpoint	Display parameter
H062-H065	Direction of rotation-dependent displacement setpoint	Synchronizing displacement setpoint (refer to Table 3-13)
H066	Fixed setpoint	Default ‘0’
H110	Angular controller as P controller	(0 / 1 = no / yes = = PI / P controller)
H111	Integral action time TN	I controller
H112	Limit value, angular controller	Positive and negative output limiting (as a % of the rated speed)
H113	P gain, KP_UE	P gain for a high ratio ü > ue_KP

Parameter	Significance	Explanation
H114	P gain, KP_UE_0	For a low ratio
H115	Limit value, ue_KP	From a P gain = KP_UE
H116	Limit value, ue_KP_0	From a P gain = KP_UE_0
H117	Smoothing, differential pos. act. value	Smoothing time
H118	Threshold for angular controller enable and monitoring the slave speed	Reduce for a low speed setpoint (default 0.1)
d120	Output, angular controller	Display parameter
d121	System deviation, angular controller	Display parameter
d122	I component, angular controller	Display parameter
d109	Status of the angular controller enable	Also available at digital terminal 48

Table 3-14 Parameters for the angular controller

3.5 Closed-loop speed control

External or internal

The **closed-loop speed control** is either **external** using the connected drive converter or **internal** on the T400 processor module. The ”Closed-loop speed control external or internal” option is used to select one of these alternatives, which can be controlled using parameter H140 (H140 = 1 ⇒ internal on the T400).

Parameter H140 = 0 is the default setting, i. e. the closed-loop speed control is implemented in the drive converter of the slave drive. It receives a speed setpoint via the communications interface to the basic drive.

The speed controller structure is illustrated in function chart 120.

3.5.1 Ratio

Ratio ü is defined as the ratio between the speed of the master drive referred to the speed of the slave drive. The actual ratio comprises three parts (refer to Chart 80):

- Ratio (d060)
- Relative change of the ratio (d061)
- Supplementary ratio (this is added)

Relative change

A ratio, entered as absolute value is used, for example, to set stretching factors and compression factors for material webs in a user-friendly fashion. The absolute ratio is multiplied by a value, which is supplied from a source which can be selected using H048, H068. If this factor has the value 1.0, the selected ratio is not changed.

Supplementary ratio

A fixed ratio can be set using parameter **H047**; the product of d060 with d061 is added to this value.

3.5.2 Master speed setpoint

The **master** speed setpoint is the speed setpoint at which the master drive should rotate. The speed setpoint for the slave drive is calculated from the speed master setpoint after smoothing (H072; refer to Chart 115) and after dividing by the ratio. This is fed to the speed control which is superimposed on an angular control.

The master speed setpoint source is selected using a parameter (H070, H071). The setpoint smoothing (in ms) is set using parameter H072. This is recommended, if the master speed actual value is used as master setpoint (setting, H070 = 15).

NOTE If the angular controller or synchronization is used, then the slave master setpoint with respect to the master may **only** be changed using **ratio ü**.

The angular difference, which occurs as a result of the ratio, does not appear as differential position value, so that the angular controller does not have to work to correct it.

3.5.3 Inertia compensation

System deviations from angular synchronism, which can occur when the master speed setpoint changes quickly, can be reduced using the ”inertia compensation” function. The inertia compensation acts as pre-control value for the speed controller.

The sources for the **inertia compensation** can be selected using parameters H080 and H244.

The following drawing clearly illustrates the characteristics of the DT1 element and the influence of the parameters:

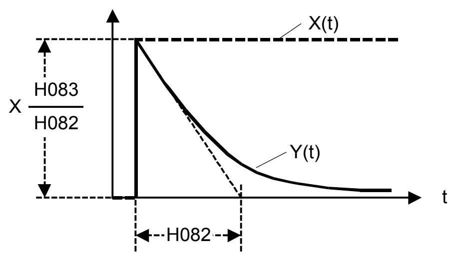


Fig. 3-10 Step response of the DT1 element to illustrate the use of parameters H082 and H083

Setting: H082 generally lies in the range between 100 ms and 500 ms. The magnitude of the differential element output quantity is set using parameter H083.

3.5.4 Speed controller Kp adaption

The speed controller is a PI controller. If extremely **low speeds** ($n^* < 0.05\ n_{rated}$) are used, then we recommend a **speed setpoint-dependent** adaption of the P gain. This can be implemented using an adjustable polygon characteristic.
The characteristic is linearly interpolated between the corner points A and B.

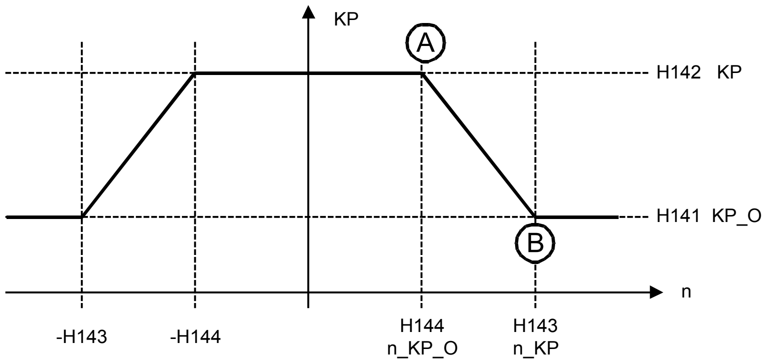


Fig. 3-11 P gain adaption for the speed controller

The adaption values should be determined using the usual techniques and using the following experiments:

1. Starting from the standard setting (no adaption), the lowest speed should be determined, where the already optimized drive, manifests the required control quality.

2. Then, for n_KP_0, the value n_KP_0 = n_KP/2 is approximately defined.

3. The speed is entered as under 2. and approached. The closed-loop control is then optimized with KP_0.

4. The values for KP_0 and n_KP_0 must still, if required, be varied.

3.5.5 Jogging

When *jogging* is *enabled,* a jog setpoint is **added to the master setpoint**. This means that the slave speed can be changed with respect to the master speed, and it is possible to take-up or slack-off with respect to the master. **Jogging is not practical in the closed-loop angular control mode**, except for test purposes, as the angular controller acts to oppose the jog setpoint.

The jog setpoint is set as fixed value using parameter H130. The source of the *jog enable* is defined using H171, H208 (refer to Chart 115).

3.5.6 Parameters to the speed controller

Param.	Significance	Explanation
H040	Multiplexer, ratio	Only required due to compatibility to V2.01.
H048	Multiplexer, relative ratio	Only required due to compatibility to V2.01.
H070	Multiplexer, master speed setpoint	Only required due to compatibility to V2.01.
H072	Smoothing, master speed setpoint	
H080	Multiplexer, inertia compensation	Only required due to compatibility to V2.01.
H130	Jog setpoint	Selectable supplementary speed value
H132	Speed setpoint limiting, positive	
H133	Speed setpoint limiting, negative	
H134	Speed controller output limiting, positive	Reference to the speed controller on T400
H135	Speed controller output limiting, negative	Reference to the speed controller on T400
H140	Speed controller calculated on T400	0/1 == no/yes
H141	KP: P gain	At high speeds n > n_KP
H142	KP_0: P gain	At low speeds
H143	Limit value for KP	Speed n_KP, from the P gain = KP
H144	Limit value for KP_0	Speed n_KP_0, up to the P gain = KP_0
H145	Integral action time, speed controller	Default 200 ms
d150	Speed controller output	Effective at H140=1
d152	Actual basic drive setpoint	At H140=1, d152=d150 At H140=0, d152= speed setpoint
d153	KP speed controller	
H171	Jog enable	Only required due to compatibility to V2.01.

Table 3-15 Parameters to the speed controllers

3.6 Open-loop control

In order to control open-loop angular synchronism, in addition to the setpoint, five control signals have to be handled (the control signals in this documentation are always written in italics):

- *displacement reset*
- *reset position*
- *angular controller enable*
- *synchronizing commend*
- *jog enable*

The sources of these control signals can be selected per multiplexer (refer to H170 to H174), or can be connected-up as required using BICO connection.

Several options are possible to generate control words for the basic drive or for output via the communications interface:

- Fixed values can entered
- Control words can be transferred from one interface to another (e. g. control word 1 from CB to control word 1 CU)
- The control word can be selected bit by bit (e. g. by combining a CB control word with digital inputs)

Also refer to function charts 170 to 570.

3.7 Faults, alarm and status display

3.7.1 General information on faults and alarms

Fault- and alarm statuses contain various monitoring quantities (Table 3-16). The quantities, which are to be transferred to the basic drive as alarm or fault are selected using the two masks H003 or H004.

If at least one of the bits, enabled per mask, is set to 1, then the associated digital output is activated (fault, terminal 49; alarm, terminal 51).

In the factory setting, all faults and alarms are de-activated, i. e. H003 = H004 = 0.

Fault

The basic drive is **fault tripped** if a bit is set in the fault word and it is appropriately enabled with mask parameter H003 (behaves the same as OFF2, i. e. the equipment is powered-down and the drive coasts-down). The fault is saved in the basic drive. As soon as the cause has been resolved, i.e. the associated bit has become 0, then the fault can be **acknowledged** on the basic drive. The fault cannot be acknowledged as long as a fault exists (=”1”), and is transferred to the basic drive via the dual port RAM!

Alarms

When appropriately enabled with mask parameter H004, alarms are displayed as appropriate numbers on the operator panels. They do not influence the drive. They cannot be acknowledged, but can be deleted automatically when the cause has been removed, as soon as the appropriate bit has become 0.

Bit	Monitoring	Fault	Alarm
0	Time overflow COMBOARD (correct data have not been received)	F116	A097
1	Time overflow peer-to-peer (correct data have not been received)	F117	A098
2	Speed controller at its limit	F118	A099
3	Angular controller at its limit	F119	A100
4	External fault	F120	A101
5	Master speed not plausible (deviation w. r. t. the master setpoint is too high)	F121	A102
6	Slave speed not plausible (deviation w. r. t. the setpoint is too high)	F122	A103
7	Error, speed sensing, master (illegal parameterization, refer to d021)	F123	A104
8	Error, speed sensing, slave (illegal parameterization, refer to d120)	F124	A105

Table 3-16 Monitoring functions and associated faults and alarms

Suppressing the fault/alarm message

Fault- and alarm messages can be suppressed using selectable masks. The appropriate monitoring function is evaluated if a bit in the mask is set to 1.

Example: H003 = 16#0021 (input with CFC)
H003 = 0000 0000 0010 0001 (digital input with OP1S)

Bit 0 = 1 ⇒ time monitoring COMBOARD (watchdog) can initiate a fault
Bit 4 = 1 ⇒ external fault can initiate a fault

We recommend that when commissioning the basic drive, the fault- and alarm messages of the T400 are de-activated using parameters **H003** and **H004**. When the system is operated, these monitoring functions should be re-enabled.

3.7.2 Monitoring the communication coupling

Principle

The communication monitoring function checks, whether in a definable period, a valid telegram (and error-free) has been received. If this is not the case, the associated error bit is set. If valid telegrams are again received after an error, the error bit is again reset.

Note

In order to make the first commissioning steps easier, so that they are not hindered by non-relevant fault trips, when the angular synchronous software package is supplied, the communication errors and alarms are suppressed per mask (H003, H004).

If communications are used, the associated status bits to initiate a fault must be re-enabled!

Power-on time limit

After power-up, it must be assumed that it will take several seconds until the communication channels become operational. Thus, the so-called power-on time limit is decisive for this particular phase (peer H360; COMBOARD H462).

Time limit for cyclic operation

As soon as the initialization delay time after power-on has expired, or already valid telegrams have been received, the cyclic monitoring time for the telegram error identification becomes effective (watchdog). This is defined using parameter H361 (peer), H496 (COMBOARD). For this monitoring time, for CB1 (PROFIBUS), if necessary, the number of nodes must be taken into account, as the reception of telegrams depends on the number of nodes (stations) and the send clock cycle.

3.8 Application example

3.8.1 Synchronous operation and synchronizing using as an example a gantry crane

The following traversing gear of a container crane can be used as a specific example for the necessity of having synchronization.

Task description

Both sides of the crane traversing gear (fixed legs-master drive and moving legs-slave drive) should operate with position synchronous control and in synchronism. This prevents the crane running skew in the rails along the quay.

Necessity

Synchronization is required in this case, as the pulse encoders are mounted on the motor and therefore do not directly represent the movement of the crane (position actual value), but instead, the position of the wheels (as a result of slip, wheel slip, etc.). If the wheels slip, then errors can occur in the drive actual value sensing resulting in errors in the position difference as controlled variable between the two drives.

Task

The task of synchronization is to correct the above mentioned errors. The position actual values of the two drives are set to defined, actual position values when fixed synchronizing marks are passed. The difference between the two drives, after the second drive has passed its mark, is known as displacement. This displacement is the real position difference between the two drives, which must be corrected.

As it involves a linear-axis application, synchronization is always realized when the position value of the master and slave is approx. 0.0. Thus, in this case, synchronization must always be enabled. This means that the position-dependent synchronization must be de-activated (H105 = H107 = 0.0).

Bero proximity switch

To realize this, the position actual value is set to zero on both sides when the synchronizing mark is passed - Bero proximity switch 3. The position marks are mechanically located and precisely aligned along the crane track.

Displacement

If the crane traversing gear arrives at the synchronizing mark in a skew position, then at first, the position actual value of side 1 is set to zero, and then the position actual value of side 2. The position actual values of the master and slave are therefore corrected.

The pulses, which are sensed between these two events, represent the displacement. The displacement is added to the position difference (in small steps), whereby the angular controller identifies a position difference which is the same as the displacement. The skew position is resolved after the position difference has been corrected.

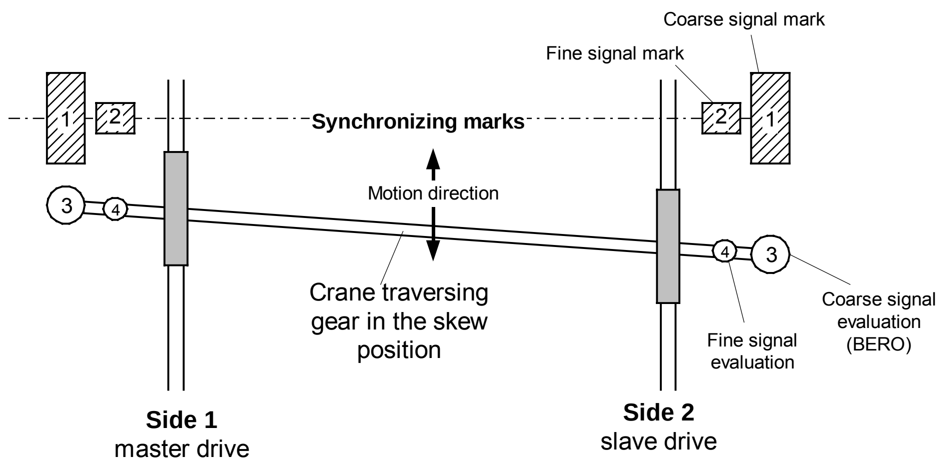


Fig. 3-12 Closed-loop synchronous operation of a crane traversing gear

4 Parameters and connectors

4.1 Parameter handling

Definition

Parameters are used to

- visualize internal quantities (monitoring parameters)
- to change fixed values
- to change connections (BICO parameters)

All of the parameters which refer to the function and setting of the technology module are called *technology parameters.* The technology parameters for the closed-loop synchronous control appear in the function charts with the following symbols:

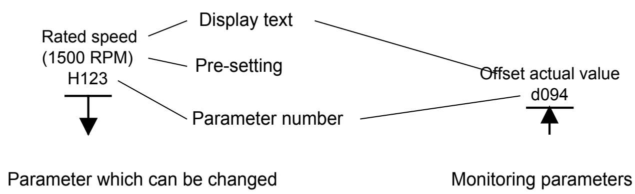


Fig. 4-1 Representing parameters in the function charts

When changing parameters, it should be observed that there are initialization parameters, which only become effective after the T400 has re-started.

In addition to technology parameters, there are so-called basic drive parameters for the drive converters used. These should be taken, together with the associated function charts of the documentation of the drive converter used.

It should be noted, that the parameters are selected by entering a number (e.g. at the drive converter operator panel). However, for the display, the most significant position is replaced by a letter, which is intended to symbolize as to whether it involves a quantity which can be changed or not changed.

Example

Number “1956“ is entered to select technology parameter “H956“.

Value range	Significance	Parameter display (example)	
		can be changed	cannot be changed
0 ... 999	Lower parameter range of the drive converter	P123	r123
1000 ... 1999	Lower parameter range of the T400	H123	d123
2000 ... 2999	Upper parameter range of the drive converter	U123	n123
3000 ... 3999	Upper parameter range of the T400	L123	c123

Table 4-1 Parameter number specification

4.1.1 BICO parameters

Contrary to (value) parameters, BICO parameters define connections. This means that parameters specify a fixed value at an input, and on the other hand, BICO parameters select the signal source, which is connected to the input. This signal source must be defined in the form of a connector. The BICO parameter appears as a parameter in the symbol of a BICO input (refer to Fig. 4-2). The source and target of a BICO connection must have the same data type. This means that digital quantities (BOOL) cannot, for example, be connected to floating-point inputs. Thus, for the data type used, there are different symbols in the function charts for connectors and BICO inputs.

Changes not possible

Re-wiring work demands memory space if new connections are to be generated, and if it involves connections between various time sectors. If the available memory space can no longer accept connection changes, then this can be identified when the required re-connection is no longer possible (OP1S display jumps to the old connector value).

Remedy:

Rest the module (power OFF - ON). Memory space which is not used is enabled when the module restarts.

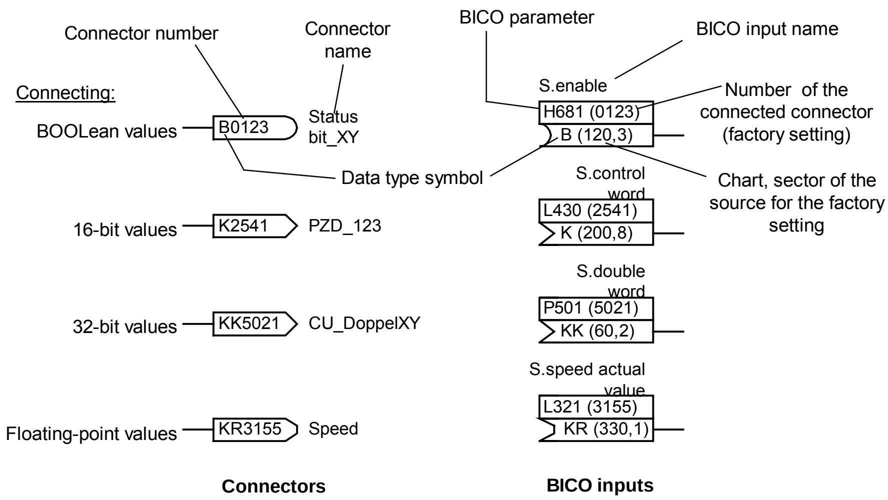


Fig. 4-2 Symbols for connectors and BICO inputs

4.1.2 Resources to adapt the software and commissioning

Various resources are available to adapt the standard software package to particular applications. The resources essentially differ by the intervention possibilities, which are shown in the following table. The **parameter name**, displayed at OP1S, is a maximum of 16 characters long, and it is possible to toggle between *German* and *English* using initialization parameter H000 (reset is required after a change has been made!).

Name	Explanation
PMU	Input field for all MASTERDRIVES- and DC Master units (with 4-digit display)
OP1S	Operator device with numerical keypad and 4-line text display; can be directly connected to the PMU.
SIMOVIS	Start-up- and parameterizing software for the PC (Windows). It provides an oscilloscope function for MASTERDRIVES MC.
CFC	Graphic engineering tool which is used to generate the standard software package. It is connected to the service interface of the T400. Prerequisite: STEP 7; D7-SYS
Service-IBS (Service-start-up)	Simple start-up- and diagnostics tool for PC (DOS). It can also be used as Telemaster for remote diagnostics.

Table 4-2 Adaption- and start-up tools

Intervention	CFC	PMU	OP1S	SIMOVIS	Service-IBS
View value	Any	Parameter	Parameter	Parameter	Any
Change value	Any	Parameter	Parameter	Parameter	Any
Change connection	Any	BICO	BICO	BICO	Any
Insert block	Yes	No	No	No	No
Delete block	Yes	No	No	No	No
Change execution sequence	Yes	No	No	No	No
Change cycle time for processing	Yes	No	No	No	No
Duplicate software	Yes	No	No	No	No
Duplicate the complete parameter set	No	No	No	Yes	(Macro)
Documentation	Charts	No	No	Parameter lists	No

Table 4-3 Adaption- and start-up tools

For several parameter types, as a result of the limited resolution at input or due to conversion operations, **rounding-off errors** can be expected. Further, in some cases, more decimal places are offered than can actually be set.

I/O can be read and changed using CFC online or the simple IBS program (start-up program) (TELEMASTER) via the T400. This allows parameters to be influenced.

Changing connections:

If a connection between function blocks is required, which is not intended as BICO connection, then this can be simply realized using the basic IBS program (TELEMASTER). In this case, the complete path name (CFC software package) of the source and target are required in the following form:

CFC-chart name.Block name.Connector name

To realize this, the parameter list, in addition to the parameter description, contains the complete I/O designation, which can be used as source or target for a connection.

Caution: If a connection is changed using the simple IBS, this is **not identified as a parameter change**, and therefore **cannot** be **read-out** with SIMOVIS. This means that it cannot be **transferred** to any other modules with angular synchronism!

4.2 Parameter list

The parameters used in the standard angular synchronism software package are listed on the following pages. The list has the following format:

Parameter	Description	Data
Hxyz (Lxyz) Parameter designation *Initialization parameter*	Parameter description for a technology parameter which can be set Parameter with the supplement *initialization parameter*, means when this parameter is changed, the change only becomes effective after the power supply voltage has been powered-up again. Chart name.Block name.Connection	Value, factory setting type Min lower limit Max upper limit Chart chart, sector
dxxx (cxyz) Parameter designation	Parameter description for a visualization parameter (cannot be set). Letters ”d” or ”c” symbolize the displacement values 1000 (”d”) or 3000 (”c”). This should be taken into account when selecting the parameter with OP1(S). Chart name.Block name.Connection	Type Chart chart, sector

Table 4-4 Listing type for input- or display parameters

Type abbrev.	Type	Significance	Example, display on OP1S	Value range, OP1S
BO	BOOL	Logical quantity	0	0, 1
I	INT	Integer number; signed	-12345	-32768 ...32767
W	WORD	Integer number; unsigned; hexadecimal and binary displayed at OP1(S)	2F03hex 0010111100000011	0000 ... FFFF (0 ... 65535)
DI	DINT	Double integer number (32 bit); signed	123456789	±2147483647
R	REAL	Floating-point number. Input using OP1(S) is restricted to 6 places before the decimal point and 3 places after the decimal point, whereby the range is limited to 199999.999.	123456.789	±2147483.647
SD	SDTIME	Time in [ms]	200.000 ms	0 ... 2147483.647 ms
N2	INT	16-bit fixed point quantity for drive converter comp. Value range: -32768 ... 32767 => -200% ... 200%		
N4	DINT	As for N2; however 32-bit resolution: 16#40000000 = 1073741824 => 100%		

Table 4-5 Data types and range for parameterization with OP1S

Table 4-6 **Parameters of the SPA440 standard software package**

Parameter	Description	Data
H000 Language select *Initialization parameter*	0 = German 1 = English IF_CU.DRIVE.PLA	Value: 0 Type: I
d001 Software Type	Identification of the angular synchronism, standard software package on T400 = 440 PAR_GER.SW_TYP.Y	Type: I Chart: 40, 3
d002 Software Version	Actual software version (2.020) PAR_GER.SWVERS.Y	Type: R Chart: 40, 3
H003 Error Mask	Fault messages are enabled bitwise Bit 0 COMBOARD, receive faulted F116 Bit 1 Peer-to-peer, receive faulted F117 Bit 2 Speed controller at its limit F118 Bit 3 Angular controller at its limit F119 Bit 4 External fault (refer to H665) F120 Bit 5 Master speed outside the tolerance (refer to H119) F121 Bit 6 Slave speed outside the tolerance (refer to H118) F122 Bit 7 Error, speed sensing, master (refer to d020) F123 Bit 8 Error, speed sensing, slave (refer to d021) F124 Bits 9 ..15 can be optionally assigned. In the default setting, all of the error messages are suppressed to facilitate commissioning. If communications are used, the monitoring function must be re-enabled CONTR.ErrorMask.I2	Value: 16#0000 Type: W Chart: 160, 4
H004 Warning Mask	Warnings are enabled bitwise Bit 0 COMBOARD, data receive faulted A097 Bit 1 Peer-to-peer, data receive faulted A098 Bit 2 Speed controller at its limit A099 Bit 3 Angular controller at its limit A100 Bit 4 External fault (refer to H665) A101 Bit 5 Master speed outside its tolerance (refer to H119) A102 Bit 6 Slave speed outside its tolerance (refer to H118) A103 Bit 7 Error, speed sensing, master (refer to d020) A104 Bit 8 Error, speed sensing, slave (refer to d021) A105 Bits 9 ..15 can be optionally assigned. The default suppresses all warning messages! CONTR.WarnMaske.I2	Value: 16#0000 Type: W Chart: 160, 7
d005 State of Control	Status of the standard angular synchronous control software package Bit 0 Angular controller enabled Bit 1 Speed controller on T400 enabled Bit 2 Synchronism reached Bit 3 Angular controller at its limit Bit 4 Speed controller at its limit Bit 5 Master speed outside its tolerance (refer to H119) Bit 6 Slave speed outside its tolerance (refer to H118) Bit 7 Time overflow, basic drive Bit 8 PROFIBUS, data receive faulted Bit 9 Peer-to-peer, data receive faulted Bit 10 Slave has synchronized (10 ms pulse) Bit 11 Master has synchronized (10 ms pulse) Bit 12 Position actual value slave > enable threshold Bit 13 Status displacement determined Bit 14 Warning active Bit 15 Fault active CONTR.Statuswort.QS	Value: 16#0000 Type: W Chart: 40, 7
d006 Error Bits	Status of the monitored error sources. The assignment corresponds to the mask in H003 CONTR.Fehlerzustand.QS	Type: W Chart: 160, 4

Parameter	Description	Data
d007 Warning Bits	Status of the monitored warning sources. The assignment corresponds to the mask in H004 CONTR.Warnzustand.QS	Type: W Chart: 160, 6
H008 TechBoard ParTyp *Initialization parameter*	H008 is used to define the data type which is used to transfer type R parameters (real) via the USS slave interface. Generally, real parameters must be converted into a 32-bit fixed-point value (e. g. for OP1S). 0: Transfer in the fixed-point format 1: Transfer in the floating-point format IF_CU.DRIVE.TF	Value: 0 Type: BO Chart: 40,1
H009 T400 = Baseboard *Initialization parameter*	Activates basic drive converter functions if the T400 is used in the SRT400 without a basic drive, and if it should behave with respect to an adjacent T400 just like a basic drive. In this case, all of the parameter numbers are shifted (offset) by 1000. This means, that H123 becomes P123. **Caution**: Only set H009 to 1, if parameterization is still possible, as it is neither possible to operate in the basic drive nor parameterize via the PMU or OP1(S)! 0 T400 operates as technology module (in the basic drive or SRT400) 1 T400 behaves just like a basic drive (in the SRT400 as basic drive) IF_CU.DRIVE.BBF	Value: 0 Type: BO Chart: 40,1
H010 Pulses Slave *Initialization parameter*	Number of pulses (of a track) per revolution of the incremental encoder at the slave drive. SYNCO2.SlavePulse.X	Value: 1024 Type: I Chart: 60, 4
H011 Pulses Master *Initialization parameter*	Number of pulses (of a track) per revolution of the incremental encoder at the master drive (=speed sensing 2); SYNCO2.MasterPulse.X	Value: 1024 Type: I Chart: 70, 4
H012 Nom. Speed Slave	Nominal (rated) speed of the slave drive in RPM. This is referred to speed 1.0. A sign reversal of the value corresponds to interchanging the pulse encoder tracks. It is not permissible to use the value 0. SYNCO2.SlaveNnenn.X	Value: 1500.0 Type: R Chart: 60, 4
H013 Nom. Speed Master	Nominal (rated) speed of the master drive in RPM. This is referred to speed 1.0. A sign reversal of the value corresponds to interchanging the pulse encoder tracks. It is not permissible to use the value 0. It is especially important to enter the right value when using the master encoder signal as master setpoint for the slave. SYNCO2.MasterNnenn.X	Value: 1500.0 Type: R Chart: 70, 4
d014 Speed Slave	Speed actual value of the slave in RPM; (normalization can be selected with parameter H058) SYNCO2.n_Slave.Y	Type: R Chart: 60, 7
d015 Speed Master	Speed actual value of the master in RPM (normalization can be selected with parameter H059) SYNCO2.n_Master.Y	Type: R Chart: 70, 7
d016 Slave Position	Number of quadrupled pulses of the slave drive since the last synchronizing pulse. For a negative direction of rotation, the value is counted down (decremented). SYNCO2.Slave.YP	Type: R Chart: 60, 7
d017 Master Position	Number of quadrupled pulses of the master drive since the last synchronizing pulse. For a negative direction of rotation, the value is counted down (decremented). SYNCO2.Master.YP	Type: R Chart: 70, 6

Parameter	Description	Data
H018 Mode Slave Speed *Initialization parameter*	Slave speed sensing mode 1 The mode of the speed sensing block for the slave drive is selected using this parameter; this especially involves the digital filter, the encoder type, the coarse signal type selection and the direction of rotation dependency of the synchronizing pulse (zero encoder pulse), as well as the source of the encoder pulses. The selected mode is highlighted (in bold letters). Refer to the SIMADYN D Reference Manual for an additional description as well as the function block library, function block NAVS, connection MOD. - - - X: the last hexadecimal position = 2 has the following significance: Bit 0 **0 encoder 1:** Two pulse tracks, offset through 90° 1 encoder 2: There is a dedicated track for each direction of rotation Bit 3..1 digital filter with time constant/limiting frequency 500 ns / 2 MHz 000x no filter **001x 500 ns (encoder 1)** 125 ns (encoder 2) 010x 2 µs (encoder 1) illegal (encoder 2) 011x 8 µs (encoder 1) illegal (encoder 2) 100x 16 µs (encoder 1) illegal (encoder 2) Rest illegal - - X -: the last but one position = E has the following significance: Bit 4 setting mode for input S **0 set YP to SV** 1 subtract SV from YP Bit 5 setting mode for input SD 0 set YDP to SVD **1 subtract SVD from YDP** Bit 6 source of the encoder tracks (can only be selected for terminal XE1) 0 T400 **1 from the BASEBOARD** Bit 7 source of the zero pulse (can only be selected for terminal XE1) 0 from terminal XE1 of the T400 **1 from the BASEBOARD** XX - -: the two highest positions = 7F has the following significance: Correcting the standstill limit for 127 sampling cycles SYNCO2.Slave.MOD	Value: 16#7FE2 Type: W Chart: 60, 2

Parameter	Description	Data
H019 Mode MasterSpeed *Initialization parameter*	Operating mode of master speed sensing 2 For this particular software package, the only difference between H018 and H019 is in the last but one position (refer below) This parameter is used to set the speed sensing block mode for the master drive, especially the digital filter, the encoder type, the coarse pulse version and the source of the encoder pulses. In the following text, only those operating modes will be described which are possible when supplied from the factory. Refer to H018 for additional information. - - - X: last position = 2 has the following significance: Digital filter with time constant/limiting frequency 500 ns / 2 MHz Encoder type : pulse encoder with 2 tracks offset through 90 degrees - - X -: last but one position = 0 has the following significance: Zero- and incremental pulses from the terminal, encoder 2 of the T400 Setting mode S=0 : set YP to SV Setting mode SD=0: set YDP to SVD (contrary to parameter H018, however this is not relevant for this particular software package, as YDP is not accessed by the master speed sensing block.) XX - -: the two highest position = 7F have the following significance: Correcting the standstill limit at 127 sampling cycles SYNCO2.Master.MOD	Value: 16#7F02 Type: W Chart: 70, 4
d020 Error Code Slave	Error code of the slave drive speed sensing. In order to use angular synchronism, the value must be 0. If this value is not 0, an error has been made when parameterizing the speed sensing. The cases designated with *) can occur after the software package has been modified in-line with application specific requirements. Significance of the error bits 0 Parameters which may not be 0: H010, H012, H044 1 Sampling time > 20 ms *) 2 H018, illegal filter parameterization 3 Slave without master *) 4 Master and slave in various sampling times *) 5 Several masters use the same encoder *) 6 Master and slave use the same encoder *) 7 Pulse counter overflow SYNCO2.Slave.YFC	Type: W Chart: 60, 7
d021 ErrorCode Master	Error code of the master drive speed sensing. In order to use angular synchronism, the value must be 0. If this value is not 0, an error has been made when parameterizing the speed sensing. The cases designated with *) can occur after the software package has been modified in-line with application specific requirements. Significance of the error bits 0 Parameters which may not be 0: H011, H013, H044 1 Sampling time > 20 ms *) 2 H018, illegal filter parameterization 3 Slave without master *) 4 Master and slave in various sampling times *) 5 Several masters use the same encoder *) 6 Master and slave use the same encoder *) 7 Pulse counter overflow SYNCO2.Master.YFC	Type: W Chart: 70, 6

Parameter	Description	Data
H022 CoarsePulseSlave	Sets the synchronizing type of the slave speed sensing. The value has several functions, however, only the coarse pulse evaluation selection can be modified in this application (refer to Fig. 2-3). Bit(s) Value Significance 0 0 Synchronization using the zero pulse 1 0 For the zero pulse, the pos. is set to the setting value 0.0 3...2 00 Not evaluated 6...4 XYZ Coarse pulse version number (refer to Doc. T400) 000 Example: No. 0 (coarse pulse is not evaluated; as for mode 1) 011 Example: No. 3 (mode 3; the zero pulse is always evaluated if the coarse pulse has a high signal level) 15...7 any Not evaluated SYNCO2.Slave.SYM	Value: 0 Type: W Chart: 60, 3
H023 CoarsePulseMaster	Sets the synchronizing type of the master speed sensing. The value has several functions, however, only the coarse pulse evaluation selection can be modified in this application. Significance, refer to H022. SYNCO2.Master.SYM	Value: 0 Type: W Chart: 70, 3
H024 COMBOARD ParTyp *Initialization parameter*	H024 is used to define the data type parameter type R (real = floating point) which is transferred via the COMBOARD interface. 0: Transfer in the fixed-point format 1: Transfer in the floating-point format IF_CU.DRIVE.CF1	Value: 0 Type: BO Chart: 40, 1
d025 State dig. Inputs	Digital inputs 1 .. 8 and their inverse values, combined as a word: 0 BinInput 1 (terminal 53) 1 BinInput 2 (terminal 54) 2 BinInput 3 (terminal 55) 3 BinInput 4 (terminal 56) 4 BinInput 5 (terminal 57) 5 BinInput 6 (terminal 58) 6 BinInput 7 (terminal 59) 7 BinInput 8 (terminal 60) 8 BinInput 1 inverse (terminal 53) 9 BinInput 2 inverse (terminal 54) 10 BinInput 3 inverse (terminal 55) 11 BinInput 4 inverse (terminal 56) 12 BinInput 5 inverse (terminal 57) 13 BinInput 6 inverse (terminal 58) 14 BinInput 7 inverse (terminal 59) 15 BinInput 8 inverse (terminal 60) T400_EA.Invert_Bin.QS	Type: W Chart: 52, 7
d026 Control Word1 CU	Control word 1; is sent to the basic drive converter. Bit Significance 0 On (main contactor) 1=ON 1 /OFF2 (voltage-free) 0=OFF 2 /OFF3 (fast stop) 0=OFF 3 Pulse enable 4 Ramp-function generator enable 5 Start ramp-function generator 6 Setpoint enable 1=enable 7 Acknowledge fault 1=acknowledge 8 Jogging 1 9 Jogging 2 10 Control requested 11 Enable positive direction of rotation 12 Enable negative direction of rotation 13 Motorized potentiometer, raise 14 Motorized potentiometer, lower 15 Fault, external 1 0 = fault IF_CU.Steuerwort1.QS	Type W Chart: 220, 4

Parameter	Description	Data
d027 Control Word2 CU	2nd control word for the basic drive. Only bit 9 (enabling the speed controller in the basic drive) is used. IF_CU.Steuerwort2.QS	Type: W Chart: 220, 8
d028 ... d031 Display R1 ... Display R4	Four display parameters, type REAL (floating point) to display connectors without their own display parameter. The source is selected using parameters L028 ... L031. Free_FBs.Display_R.Y1 ... Free_FBs.Display_R.Y4	Type: R Chart: 470, 8
d032 ... d035 Display B1 ... Display B4	Four display parameters, type BOOL to display connectors without their own display parameter. The source is selected using parameters L032 ... L032. Free_FBs.Display_BO.Q1 ... Free_FBs.Display_BO.Q4	Type: BO Chart: 470, 8
d036, d037 Display I1 ... Display I2	Two display parameters, type integer (16-bit) to display connectors without their own display parameter. The source is selected using parameters L036 and L037. Free_FBs.Display_I.Y1, Free_FBs.Display_I.Y2	Type: BO Chart: 470, 8
d038, d039 Display W1 ... Display W2	Two display parameters, type word (16-bit) to display connectors without their own display parameter. The source is selected using parameters L038 and L039. Free_FBs.Display_W.Y1, Free_FBs.Display_W.Y2	Type: BO Chart: 470, 8
H040 MUX ratio	Multiplexer selection of the source for the ratio: 0 Fixed value 0.0 1 Fixed value, parameter H043 2 Analog value 1, smoothed 3 Analog value 2, smoothed 4 Analog value 3, smoothed 5 Analog value 4, smoothed 6 Actual value1 from the basic drive 7 Actual value2 from the basic drive 8 Actual value3 from the basic drive 9 Setpoint1 from the COMBOARD 10 Setpoint2 from the COMBOARD 11 Setpoint3 from the COMBOARD 12 Setpoint4 from the COMBOARD 13 Peer Float1 14 Peer Float2 MUXsoll.MUX_Uebersetzung.XCS	Value: 1 Min: 0 Max: 14 Type: I Chart: 500, 1
H041 S.Addition.Ratio	Source for the supplementary ratio. SYNCO1.UE4PRO.X2	Value: 3047 Type: I Chart: 80,2
H043 Constant Ratio	Fixed value for the ratio. SYNCO1.CONST_UEB.X1	Value: 1.0 Type: R Chart: 30,3
d044 Ratio	Actual ratio calculated from the fixed value and the relevant ratio Actual ratio = (d060 * d061) + source (H041) SYNCO1.UE4PRO.Y	Type: R Chart: 80, 4
d045 Ratio Numerator	Actual value of the ratio numerator SYNCO1.PNRAT.NM	Type: DI Chart: 80, 5
d046 RatioDenominator	Actual value of the ratio denominator SYNCO1.PNRAT.DN	Type: DI Chart: 80, 5
H047 Addition. Ratio	Additional ratio: Summand to enter the ratio as follows: ratio * rel.ratio + additional ratio SYNCO1.CONST_UEB.X3	Value: 0.0 Type: R Chart: 80, 1

Parameter	Description	Data
H048 MUXrelativeRatio	Multiplexer selection of the source for the relative ratio 0 Fixed value 0.0 1 Fixed value, parameter H049 2 Analog value 1, smoothed 3 Analog value 2, smoothed 4 Analog value 3, smoothed 5 Analog value 4, smoothed 6 Actual value1 from the basic drive 7 Actual value2 from the basic drive 8 Actual value3 from the basic drive 9 Setpoint1 from the COMBOARD 10 Setpoint2 from the COMBOARD 11 Setpoint3 from the COMBOARD 12 Setpoint4 from the COMBOARD 13 Peer Float1 14 Peer Float2 MUXsoll.MUX_RelUebersetz.XCS	Value: 1 Min: 0 Max: 14 Type: I Chart: 500, 4
H049 Rel. Ratio Const	Fixed value for a factor to relatively change the ratio SYNCO1.CONST_UEB.X2	Value: 1.0 Type: R Chart: 30, 3
H050 MUXdisplace.Setp	Multiplexer selection of the source for the displacement setpoint 0 Fixed value 0.0 1 Fixed value, parameter H066 2 Analog value 1, smoothed 3 Analog value 2, smoothed 4 Analog value 3, smoothed 5 Analog value 4, smoothed 6 Actual value1 from the basic drive 7 Actual value2 from the basic drive 8 Actual value3 from the basic drive 9 Setpoint1 from the COMBOARD 10 Setpoint2 from the COMBOARD 11 Setpoint3 from the COMBOARD 12 Setpoint4 from the COMBOARD 13 Peer Float1 14 Peer Float2 MUXsoll.MUX_Versatz.XCS	Value: 1 Min: 0 Max: 14 Type: I Chart: 500, 1
H051 S.Displacem.Setp	Source for the displacement setpoint (angular controller). SYNCO2.Q_Versatz.X	Value: 3050 Type: I Chart: 110, 1
H052 RmpUp Displacem H053 RampDownDisplace	Time, in which the displacement setpoint changes by 2048 quadrupled pulses (2048 quadrupled pulses correspond to the maximum or minimum displacement setpoint, i.e. half a revolution, also refer to H054 and H055). SYNCO2.HLG_Versatz.TU SYNCO2.HLG_Versatz.TD	Value: 2.5 ms Min: 0 ms Type: SD Chart: 110, 2
H054 Max.Displacement	Upper displacement setpoint limit (pulses*4) When the displacement calculation is in the retrigger mode (i. e. H091=1), the maximum displacement setpoint should not exceed the ”half pulse number (*4) value per revolution (i. e. half a revolution) of the parts to be synchronized” (control margin)! SYNCO2.HLG_Versatz.LU	Value: 2048 Min: 0 Type: R Chart: 110, 3
H055 Min.Displacement	Lower displacement setpoint limit (pulses*4) When the displacement calculation is in the retrigger mode (i. e. H091=1), the maximum displacement setpoint should not exceed the ”half pulse number (*4) value per revolution (i. e. half a revolution) of the parts to be synchronized” (control margin). SYNCO2.HLG_Versatz.LL	Value: -2048 Min: 0 Type: R Chart: 110, 3
d056 DisplacementSetp	Displacement setpoint (pulses*4) at the ramp-function generator output (angular controller) SYNCO2.HLG_Versatz.Y	Type: R Chart: 110, 4
H057 S.set Displ.Ramp	Source of the control signal to set the displacement ramp-function generator. SYNCO2.HLG_Versatz.S	Value: 0175 Type: I Chart: 110, 1

Parameter	Description	Data
H058 Q.Norm. n_Slave	Source for the normalization factor to display the slave drive speed (d014). In the factory setting, this is linked to the rated slave drive speed. SYNCO2.n_Slave.X1	Value: 3012 Type: I Chart: 60, 7
H059 Q.Norm. n_Master	Source for the normalization factor to display the master drive speed (d015). In the factory setting, this is linked to the rated master drive speed. SYNCO2.n_Master.X1	Value: 3013 Type: I Chart: 60, 6
d060 Ratio 1	Actual ratio before being multiplied by the relative ratio. SYNCO1.CONST_UEB.Y4	Type: R Chart: 80, 2
d061 Ratio relative	Actual value for the relative ratio. SYNCO1.CONST_UEB.Y5	Type: R Chart: 80, 2
H062 - H065 DisplaceMas+Sla+ f(n)	Direction of rotation-dependent displacement of the synchronization. This is only necessary, if different displacement values are required as a function of the directions of rotation of the master and slave. H062 Displacement setpoint for: n_Master > 0; n_Slave > 0 H063 Displacement setpoint for: n_Master < 0; n_Slave > 0 H064 Displacement setpoint for: n_Master > 0; n_Slave < 0 H065 Displacement setpoint for: n_Master < 0; n_Slave < 0 The displacement setpoints correspond to the number of pulses*4 SYNC01.DREFS1.X1 and .X2 SYNC01.DREFS2.X1 and .X2	Value: 0.0 Type: R Chart: 100, 1
H066 Const.Displacem.	Fixed displacement setpoint (pulses*4) SYNCO1.FixVersatz.X	Value: 0.0 Type: R Chart: 30, 3
H067 S.Ratio	Source for the speed ratio before being multiplied by the relative ratio. SYNCO1.CONST_UEB.X4	Value: 3040 Type: I Chart: 80, 1
H068 S.relative Ratio	Source for the relative ratio before being multiplied by the ratio. SYNCO1.CONST_UEB.X5	Type: I Chart: 80, 1
H070 MUX Refer.speed	Multiplexer selection of the source for the master speed setpoint 0 Fixed value 0.0 1 Fixed value, parameter H073 2 Analog value 1, smoothed 3 Analog value 2, smoothed 4 Analog value 3, smoothed 5 Analog value 4, smoothed 6 Actual value1 from the basic drive 7 Actual value2 from the basic drive 8 Actual value3 from the basic drive 9 Setpoint1 from the COMBOARD 10 Setpoint2 from the COMBOARD 11 Setpoint3 from the COMBOARD 12 Setpoint4 from the COMBOARD 13 Peer Float1 14 Peer Float2 15 Speed, master MUXsoll.MUX_Leitsollwert.XCS	Value: 15 Min: 0 Max: 15 Type: I Chart: 500, 7
H071 S.ReferenceSpeed	Source for the master setpoint (speed setpoint for the master and slave) SYNCO1.Leitsollwert.X	Value: 3070 Type: I Chart: 115, 1
H072 Tfilt Ref. Speed	Smoothing time (PT1 element) for the master speed setpoint SYNCO1.SREFSM.T	Value: 10 ms Type: SD Chart: 115, 2
H073 Const. Ref.Speed	Fixed value, master speed setpoint SYNCO1.fixLeitsoll.X	Value: 0.0 Type: R Chart: 30,3
d074 Refer.Speed filt	Actual value of the smoothed master speed setpoint SYNCO1.SREFSM.Y	Type: R Chart: 115, 3
d076 Reference Speed	Actual value of the master speed setpoint (before smoothing) SYNCO1.Leitsollwert.Y	Type: R Chart: 115, 2

Parameter	Description	Data
H077 S.DisplaceNumer.	Source for the value of the ratio numerator for the displacement calculation. SYNCO2.Displace.NM	Value: 5088 Type: I Chart: 100, 4
H078 S.DisplaceDenom	Source for the value of the ratio denominator for the displacement calculation. SYNCO2.Displace.DN	Value: 5089 Type: I Chart: 100, 4
H079 S.DT1 Acc. Comp.	Source for the input quantity of the high-pass filter to generate inertia compensation. SYNCO1.DT1_BAusgleich.X	Value: 3129 Type: I Chart: 120, 6
H080 MUX Accel.Comp.	Selects the source for the inertia compensation (pre-control value for the speed controller): 0 Fixed value 0.0 1 From dn/dt generated value 2 Analog value 1, smoothed 3 Analog value 2, smoothed 4 Analog value 3, smoothed 5 Analog value 4, smoothed 6 Actual value1 from the basic drive 7 Actual value2 from the basic drive 8 Actual value3 from the basic drive 9 Setpoint1 from the COMBOARD 10 Setpoint2 from the COMBOARD 11 Setpoint3 from the COMBOARD 12 Setpoint4 from the COMBOARD 13 Peer Float1 14 Peer Float2 MUXsoll.MUX_BAusgleich.XCS	Value: 1 Min: 0 Max: 14 Type: I Chart: 500, 5
H082 Tfilt Acc.Comp.	Smoothing time constant of the derivative action element (DT1 element) to generate the inertia compensation value; higher time values signify a lower influence. SYNCO1.DT1_BAusgleich.T1	Value: 100ms Type: SD Chart: 120, 7
H083 Tdif Accel.Comp.	Differentiating time constant of the DT1 element to generate the inertia compensation value; higher values signify a higher influence. SYNCO1.DT1_BAusgleich.TD	Value: 4 ms Type: R Chart: 120, 7
d085 DT1 (SpeedSetp.)	Actual value of the inertia compensation. SYNCO1.DT1_BAusgleich.Y	Type: R Chart: 120, 7
H086 Fine Ratio Numer	This is used to directly enter numerator and denominator of the ratio. Constant.DINT_Const.X1	Value: 1000 Type: DI Chart: 80, 3
H087 Fine Ratio Denom	Refer to H086 Constant.DINT_Const.X2	Value: 1000 Type: I Chart: 80, 3
H088 enable FineRatio	The source of the ratio is changed-over using H088 0 The numerator and denominator are automatically calculated 1 Fine setting (H086, H087) SYNCO1.FEINPZ.I1	Value: 0 Type: BO Chart: 80, 6
H090 Pos.Correct Mode	H090 is used to define whether the position can always be corrected or only if there is an active synchronizing command. The position correction is required for a position reset and for the displacement correction. For H090=0, the edge-controlled correction mode only works, if after passing the synchronizing marks, the synchronizing command = 1. 0 Displacement correction or reset only as long as the synchronizing command=1 1 Displacement correction is always possible CONTR.LagekorrektLogik.I2	Value: 1 Type: BO Chart: 60, 4

Parameter	Description	Data
H091 SynchrRetrigMode	Selects whether synchronization (determining the displacement and displacement correction) should be realized in the ”retrigger” mode or ”continuously”. 0 = Continuously The displacement is sensed over several revolutions and corrected (parameters H100 and H102 have to be set!) 1 = Retrigger The displacement is only determined over 1 revolution and corrected. Only the actual position since the last synchronizing operation is evaluated. (this may be recommendable for negative ratios and a negative displacement setpoint) SYNCO2.Displace.RTM	Value: 0 Type: BO Chart: 100, 6
H092 Synchr.Edge Mode	Evaluation modes of the ”synchronizing command” (i. e. displacement correction). The synchronizing command must be 1 while synchronizing. H092 is used to define whether the displacement correction should be made continuously or only once. 0 = Continuous (signal level-controlled) 1 = Once (edge controlled) SYNCO2.Displace.ENM	Value: 0 Type: BO Chart: 100, 6
H093 CorrectionPulses	Number of quadrupled pulses, which are fed to the angular controller to correct the displacement for displacement correction per sampling time. This generates a position difference, which the angular controller corrects. A lower value (e.g. 1) is recommended in order to achieve low-oscillation synchronization. This value must be increased (e. g. to 10) if, for very low-frequency synchronizing pulses (e. g. as a result of a high ratio or small speed), fast synchronization is required SYNCO2.Displace.CPN	Value: 1 Type: R Chart: 100, 7
d094 act.Displacement	Displacement actual value in quadrupled slave pulses since the displacement determination was enabled and after both synchronizing pulses have been received. (Synchronizing command is not required.) It is the actual angular difference between the synchronizing pulses. It is only re-calculated at the instant in time that one (H91=0; setting of H100 and H102) or two (H091=1) synchronizing pulses occur. It contains the set displacement- (d056) as well as the direction of rotation-dependent synchronizing displacement setpoints (H062 - H065). In the synchronous status, it is 0 or includes the displacement setpoint. This status is signaled to terminal 46, taking into account a tolerance bandwidth which can be set using H103. SYNCO2.Displace.DV	Type: R Chart: 100, 7
d095 Displ.-Pos.diff	Difference ”actual displacement minus the position difference actual value” in quadrupled slave pulses. This value is zero (independent of a possibly existing displacement setpoint) if the system is in the angular synchronous status! During synchronizing, this value is not equal to zero, and during synchronization, is always less. Update, as is described for d094. The following is essentially valid: d095 = d094 - d124 SYNCO2.Displace.DVD	Type: R Chart: 100, 7
d096 ErrorCode Displ.	Error IDs from the displacement sensing. The error ID is deleted when the position difference is reset. Bit Hex Significance 0 1 Overflow, number of synchronizing operations 1 (more than 2^{31}) 1 2 Overflow, number of synchronizing operations 2 (more than 2^{31}) 2 4 Number of synchronizing operations 1 * PR1 > 2^{31} 3 8 Number of synchronizing operations 1 * PR2 >2^{31} If one of the bits 0-3 is set, then synchronization was probably erroneous. 8 100 = Displacement position difference cannot be represented with 32 bit, i. e. synchronization must be repeated. SYNCO2.Displace.FC	Type: W Chart: 100, 7

Parameter	Description	Data
H097 S.Reset Pos_1	Source for the 2^{nd} digital signal to reset the position and displacement. CONTR.Zus_Lage-RS.I1	Value: 0108 Type: I Chart: 90, 1
H098 S.Synchr.Command	Source for the 2^{nd} digital signal to enable displacement correction. CONTR.OR_Sync.I1	Value: 0173 Type: I Chart: 90, 1
H100 SyncPulsesMaster	The synchronizing pulse number is set in the master drive, and corresponds to one revolution in quadrupled pulses. The default for H100 is set for a pulse encoder with 1024 pulses, and is 4 · 1024 = 4096. SYNCO2.Displace.PR2	Value: 4096 Type: DI Chart: 100, 5
H101 S.StopStartSynch	Source for the signal to end the start synchronizing (refer to H168). CONTR.SyncFlipFlop.R	Value: 0105 Type: BI Chart: 90,6
H102 SyncPulses Slave	The synchronizing pulse number is set to the slave drive and corresponds to one revolution in quadrupled pulses. The default for H102 is set for a pulse encoder with 1024 pulses, and is 4 · 1024 = 4096. SYNCO2.Displace.PR1	Value: 4096 Type: DI Chart: 100, 6
H103 Threshold Synchr	If the actual displacement is less than this response threshold, then the "synchronism" reached status bit is set to 1. In the other case, it is reset to 0. SYNCO2.CmpSynchr.L	Value: 20.0 Type: R Chart: 100, 6
H104 S.Enable Control	Source for the control signal to enable the angular controller. SYNCO2.AngleControl.EN	Value: 0109 Type: I Chart: 110, 6
H105 Thresh.SyncSlave	Minimum number of quadrupled pulses, which must be received after an effective synchronizing pulse, before a new synchronizing pulse may become effective. This is used, for example, to suppress multiple edges due to switch bounce. **Caution:** The pulse number specified here must be greater than the number of pulses, which are received while the synchronizing pulse is active (active time). This threshold value is also effective for the first synchronization (after power off, power on / restart). SYNCO2.CmpSPslave.X2	Value: 500 Unit: Pulse Type: R Chart: 60, 3
H107 Thresh.SyncMaster	Enable threshold, synchronizing, master. The function is as for H105 for the master speed sensing. SYNCO2.CmpSPmaster.X2	Value: 500 Type: R Chart: 70, 2
H108 S.KP Pos.Contrl.	Source for the input quantity of the characteristic to adapt the P gain of the angular controller. SYNCO2.AngleKP.X	Value: 3044 Type: I Chart: 110, 1
d109 enable Pos.Cntrl	Actual status of the angular controller enable 1: Angular controller enabled 0: Angular controller inhibited CONTR.WR-Freigabe.Q	Value: 0 Type: BO Chart: 90, 7
H110 Hold I-Component	The angular controller mode can be changed-over using this parameter: 0 = Controller operates as PI controller 1 = Controller operates as P controller (the I component is kept constant) **Caution:** Only changeover from 0 to 1 when the controller is inhibited, as otherwise the I component will not be cancelled! SYNCO2.AngleControl.HI	Value: 1 Type: BO Chart: 110, 7
H111 Tn Pos.Control	Integral action time of the angular controller (only relevant for H110 = 0) The minimum integral action time corresponds to the sampling time, in which the AngleControl block is configured. SYNCO2.AngleControl.TN	Value: 500 ms Type: SD Chart: 110, 7
H112 Max. Position	Absolute value of the maximum output quantity of the angular controller SYNCO2.SYNMAX.X	Value: 0.3 Type: R Chart: 110, 5

Parameter	Description	Data
H113 KP_UE Pos.Contrl	P gain (angular controller) without adaption or P gain for the largest ratio ue_KP SYNCO2.AngleKP.B2	Value: 1.0 Type: R Chart: 110, 3
H114 KP_UE_0 PosCntrl	P gain (angular controller) for low ratios ue_KP_0 SYNCO2.AngleKP.B1	Value: 1.0 Type: R Chart: 110, 2
H115 ue_KP Value	Limit of the ratio ü, which is linearly interpolated up to from ue_KP_0. For ü > ue_KP, KP = KP_UE (angular controller). SYNCO2.AngleKP.A2	Value: 0.0 Type: R Chart: 110, 3
H116 ue_KP_0 Value	Limit of the ratio ü, from which is linearly interpolated up to ue_KP_0. For ü < ue_KP_0, KP = KP_UE_0 (angular controller) SYNCO2.AngleKP.A1	Value: 0.0 Type: R Chart: 110, 3
H117 Tfilt Pos.Differ	Smoothing time constant (PT1 element) for the differential position actual value SYNCO2.LageDifferenz.T	Value: 4.0 ms Type: SD Chart: 60, 7
H118 dn enable Max.	Maximum system deviation between the speed setpoint and actual value of the slave when the angular controller is enabled. The angular controller is only enabled if the system deviation lies below the threshold (N_soll_slave H136 - H118). A low value must be set for a low speed setpoint. SYNCO2.dnFreigabe.X	Value 0.1 Type R Chart: 75, 3
H119 dn Master Max.	Maximum deviation of the speed actual value of the master to its setpoint. SYNCO2.dnMaster.X	Value 0.1 Type R Chart: 75, 3
d120 Outp.Pos.Control	Angular controller output = supplementary speed setpoint SYNCO2.PT_Angle.Y	Type: R Chart: 110, 7
d121 Diff.Pos.Control	Actual angular deviation (referred to the slave pulses). A possibly existing displacement setpoint is taken into account: Angular controller, system deviation = displacement setpoint - differential actual value. (The differential position actual value includes the displacement setpoint as "steady-state component") SYNCO2.AngleControl.YE	Type: R Chart: 110, 5
d122 IntegralComp.Pos	Integral component of the angular controller output SYNCO2.AngleControl.YI	Type: R
d123 KP Pos.Control	Actual P gain of the angular controller. This value must be multiplied by 10^4, so that small KP values do not have to be entered using the OP1S. SYNCO2.AngleKP.Y	Type: R Chart: 110, 3
d124 Pos.Diff. filt	Smoothed differential angular actual value, smoothed with H117. This is independent of the displacement determination or the synchronizing pulses; this means that it provides no information about the position with respect to one another (synchronism). On the other hand, d094 is the displacement actual value between two synchronizing pulses. After successful synchronization, this value is 0 or contains the selected displacement setpoint! SYNCO2.LageDifferenz.Y	Unit: Pulse Type: R Chart: 60, 8
H125 n_max Ramp Gen.	Upper limit of the speed setpoint at the ramp-function generator SYNCO1.HLG_Speed.LU	Value: 1.0 Type R Chart: 115, 5
H126 n_min Ramp Gen.	Lower limit of the speed setpoint at the ramp-function generator SYNCO1.HLG_Speed.LL	Value: -1.0 Type R Chart: 115, 5
H127 n Ramp Up Time	Time, in which the speed setpoint may change from 0 to rated speed. SYNCO1.HLG_Speed.TU	Value: 0 ms Type R Chart: 115, 6

Parameter	Description	Data
H128 n Ramp Down Time	Time, in which the speed setpoint may change from the rated speed to 0. SYNCO1.HLG_Speed.TD	Value: 0 ms Type R Chart: 115, 6
H129 SpeedSetpRampOut	Speed setpoint after the ramp-function generator. SYNCO1.HLG_Speed.Y	Value: 0 ms Type R Chart: 115, 7
H130 Jog Setpoint	Supplementary speed setpoint, which is added to the master setpoint in the jog mode. CONTR.TIPPEN.X	Value: 0.0 Type: R Chart: 115, 1
H131 S.enablePosCtrll	Source for the 1^{st} control signal to enable the angular controller. CONTR.Steuerbits.I1	Value: 0172 Type: I Chart: 90, 5
H132 Max. n_Setpoint	Upper speed setpoint limit for the speed controller on T400. **Caution**: H132 must be > H133 SYNCO2.NsollLimit.LU	Value: 1.0 Type: R Chart: 120, 2
H133 Min. n_Setpoint	Lower speed setpoint limit for the speed controller on T400 **Caution**: H132 must be > H133 SYNCO2.NsollLimit.LL	Value: -1.0 Type: R Chart: 120, 2
H134 Max. n-Controller	Upper limit of the speed controller output on T400 **Caution**: H134 must be > H135 SYNCO2. SpeedControl.LU	Value: 1.0 Type: R Chart: 120, 6
H135 Min. n-Controller	Lower limit of the speed controller output on T400 **Caution**: H134 must be > H135 SYNCO2.SpeedControl.LL	Value: -1.0 Type: R Chart: 120, 6
d136 Speed Setpoint	Actual speed setpoint after smoothing and multiplication with the ratio. SYNCO1.SREFR.Y	Type: R Chart: 115, 3
d137 Speed Setp. ltd.	Actual speed setpoint sum after limiting (setpoint for the speed controller on T400). SYNCO2.NsollLimit.Y	Type: R Chart: 120, 2
H138 Tfilt Pos.Cntrl	Smoothing time constant for the angular controller output SYNCO2.PT_Angle.T	Value: 0 ms Type R Chart: 110, 7
H139 S.enablePosCtrl2	Source for the 2^{nd} control signal to enable the angular controller. CONTR.WR-Freigabe.I1	Value: 0193 Type: I Chart: 90, 5
H140 ModeSpeedControl	The speed controller can be either computed on the T400 or in the basic drive. 0 The T400 outputs the speed setpoint, taking into account the limits on the basic drive. The speed controller blocks on the T400 are no longer processed. 1 Speed controller is on the T400. The torque setpoint is transferred to the basic drive. CONTR.SCONI.I	Value: 0 Type: BO Chart: 120, 5
H141 KP Speed Control	Upper Y value of the 2-point characteristic for the KP adaption of the speed controller. P gain for large speed setpoints or if H143 = H144. SYNCO2.SpeedKP.B2	Value: 10.0 Type: R Chart: 120, 2
H142 KP_O SpeedContrl	Lower Y value of the 2-point characteristic for the KP adaption of the speed controller. P gain for low speed setpoints. SYNCO2.SpeedKP.B1	Value: 10.0 Type: R Chart: 120, 2
H143 n_KP Threshold	Limit value of the speed setpoint which is interpolated up to, starting from n_KP_0. The P gain = KP for n > n_KP SYNCO2.SpeedKP.A2	Value: 0.0 Type: R Chart: 120, 3
H144 n_KP_0 Threshold	Limit value of the speed setpoint which is interpolated from up to n_KP. For n < n_KP_0, the P gain = n_KP_0 SYNCO2.SpeedKP.A1	Value: 0.0 Type: R Chart: 120, 2

Parameter	Description	Data
H145 Tn SpeedControl	Integral action time of the speed controller SYNCO2. SpeedControl. TN	Value: 200ms Type R Chart: 120, 5
H146 Tfilt Speed	Smoothing time (PT1 element) for the slave speed actual value, which is used for the closed-loop speed control SYNCO2.NslaveFilter.T	Value: 4.0ms Type: R Chart: 60, 7
d147 Control Word 1	Control word 1 for the basic drive IF_CU.Sammeln.Y1	Type: W Chart: 230, 7
d148 Control Word 2	Control word 2 for the basic drive IF_CU.Sammeln.Y4	Type: W Chart: 230, 7
H149 T SyncPulsMaster	Pulse extension for the synchronizing pulse of the master-speed sensing. (for diagnostics) CONTR.Puls_SS_Master.T	Value: 10 ms Type: SD Chart: 70, 6
d150 Outp.SpeedContrl	Speed controller output SYNCO2.SpeedControl.Y	Type: R Chart: 120, 7
d151 DifferSpeedCntrl	Setpoint/actual value deviation of the speed controller SYNCO2.SpeedControl.YE	Type: R Chart: 120, 4
d152 SetpSpeed;Torque	Actual setpoint for the basic drive: H140 = 1 torque setpoint (d150) H140 = 0 speed setpoint SYNCO2.SetpSwitch.Y	Type: R Chart: 115, 7
d153 KP Speed Control	Effective P gain of the speed controller SYNCO2.SpeedKP.Y	Type: R Chart: 120, 3
H154 S.SlaveSynchrPos	Source for the slave position for synchronizing enable of the position sensing of the slave drive. SYNCO2.CmpSPslave.X1	Value: 3186 Type: I Chart: 60, 3
H155 Ratio Resolution *Initialization connection*	Resolution when calculating the numerator- and denominator components from the ratio. H155 specifies the numerator of the ratio. The value should not exceed 100000. Examples: H155 Ratio Numer. Denominator 10000 1.2351 10000 12351 10000 0.0333 10000 333 1000 0.0333 1000 33 SYNCO1.PNRAT.RR	Value: 10000 Type: R Chart: 80, 4
H156 S.Ref_Pos_1	Source for the main setpoint of the angular controller. SYNCO2.AngleControl.W1	Value: 3056 Type: I Chart: 110, 5
H157 S.Ref_Pos_2	Source for the supplementary setpoint of the angular controller. SYNCO2.AngleControl.W2	Value: 3000 Type: I Chart: 110, 5
H158 S.Act_Pos_1	Source for the actual value of the angular controller. SYNCO2.AngleControl.X1	Value: 3124 Type: I Chart: 110, 5
H159 S.Act_Pos_2	Source for the supplementary actual value of the angular controller. SYNCO2.AngleControl.X2	Value: 3000 Type: I Chart: 110, 5
H160 Aout 1 Offset	Offset value of analog output 1 (terminal 97; also refer to H161) T400_EA.AnaOut_1.OFF	Value: 0.0 Type: R Chart: 51, 3
H161 Aout 1 Scalefact	Scaling factor for analog output 1 (terminal 97) Output voltage = (input value + offset) * 5 V / scaling factor T400_EA.AnaOut_1.SF	Value: 1.0 Type: R Chart: 51, 4
H162 Aout 2 Offset	Offset value of analog output 2 (terminal 98; also refer to H163) T400_EA.AnaOut_2.OFF	Value: 0.0 Type: R Chart: 51, 3

Parameter	Description	Data
H163 Aout 2 Scalefact	Scaling factor for analog output 2 (terminal 98) Output voltage = (input value + offset) * 5 V / scaling factor T400_EA.AnaOut_2.SF	Value: 1.0 Type: R Chart: 51, 4
H164 Erase EEPROM	Task to re-establish the factory setting. All of the changes are deleted. Beforehand, H165 must be set to 165. Deleting is started when H164 = 1. If data is deleted, it cannot be re-done (retrieved)! CONTR. EEPROM_T400. ERA	Value: 0 Type: BO Chart: 40, 1
H165 Key EEPROM	Password to prevent the change memory being accidentally erased (EEPROM). H165 must be set to 165 before erasing. CONTR. EEPROM_T400. KEY	Value: 0 Type: I Chart: 40, 1
d166 State EEPROM	Indicates whether the standard software package is unchanged (factory settings), or whether parameters were changed (change memory not empty). d166 = 1 change memory empty ⇒ factory setting CONTR. EEPROM_T400. EPE	Type: BO Chart: 40, 3
H167 S.Pos.Reset_1	Source for the 1st digital signal to reset position and offset. CONTR.Steuerbits.I3	Value: 0173 Type: I Chart: 90, 1
H168 DelayStartSynchr	When the start synchronization is enabled (H169 = 1), after the power supply is switched-on and after the power-on delay has expired (according to H168), a synchronizing command is output once. CONTR. Start_Sync. T	Value: 1000 ms Type: SD Chart: 90, 6
H169 EnableStartSynch	Enables start synchronization (refer to H168) 0 Not enabled 1 Enabled CONTR.EnableAutoSync.I	Value: 0 Type: BO Chart: 90,5
H170 MUX Displ.Reset	Multiplexer selection of the digital source to reset the displacement setpoint 0 Fixed value 0 1 Fixed value 1 2 Control word from CU bit 0 3 Digital input 3 (terminal 55) 4 Digital input 4 (terminal 56) 5 Digital input 5 (terminal 57) 6 Digital input 6 (terminal 58) 7 Digital input 7 (terminal 59) 8 Digital input 8 (terminal 60) 9 Control word 2 CB bit 0 10 Control word 2 CB bit 1 11 Control word 2 CB bit 2 12 Control word 2 CB bit 3 13 Control word 2 CB bit 4 14 Control word 2 CB bit 5 15 Control word 2 CB bit 6 16 Control word 2 CB bit 7 17 Control word, peer bit 0 18 Control word, peer bit 1 19 Control word, peer bit 2 20 Control word, peer bit 3 21 Control word, peer bit 4 22 Control word, peer bit 5 23 Control word, peer bit 6 24 Control word, peer bit 7 25 Control word 2 CB bit 0 26 Control word 2 CB bit 1 27 Control word 2 CB bit 2 28 Control word 2 CB bit 3 29 Control word 2 CB bit 4 30 Control word 2 CB bit 5 31 Control word 2 CB bit 6 32 Control word 2 CB bit 7 MUX_B.MUX_VersatzReset.XCS	Value: 0 Type: BO Chart: 520, 2

Parameter	Description	Data
H171 MUX enable Jog	Multiplexer selection of the digital source to enable jog operation. Selected as for H170 except: 2 control word from the basic drive, bit 1 MUX_B.MUX_TippFreigabe.XCS	Value: 0 Type: BO Chart: 520, 3
H172 MUX en.Pos.Cntrl	Multiplexer selection of the digital source to enable the angular controller. Selected as for H170 except: 2 control word from the basic drive, bit 2 MUX_B.MUX_WReglerFreig.XCS	Value: 0 Type: BO Chart: 520, 5
H173 MUX Reset Posit.	Multiplexer selection of the digital source to reset position and displacement. Selected as for H170 except: 2 control word from the basic drive, bit 3 MUX_B.MUX_LageReset.XCS	Value: 0 Type: BO Chart: 520, 6
H174 MUX Synchr.Cmd	Multiplexer selection of the digital source for the synchronizing command. This enables displacement errors to be corrected. Selected as for H170 except: 2 control word from the basic drive, bit 4 MUX_B.MUX_SyncSignal.XCS	Value: 0 Type: BO Chart: 520, 8
d175 Displacem. Reset	Actual value for the control signal to reset the position difference. CONTR.Steuerbits.Q4	Type: BO Chart: 60, 2
d176 Enable Jog	Actual value for the control input *jog enable* CONTR.Steuerbits.Q7	Type: BO Chart: 115, 2
d177 EnableSpeedCntrl	Actual value for the control input *angular controller enable* CONTR.Steuerbits.Q1	Type: BO Chart: 90, 6
d178 Reset Position	Actual value for the control input *reset position* (H167) CONTR.Steuerbits.Q3	Type: BO Chart: 90, 2
d179 Synchron.Command	Actual value for the control input (H191) *synchronizing command* CONTR.Steuerbits.Q2	Type: BO Chart: 90, 2
H180 S.EnableSynSlave	Source for the digital signal to enable slave drive synchronization. SYNCO2.Slave.SP	Value: 0154 Type: I Chart: 60, 4
H181 S.ResetSlavePos.	Source for the digital signal to reset the slave drive position. SYNCO2.Slave.R	Value: 0097 Type: I Chart: 60, 4
H182 S.Slave Numerat.	Source for the numerator of the speed ratio. SYNCO2.Slave.NM	Value: 5088 Type: I Chart: 60, 4
H183 S.Slave Denomin.	Source for the denominator of the speed ratio. SYNCO2.Slave.DN	Value: 5089 Type: I Chart: 60, 4
H184 S.Corr.Pos.Diff.	Source for the digital signal to enable the differential position correction of the slave drive. As long as the signal at this input is 1, the position difference is corrected as follows at each processing cycle: Position difference (new) = position difference (old) – position difference-correction value (prerequisite, H018 is in the factory setting) CONTR.LagekorrektLogik.I1	Value: 0098 Type: I Chart: 60, 4
H185 S.Reset PosDiff2	Source for the 2nd digital signal to reset the determined position difference (slave drive). CONTR.PosDiff_Reset.I1	Value: 0108 Type: I Chart: 60, 1
H186 S.Abs.Pos.Slave	Source for the slave drive position to generate the absolute value and sign. SYNCO2.Pos_Slave_Abs.X	Value: 3016 Type: I Chart: 60, 1

Parameter	Description	Data
H187 S.ResetPos.Diff1	Source for the 1st digital signal to reset the determined position difference (slave drive). CONTR.Steuerbits.I4	Value: 0170 Type: I Chart: 60, 1
H188 S.EnableSynMaster	Source for the signal to enable synchronization of the master speed sensing. SYNCO2.Master.SP	Value: 0190 Type: I Chart: 70, 4
H189 S.ResetMasterPos	Source for the signal to set the master position actual value to zero. SYNCO2.Master.R	Value: 0097 Type: I Chart: 70, 4
H190 S.MasterSynchPos	Source for the position actual value to enable synchronization of the master speed sensing. SYNCO2.CmpSPmaster.X1	Value: 3017 Type: I Chart: 70, 1
H191 S.Synchr.Comd2	Source for the control signal synchronizing command to enable the displacement correction. CONTR.Steuerbits.I2	Value: 0174 Type: I Chart: 90, 1
H192 S.n_Slave Compar	Source for the input signal of the comparator to monitor the slave speed. If the slave speed reaches the setpoint speed, then the angular controller can be enabled. SYNCO2.CMP_nSlave.X	Value: 3018 Type: I Chart: 75, 2
H193 S.n_ref SlaveCmp	Source for the setpoint of the slave speed. (comparator to enable the angular controller) SYNCO2.CMP_nSlave.M	Value: 3136 Type: I Chart: 75, 2
H195 S.n_MasterCompar	Source for the input signal of the comparator to monitor the master speed. SYNCO2.CMP_nMaster.X	Value: 3019 Type: I Chart: 75, 2
H196 S.n_ref MastComp	Source for the master speed setpoint. (comparator to check the plausibility of the master speed) SYNCO2.CMP_nMaster.M	Value: 3076 Type: I Chart: 75, 2
H197 S.FineRatioNumer	Source for the numerator of the fine ratio. SYNCO1.FEIN_NM.X2	Value: 5086 Type: I Chart: 80, 5
H198 S.FineRatioDenom	Source for the denominator of the fine ratio. SYNCO1.FEIN_DN.X2	Value: 5087 Type: I Chart: 80, 5
H199 S.Abs.Pos.Master	Source for the position of the master drive to generate the absolute value and sign. SYNCO2.Pos_Master_Abs.X	Value: 3017 Type: I Chart: 70, 6
H200 S.1 n(ref-act)	Source for the main setpoint of the speed controller (without limiting). SYNCO2.SpeedControl.W1	Value: 3137 Type: I Chart: 120, 3
H201 S.2 n(ref-act)	Source for the supplementary setpoint of the speed controller (without limiting). SYNCO2.SpeedControl.W2	Value: 3000 Type: I Chart: 120, 3
H202 S.3 n(ref-act)	Source for the 1st actual value of the speed controller. SYNCO2.SpeedControl.X1	Value: 3146 Type: I Chart: 120, 3
H203 S.4 n(ref-act)	Source for the 2nd actual value of the speed controller. SYNCO2.SpeedControl.X2	Value: 3000 Type: I Chart: 120, 3
H204 S.KP (speedCtrl)	Source for the input quantity of the KP adaption characteristic of the speed controller. SYNCO2.SpeedKP.X	Value: 3129 Type: I Chart: 120, 1
H205 S.n(ref,speed)	Source for the main setpoint of the speed controller (before limiting). SYNCO2.SumNsoll.X1	Value: 3129 Type: I Chart: 120, 1

Parameter	Description	Data
H206 S.n(addit.)	Source for the supplementary setpoint of the speed controller (before limiting). SYNCO2.SumNsoll.X2	Value: 3120 Type: I Chart: 120, 1
H207 S.Jog Ref.Speed	Source for the jog setpoint. SYNCO1.Tippen-Schalter.X2	Value: 3120 Type: I Chart: 115, 1
H208 S.enable Jog	Source for the signal to enable the jog setpoint. When enabled, the jog setpoint is added to the speed setpoint. CONTR.Steuerbits.I7	Value: 3120 Type: I Chart: 115, 1
H209 T SyncPulseSlave	Pulse extension for the synchronizing pulse of the slave speed sensing. (for diagnostics). CONTR.Puls_SS_Slave.T	Value: 10 ms Type: SD Chart: 60, 7
H210 AI 1 Scalefactor	Scaling factor SF for analog input 1 (setting, refer to d212). T400_EA.AnaIn_1.SF	Value: 1.0 Type: R Chart: 50, 3
H211 AI 1 Offset	Offset for analog input 1 (setting, refer to d212). T400_EA.AnaIn_1.OFF	Value: 0.0 Type: R Chart: 50, 4
d212 AI 1 act. value	Actual measured value at the analog input 1 (AI1). This analog input is sensed in the fastest time sector (T1). The measured value is obtained as follows: d212 = terminal voltage * scaling factor / 5 V + offset d212 = terminal voltage * H210 / 5 V + H211 T400_EA.AnaIn_1.Y	Type: R Chart: 50, 5
H213 AI 2 Scalefactor	Scaling factor SF for analog input 2 (setting, refer to d215). T400_EA.AnaIn_2.SF	Value: 1.0 Type: R Chart: 50, 3
H214 AI 2 Offset	Offset value for analog input 2 (setting, refer to d215). T400_EA.AnaIn_2.OFF	Value: 0.0 Type: R Chart: 50, 4
d215 AI 2 act. value	Actual measured value at analog input 2 (AI2). This analog input is sensed in time sector T2. The measured value is obtained as follows: d215 = terminal voltage * scaling factor / 5 V + offset d215 = terminal voltage * H213 / 5 V + H214 T400_EA.AnaIn_2.Y	Type: R Chart: 50, 5
H216 AI 3 Scalefactor	Scaling factor SF for analog input 3 (setting, refer to d218). T400_EA.AnaIn_3.SF	Value: 1.0 Type: R Chart: 50, 3
H217 AI 3 Offset	Offset value for analog input 3 (setting, refer to d218). T400_EA.AnaIn_3.OFF	Value: 0.0 Type: R Chart: 50, 4
d218 AI 3 act. value	Actual measured value at analog input 3 (AI3). This analog input is sensed in time sector T2. The measured value is obtained as follows: d218 = terminal voltage * scaling factor / 5 V + offset d218 = terminal voltage * H216 / 5 V + H217 T400_EA.AnaIn_3.Y	Type: R Chart: 50, 5
H219 AI 4 Scalefactor	Scaling factor SF for analog input 4 (setting, refer to d221). T400_EA.AnaIn_4.SF	Value: 1.0 Type: R Chart: 50, 3
H220 AI 4 Offset	Offset value for analog input 4 (setting, refer to d221). T400_EA.AnaIn_4.OFF	Value: 0.0 Type: R Chart: 50, 4
d221 AI 4 act. value	Actual measured value at analog input 4 (AI4). This analog input is sensed in time sector T2. The measured value is obtained as follows: d221 = terminal voltage * scaling factor / 5 V + offset d221 = terminal voltage * H219 / 5 V + H220 T400_EA.AnaIn_4.Y	Type: R Chart: 50, 5

Parameter	Description	Data
H222 AI 1 Filter Time	Smoothing time constant for the 1st analog input. A value of 0 de-activates the filter. T400_EA.AE1_FILT.T	Value: 500 Type: R Unit: ms Chart: 50, 5
d223 AI 1 filtered	Analog value 1 after smoothing with smoothing time constant H222. T400_EA.AE1_FILT.Y	Type: R
H224 AI 2 Filter Time	Smoothing time constant for the 2nd analog input. A value of 0 de-actives the filter. T400_EA.AE2_FILT.T	Value: 0.0 Type: R Unit: ms Chart: 50, 5
d225 AI 2 filtered	Analog value 2 after smoothing with the smoothing time constant H224. T400_EA.AE2_FILT.Y	Type: R
H226 AI Filter Time	Smoothing time constant for the 3rd analog input. A value of 0 de-activates the filter. T400_EA.AE3_FILT.T	Value: 0.0 Type: R Unit: ms Chart: 50, 5
d227 AI 3 filtered	Analog value 3 after smoothing with the smoothing time constant H226. T400_EA.AE3_FILT.Y	Type: R Chart: 50, 6
H228 AI 4 Filter Time	Smoothing time constant for the 4th analog input. A value of 0 de-activates the filter. T400_EA.AE4_FILT.T	Value: 0.0 Type: R Unit: ms Chart: 50, 5
d229 AI 4 filtered	Analog value 4 after smoothing with the smoothing time constant H228. T400_EA.AE4_FILT.Y	Type: R Chart: 50, 6
H230 ... H233 S.set AE1 zero ... S.set AE4 zero	4 sources for digital signals to set the 4 analog inputs to zero. T400_EA.AE1_FILT.S ... T400_EA.AE4_FILT.S	Type: I Value: 0000 Chart: 50, 4
H234 S.Position Diff1	Source for the position difference for the displacement calculation. SYNCO2.Displ_Ist.X1	Value: 3118 Type: I Chart: 80, 4
H235 S.Position Diff2	Source for a correction value of the position difference for the displacement calculation. SYNCO2.Displ_Ist.X2	Value: 3062 Type: I Chart: 80, 4
H236 S.ResetDisplacem	Source for the signal to reset the displacement calculation. SYNCO2.Displace.R	Value: 0097 Type: I Chart: 80, 4
H237 S.Setp Displace1	Source for the displacement setpoint (this checks whether synchronism has been reached). SYNCO2.DisplacmentSetp.X1	Value: 3051 Type: I Chart: 80, 4
H238 S.Setp Displace2	Source for the value to correct the displacement setpoint (this checks whether synchronism has been reached). SYNCO2.DisplacmentSetp.X2	Value: 3062 Type: I Chart: 80, 4
H239 S.Ratio n_ref	Source for the ratio to calculate the slave setpoint speed from the master setpoint. SYNCO1.SREFR.X2	Value: 3044 Type: I Chart: 115, 2
H240 S.Slave n_ref_1	1st source for the setpoint speed of the slave for the ramp-function generator. SYNCO1.SSUM.X2	Value: 3136 Type: I Chart: 115, 4
H241 S.Slave n_ref_2	2nd source for the setpoint speed of the slave for the ramp-function generator. (this is used for the jog setpoint) SYNCO1.SSUM.X1	Value: 3176 Type: I Chart: 115, 4
H242 S.SV Int(speed)	Source for the setting value of the integral component of the speed controller. SYNCO2.SpeedControl.SV	Value: 3137 Type: I Chart: 120, 4

Parameter	Description	Data
H243 S.Set Int(speed)	Source for the signal to set the integral component of the speed controller. SYNCO2.SpeedControl.S	Value: 0000 Type: I Chart: 120, 4
H244 S.Precontrol	Source for the pre-control value of the speed controller. SYNCO2.EnVorstSpeed.X2	Value: 3080 Type: I Chart: 120, 5
H245 S.enable PreCtrl	Source for the signal to enable the pre-control of the speed controller. SYNCO2.EnVorstSpeed.I	Value: 0140 Type: I Chart: 120, 5
d246 Status Word1 CU	Status word 1 from the basic drive (in the factory setting; i. e. at H558 = 2571). IF_CU.Q_ZWort1.Y	Type: W Chart: 180, 1
d300 Peer W1 send	Word 1 for output at the peer-to-peer interface. IF_Peer.Peer_Zustand_W1.Y	Type: W Chart: 300, 6
H303 MUX word 1 Peer	Multiplexer selection of the source for the value, output as PZD 1, at the peer-to-peer interface 0 Fixed value 0 1 Fixed value H306 2 Status word 1 from peer-to-peer (refer to H310 ... H325) 3 Status word, angular synchronism 4 Control word 1 from the COMBOARD (PZD 1, receive) 5 Control word 2 from the COMBOARD (PZD 4, receive) 6 Status word 1 basic drive (PZD 1 receive) 7 Status word 2 basic drive (PZD 4 receive) 8 Control word 1 peer-to-peer (PZD 1 receive) 9 Control word 1 for the basic drive 10 Control word 2 for the basic drive MUX_Peer.MUX_Peer_W1.XCS	Value: 2 Min: 0 Max: 10 Type: I Chart: 570, 2
H304 MUX float1 Peer	Multiplexer selection of the source for output as 1st floating-point value at the peer-to-peer interface 0 Fixed value 0.0 1 Actual setpoint for the basic drive (speed or torque) 2 Displacement setpoint 3 Ratio 4 Master speed setpoint 5 Relative ratio 6 Inertia compensation 7 Speed setpoint (limited) 8 Slave speed (smoothed) 9 Speed controller output 10 System deviation, speed controller 11 KP speed controller 12 Speed setpoint after the ramp-function generator 13 Angular controller output 14 System deviation, angular controller 15 KP angular controller 16 Displacement actual value 17 Displacement – differential position actual value 18 Position difference (smoothed) 19 Speed actual value slave 20 Position actual value slave 21 Speed actual value master 22 Position actual value master 23 Actual value1 from the basic drive 24 Actual value2 from the basic drive 25 Actual value3 from the basic drive 26 Setpoint1 from the COMBOARD 27 Setpoint2 from the COMBOARD 28 Setpoint3 from the COMBOARD 29 Setpoint4 from the COMBOARD 30 Floating-point value1 from peer-to-peer 31 Floating-point value2 from peer-to-peer 32 Fixed value H307 MUX_Peer.MUX_Peer_W2.XCS	Value: 1 Min: 0 Max: 32 Type: I Chart: 570, 6

Parameter	Description	Data
H305 MUX float2 Peer	Multiplexer selection of the source for output as 2nd floating-point value at the peer-to-peer interface. 0 .. 31 as for H304 32 Fixed value H308 MUX_Peer.MUX_Peer_W3.XCS	Value: 0 Min: 0 Max: 32 Type: I Chart: 570, 7
H306 W1 Peer constant	Fixed value to output via peer-to-peer. MUX_Peer.Festwert_Peer.X	Value 0 Type: W Chart: 570, 1
H307 W2 Peer constant	Fixed value to output via peer-to-peer. (word1 + word2 as floating-point value) MUX_Peer.MUX_Peer_W2.X32	Value 0.0 Type: R Chart: 570, 3
H308 W3 Peer constant	Fixed value to output via peer-to-peer. (word4 + word5 as floating-point value) MUX_Peer.MUX_Peer_W3.X32	Value 0.0 Type: R Chart: 570, 6
H309 Peer enable *Initialization parameter*	Enables communications via the peer-to-peer interface and also its monitoring. 0 Inhibited 1 Enabled IF_Peer. Enable_Peer.I	Value: 1 Type: BO Chart: 300, 1
H310 ... H325 S.PeerState1_B0 ... S.PeerState1_B15	Select sources for the bits of status word 1 of the peer-to-peer interface. H310 Bit 0 — H318 Bit 8 H311 Bit 1 — H319 Bit 9 H312 Bit 2 — H320 Bit 10 H313 Bit 3 — H321 Bit 11 H314 Bit 4 — H322 Bit 12 H315 Bit 5 — H323 Bit 13 H316 Bit 6 — H324 Bit 14 H317 Bit 7 — H325 Bit 15 IF_Peer.Zustandswort1.I1 ... I15	Type I Chart: 310, 5 – 6
d327 Status Word Peer	Status word to output at the peer-to-peer interface. The status word is combined by selecting sources H310 ... H325. IF_Peer.Zustandswort1.QS	Type: W Chart: 310, 7
d329 ... d333 PZD1 Peer ... PZD5 Peer	5 process data from the peer-to-peer interface. IF_Peer.Peer_Empf_W1.Y IF_Peer.PZD2_PZD3.YWL ... YWH IF_Peer.PZD4_PZD5.YWL ... YWH	Type: W Chart: 300, 2
H334 S.ContrlWordPeer	Source for the control word for output at the peer-to-peer interface. IF_Peer.STW_NOP.X	Type: I Chart: 310, 1
H335 S.Peer PZD2	Source for the 2nd PZD for output at the peer-to-peer interface. IF_Peer.PZD2_3_out.XWL	Type: I Chart: 300, 5
H336 S.Peer PZD3	Source for the 3rd PZD for output at the peer-to-peer interface. IF_Peer.PZD2_3_out.XWH	Type: I Chart: 300, 5
H337 S.Peer DW1	Source for the 1st double word for output at the peer-to-peer interface (PZD2 + PZD3). IF_Peer.PZD2_3_out.XDI	Type: I Chart: 300, 5
H338 S.Peer Float1	Source for the 1st floating-point value for output at the peer-to-peer interface (PZD2 + PZD3). IF_Peer.PZD2_3_out.XR	Value: 3304 Type: I Chart: 300, 5
H339 Peer Sendtype1	Selects the data to be output as PZD2 + PZD3: 0: PZD2, PZD3 as single words 1: DW1 double word 1 (H337) 2: Float1 (H338) IF_Peer.PZD2_3_out.SEL	Value: 0 Type: I Chart: 300, 6
H340 S.Peer PZD4	Source for the 4th PZD for output at the peer-to-peer interface. IF_Peer.PZD45_out.XWL	Type: I Chart: 300, 5

Parameter	Description	Data
H341 S.Peer PZD5	Source for the 5th PZD for output at the peer-to-peer interface. IF_Peer.PZD45_out.XWH	Type: I Chart: 300, 5
H342 S.Peer DW2	Source for the 2nd double word for output at the peer-to-peer interface (PZD4 + PZD5). IF_Peer.PZD45_out.XDI	Type: I Chart: 300, 5
H343 S.Peer Float2	Source for the 2nd floating-point value for output at the peer-to-peer interface (PZD4 + PZD5). IF_Peer.PZD45_out.XR	Value: 3305 Type: I Chart: 300, 5
H344 Peer Sendtype2	Selects the data to be output as PZD4 + PZD5: 0: PZD4, PZD5 as single words 1: DW2 double word 2 (H342) 2: Float2 (H343) IF_Peer.PZD45_out.SEL	Value: 0 Type: I Chart: 300, 6
H345 S.Peer PZD1	Source for the 1st PZD for output at the peer-to-peer interface. IF_Peer.Peer_Zustand_W1.X	Value: 2303 Type: I Chart: 300, 5
d346 Peer ControlWord	Receive data from the peer-to-peer interface, word 1. IF_Peer.STW_NOP.Y	Type: W Chart: 310, 1
H360 tmaxPeer PowerOn	Time in which a valid telegram must be received after the device has been powered-up. If a telegram was not received after T > H360 has expired, fault F117 is generated (if this was not suppressed using H003). IF_Peer.StartTimeout.T	Value: 20 s Type: SD Chart: 300, 6
H361 tmax Peer OpMode	Monitoring time during operation. If no data are received within the time interval, parameterized using H361, fault F117 is generated (if this is not suppressed with H003). IF_Peer. Empf_PEER.TMX	Value: 100 ms Type: SD Chart: 300, 1
H362 Mask Peer tmax	The status word of the receive block of the peer-to-peer interface is masked using H362. If the result of this bitwise AND logic operation is not equal to 0, then a communications error is assumed. If the error remains for longer than the time parameterized in H360, the power-on monitoring signals a fault (refer to H360). IF_Peer.Filter.I2	Value 16#FFFF Type: W Chart: 300, 4
H363 Baud Rate Peer	Baud rate for peer-to-peer communications. Permissible values: 9600, 19200, 38400, 93750, 187500 IF_Peer.PEER_Zentral.BDR	Value: 19200 Type: DI Chart: 300, 1
d364 Peer RecStateYTS	Status output of the receive block CRV as information for the fault signal 'F117' IF_Peer.Empf_PEER.YTS	Type: W Chart: 300, 4
H381 ... H388 S.PZD1 CU ... S.PZD8 CU	Selects 8 sources for output as PZD to the basic drive converter. The source must either be a word- or integer type. Factory setting: H381 = 2026 Control word 1 (Chart220) H382 = 2500 Setpoint1 CU N2 H383 = 2502 Setpoint2 CU N2 H384 = 2027 Control word 2 (Chart220) H385 = 2504 Setpoint3 CU N2 H386 = 2506 Setpoint4 CU N2 H387 = 2510 Setpoint CU DW high H388 = 2508 Setpoint5 CU N2 IF_CU.Sammeln.X1 ... X8	Type: I Chart: 410, 5
H401 CB actval1 norm.	Normalization factor for the 1st actual value for output in the N2 format at the communications interface. Output value = 100% * source(H822) / H401 IF_COM.Istwert_W2.NF	Value 1.0 Type: R Chart: 440, 2

Parameter	Description	Data
H403 CB actval2 norm.	Normalization factor for the 2nd actual value for output in the N2 format at the communications interface. Output value = 100% * source(H823)/ H403 IF_COM.Istwert_W3.NF	Value 1.0 Type: R
H405 CB actval3 norm.	Normalization factor for the 3rd actual value for output in the N2 format at the communications interface. Output value = 100% * source(H824) / H405 IF_COM.Istwert_W5.NF	Value 1.0 Type: R
H407 CB actval4 norm.	Normalization factor for the 4th actual value for output in the N2 format at the communications interface. Output value = 100% * source(H825) / H407 IF_COM.Istwert_W6.NF	Value 1.0 Type: R
H409 ComBoard enable *Initialization parameter*	Enables communications via PROFIBUS and its monitoring. 0 Inhibited 1 Enabled IF_COM.Enable_ComBoard.I	Value: 1 Type: BO Chart: 400, 1
H410 ... H425 S.CB state1 B0 ... S.CB state1 B15	Sources for the bits of status word 1 to output at COMBOARD. All of the status bits are connected to constant 0 in the factory setting. H410 Bit 0 / H418 Bit 8 H411 Bit 1 / H419 Bit 9 H412 Bit 2 / H420 Bit 10 H413 Bit 3 / H421 Bit 11 H414 Bit 4 / H422 Bit 12 H415 Bit 5 / H423 Bit 13 H416 Bit 6 / H424 Bit 14 H417 Bit 7 / H425 Bit 15 IF_COM.Zustandswort1.I1 ... I16	Value 0 Type BO Chart: 430, 1 - 2
H426 ... H441 S.CB state2 B0 ... S.CB state2 B15	Sources for the bits of status word 2 to output at COMBOARD. All of the status bits are connected to constant 0 in the factory setting. H426 Bit 0 / H434 Bit 8 H427 Bit 1 / H435 Bit 9 H428 Bit 2 / H436 Bit 10 H429 Bit 3 / H437 Bit 11 H430 Bit 4 / H438 Bit 12 H431 Bit 5 / H439 Bit 13 H432 Bit 6 / H440 Bit 14 H433 Bit 7 / H441 Bit 15 IF_COM.Zustandswort2.I1 ... I16	Value 0 Type BO
H442 MUX word1 CB	Multiplexer selection of the source for the value output, at the COMBOARD interface as PZD 1 0 Fixed value 0 1 Fixed value H443 2 Status word 1 from the COMBOARD 3 Status word angular synchronism 4 Control word 1 from the COMBOARD (PZD 1, receive) 5 Control word 2 from the COMBOARD (PZD 4, receive) 6 Status word 1 basic drive (PZD 1, receive) 7 Status word 2 basic drive (PZD 4, receive) 8 Control word 1 peer-to-peer (PZD 1, receive) 9 Control word 1 for the basic drive 10 Control word 2 for the basic drive MUX_CB.MUX_COM_W1.XCS	Value: 0 Min: 0 Max: 10 Type: I Chart: 560, 3
H443 word1 CB constan	Fixed value for output at the communications interface as PZD1. MUX_CB.Festwerte_CB.X1	Value: 0 Type: W Chart: 560, 2

Parameter	Description	Data
H444 MUX word4 CB	Multiplexer selection of the source for the value output, at the COMBOARD interface as PZD 4 0 Fixed value 0 1 Fixed value H445 2 Status word 2 from the COMBOARD 3 Status word angular synchronism 4 Control word 1 from the COMBOARD (PZD 1, receive) 5 Control word 2 from the COMBOARD (PZD 4, receive) 6 Status word 1 basic drive (PZD 1, receive) 7 Status word 2 basic drive (PZD 4, receive) 8 Control word 1 peer-to-peer (PZD 1, receive) 9 Control word 1 for the basic drive 10 Control word 2 for the basic drive MUX_CB.MUX_COM_W4.XCS	Value: 0 Min: 0 Max: 10 Type: I Chart: 5600, 7
H445 word4 CB constan	Fixed value for output at the communications interface, as PZD 4. MUX_CB.Festwerte_CB.X2	Value: 0 Type: W Chart: 560, 6
H446 MUX word2 CB	Multiplexer selection of the source for the value output at COMBOARD, as PZD 2. 0 .. 31 Refer to H304 32 Fixed value H470 MUX_CB.MUX_CB_W2.XCS	Value: 1 Min: 0 Max: 32 Type: I Chart: 550, 3
H447 MUX word3 CB	Multiplexer selection of the source for the value output at COMBOARD, as PZD 3. 0 .. 31 Refer to H304 32 Fixed value H471 MUX_CB.MUX_CB_W3.XCS	Value: 0 Min: 0 Max: 32 Type: I Chart: 550, 4
H448 MUX word5 CB	Multiplexer selection of the source for the value output at COMBOARD, as PZD 5. 0 .. 31 Refer to H304 32 Fixed value H472 MUX_CB.MUX_CB_W5.XCS	Value: 0 Min: 0 Max: 32 Type: I Chart: 550, 6
H449 MUX word6 CB	Multiplexer selection of the source for the value output as PZD 6 at COMBOARD. 0 .. 31 Refer to H304 32 Fixed value H473 MUX_CB.MUX_CB_W6 XCS	Value: 0 Min: 0 Max: 32 Type: I Chart: 550, 7
d450 CB Setp_1 rec.	1st setpoint from the communications module. IF_COM.Sollwert_W2.Y	Type: R Chart: 410, 7
H451 CB Setp_1 norm.	Normalization factor for the 1st setpoint from the communications module. d450 = H451 * source(H813) / 100% IF_COM.Sollwert_W2.NF	Value 1.0 Type: R Chart: 410, 6
d452 CB Setp_2 rec.	2nd setpoint from the communications module. IF_COM.Sollwert_W3.Y	Type: R Chart: 410, 7
H453 CB Set_2 norm.	Normalization factor for the 2nd setpoint from the communications module. d452 = H453 * source(H814) / 100% IF_COM.Sollwert_W3.NF	Value 1.0 Type: R Chart: 410, 6
d454 CB Setp_3 rec.	3rd setpoint from the communications module. IF_COM.Sollwert_W5.Y	Type: R Chart: 410, 7
H455 CB Setp_3 norm.	Normalization factor for the 3rd setpoint from the communications module. d454 = H455 * source(H815) / 100% IF_COM.Sollwert_W5.NF	Value 1.0 Type: R Chart: 410, 6
d456 CB Setp_4 rec.	4th setpoint from the communications module. IF_COM.Sollwert_W6.Y	Type: R Chart: 410, 7

Parameter	Description	Data
H457 CB setp_4 norm.	Normalization factor for the 4th setpoint from the communications module. d456 = H457 * source(H816) / 100% IF_COM.Sollwert_W6.NF	Value 1.0 Type: R Chart: 410, 6
d458 Word 1 CB Send	Send data of the communications interface, word 1 IF_COM.Sammeln2.Y3	Type: W
d459 Word 4 CB Send	Send data of the communications interface, word 4 IF_COM.Sammeln2.Y4	Type: W
d460 ControlWord 1 CB	Process data, which interprets control word1 from the communications module. Connected with PZD1 from CB in the factory setting. IF_COM.Verteil2.Y3	Type: W Chart: 420, 1
d461 ControlWord 2 CB	Process data, which interprets control word1 from the communications module. Connected with PZD4 from CB in the factory setting. IF_COM.Verteil2.Y4	Type: W Chart: 420, 5
H462 tmax CB PowerOn	Time, in which a valid telegram must be received after the device has been powered-up. If a telegram was not received after T > H462 has expired, fault F116 is generated (if this was not suppressed using H003). IF_COM.StartTimeout.T	Value: 20000 ms Type: SD Chart: 400, 5
H463 tmax CB OpMode	Monitoring time during operation. If no data are received within the time interval, parameterized using H463, fault F116 is generated (if this is not suppressed with H003). IF_COM. Empf-COM.TMX	Value: 100 ms Type: SD Chart: 400, 1
H464 Mask tmax CB	The status word of the receive block of the peer-to-peer interface is masked using H464. If the result of this bitwise AND logic operation is not equal to 0, then a communications error is assumed. If the error remains for longer than the time parameterized in H462, the power-on monitoring signals a fault (refer to H462). IF_COM.Filter.I2	Value 16#FFFF Type: W Chart: 400, 4
d465 CB receive state	Status display of receive block CRV as information for the fault message 'F116' IF_COM.Empf-COM.YTS	Type: W Chart: 400, 3
d466 Status Word1 CB	1st status word for the communications module (as PZD1). IF_COM.Zustandswort1.QS	Type: W Chart: 430, 4
d467 Status Word2 CB	2nd status word for the communications module (as PZD4). IF_COM.Zustandswort2.QS	Type: W Chart: 430, 7
H470 W2 CB constant	Fixed value for output via COMBOARD (as actual value1) MUX_CB.MUX_CB_W2.X32	Value 0.0 Type: R Chart: 550, 1
H471 W3 CB constant	Fixed value for output via COMBOARD (as actual value2) MUX_CB.MUX_CB_W3.X32	Value 0.0 Type: R Chart: 550, 3
H472 W5 CB constant	Fixed value for output via COMBOARD (as actual value3) MUX_CB.MUX_CB_W5.X32	Value 0.0 Type: R Chart: 550, 5
H473 W6 CB constant	Fixed value for output via COMBOARD (as actual value4) MUX_CB.MUX_CB_W6.X32	Value 0.0 Type: R Chart: 550, 7
H480 CB Slave address	Slave address of the COMBOARD. This parameter is only relevant for operation without basic drive. For operation with basic drive, the COMBOARD is parameterized from the basic drive. IF_COM.ComBoardConfig.MAA	Value 3 Type: I Chart: 400, 6

Parameter	Description	Data
H481 ... H493 CB Parameter 1 .... CB Parameter 13	Parameterizing the COMBOARD. The settings are made depending on the COMBOARD type used (refer to the User Documentation of the COMBOARD; H482 = 2 sets PPO type 2 for Profibus) These parameters are only relevant when using the system without basic drive. When used with the basic drive, the COMBOARD is parameterized from the basic drive. IF_COM.ComBoardConfig. P01 ... P13	Value 0 except H482 = 2 Type: I Chart: 400, 6 - 8
H495 CB Param.valid	The COMBOARD settings are set valid. In operation, H495 must be set to 1. After a parameter change (H480 .. H493), H495 is first set to 0 and then to 1, in order to update the parameters on COMBOARD. This parameter is only relevant for operation without a basic drive. When a basic drive is used, the COMBOARD is parameterized from the basic drive. IF_COM.ComBoardConfig.SET	Value 1 Type: BO Chart: 400, 6
d496 CB state SRT400	Status of the COMBOARD. This is only relevant for operation without basic drive. When used with the basic drive, 16#7CB3 is displayed (i.e. ”Basic drive available”). IF_COM.ComBoardConfig.YTS	Type: W Chart: 400, 8
H498 S.Setp DW_CU	Source for the setpoint for output as double word (N4 normalization) at the basic drive (normalization H499). IF_CU.SollwertN4CU.X	Type: I Chart: 230, 1
H499 CU DW norm.	Normalization factor for the setpoint for output as double word at the basic drive. In the factory setting, the high word is output as PZD7: Double word = 100 % * source(H498) / H499 IF_CU.SollwertN4CU.NF	Value 1.0 Type: R Chart: 230, 2
H500 S.CU setp_1	Source for the 1st setpoint for output at the basic drive (normalization H501). IF_CU.Sollwert_W2.X	Type: I Chart: 230, 1
H501 CU setp_1 norm.	Normalization factor for the 1st setpoint for output at the basic drive. In the factory setting, output as PZD2: PZD2 = 100 % * source(H500) / H501 IF_CU.Sollwert_W2.NF	Value 1.0 Type: R Chart: 230, 2
H502 S.CU setp_2	Source for the 2nd setpoint for output to the basic drive (normalization H503). IF_CU.Sollwert_W3.X	Type: I Chart: 230, 1
H503 CU setp_2 norm.	Normalization factor for the 2nd setpoint for output at the basic drive. In the factory setting, output as PZD3: PZD3 = 100 % * source(H502) / H503 IF_CU.Sollwert_W3.NF	Value 1.0 Type: R Chart: 230, 2
H504 S.CU setp_3	Source for the 3rd setpoint for output at the basic drive (normalization H505). IF_CU.Sollwert_W5.X	Type: I Chart: 230, 1
H505 CU setp_3 norm.	Normalization factor for the 3rd setpoint for output at the basic drive. In the factory setting, output as PZD5: PZD5 = 100 % * source(H504) / H505 IF_CU.Sollwert_W5.NF	Value 1.0 Type: R Chart: 230, 2
H506 S.CU setp_4	Source for the 4th setpoint for output at the basic drive (normalization H507). IF_CU.Sollwert_W6.X	Type: I Chart: 230, 1
H507 CU setp_4 norm.	Normalization factor for the 4th setpoint for output at the basic drive. In the factory setting, output as PZD6: PZD6 = 100 % * source(H506) / H507 IF_CU.Sollwert_W6.NF	Value 1.0 Type: R Chart: 230, 2
H508 S.CU setp_5	Source for the 5th setpoint for output at the basic drive (normalization H509). IF_CU.Sollwert_W8.X	Type: I Chart: 230, 1

Parameter	Description	Data
H509 CU setp_5 norm.	Normalization factor for the 5th setpoint for output at the basic drive. In the factory setting, output as PZD8: PZD8 = 100 % * source(H508) / H509 IF_CU.Sollwert_W8.NF	Value 1.0 Type: R Chart: 230, 2
H510 ... H525 S.Bit0 CTW1 CU ... S.Bit15 CTW1 CU	Sources for the bits of control word 1 for outputs at the basic drive. Par. Bit Factory Significance H510 Bit 0 0650 On (main contactor) 1=ON H511 Bit 1 0651 /OFF2 (powered-down) 0=OFF H512 Bit 2 0652 /OFF3 (fast stop) 0=OFF H513 Bit 3 0653 Pulse enable H514 Bit 4 0654 Ramp-function generator enable H515 Bit 5 0655 Start, ramp-function generator H516 Bit 6 0656 Setpoint enable 1=enable H517 Bit 7 0657 Acknowledge fault 1=acknowledge H518 Bit 8 0658 Jogging 1 H519 Bit 9 0659 Jogging 2 H520 Bit 10 0660 Control requested H521 Bit 11 0661 Enable positive direction of rotation H522 Bit 12 0662 Enable negative direction of rotation H523 Bit 13 0663 Motorized potentiometer, raise H524 Bit 14 0664 Motorized potentiometer, lower H525 Bit 15 0665 Fault, external 1 0 = fault IF_CU.Steuerwort1.I1 ... I15 IF_CU.Q_ext_Error.I	Type I Chart: 220, 1... 2
H526 ... H541 S.Bit0 CTW2 ... S.Bit15 CTW2	Sources for the bits of control word 2 for output at the basic drive. Only bit 9 (speed controller enable) is used. H526 Bit 0 H534 Bit 8 H527 Bit 1 H535 Bit 9 0546 H528 Bit 2 H536 Bit 10 H529 Bit 3 H537 Bit 11 H530 Bit 4 H538 Bit 12 H531 Bit 5 H539 Bit 13 H532 Bit 6 H540 Bit 14 H533 Bit 7 H541 Bit 15 IF_CU.Steuerwort2. I1 ... I16	Type I Chart: 220, 5
H542 Mask CU ready	Using this mask, a bit of status word 1 from the basic drive can be selected, which then signals the operational readiness of the basic drive. Status word 1 of the basic drive is AND'ed bitwise with H542. If at least the 1st bit of the result word is set, the following is valid: "Basic drive ready". This is the prerequisite for the speed controller enable. IF_CU.BereitBitMaske.I2	Value 16#0004 Type: W Chart: 90, 5
H543 TestEnable CU n	For test purposes, the speed controller can be enabled in the basic drive, bypassing the enable logic. IF_CU.n-Reg_Freigabe.I2	Value 0 Type: BO Chart: 90, 7
H544 MUX Speed enable	Multiplexer selection of the source to enable the speed controller in the basic drive. In order that the speed controller is enabled, the basic drive must be ready (refer to H542) 0 Fixed value 0 1 Fixed value 1 2 Bit 9 from control word 2 from the COMBOARD 3 Bit 10 from control word 1 from the COMBOARD 4 Bit 9 from control word 1 from peer-to-peer 5 Digital input 8 (terminal 60) 6 Bit 15 from the control word from the basic drive MUX_CU.Mux_Enable_nRegl.XCS	Value: 1 Min: 0 Max: 5 Type: BO Chart: 560, 3

Parameter	Description	Data
d545 ... d548 CPU load T1 to T4 d549 Total CPU load	Computer utilization level of the standard software package, assigned according to time sectors. T1 is the fastest (highest priority), T5 is the slowest time sector. It is important that the total CPU load are not utilized more than 100% , as otherwise they will not be processed in the configured time intervals. d545 Utilization of T1 d546 Utilization of T2 d547 Utilization of T3 d548 Utilization of T4 d549 Total CPU load IF_CU.LoadMeasure.YC1 ... YC4, IF_CU.LoadMeasure.Y	Type: R Chart: 40, 7
H550 CU actval1 norm.	Normalization factor for the 1st actual value channel (factory setting: PZD2) of the receive data from the basic drive d551 = H550 * PZD2 / 100% IF_CU.Istwert_W2.NF	Value 1.0 Type: R Chart: 170, 7
d551 CU actval1	Actual value1 basic drive (factory setting: PZD2) after normalization IF_CU.Istwert_W2.Y	Type: R Chart: 170, 7
H552 CU actval2 norm.	Normalization factor for the 2nd actual value channel (factory setting: PZD3) of the receive data from the basic drive d553 = H552 * PZD3 / 100% IF_CU.Istwert_W3.NF	Value 1.0 Type: R Chart: 170, 7
d553 CU actval2	Actual value2 basic drive (factory setting: PZD3) after normalization IF_CU.Istwert_W3.Y	Type: R Chart: 170, 7
H554 CU actval3 norm.	Normalization factor for the 3rd actual value channel (factory setting: PZD5) of the receive data from the basic drive d555 = H554 * PZD5 / 100% IF_CU.Istwert_W5.NF	Value 1.0 Type: R Chart: 170, 7
d555 CU actval3	Actual value3 basic drive (factory setting: PZD5) after normalization IF_CU.Istwert_W5.Y	Type: R Chart: 170, 7
d556 CTW from CU	Optional control word; e.g. to control angular synchronism via SIMOLINK ➔ basic drive ➔ T400. IF_CU.STW_SPA.Y	Type: W Chart: 180, 6
H557 S.CTW from CU	Source for an optional control word. Factory setting, PZD6 from the basic drive. The selected source is split-up into status bits and inverse status bits (connectors 0550 and onwards). IF_CU.STW_SPA.X	Value: 2576 Type: I Chart: 180, 1
H558 S.StatusWord1 CU	Source for status word1 from the basic drive. The selected source is split-up into status bits and inverse status bits (connectors 0510 and onwards). IF_CU.Q_ZWort1.X	Value: 2571 Type: I Chart: 180, 1
H559 S.StatusWord2 CU	Source for the status word1 from the basic drive. The selected source is split-up into status bits (connectors 0480 and onwards). IF_CU.Zustand2CU.IS	Value: 2571 Type: I Chart: 180, 1
d560 CU Status Word 1	Receive word 1 from the basic drive (PZD1) = status word 1 IF_CU.Verteilung.X1	Type: I
d561 CU Status Word 2	Receive word 4 from the basic drive (PZD4) = status word 2 IF_CU.Verteilung.X4	Type: I
d562 CU Rec.State	Status of the receive channel from the basic drive IF_CU.Empf_BASE.YTS	Type: W Chart: 150, 4
H563 S.actval_1 CU	Source of the 1st actual value from the basic drive, which should be converted from the N2 format into the floating-point format (normalization factor H550). IF_CU.Istwert_W2.X	Value: 2572 Type: I Chart: 170, 4

Parameter	Description	Data
H564 S.actval_2 CU	Source of the 2nd actual value from the basic drive, which should be converted from the N2 format into the floating-point format (normalization factor H552). IF_CU.Istwert_W3.X	Value: 2573 Type: I Chart: 170, 4
H565 S.actval_3 CU	Source of the 3rd actual value from the basic drive, which should be converted from the N2 format into the floating-point format (normalization factor H554). IF_CU.Istwert_W5.X	Value: 2575 Type: I Chart: 170, 4
H567 S.DW high CU	Source of the double word (high word) from the basic drive, which should be converted from the N4 format into the floating-point format (normalization factor H558). IF_CU.W_DW.XWH	Value: 2582 Type: I Chart: 170, 3
H568 S.DW low CU	Source of the double word (low word) from the basic drive, which should be converted from the N4 format into the floating-point format (normalization factor H558). IF_CU.W_DW.XWL	Value: 2581 Type: I Chart: 170, 3
H569 S.DW CU	Source of the double word from the basic drive, which is to be directly converted into the floating-point format. IF_CU.CU_DI_R.X	Value: 5567 Type: I Chart: 170, 5
d570 CU DW_R	Result of the double word ➔ floating-point conversion (received from the basic drive) IF_CU.CU_DI_R.Y	Type: R Chart: 170, 7
d571 .. d584 PZD1 CU rec.... PZD14 CU rec.	Actual value of the first 14 process data from the basic drive. In the factory setting, only PZD1 (status word 1) is evaluated. IF_CU.Verteilung.Y1 ... Y8 IF_CU.Verteil2CU.Y1 ... Y6	Type: W Chart: 170, 2
H587 S.N4 CU	Source of the double word from the basic drive, which is to be converted from the N4 format into the floating-point format. IF_CU.CU_N4_R.X	Value: 5567 Type: I Chart: 170, 5
H588 CU N4 norm.	Normalization factor for the conversion from N4 into the floating-point format. For H588 = 1.0, N4 = 100% (16#40000000) is emulated as 1.0. IF_CU.CU_N4_R.NF	Value: 1.0 Type: R Chart: 170, 7
d589 CU N4_R	Result of the double word (N4 normalization) -> floating-point conversion (received from the basic drive) IF_CU.CU_N4_R.Y	Type: R Chart: 170, 7
H590 Q.CU_I_R	Source of the actual value from the basic drive which is to be directly converted into the floating-point format (i.e. PZD= 1234 => d591 = 1234.0). IF_CU.CU_I_R.X	Value: 2577 Type: I Chart: 170, 4
d591 CU I_R	Actual value from the basic drive after conversion into a floating-point value. IF_CU.CU_I_R.Y	Type: R Chart: 170, 7
H592 S.en.Speed CU1	Source for the status word from the basic drive. From this, mask H542 selects a status bit, which is used to enable the speed controller. IF_CU.BereitBitMaske.I1	Value: 2571 Type: I Chart: 90, 5
H593 S.en.Speed CU2	Source for an additional condition to enable the speed controller. IF_CU.Enable_n_Regler.I2	Value: 0547 Type: I Chart: 90, 6
d601 ... d604 Pin46 input ... Pin49 input	Input value of the bi-directional I/O of the T400. (For the case, where the terminals are used as inputs; i.e. driver H637 ... H640 inactive) *Parameter* — *T400 terminal* — *´1´ signifies:* d601 — Terminal 46 — Synchronism reached d602 — Terminal 47 — Angular controller at its limit d603 — Terminal 48 — Angular controller enabled d604 — Terminal 49 — Fault present T400_EA.BinOut.Q1 ... Q4	Type: BO Chart: 53, 3 .. 7

Parameter	Description	Data
d607 Pin84 Coarse P1	Actual value of the 1st coarse pulse input (terminal 84) on the T400. T400_EA.BinOut.Q7	Type: BO Chart: 52, 7
d608 Pin65 Coarse P2	Actual value of the 2nd coarse pulse input (terminal 65) on the T400. T400_EA.BinOut.Q8	Type: BO Chart: 52, 7
H609 BinInp Inverters	This parameter is available, for compatibility reasons, to earlier software releases. From version V2.02 onwards, the digital inputs are available inverted and not inverted, and can be selected using BICO connections. The digital inputs can be individually inverted using H609. In this case, every bit from H609 is EXOR'd with the appropriate input bit. 1-bits result in an inversion. For example: H609 = 16#0005 = 0000 0101b ⇒ inputs 1 and 3 are inverted T400_EA.Invert_BinInp.I2	Value 16#0000 Type: W Not included in the charts!
d610 ... d617 BinInput1 Pin53	Digital inputs of the T400. d610 Input 1 (terminal 53) d611 Input 2 (terminal 54) d612 Input 3 (terminal 55) d613 Input 4 (terminal 56) d614 Input 5 (terminal 57) d615 Input 6 (terminal 58) d616 Input 7 (terminal 59) d617 Input 8 (terminal 60) T400_EA.BinInput.Q1 ... Q8	Type BO Chart: 52, 3
H618 MUX AnalogOutp 1	Selects the source for the 1st analog output of the T400 (terminal 97). 0 .. 31 as for H304 32 DT1 (n_set) (inertia compensation from n_set) MUX_AnaOut.MUX_DAC_1.XCS	Value: 1 Min: 0 Max: 31 Type: I Chart: 510, 4
H619 MUX AnalogOutp 2	Selects the source for the 2nd analog output of the T400 (terminal 98). 0 .. 31 as for H304 32 DT1 (n_set) (inertia compensation from n_set) MUX_AnaOut.MUX_DAC_2. XCS	Value: 0 Min: 0 Max: 31 Type: I Chart: 510, 6
H620 S.Analog Outp1	Source for the signal for output at the 1st analog output of the T400. T400_EA.Filt_DAC1.X	Value: 3618 Type: I Chart: 51, 2
H621 S.set DAC1 zero	Source of the signal to set the output value to zero for the 1st analog output of the T400. If H160 = 0.0 (DA1 offset), this allows the analog output to be inhibited (output voltage = 0V) or enabled. T400_EA.Filt_DAC1.S	Value: 0000 Type: I Chart: 51, 2
H622 S.Analog Outp2	Source for the signal for output at the 2nd analog output of the T400. T400_EA.Filt_DAC2.X	Value: 3619 Type: I Chart: 51, 2
H623 S.set DAC2 zero	Source of the signal to set the output value to zero for the 2nd analog output of the T400. If H162 = 0.0 (DA2 offset), this allows the analog output to be inhibited (output voltage = 0V) or enabled. T400_EA.Filt_DAC2.S	Value: 0000 Type: I Chart: 51, 2
H631 S.BiDir Out1	Source for the digital signal for output at terminal 46. The output driver is activated with H637 = 1. T400_EA.BinOut.I1	Value: 0105 Type: I Chart: 53, 1
H632 S.BiDir Out2	Source for the digital signal for output at terminal 47. The output driver is activated with H638 = 1. T400_EA.BinOut.I2	Value: 0116 Type: I Chart: 53, 1
H633 S.BiDir Out3	Source for the digital signal for output at terminal 48. The output driver is activated with H639 = 1. T400_EA.BinOut.I3	Value: 0109 Type: I Chart: 53, 5

Parameter	Description	Data
H634 S.BiDir Out4	Source for the digital signal for output at terminal 49. The output driver is activated with H640 = 1. T400_EA.BinOut.I4	Value: 0003 Type: I Chart: 53, 5
H635 S.Bin.Output1	Source for the digital signal for output at terminal 51. T400_EA.BinOut.I6	Value: 0004 Type: I Chart: 53, 1
H636 S.Bin.Output2	Source for the digital signal for output at terminal 52. T400_EA.BinOut.I5	Value: 0000 Type: I Chart: 53, 1
H637 ... H640 enable BiDir1 ... enable BiDir4 *Initialization parameter*	Activates the driver for the bi-directional I/O of the T400. (1: Driver active; 0: Only the input can be used) H637: Terminal 46 H638: Terminal 47 H639: Terminal 48 H640: Terminal 49 T400_EA.BinOut.DI1 ... DI4	Type: BO Chart: 53, 2 - 6
H650 MUX CTW1 Bit0	Selects the source for bit 0 in control word 1 to the basic drive 0 Fixed value 0 1 Fixed value 1 2 Bit 0 from control word 1 from the COMBOARD 3 Bit 0 from control word 1 of the peer-to-peer interface 4 Digital input 1 (terminal 53) 5 Control word from the basic drive, bit 5 MUX_CU.Mux_STW1_B0.XCS	Value: 0 Type: I Chart: 530, 2
H651 MUX CTW1 Bit1	Selects the source for bit 1 in control word 1 to the basic drive 0 Fixed value 0 1 Fixed value 1 2 Bit 1 from control word 1 from the COMBOARD 3 Bit 1 from control word 1 of the peer-to-peer interface 4 Digital input 2 (terminal 54) 5 Control word from the basic drive, bit 6 MUX_CU.Mux_STW1_B1.XCS	Value: 1 Type: I Chart: 530, 2
H652 MUX CTW1 Bit2	Selects the source for bit 2 in control word 1 to the basic drive 0 Fixed value 0 1 Fixed value 1 2 Bit 2 from control word 1 from the COMBOARD 3 Bit 2 from control word 1 of the peer-to-peer interface 4 Digital input 3 (terminal 55) 5 Control word from the basic drive, bit 7 MUX_CU.Mux_STW1_B2.XCS	Value: 1 Type: I Chart: 530, 2
H653 MUX CTW1 Bit3	Selects the source for bit 3 in control word 1 to the basic drive 0 Fixed value 0 1 Fixed value 1 2 Bit 3 from control word 1 from the COMBOARD 3 Bit 3 from control word 1 of the peer-to-peer interface 4 Digital input 4 (terminal 56) 5 Control word from the basic drive, bit 8 MUX_CU.Mux_STW1_B3.XCS	Value: 1 Type: I Chart: 530, 2
H654 MUX CTW1 Bit4	Selects the source for bit 4 in control word 1 to the basic drive 0 Fixed value 0 1 Fixed value 1 2 Bit 4 from control word 1 from the COMBOARD 3 Bit 4 from control word 1 of the peer-to-peer interface 4 Digital input 5 (terminal 57) 5 Control word from the basic drive, Bit 9 MUX_CU.Mux_STW1_B4.XCS	Value: 1 Type: I Chart: 530, 6

Parameter	Description	Data
H655 MUX CTW1 Bit5	Selects the source for bit 5 in control word 1 to the basic drive 0 Fixed value 0 1 Fixed value 1 2 Bit 5 from control word 1 from the COMBOARD 3 Bit 5 from control word 1 of the peer-to-peer interface 4 Digital input 6 (terminal 58) 5 Control word from the basic drive, Bit 10 MUX_CU.Mux_STW1_B5.XCS	Value: 1 Type: I Chart: 530, 6
H656 MUX CTW1 Bit6	Selects the source for bit 6 in control word 1 to the basic drive 0 Fixed value 0 1 Fixed value 1 2 Bit 6 from control word 1 from the COMBOARD 3 Bit 6 from control word 1 of the peer-to-peer interface 4 Digital input 7 (terminal 59) 5 Control word from the basic drive, Bit 11 MUX_CU.Mux_STW1_B6.XCS	Value: 1 Type: I Chart: 530, 6
H657 MUX CTW1 Bit7	Selects the source for bit 7 in control word 1 to the basic drive 0 Fixed value 0 1 Fixed value 1 2 Bit 7 from control word 1 from the COMBOARD 3 Bit 7 from control word 1 of the peer-to-peer interface 4 Digital input 8 (terminal 60) 5 Control word from the basic drive, Bit 12 MUX_CU.Mux_STW1_B7.XCS	Value: 0 Type: I Chart: 530, 6
H658 MUX CTW1 Bit8	Selects the source for bit 8 in control word 1 to the basic drive 0 Fixed value 0 1 Fixed value 1 2 Bit 8 from control word 1 from the COMBOARD 3 Bit 8 from control word 1 of the peer-to-peer interface 4 Coarse pulse input, encoder 2 (terminal 84) MUX_CU.Mux_STW1_B8.XCS	Value: 0 Type: I Chart: 540, 2
H659 MUX CTW1 Bit9	Selects the source for bit 9 in control word 1 to the basic drive 0 Fixed value 0 1 Fixed value 1 2 Bit 9 from control word 1 from the COMBOARD 3 Bit 9 from control word 1 of the peer-to-peer interface 4 Coarse pulse input, encoder 1 (terminal 65) MUX_CU.Mux_STW1_B9.XCS	Value: 0 Type: I Chart: 540, 2
H660 MUX CTW1 Bit10	Selects the source for bit 10 in control word 1 to the basic drive 0 Fixed value 0 1 Fixed value 1 2 Bit 10 from control word 1 from the COMBOARD 3 Bit 10 from control word 1 of the peer-to-peer interface MUX_CU.Mux_STW1_B10.XCS	Value: 1 Type: I Chart: 540, 2
H661 MUX CTW1 Bit11	Selects the source for bit 11 in control word 1 to the basic drive 0 Fixed value 0 1 Fixed value 1 2 Bit 11 from control word 1 from the COMBOARD 3 Bit 11 from control word 1 of the peer-to-peer interface 4 Word 6 bit 13 from the basic drive MUX_CU.Mux_STW1_B11.XCS	Value: 1 Type: I Chart: 540, 2
H662 MUX CTW1 Bit12	Selects the source for bit 12 in control word 1 to the basic drive 0 Fixed value 0 1 Fixed value 1 2 Bit 12 from control word 1 from the COMBOARD 3 Bit 12 from control word 1 of the peer-to-peer interface 4 Word 6 bit 14 from the basic drive MUX_CU.Mux_STW1_B12.XCS	Value: 1 Type: I Chart: 540, 6

Parameter	Description	Data
H663 MUX CTW1 Bit13	Selects the source for bit 13 in control word 1 to the basic drive 0 Fixed value 0 1 Fixed value 1 2 Bit 13 from control word 1 from the COMBOARD 3 Bit 13 from control word 1 of the peer-to-peer interface MUX_CU.Mux_STW1_B13.XCS	Value: 0 Type: I Chart: 540, 6
H664 MUX CTW1 Bit14	Selects the source for bit 14 in control word 1 to the basic drive 0 Fixed value 0 1 Fixed value 1 2 Bit 14 from control word 1 from the COMBOARD 3 Bit 14 from control word 1 of the peer-to-peer interface MUX_CU.Mux_STW1_B14.XCS	Value: 0 Type: I Chart: 540, 6
H665 MUX CTW1 Bit15 (external fault)	Selects the source for bit 15 (external fault) in control word 1 to the basic drive ('1' = no fault) 0 Fixed value 0 1 Fixed value 1 2 Bit 15 from control word 1 from the COMBOARD 3 Bit 15 from control word 1 of the peer-to-peer interface 4 Fault (refer to H003) 5 Alarm (refer to H004) 6 Digital input 8 (terminal 60) MUX_CU.Mux_STW1_B15.XCS	Value: 1 Type: I Chart: 540, 6
d666 Analog output 1	Value, which is output at analog output 1. T400_EA.Filt_DAC1.Y	Type: R Chart: 51, 3
d667 Analog output 2	Value, which is output at analog output 2. T400_EA.Filt_DAC2.Y	Type: R Chart: 51, 3
H668 T_Filter_DAC1	Smoothing time constant for analog output 1 T400_EA.Filt_DAC1.T	Value: 0 ms Type: R Chart: 51, 2
H669 T_Filter_DAC2	Smoothing time constant for analog output 2 T400_EA.Filt_DAC2.T	Value: 0 ms Type: R Chart: 51, 2
H700 USS enable	Enables the serial interface 1 of the T400 for operation as USS slave. Further, switch S1/8 should be set into the ON position. Online operation with CFC or with the basic IBS (start-up) is then <u>no longer possible</u>! USS slave is only required for operator control and visualization, if the T400 is to be operated without basic drive (in the SRT400). **Prerequisite for OP1S**: Software version from V2.2 IF_USS.Enable.I	Value: 1 Type: BO Chart: 450, 1
H701 Baud rate USS	Data transfer rate for the USS interface. Example OP1S: 9600 or 19200 IF_USS.Slave_ZB.BDR	Value: 9600 Type: DI Chart: 450, 1
H703 USS Address	Station address, USS interface. IF_USS.Slave_ZB.MAA	Value: 0 Type: I Chart: 450, 1
H704 USS 4-Wire	Difference between 2-wire (half duplex) and 4-wire operation (full duplex) for the USS interface. <u>Value</u> <u>Significance</u> <u>Required for</u> 0 RS485 2-wire (half duplex) for OP1S 1 RS232 4-wire (full duplex) for SIMOVIS For end nodes on the USS bus (RS485), terminating resistors must be used to terminate the bus. The appropriate resistors are switched-in using switches S1/1 and S1/2 on the T400; the resistors are switched-in in the ON setting. IF_USS.Slave_ZB. WI4	Value: 0 Type: BO Chart: 450, 1

Parameter	Description	Data
d705 USS rec. state	Status of the central block of the USS interface (*@USS_S*). This value is only of significance, if the T400 is operated without basic drive, and parameterization should be realized via the serial interface 1 of the T400 in the USS protocol (refer to H700 to H704). IF_USS.Slave_ZB.YTS	Type: W Chart: 450, 4
d706 ... d707 PZD1 USS ... PZD2 USS	Two pieces of process data, received from the USS interface. IF_USS.USS_Dummy.Y1 ... Y2	Type: W Chart: 450, 6
H708 ... H709 S.PZD1 USS Slave ... S.PZD2 USS Slave	Sources for 2 words, which are output at the USS interface. IF_USS.USS_Dummy.X1 ... X2	Value: 2000 Type: I Chart: 450, 5
d801 ... d810 PZD1 CB rec. ... PZD10 CB rec.	10 process data when receiving data from the communications module. Depending on the PPO type used, not all PZD are used. These values are then undefined! IF_COM.Verteilung.Y1 ... Y8 IF_COM.Verteil2.Y1 ... Y2	Type: W Chart: 410, 3
H811 S.Control W1 CB	Selects the source for the 1st control word from the communications module. IF_COM.Verteil2.X3	Value: 2801 Type: I Chart: 420, 1
H812 S.Control W2 CB	Selects the source for the 2nd control word from the communications module. IF_COM.Verteil2.X4	Value: 2804 Type: I Chart: 420, 1
H813 ... H816 S.setp_1 CB ... S.setp_4 CB	Selects, from 4 sources, for setpoints from the communications interface, those which are to be converted from the N2 format into the floating-point format. Factory setting: H813 = 2802 PZD2 H814 = 2803 PZD3 H815 = 2805 PZD5 H816 = 2806 PZD6 IF_COM.Sollwert_W2.X, _W3.X, _W5.X, _W6.X	Type: I Chart: 410, 5
H817 S.setp. I_R CB	Selects the source, which is to be converted from integer to floating-point. IF_COM.Sollw_IR.X	Value: 2807 Type: I Chart: 410, 1
H818 Setp. I_R CB	Result of the conversion from integer to floating-point (refer to H817). IF_COM.Sollw_IR.Y	Type: R Chart: 410, 2
H819 ... H820 S.DW high CB ... S.DW low CB	Selects from high and low word, a double word (format N4), which is to be converted into the floating-point-format. Normalization using H841. Factory setting: H819 = 2809 PZD9 IF_COM.Sollw_DW.XWH H820 = 2810 PZD10 IF_COM.Sollw_DW.XWL	Type: I Chart: 410, 4
H821 CB setp. DW	Result of the N4 to floating-point conversion (refer to H818, H819, H841). IF_COM.Sollw_N4.Y	Type: R Chart: 410, 7
H822 ... H825 S.actval_1 CB ... S.actval_4 CB	Selects from 4 sources, which are output at the communications interface as actual values. They are converted from the floating-point format into the N2 format. Factory setting: H822 = 3446 Output, multiplexer MuxWord2 CB H823 = 3447 Output, multiplexer MuxWord3 CB H824 = 3448 Output, multiplexer MuxWord5 CB H825 = 3449 Output, multiplexer MuxWord6 CB IF_COM.Istwert_W2.X, _W3.X, _W5.X, _W6.X	Type: I Chart: 440, 1
H826 S.actval R_I CB	Selects the source, which should be converted from floating-point to integer. IF_COM.Ist_RI.X	Value: 3000 Type: I Chart: 440, 6
H828 S.actval_5 CB	Selects the source, which should be converted from floating-point to double word. IF_COM.Ist_R_N4.X	Value: 3000 Type: I Chart: 440, 1

Parameter	Description	Data
H829 Actval5 CB norm.	Normalization for H828. For H829 = 1.0, the input value is emulated as 1.0 for 100% in the N4 format. IF_COM.Ist_R_N4.NF	Value: 1.0 Type: R Chart: 440, 2
H831 ... H840 S.PZD1 CB ... S.PZD10 CB	Selects from 10 sources for output as PZD via the communications interface. The source must be a word or integer type. Only as many PZD are transferred as the selected PPO type makes provision for! Factory setting: H831 = 2442 Multiplexer *Mux Word1 CB* (chart 560) H832 = 2822 Actual value1 CB H833 = 2823 Actual value2 CB H834 = 2444 Multiplexer *Mux Word4 CB* (chart 560) H835 = 2824 Actual value3 CB H836 = 2825 Actual value4 CB H837 = 2827 Actual value R_I CB H838 = 2000 Constant 0 H839 = 2828 Actual value5 high CB H840 = 2829 Actual value5 low CB IF_COM.Sammeln.X1 ... X8 IF_COM.Sammeln2.X1 ... X2	Type: I Chart: 410, 5
H841 CB DW norm.	Normalization factor for the N4 to floating-point conversion (refer to H818, H819, H821). For H841, 100% (16#40000000) is converted into 1.0. IF_COM.Sollw_N4.NF	Value: 1.0 Type: R Chart: 410, 6
H900 ... H913 S.F125 ... S.F131 S.A106 ... S.A112	Sources for optional digital quantities, which should initiate a fault or alarm in the basic drive. Source Fault — Source Alarm H900 F125 — H907 A106 H901 F126 — H908 A107 H902 F127 — H909 A108 H903 F128 — H910 A109 H904 F129 — H911 A110 H905 F130 — H912 A111 H906 F131 — H913 A112 CONTR.Fehlerzustand.I10 ... I16 CONTR.Warnzustand.I10 ... I16	Type: I Chart: 160, 1 160, 4
d921 ... d930 PZD1 CB out ... PZD10 CB out	Actual value which should output up to 10 process data via the communications module. IF_COM.Sammeln.Y1 ... Y8 IF_COM.Sammeln2.Y1 ... Y2	Type: W Chart: 440, 6
H960 ... H965 Constant I1 ... Constant I6	6 fixed values, integer type (16 bit, signed) Constant.INT_Const.X1 ... X6	Value: 0 Type: I Chart: 30,6
H971 ... H974 Constant W1 ... Constant W4	4 fixed value, word type (16 bit) Constant.WORD_Const.X1 ... X4	Value: 16#0000 Type: W Chart: 30,6
H981 ... H984 Constant DI1 ... Constant DI4	4 fixed values, double word type (32 bit signed). Constant.DINT_Const.X3 ... X6	Value: 0 Type: DI Chart: 30,8
H990 ... H997 Constant R1 ... Constant R8	8 fixed values, floating-point type. Constant.Const_Float.X1 ... X8	Value: 0.0 Type: R Chart: 30,5
d998, d999 SIMADYN D, SIMOVIS SW ID	Identification parameters for SIMOVIS to identify the standard software package. Constant.SIMADYN_D.Y	Chart: 40,3
L028 ... L031 S.Display R1 ... S.Display R4	Four sources for display parameters, REAL type (floating-point) to display connectors without their own display parameters. The display is realized using parameters d028 ... d031. Free_FBs.Display_R.X1 ... Free_FBs.Display_R.X4	Type: I Chart: 470, 7

Parameter	Description	Data
L032 ... L035 S.Display B1 ... S.Display B4	Four sources for display parameters, BOOL type to display connectors without their own display parameters. The display is realized using parameters d032 ... d035. Free_FBs.Display_BO.I1 ... Free_FBs.Display_BO.I4	Type: BO Chart: 470, 7
L036, L037 S.Display I1, S.Display I2	Two sources for display parameters, type integer (16 bit) to display connectors without their own display parameters. The display is realized using parameters d036 and d037. Free_FBs.Display_I.X1, Free_FBs.Display_I.X2	Type: BO Chart: 470, 7
L038, L039 S.Display W1, S.Display W2	Two sources for display parameters, type word (16 bit) to display connectors without their own display parameters. The display is realized using parameters d038 and d039. Free_FBs.Display_W.X1, Free_FBs.Display_W.X2	Type: BO Chart: 470, 7
L098	Enables position sensing via pulse encoder (NAVS). Reset required after value change!	Value ! Type BO Chart 60, 5
L099	Enables position sensing via absolute value encoder (AENC). Reset required after value change!	Value 0 Type BO Chart 60, 7
L100 – L302	Differential position sensing with absolute value encoder: Setting parameters for the absolute value encoder and diagnostic parameters. Detailed description, refer to Section 3.2.3.	
L400	Length buffer Length of Trace-buffer (in double words) for offline-trace with “symTrace-D7” TRACE.Trace_Kopplung.TBL	Value: 2048 Min. 0 Max. 256000 Type I
c401	Coupling Trace 0: No interconnection to the trace blocks 1: Interconnection to the trace blocks is activ. TRACE.Trace_Kopplung.QTS	Typ: B
c402	Status Trace Status-word of trace. Description in “symTrace-D7” (Help-> Help subjects->Function blocks error messages) TRACE.Trace_Kopplung.YTS	Typ: W
L605 S.DW_W1	Sources for a double word quantity, which should be split-up into two words. Free_FBs.DW_W1.X	Value 5000 Type I Chart 490, 4
L606, L607 S.ADDI_1 X1 S.ADDI_1 X2	Sources for the summands of the 1st integer adder. Free_FBs.ADDI_1.X1	Value 2000 Type I Chart 470, 1
L608, L609 S.SUBI_1 X1 S.SUBI_1 X2	Sources for the inputs of the 1st integer subtractor. Free_FBs.SUBI_1.X1 ... X2	Value 2000 Type I Chart 470, 1
L646 S.I_R_1	Sources for an integer quantity, which should be converted into floating-point. Free_FBs.I_R1.X	Value 2000 Type I Chart 490, 4
L647 S.R_I1	Sources for a floating-point quantity, which should be converted into integer. Free_FBs.R_I1.X	Value 3000 Type I Chart 490, 4
L698, L699 S.S RS-FlipFlop1 S.R RS-FlipFlop1	Sources for the setting- and reset input of an RS flipflop (R dominant). (free block). Free_FBs.RS_FF2.S ... R	Type I Chart 460, 1

Parameter	Description	Data
L700 ... L702 S.AND1_I1 ... S.AND1_I3	Three sources for the inputs of the 1st free AND block. Free_FBs.AND1.I1 ... I3	Type I Chart 460, 1
L703 ... L705 S.AND2_I1 ... S.AND2_I3	Three sources for the inputs of the 2nd free AND block. Free_FBs.AND2.I1 ... I3	Type I Chart 460, 4
L706 , L707 S.Switch1_0 ... S.Switch1_1	2 sources for the inputs of the 1st free changeover. The output is selected using L708. Free_FBs.Switch1.X1 ... X2	Type I Chart 460, 1
L708 S.Switch1_sel	Source for the signal to a signal. 0: Source(L706) 1: Source(L707) Free_FBs.Switch1.I	Type I Chart 460, 1
L709 S.Edge1	Source for the 1st free edge detecting block. Free_FBs.Edge1.I	Value I Chart 430, 6
L710 ... L712 S.OR1_I1 ... S.OR1_I3	3 sources for the inputs of the 1st free OR block. Free_FBs.OR1.I1 ... I3	Type I Chart 460, 1
L713 ... L715 S.OR2_I1 ... S.OR2_I3	3 sources for the inputs of the 2nd free OR block. Free_FBs.OR2.I1 ... I3	Type I Chart 460, 4
L716 , L717 S.Switch2_0 ... S.Switch2_1	2 sources for the inputs of the 2nd free changeover. The output is selected using L718. Free_FBs.Switch2.X1 ... X2	Type I Chart 460, 4
L718 S.Switch2_sel	Source for the signal to a signal. 0: Source(L716) 1: Source(L717) Free_FBs.Switch2.I	Value 0000 Type I Chart 460, 4
L728 S.OnDelay1	Source for the 1st power-on delay. Free_FBs.OnDelay1.I	Value 0000 Type I Chart 490, 7
L729 T_OnDelay1	1st power-on delay time. Free_FBs.OnDelay1.T	Value 100 ms Type SD Chart 490, 7
L730 S.OffDelay1	Source for the 1st power-off delay time. Free_FBs.OffDelay1.I	Value 0000 Type I Chart 490, 7
L731 T_OffDelay1	1st power-off delay time. Free_FBs.OffDelay1.T	Value 100 ms Type SD Chart 490, 7
L732, L733 S.Not1, S.Not2	Sources for the 2nd logical inverter. Free_FBs.Not1.I ... Not2.I	Type I Chart 460, 7
L734, L735 S.S RS-FlipFlop2 S.R RS-FlipFlop2	Sources for the setting- and reset input of an RS flipflop (R dominant). (free block). Free_FBs.RS_FF1.S ... R	Type I Chart 460, 4
L738 S.set_PT1_zero	Source for the digital signal to set the output of the free lowpass filter to zero. Behavior of the setting function: Setting 0 ➔1: Output is immediately set to zero Setting 1 ➔0: Output goes to the input value corresponding to L741 Free_FBs.FreePT1.S	Value 0000 Type I Chart 480, 1
L739 QualityFact.Filt	Quality of the bandstop filter. Practical values lie in the range 1.0 ... 10.0. Free_FBs.SperrFilt.Q	Value 2.0 Type I Chart 480, 4
L740 S.PT1_input	Source of the input signal for the lowpass 1st order filter (free block). Free_FBs.FreePT1.X	Value 3000 Type I Chart 480, 2

Parameter	Description	Data
L741 Tfilt PT1	Filter time constant of the 1st order lowpass filter. Free_FBs.FreePT1.T	Value 20 ms Type SD Chart 480, 2
L742 S.Band-Stop filt	Source of the input signal for a bandstop filter (free block). Free_FBs.SperrFilt.X	Value 3000 Type I Chart 480, 3
L743 S.FilterFrequenc	Source of the input signal for the bandstop frequency (in Hz) of the bandstop filter. Free_FBs.SperrFilt.FG	Value 3002 Type I Chart 480, 3
L744, L745 S.Compare_X, S.Compare_Y	Sources for the input signals of a comparator. Free_FBs.Compare.X1 ... X2	Type I Chart 480, 6
L746 S.Limit_max	Source for the upper limit of a free limiting block. Free_FBs.Begrenzer.LU	Value 3001 Type I Chart 480, 6
L747 S.Limit_input	Source for the signal to be limited of a free limiting block. Free_FBs.Begrenzer.X	Value 3000 Type I Chart 480, 6
L748 S.Limit_min	Source for the lower limit of a free limiting block. Free_FBs.Begrenzer.LL	Value 3000 Type I Chart 480, 6
L749 S.Compare2	Source for the input signal of a comparator with hysteresis (free block). Free_FBs.Comp2.X	Value 3000 Type I Chart 480, 1
L750 S.Compare2 Range	Source for the range limit of the comparator with hysteresis (free block). Free_FBs.Comp2.L	Value 3001 Type I Chart 480, 1
L751 Compare2 Hyst	Hysteresis of the comparator with hysteresis (free block). Free_FBs.Comp2.HY	Value 0.1 Type I Chart 480, 2
L752 S.Compare2 Mid	Source for the comparator center of range with hysteresis (free block). Free_FBs.Comp2.M	Value 3003 Type I Chart 480, 1
L753 S.Curve_X	Source for the input signal of a characteristic with 2 points. If the signal is less than X1, the output = Y1; if it is greater than X2, the output = Y2. The characteristic is approximately linear between these two points. Free_FBs.Kennlin.X	Value 3000 Type I Chart 480, 1
L754, L755 Curve_X1, Curve_Y1	Value pair for the lefthand characteristic point (lower X coordinate). Free_FBs.Kennlin.A1 ... B1	Value 0.0 Type I Chart 480, 2 – 3
L756, L757 Curve_X2, Curve_Y2	Value pair for the righthand characteristic point (higher X coordinate). Free_FBs.Kennlin.A2 ... B2	Value 1.0 Type I Chart 480, 2 - 3
L760 S.FreeWord	Source for a 16-bit value, which is to be split-up into individual bits (connectors 0760 to 0775) Free_FBs.Free_W_B_1.IS	Value 2000 Type I Chart 490, 1
L761... L763 S.DW_high, S.DW_low, DW norm.	2 sources for a double word, which are to be converted into a floating-point value. L763 is the normalization; i. e. the output value for an input value of 16#40000000. Free_FBs.DW_inp.XWH ... XWL Free_FBs.Free_N4_R.NF	Type I Chart 490, 5 - 7
L764, L765 S.Word Word norm.	Source and normalization for a 16-bit value, which is to be converted into a floating-point value. L765 is the normalization; i. e. the output value for input value 16#4000. Free_FBs.Free_N2_R.X, Free_FBs.Free_N2_R.NF	Type I Chart 490, 4 - 5

Parameter	Description	Data
L766, L767 S.Float Float norm.	Source for a floating-point value, which is to be converted into type N2. L767 is the normalization; i. e. the input value for output = 16#4000. Free_FBs.Float_N2.X, Free_FBs.Float_N2.NF	Type I Chart 490, 6 - 7
L786 ... L788 S.ADD1 X1 ... S.ADD1 X3	Source for the summands of a free adder. Free_FBs.ADD1.X1 ... X3	Value 3000 Type I Chart 470, 3
L789 ... L791 S.ADD2 X1 ... S.ADD2 X3	Source for the summands of a free adder. Free_FBs.ADD2.X1 ... X3	Value 3000 Type I Chart 470, 3
L792 ... L793 S.SUB1 X1 ... S.SUB1 X2	Source for the inputs of a free subtractor (X1 – X2). Free_FBs.SUB1.X1 ... X3	Value 3000 Type I Chart 470, 3
L794 ... L795 S.SUB2 X1 ... S.SUB2 X2	Source for the inputs of a free subtractor (X1 – X2). Free_FBs.SUB2.X1 ... X3	Value 3000 Type I Chart 470, 3
L796 ... L798 S.MUL1 X1 ... S.MUL1 X3	Source for the inputs of a free multiplier. Free_FBs.MUL1.X1 ... X3	Value 3001 Type I Chart 470, 5
L799 ... L801 S.MUL2 X1 ... S.MUL2 X3	Source for the inputs of a free multiplier. Free_FBs.MUL2.X1 ... X3	Value 3001 Type I Chart 470, 5
L802 ... L803 S.DIV1 X1 ... S.DIV1 X2	Source for the inputs of a free divider (X1 / X2). Free_FBs.DIV1.X1 ... X2	Value 3001 Type I Chart 470, 5
L804 ... L805 S.DIV2 X1 ... S.DIV2 X2	Source for the inputs of a free divider (X1 / X2). Free_FBs.DIV2.X1 ... X2	Value 3001 Type I Chart 470, 5
L810 S.Free_W_B_2	Source for free word-to-binary converter. Free_FBs.Free_W_B_2.IS	Value 2000 Type I Chart 490, 1
L812 ... L813 S.DIVI_1 X1 ... S.DIVI_1 X2	Source for the inputs of a free integer divider (X1 / X2). Free_FBs.DIVI_1.X1 ... X2	Value 2001 Type I Chart 470, 1
L814 ... L815 S.MULI_1 X1 ... S.MULI_1 X2	Source for the inputs of a free integer multiplier. Free_FBs.MULI_1.X1 ... X2	Value 2001 Type I Chart 470, 1
L816, L817 S.W_DW1 high S.W_DW1 low	Source for free word-to-double-word converter. Free_FBs.WDW1.XWH ... XWL	Value 2000 Type I Chart 490, 4
L818 S.Integrator X	Source of the input quantity of the freely available integrator. Free_FBs.Integrator.X	Value 3000 Type I Chart 480, 5
L819 Integrator LU	Upper limit value of the freely available integrator Free_FBs.Integrator.LU	Value 1.0 Type R Chart 480, 6
L820 Integrator LL	Lower limit value of the freely available integrator Free_FBs.Integrator.LL	Value -1.0 Type R Chart 480, 6
L821 S.Integrator SV	Source for the setting value of the freely available integrator Free_FBs.Integrator.SV	Value 3000 Type R Chart 480, 5
L822 Integrator T	Integration time constant of the freely available integrator Free_FBs.Integrator.TI	Value 1000 ms Type SD Chart 480, 6

Parameter	Description	Data
L823 S.Integrator set	Source for the setting signal of the freely available integrator. Free_FBs.Integrator.S	Value 0000 Type I Chart 480, 5
L824 , L825 S.Switch3_0 ... S.Switch3_1	2 sources for the inputs of the 3rd free changeover switch. The output is selected using L826. Free_FBs.Switch3.X1 ... X2	Type I Chart 460, 5
L826 S.Switch3_sel	Source for the signal to a signal. 0: Source(L824) 1: Source(L825) Free_FBs.Switch3.I	Value 0000 Type I Chart 460, 5
L827, L828 S.Switch4_0 ... S.Switch4_1	2 sources for the inputs of the 4th free changeover switch. The output is selected using L829. Free_FBs.Switch4.X1 ... X2	Type I Chart 460, 7
L829 S.Switch4_sel	Source for the signal to a signal. 0: Source(L827) 1: Source(L828) Free_FBs.Switch4.I	Value 0000 Type I Chart 460, 7
L830 ... .L832 S.AND_OR1_1 ... S.AND_OR1_3	Sources of the 1st AND-OR logic in Chart 425. Output is B1830. Free_FBs.andOR1.I1 Free_FBs.ANDor1.I1 ... I2	Type I Chart 460, 6
L833 ... .L835 S.AND_OR2_1 ... S.AND_OR2_3	Sources of the 2nd AND-OR logic in Chart 425. Output is B1833. Free_FBs.andOR2.I1 Free_FBs.ANDor2.I1 ... I2	Type I Chart 460, 6

4.3 Connector list

TC	Chart	Path Name	Significance
0000	30,2	Constant.FALSE.Q	BOOL constant FALSE
0001	30,2	Constant.TRUE.Q	BOOL constant TRUE
0003	160,7	CONTR.ErrorMask.Q	Fault
0004	160,8	CONTR.WarnMaske.Q	Alarm
0005	160,7	CONTR.Stoerung.Q	No fault
0020	60,8	CONTR.ErrorNAVSslave.Q	Error, speed sensing slave
0021	70,7	CONTR.ErrorNAVSMaster.Q	Error, speed sensing master
0097	90,3	CONTR.Zus_Lage-RS.Q	Position reset
0098	90,3	CONTR.OR_Sync.Q	Synchronizing command
0100	90,7	CONTR.SyncFlipFlop.QN	Automatic start synchronization, inverse
0101	90,7	CONTR.SyncFlipFlop.Q	Automatic start synchronization
0102	100.7	SYNCO2.CmpSynchr.QU	Displacement > synchronism threshold (H103)
0103	100.7	SYNCO2.CmpSynchr.QM	Displacement within threshold range
0104	100.7	SYNCO2.CmpSynchr.QL	Displacement < synchronism threshold (H103) (negative)
0105	100,8	SYNCO2.DisplValid.Q	Synchronism reached
0106	100,8	SYNCO2.Displace.DC	Displacement determined
0108	90,7	CONTR.Lage_RS.Q	Angular controller inhibit
0109	90,7	CONTR.WR-Freigabe.Q	Status of the angular controller enable
0110	100,3	SYNCO1.SignNmaster.QU	n_slave > 0
0111	100,3	SYNCO1.SignNmaster.QE	n_slave = 0
0112	100,3	SYNCO1.SignNmaster.QL	n_slave < 0
0113	100,3	SYNCO1.SignNslave.QU	n_master > 0
0114	100,3	SYNCO1.SignNslave.QE	n_master = 0
0115	100,3	SYNCO1.SignNslave.QL	n_master < 0
0116	110,7	SYNCO2.AngleLimit.Q	Angular controller at its limit
0134	120,8	SYNCO2.SpeedCtrlLimit.Q	Speed controller at its limit
0140	120,5	CONTR.SCONI.Q	Speed controller enable
0148	70,7	SYNCO2.Master.SS	Position master drive set when synchronized
0149	70,7	CONTR.Puls_SS_Master.Q	Pulse extension, position master set when synchronized
0150	60,7	SYNCO2.Slave.SS	Slave position set when synchronized
0152	60,4	SYNCO2.CmpSPslave.QL	Position, slave < 0
0153	60,4	SYNCO2.CmpSPslave.QE	0 < slave position < threshold
0154	60,4	SYNCO2.CmpSPslave.QU	Slave position > threshold (H105)
0160	75,6	SYNCO2.dnErrSlave.Q	Speed deviation, slave
0161	75,6	SYNCO2.dnError.Q	Speed deviation
0162	75,6	SYNCO2.dnErrMaster.Q	Speed deviation, master
0170	520,2	MUX_B.MUX_VersatzReset.Q	Output, multiplexer displacement reset
0171	520,4	MUX_B.MUX_TippFreigabe.Q	Output, multiplexer jog enable
0172	520,5	MUX_B.MUX_WReglerFreig.Q	Output, multiplexer angular controller enable
0173	520,7	MUX_B.MUX_LageReset.Q	Output, multiplexer reset position
0174	520,8	MUX_B.MUX_SyncSignal.Q	Output, multiplexer synchronizing command
0175	60,2	CONTR.Steuerbits.Q4	Reset position difference
0176	115,3	CONTR.Steuerbits.Q7	Jog enable
0177	90,6	CONTR.Steuerbits.Q1	Inverter enable
0179	90,2	CONTR.Steuerbits.Q2	Sync command
0186	60,2	SYNCO2.Pos_Slave_Abs.SN	Slave position negative
0188	70,3	SYNCO2.CmpSPmaster.QL	Position master < 0
0189	70,3	SYNCO2.CmpSPmaster.QE	0 < position master threshold (H107)
0190	70,3	SYNCO2.CmpSPmaster.QU	Position master > threshold (H107)
0192	75,4	SYNCO2.CMP_nSlave.QU	nslave > range
0193	75,5	SYNCO2.CMP_nSlave.QM	Slave speed within the permissible range
0194	75,4	SYNCO2.CMP_nSlave.QL	nslave < range
0195	75,4	SYNCO2.CMP_nMaster.QU	nmaster > range

TC	Chart	Path Name	Significance
0196	75,5	SYNCO2.CMP_nMaster.QM	Master speed in the permissible range
0197	75,4	SYNCO2.CMP_nMaster.QL	nmaster < range
0199	70,8	SYNCO2.Pos_Master_Abs.SN	Position master negative
0209	60,7	CONTR.Puls_SS_Slave.Q	Extended pulse, slave position set when synchronized
0211	72,2	IN_AENC.S_AENC.QF	Fault word of the absolute value encoder sensing, slave
0212	72,2	IN_AENC.M_AENC.QF	Fault word of the absolute value encoder sensing, master
0300	310,4	IF_Peer.Steuerwort1.Q1	Peer CTW.0
0301	310,4	IF_Peer.Steuerwort1.Q2	Peer CTW.1
0302	310,4	IF_Peer.Steuerwort1.Q3	Peer CTW.2
0303	310,4	IF_Peer.Steuerwort1.Q4	Peer CTW.3
0304	310,4	IF_Peer.Steuerwort1.Q5	Peer CTW.4
0305	310,4	IF_Peer.Steuerwort1.Q6	Peer CTW.5
0306	310,4	IF_Peer.Steuerwort1.Q7	Peer CTW.6
0307	310,4	IF_Peer.Steuerwort1.Q8	Peer CTW.7
0308	310,4	IF_Peer.Steuerwort1.Q9	Peer CTW.8
0309	310,4	IF_Peer.Steuerwort1.Q10	Peer CTW.9
0310	310,4	IF_Peer.Steuerwort1.Q11	Peer CTW.10
0311	310,4	IF_Peer.Steuerwort1.Q12	Peer CTW.11
0312	310,4	IF_Peer.Steuerwort1.Q13	Peer CTW.12
0313	310,4	IF_Peer.Steuerwort1.Q14	Peer CTW.13
0314	310,4	IF_Peer.Steuerwort1.Q15	Peer CTW.14
0315	310,4	IF_Peer.Steuerwort1.Q16	Peer CTW.15
0320	310,4	IF_Peer.invSteuerwort.Q1	Peer CTW.0 inverse
0321	310,4	IF_Peer.invSteuerwort.Q2	Peer CTW.1 inverse
0322	310,4	IF_Peer.invSteuerwort.Q3	Peer CTW.2 inverse
0323	310,4	IF_Peer.invSteuerwort.Q4	Peer CTW.3 inverse
0324	310,4	IF_Peer.invSteuerwort.Q5	Peer CTW.4 inverse
0325	310,4	IF_Peer.invSteuerwort.Q6	Peer CTW.5 inverse
0326	310,4	IF_Peer.invSteuerwort.Q7	Peer CTW.6 inverse
0327	310,4	IF_Peer.invSteuerwort.Q8	Peer CTW.7 inverse
0328	310,4	IF_Peer.invSteuerwort.Q9	Peer CTW.8 inverse
0329	310,4	IF_Peer.invSteuerwort.Q10	Peer CTW.9 inverse
0330	310,4	IF_Peer.invSteuerwort.Q11	Peer CTW.10 inverse
0331	310,4	IF_Peer.invSteuerwort.Q12	Peer CTW.11 inverse
0332	310,4	IF_Peer.invSteuerwort.Q13	Peer CTW.12 inverse
0333	310,4	IF_Peer.invSteuerwort.Q14	Peer CTW.13 inverse
0334	310,4	IF_Peer.invSteuerwort.Q15	Peer CTW.14 inverse
0335	310,4	IF_Peer.invSteuerwort.Q16	Peer CTW.15 inverse
0360	300,7	IF_Peer.Timeout_Peer.Q	Timeout peer
0361	300,4	IF_Peer.Empf_PEER.QTS	Peer receive initialized
0362	300,4	IF_Peer.Send_PEER.QTS	Peer send initialized
0400	400,4	IF_COM.Empf-COM.QTS	CB receive initialized
0401	400,4	IF_COM.E_init_inv.Q	CB receive not initialized
0402	400,4	IF_COM.Send_COM.QTS	CB send initialized
0403	400,4	IF_COM.S_init_inv.Q	CB send not initialized
0405	400,7	IF_COM.Timeout_CB.Q	Timeout CB
0480	180,8	IF_CU.Zustand2CU.Q1	CU status2.0
0481	180,8	IF_CU.Zustand2CU.Q2	CU status2.1
0482	180,8	IF_CU.Zustand2CU.Q3	CU status2.2
0483	180,8	IF_CU.Zustand2CU.Q4	CU status2.3
0484	180,8	IF_CU.Zustand2CU.Q5	CU status2.4
0485	180,8	IF_CU.Zustand2CU.Q6	CU status2.5
0486	180,8	IF_CU.Zustand2CU.Q7	CU status2.6
0487	180,8	IF_CU.Zustand2CU.Q8	CU status2.7
0488	180,8	IF_CU.Zustand2CU.Q9	CU status2.8

TC	Chart	Path Name	Significance
0489	180,8	IF_CU.Zustand2CU.Q10	CU status2.9
0490	180,8	IF_CU.Zustand2CU.Q11	CU status2.10
0491	180,8	IF_CU.Zustand2CU.Q12	CU status2.11
0492	180,8	IF_CU.Zustand2CU.Q13	CU status2.12
0493	180,8	IF_CU.Zustand2CU.Q14	CU status2.13
0494	180,8	IF_CU.Zustand2CU.Q15	CU status2.14
0495	180,8	IF_CU.Zustand2CU.Q16	CU status2.15
0500	150,5	IF_CU.Empf_BASE.QTS	CU receive initialized
0501	150,5	IF_CU.Send_BASE.QTS	CU send initialized
0502	150,5	IF_CU.Empf_BASE.QT	CU timeout
0503	150,5	IF_CU.DRIVE.BS	CU in operation
0504	150,5	IF_CU.CU_Einit_inv.Q	CU receive not initialized
0505	150,5	IF_CU.CU_Sinit_inv.Q	CU send not initialized
0506	150,5	IF_CU.CU_Timeout_inv.Q	CU no timeout
0507	150,5	IF_CU.CU_RDY_INV.Q	CU not operational
0510	180,4	IF_CU.Zustandswort1.Q1	CU status1.0
0511	180,4	IF_CU.Zustandswort1.Q2	CU status1.1
0512	180,4	IF_CU.Zustandswort1.Q3	CU status1.2
0513	180,4	IF_CU.Zustandswort1.Q4	CU status1.3
0514	180,4	IF_CU.Zustandswort1.Q5	CU status1.4
0515	180,4	IF_CU.Zustandswort1.Q6	CU status1.5
0516	180,4	IF_CU.Zustandswort1.Q7	CU status1.6
0517	180,4	IF_CU.Zustandswort1.Q8	CU status1.7
0518	180,4	IF_CU.Zustandswort1.Q9	CU status1.8
0519	180,4	IF_CU.Zustandswort1.Q10	CU status1.9
0520	180,4	IF_CU.Zustandswort1.Q11	CU status1.10
0521	180,4	IF_CU.Zustandswort1.Q12	CU status1.11
0522	180,4	IF_CU.Zustandswort1.Q13	CU status1.12
0523	180,4	IF_CU.Zustandswort1.Q14	CU status1.13
0524	180,4	IF_CU.Zustandswort1.Q15	CU status1.14
0525	180,4	IF_CU.Zustandswort1.Q16	CU status1.15
0526	220,3	IF_CU.Q_ext_Error.Q	External fault in control word for CU
0530	180,4	IF_CU.Zustand1_inv.Q1	CU status1.0 inverse
0531	180,4	IF_CU.Zustand1_inv.Q2	CU status1.1 inverse
0532	180,4	IF_CU.Zustand1_inv.Q3	CU status1.2 inverse
0533	180,4	IF_CU.Zustand1_inv.Q4	CU status1.3 inverse
0534	180,4	IF_CU.Zustand1_inv.Q5	CU status1.4 inverse
0535	180,4	IF_CU.Zustand1_inv.Q6	CU status1.5 inverse
0536	180,4	IF_CU.Zustand1_inv.Q7	CU status1.6 inverse
0537	180,4	IF_CU.Zustand1_inv.Q8	CU status1.7 inverse
0538	180,4	IF_CU.Zustand1_inv.Q9	CU status1.8 inverse
0539	180,4	IF_CU.Zustand1_inv.Q10	CU status1.9 inverse
0540	180,4	IF_CU.Zustand1_inv.Q11	CU status1.10 inverse
0541	180,4	IF_CU.Zustand1_inv.Q12	CU status1.11 inverse
0542	180,4	IF_CU.Zustand1_inv.Q13	CU status1.12 inverse
0543	180,4	IF_CU.Zustand1_inv.Q14	CU status1.13 inverse
0544	180,4	IF_CU.Zustand1_inv.Q15	CU status1.14 inverse
0545	180,4	IF_CU.Zustand1_inv.Q16	CU status1.15 inverse
0546	90,8	IF_CU.n-Reg Freigabe.Q	Speed controller CU; enabling the speed controller in the basic drive
0547	560,4	MUX_CU.Mux_Enable_nRegl.Q	Output, multiplexer speed controller enable for the basic drive
0550	180,7	IF_CU.SteuerwortSPA440.Q1	CTW from CU.0
0551	180,7	IF_CU.SteuerwortSPA440.Q2	CTW from CU.1
0552	180,7	IF_CU.SteuerwortSPA440.Q3	CTW from CU.2
0553	180,7	IF_CU.SteuerwortSPA440.Q4	CTW from CU.3

TC	Chart	Path Name	Significance
0554	180,7	IF_CU.SteuerwortSPA440.Q5	CTW from CU.4
0555	180,7	IF_CU.SteuerwortSPA440.Q6	CTW from CU.5
0556	180,7	IF_CU.SteuerwortSPA440.Q7	CTW from CU.6
0557	180,7	IF_CU.SteuerwortSPA440.Q8	CTW from CU.7
0558	180,7	IF_CU.SteuerwortSPA440.Q9	CTW from CU.8
0559	180,7	IF_CU.SteuerwortSPA440.Q10	CTW from CU.9
0560	180,7	IF_CU.SteuerwortSPA440.Q11	CTW from CU.10
0561	180,7	IF_CU.SteuerwortSPA440.Q12	CTW from CU.11
0562	180,7	IF_CU.SteuerwortSPA440.Q13	CTW from CU.12
0563	180,7	IF_CU.SteuerwortSPA440.Q14	CTW from CU.13
0564	180,7	IF_CU.SteuerwortSPA440.Q15	CTW from CU.14
0565	180,7	IF_CU.SteuerwortSPA440.Q16	CTW from CU.15
0570	180,7	IF_CU.STWSPAibit.Q1	CTW from CU.0 inverse
0571	180,7	IF_CU.STWSPAibit.Q2	CTW from CU.1 inverse
0572	180,7	IF_CU.STWSPAibit.Q3	CTW from CU.2 inverse
0573	180,7	IF_CU.STWSPAibit.Q4	CTW from CU.3 inverse
0574	180,7	IF_CU.STWSPAibit.Q5	CTW from CU.4 inverse
0575	180,7	IF_CU.STWSPAibit.Q6	CTW from CU.5 inverse
0576	180,7	IF_CU.STWSPAibit.Q7	CTW from CU.6 inverse
0577	180,7	IF_CU.STWSPAibit.Q8	CTW from CU.7 inverse
0578	180,7	IF_CU.STWSPAibit.Q9	CTW from CU.8 inverse
0579	180,7	IF_CU.STWSPAibit.Q10	CTW from CU.9 inverse
0580	180,7	IF_CU.STWSPAibit.Q11	CTW from CU.10 inverse
0581	180,7	IF_CU.STWSPAibit.Q12	CTW from CU.11 inverse
0582	180,7	IF_CU.STWSPAibit.Q13	CTW from CU.12 inverse
0583	180,7	IF_CU.STWSPAibit.Q14	CTW from CU.13 inverse
0584	180,7	IF_CU.STWSPAibit.Q15	CTW from CU.14 inverse
0585	180,7	IF_CU.STWSPAibit.Q16	CTW from CU.15 inverse
0601	53,4	T400_EA.BinOut.Q1	Terminal 46
0602	53,4	T400_EA.BinOut.Q2	Terminal 47
0603	53,8	T400_EA.BinOut.Q3	Terminal 48
0604	53,8	T400_EA.BinOut.Q4	Terminal 49
0607	52,8	T400_EA.BinOut.Q7	Coarse pulse 1 (terminal 84)
0608	52,8	T400_EA.BinOut.Q8	Coarse pulse 2 (terminal 65)
0610	52,4	T400_EA.BinInput.Q1	BinInput 1 (terminal 53)
0611	52,4	T400_EA.BinInput.Q2	BinInput 2 (terminal 54)
0612	52,4	T400_EA.BinInput.Q3	BinInput 3 (terminal 55)
0613	52,4	T400_EA.BinInput.Q4	BinInput 4 (terminal 56)
0614	52,4	T400_EA.BinInput.Q5	BinInput 5 (terminal 57)
0615	52,4	T400_EA.BinInput.Q6	BinInput 6 (terminal 58)
0616	52,4	T400_EA.BinInput.Q7	BinInput 7 (terminal 59)
0617	52,4	T400_EA.BinInput.Q8	BinInput 8 (terminal 60)
0620	52,4	T400_EA.BinInput.Q9	BinInput 1 (terminal 53) inverse
0621	52,4	T400_EA.BinInput.Q10	BinInput 2 (terminal 54) inverse
0622	52,4	T400_EA.BinInput.Q11	BinInput 3 (terminal 55) inverse
0623	52,4	T400_EA.BinInput.Q12	BinInput 4 (terminal 56) inverse
0624	52,4	T400_EA.BinInput.Q13	BinInput 5 (terminal 57) inverse
0625	52,4	T400_EA.BinInput.Q14	BinInput 6 (terminal 58) inverse
0626	52,4	T400_EA.BinInput.Q15	BinInput 7 (terminal 59) inverse
0627	52,4	T400_EA.BinInput.Q16	BinInput 8 (terminal 60) inverse
0631	53,4	T400_EA.Klemme46inv.Q	Terminal 46 inverse
0632	53,4	T400_EA.Klemme47inv.Q	Terminal 47 inverse
0633	53,8	T400_EA.Klemme48inv.Q	Terminal 48 inverse
0634	53,8	T400_EA.Klemme49inv.Q	Terminal 49 inverse
0635	52,8	T400_EA.Klemme84inv.Q	Coarse pulse 1 (terminal 84) inverse

TC	Chart	Path Name	Significance
0636	52,8	T400_EA.Klemme65inv.Q	Coarse pulse 2 (terminal 65) inverse
0650	530,3	MUX_CU.Mux_STW1_B0.Q	Output multiplexer, control word1 bit 0
0651	530,3	MUX_CU.Mux_STW1_B1.Q	Output multiplexer, control word1 bit1
0652	530,3	MUX_CU.Mux_STW1_B2.Q	Output multiplexer, control word1 bit2
0653	530,3	MUX_CU.Mux_STW1_B3.Q	Output multiplexer, control word1 bit3
0654	530,7	MUX_CU.Mux_STW1_B4.Q	Output multiplexer, control word1 bit4
0655	530,7	MUX_CU.Mux_STW1_B5.Q	Output multiplexer, control word1 bit5
0656	530,7	MUX_CU.Mux_STW1_B6.Q	Output multiplexer, control word1 bit6
0657	530,7	MUX_CU.Mux_STW1_B7.Q	Output multiplexer, control word1 bit7
0658	540,3	MUX_CU.Mux_STW1_B8.Q	Output multiplexer, control word1 bit8
0659	540,3	MUX_CU.Mux_STW1_B9.Q	Output multiplexer, control word1 bit9
0660	540,3	MUX_CU.Mux_STW1_B10.Q	Output multiplexer, control word1 bit10
0661	540,3	MUX_CU.Mux_STW1_B11.Q	Output multiplexer, control word1 bit11
0662	540,7	MUX_CU.Mux_STW1_B12.Q	Output multiplexer, control word1 bit12
0663	540,7	MUX_CU.Mux_STW1_B13.Q	Output multiplexer ,control word1 bit13
0664	540,7	MUX_CU.Mux_STW1_B14.Q	Output multiplexer, control word1 bit14
0665	540,7	MUX_CU.Mux_STW1_B15.Q	Output multiplexer, control word1 bit15
0698	460,2	Free_FBs.RS_FF2.Q	RSFF1_Q (output, free RS flipflop)
0699	460,2	Free_FBs.RS_FF2.QN	RSFF1_QN (inv. output free RS flipflop)
0700	460,2	Free_FBs.AND1.Q	AND1_Q (output, free AND logic gate)
0703	460,5	Free_FBs.AND2.Q	AND2_Q (output, free AND logic gate)
0708	490,8	Free_FBs.Edge1.QN	Edge detector: falling edge identified
0709	490,8	Free_FBs.Edge1.QP	Edge detector: rising edge identified
0710	460,2	Free_FBs.OR1.Q	Q_OR1 (output, free OR logic gate)
0713	460,5	Free_FBs.OR2.Q	Q_OR2 (output, free OR logic gate)
0728	490,8	Free_FBs.OnDelay1.Q	Output, power-on delay
0730	490,8	Free_FBs.OffDelay1.Q	Output, power-off delay
0732	460,8	Free_FBs.Not1.Q	Not1_Q (output, free inverter)
0733	460,8	Free_FBs.Not2.Q	Not2_Q (output, free inverter)
0734	460,5	Free_FBs.RS_FF1.Q	RSFF2_Q (output, free RS flipflop)
0735	460,5	Free_FBs.RS_FF1.QN	RSFF2_QN (inv. output free RS flipflop)
0743	480,8	Free_FBs.Compare.QE	Output, free comparator: X = Y
0744	480,8	Free_FBs.Compare.QU	Output, free comparator: X > Y
0745	480,8	Free_FBs.Compare.QL	Output, free comparator: X < Y
0746	480,8	Free_FBs.Begrenzer.QU	Output, free limiter: upper limit reached
0748	480,8	Free_FBs.Begrenzer.QL	Output, free limiter: lower limit reached
0749	480,3	Free_FBs.Comp2.QU	Output, free comparator: input quantity > range
0750	480,3	Free_FBs.Comp2.QM	Output, free comparator: input quantity in range
0751	480,3	Free_FBs.Comp2.QL	Output, free comparator: input quantity < range
0760	490,2	Free_FBs.Free_W_B_1.Q1	FreeWord_0
0761	490,2	Free_FBs.Free_W_B_1.Q2	FreeWord_1
0762	490,2	Free_FBs.Free_W_B_1.Q3	FreeWord_2
0763	490,2	Free_FBs.Free_W_B_1.Q4	FreeWord_3
0764	490,2	Free_FBs.Free_W_B_1.Q5	FreeWord_4
0765	490,2	Free_FBs.Free_W_B_1.Q6	FreeWord_5
0766	490,2	Free_FBs.Free_W_B_1.Q7	FreeWord_6
0767	490,2	Free_FBs.Free_W_B_1.Q8	FreeWord_7
0768	490,2	Free_FBs.Free_W_B_1.Q9	FreeWord_8
0769	490,2	Free_FBs.Free_W_B_1.Q10	FreeWord_9
0770	490,2	Free_FBs.Free_W_B_1.Q11	FreeWord_10
0771	490,2	Free_FBs.Free_W_B_1.Q12	FreeWord_11
0772	490,2	Free_FBs.Free_W_B_1.Q13	FreeWord_12
0773	490,2	Free_FBs.Free_W_B_1.Q14	FreeWord_13
0774	490,2	Free_FBs.Free_W_B_1.Q15	FreeWord_14
0775	490,2	Free_FBs.Free_W_B_1.Q16	FreeWord_15

TC	Chart	Path Name	Significance
0800	420,3	IF_COM.Steuerwort1.Q1	CB control W1.0
0801	420,3	IF_COM.Steuerwort1.Q2	CB control W1.1
0802	420,3	IF_COM.Steuerwort1.Q3	CB control W1.2
0803	420,3	IF_COM.Steuerwort1.Q4	CB control W1.3
0804	420,3	IF_COM.Steuerwort1.Q5	CB control W1.4
0805	420,3	IF_COM.Steuerwort1.Q6	CB control W1.5
0806	420,3	IF_COM.Steuerwort1.Q7	CB control W1.6
0807	420,3	IF_COM.Steuerwort1.Q8	CB control W1.7
0808	420,3	IF_COM.Steuerwort1.Q9	CB control W1.8
0809	420,3	IF_COM.Steuerwort1.Q10	CB control W1.9
0810	420,3	IF_COM.Steuerwort1.Q11	CB control W1.10
0811	420,3	IF_COM.Steuerwort1.Q12	CB control W1.11
0812	420,3	IF_COM.Steuerwort1.Q13	CB control W1.12
0813	420,3	IF_COM.Steuerwort1.Q14	CB control W1.13
0814	420,3	IF_COM.Steuerwort1.Q15	CB control W1.14
0815	420,3	IF_COM.Steuerwort1.Q16	CB control W1.15
0817	480,7	Free_FBs.Integrator.QU	Free integrator at the upper limit value
0818	480,7	Free_FBs.Integrator.QL	Free integrator at the lower limit value
0820	420,7	IF_COM.Steuerwort2.Q1	CB control W2.0
0821	420,7	IF_COM.Steuerwort2.Q2	CB control W2.1
0822	420,7	IF_COM.Steuerwort2.Q3	CB control W2.2
0823	420,7	IF_COM.Steuerwort2.Q4	CB control W2.3
0824	420,7	IF_COM.Steuerwort2.Q5	CB control W2.4
0825	420,7	IF_COM.Steuerwort2.Q6	CB control W2.5
0826	420,7	IF_COM.Steuerwort2.Q7	CB control W2.6
0827	420,7	IF_COM.Steuerwort2.Q8	CB control W2.7
0828	420,7	IF_COM.Steuerwort2.Q9	CB control W2.8
0829	420,7	IF_COM.Steuerwort2.Q10	CB control W2.9
0830	420,7	IF_COM.Steuerwort2.Q11	CB control W2.10
0831	420,7	IF_COM.Steuerwort2.Q12	CB control W2.11
0832	420,7	IF_COM.Steuerwort2.Q13	CB control W2.12
0833	420,7	IF_COM.Steuerwort2.Q14	CB control W2.13
0834	420,7	IF_COM.Steuerwort2.Q15	CB control W2.14
0835	420,7	IF_COM.Steuerwort2.Q16	CB control W2.15
0840	420,3	IF_COM.STW1_inv.Q1	CB CTW1.0 inverse
0841	420,3	IF_COM.STW1_inv.Q2	CB CTW1.1 inverse
0842	420,3	IF_COM.STW1_inv.Q3	CB CTW1.2 inverse
0843	420,3	IF_COM.STW1_inv.Q4	CB CTW1.3 inverse
0844	420,3	IF_COM.STW1_inv.Q5	CB CTW1.4 inverse
0845	420,3	IF_COM.STW1_inv.Q6	CB CTW1.5 inverse
0846	420,3	IF_COM.STW1_inv.Q7	CB CTW1.6 inverse
0847	420,3	IF_COM.STW1_inv.Q8	CB CTW1.7 inverse
0848	420,3	IF_COM.STW1_inv.Q9	CB CTW1.8 inverse
0849	420,3	IF_COM.STW1_inv.Q10	CB CTW1.9 inverse
0850	420,3	IF_COM.STW1_inv.Q11	CB CTW1.10 inverse
0851	420,3	IF_COM.STW1_inv.Q12	CB CTW1.11 inverse
0852	420,3	IF_COM.STW1_inv.Q13	CB CTW1.12 inverse
0853	420,3	IF_COM.STW1_inv.Q14	CB CTW1.13 inverse
0854	420,3	IF_COM.STW1_inv.Q15	CB CTW1.14 inverse
0855	420,3	IF_COM.STW1_inv.Q16	CB CTW1.15 inverse
0860	420,7	IF_COM.STW2_inv.Q1	CB CTW2.0 inverse
0861	420,7	IF_COM.STW2_inv.Q2	CB CTW2.1 inverse
0862	420,7	IF_COM.STW2_inv.Q3	CB CTW2.2 inverse
0863	420,7	IF_COM.STW2_inv.Q4	CB CTW2.3 inverse
0864	420,7	IF_COM.STW2_inv.Q5	CB CTW2.4 inverse

TC	Chart	Path Name	Significance
0865	420,7	IF_COM.STW2_inv.Q6	CB CTW2.5 inverse
0866	420,7	IF_COM.STW2_inv.Q7	CB CTW2.6 inverse
0867	420,7	IF_COM.STW2_inv.Q8	CB CTW2.7 inverse
0868	420,7	IF_COM.STW2_inv.Q9	CB CTW2.8 inverse
0869	420,7	IF_COM.STW2_inv.Q10	CB CTW2.9 inverse
0870	420,7	IF_COM.STW2_inv.Q11	CB CTW2.10 inverse
0871	420,7	IF_COM.STW2_inv.Q12	CB CTW2.11 inverse
0872	420,7	IF_COM.STW2_inv.Q13	CB CTW2.12 inverse
0873	420,7	IF_COM.STW2_inv.Q14	CB CTW2.13 inverse
0874	420,7	IF_COM.STW2_inv.Q15	CB CTW2.14 inverse
0875	420,7	IF_COM.STW2_inv.Q16	CB CTW2.15 inverse
1810	490,2	Free_FBs.Free_W_B_2.Q1	FreeWord2_0
1811	490,2	Free_FBs.Free_W_B_2.Q2	FreeWord2_1
1812	490,2	Free_FBs.Free_W_B_2.Q3	FreeWord2_2
1813	490,2	Free_FBs.Free_W_B_2.Q4	FreeWord2_3
1814	490,2	Free_FBs.Free_W_B_2.Q5	FreeWord2_4
1815	490,2	Free_FBs.Free_W_B_2.Q6	FreeWord2_5
1816	490,2	Free_FBs.Free_W_B_2.Q7	FreeWord2_6
1817	490,2	Free_FBs.Free_W_B_2.Q8	FreeWord2_7
1818	490,2	Free_FBs.Free_W_B_2.Q9	FreeWord2_8
1819	490,2	Free_FBs.Free_W_B_2.Q10	FreeWord2_9
1820	490,2	Free_FBs.Free_W_B_2.Q11	FreeWord2_10
1821	490,2	Free_FBs.Free_W_B_2.Q12	FreeWord2_11
1822	490,2	Free_FBs.Free_W_B_2.Q13	FreeWord2_12
1823	490,2	Free_FBs.Free_W_B_2.Q14	FreeWord2_13
1824	490,2	Free_FBs.Free_W_B_2.Q15	FreeWord2_14
1825	490,2	Free_FBs.Free_W_B_2.Q16	FreeWord2_15
1830	460,8	Free_FBs.andOR1.Q	AND_OR1 (output, AND-OR logic)
1833	460,8	Free_FBs.andOR2.Q	AND_OR2 (output, AND-OR logic)
2000	30,2	Constant.INT_Const.Y7	Constant, word 0
2001	30,2	Constant.INT_Const.Y8	Constant, word 1
2002	30,2	Constant.WORD_Const.Y5	Constant, word 16#FFFF
2003	160,6	CONTR.ErrorMask.QS	Error status (for the basic drive)
2004	160,8	CONTR.WarnMaske.QS	Alarm status (for the basic drive)
2005	40,7	CONTR.Statuswort.QS	Status word, angular synchronism
2006	160,4	CONTR.Fehlerzustand.QS	Error bits
2007	160,6	CONTR.Warnzustand.QS	Alarm bits
2010	60,4	SYNCO2.SlavePulse.Y	Encoder pulses, slave
2011	70,5	SYNCO2.MasterPulse.Y	Encoder pulses, master
2020	60,7	SYNCO2.Slave.YFC	Error code, slave-speed sensing
2021	70,7	SYNCO2.Master.YFC	Error code, master
2025	52,8	T400_EA.Invert_Bin.QS	Status binary input (binary inputs and inverse values)
2026	220,4	IF_CU.Steuerwort1.QS	Control word1 CU
2027	220,8	IF_CU.Steuerwort2.QS	Control word2 CU
2096	100.8	SYNCO2.Displace.FC	Error identification, displacement calculation
2246	180,2	IF_CU.Q_ZWort1.Y	Status word 1CU
2303	570,3	MUX_Peer.MUX_Peer_W1.Y	Output, multiplexer for 1st PZD send peer-to-peer
2306	570,2	MUX_Peer.Festwert_Peer.Y	Fixed value for PZD1 send peer-to-peer
2327	310,8	IF_Peer.Zustandswort1.QS	Status word, peer
2329	300,7	IF_Peer.Peer_Empf_W1.Y	PZD1 from peer
2330	300,7	IF_Peer.PZD2_PZD3.YWL	PZD2 from peer
2331	300,7	IF_Peer.PZD2_PZD3.YWH	PZD3 from peer
2332	300,7	IF_Peer.PZD4_PZD5.YWL	PZD4 from peer
2333	300,7	IF_Peer.PZD4_PZD5.YWH	PZD5 from peer
2346	310,2	IF_Peer.STW_NOP.Y	Control word peer

TC	Chart	Path Name	Significance
2442	560,4	MUX_CB.MUX_COM_W1.Y	Output, multiplexer word1 CB
2443	560,2	MUX_CB.Festwerte_CB.Y1	Fixed value for CB word 1
2444	560,7	MUX_CB.MUX_COM_W4.Y	Output, multiplexer word4 CB
2445	560,6	MUX_CB.Festwerte_CB.Y2	Fixed value for CB word 4
2460	420,2	IF_COM.Verteil2.Y3	CB CTW1 (control word1 from CB)
2461	420,6	IF_COM.Verteil2.Y4	CB CTW2 (control word2 from CB)
2466	430,4	IF_COM.Zustandswort1.QS	Status word1 CB
2467	430,8	IF_COM.Zustandswort2.QS	Status word2 CB
2500	230,4	IF_CU.Sollwert_W2.Y	Setpoint1 CU N2
2502	230,4	IF_CU.Sollwert_W3.Y	Setpoint2 CU N2
2504	230,4	IF_CU.Sollwert_W5.Y	Setpoint3 CU N2
2506	230,4	IF_CU.Sollwert_W6.Y	Setpoint4 CU N2
2508	230,4	IF_CU.Sollwert_W8.Y	Setpoint5 CU N2
2509	230,5	IF_CU.DW_W_CU.YWL	Setpoint6 low CU
2510	230,5	IF_CU.DW_W_CU.YWH	Setpoint6 high CU
2571	170,7	IF_CU.Verteilung.Y1	PZD1 from CU
2572	170,7	IF_CU.Verteilung.Y2	PZD2 from CU
2573	170,7	IF_CU.Verteilung.Y3	PZD3 from CU
2574	170,7	IF_CU.Verteilung.Y4	PZD4 from CU
2575	170,7	IF_CU.Verteilung.Y5	PZD5 from CU
2576	170,7	IF_CU.Verteilung.Y6	PZD6 from CU
2577	170,7	IF_CU.Verteilung.Y7	PZD7 from CU
2578	170,7	IF_CU.Verteilung.Y8	PZD8 from CU
2579	170,7	IF_CU.VerteilCU_CB.Y1	PZD9 from CU
2580	170,7	IF_CU.VerteilCU_CB.Y2	PZD10 from CU
2581	170,7	IF_CU.VerteilCU_CB.Y3	PZD11 from CU
2582	170,7	IF_CU.VerteilCU_CB.Y4	PZD12 from CU
2583	170,7	IF_CU.VerteilCU_CB.Y5	PZD13 from CU
2584	170,7	IF_CU.VerteilCU_CB.Y6	PZD14 from CU
2605	490,6	Free_FBs.DW_W1.YWH	DW_W1 high (output, double word ⇒ word converter high word)
2606	490,6	Free_FBs.DW_W1.YWL	DW_W1 low (output, double word ⇒ word converter low word)
2607	470,2	Free_FBs.ADDI_1.Y	ADDI_Y (output, free adder type int)
2608	470,2	Free_FBs.SUBI_1.Y	SUBI_Y (output, free subtractor type int)
2647	490,5	Free_FBs.R_I1.Y	R_I1 (output, floating-point ⇒ integer converter)
2706	450,7	IF_USS.USS_Dummy.Y1	PZD1 USS
2707	450,7	IF_USS.USS_Dummy.Y2	PZD2 USS
2766	490,8	Free_FBs.Float_N2.Y	R_N2 (output, floating-point ⇒ N2 converter)
2801	410,7	IF_COM.Verteilung.Y1	PZD1 from CB
2802	410,7	IF_COM.Verteilung.Y2	PZD2 from CB
2803	410,7	IF_COM.Verteilung.Y3	PZD3 from CB
2804	410,7	IF_COM.Verteilung.Y4	PZD4 from CB
2805	410,7	IF_COM.Verteilung.Y5	PZD5 from CB
2806	410,7	IF_COM.Verteilung.Y6	PZD6 from CB
2807	410,7	IF_COM.Verteilung.Y7	PZD7 from CB
2808	410,7	IF_COM.Verteilung.Y8	PZD8 from CB
2809	410,7	IF_COM.Verteil2.Y1	PZD9 from CB
2810	410,7	IF_COM.Verteil2.Y2	PZD10 from CB
2812	470,2	Free_FBs.DIVI_1.Y	DIVI_1 Y (output, free divider type int)
2813	470,2	Free_FBs.DIVI_1.MOD	DIVI_1 (modulo output, free divider type int)
2814	470,2	Free_FBs.MULI_1.Y	MULI_1Y (output, free multiplier type int)
2822	440,3	IF_COM.Istwert_W2.Y	Actual value1 CB
2823	440,3	IF_COM.Istwert_W3.Y	Actual value2 CB
2824	440,3	IF_COM.Istwert_W5.Y	Actual value3 CB
2825	440,3	IF_COM.Istwert_W6.Y	Actual value4 CB
2827	440,7	IF_COM.Ist_RI.Y	Actual value R_I CB

TC	Chart	Path Name	Significance
2828	440,4	IF_COM.Ist_DW_W.YWH	Actual value5 high CB
2829	440,4	IF_COM.Ist_DW_W.YWL	Actual value5 low CB
2960	30,6	Constant.INT_Const.Y1	Fixed value I1 (16 bit, signed)
2961	30,6	Constant.INT_Const.Y2	Fixed value I2
2962	30,6	Constant.INT_Const.Y3	Fixed value I3
2963	30,6	Constant.INT_Const.Y4	Fixed value I4
2964	30,6	Constant.INT_Const.Y5	Fixed value I5
2965	30,6	Constant.INT_Const.Y6	Fixed value I6
2971	30,6	Constant.WORD_Const.Y1	Fixed value W1 (16 bit, unsigned)
2972	30,6	Constant.WORD_Const.Y2	Fixed value W2
2973	30,6	Constant.WORD_Const.Y3	Fixed value W3
2974	30,6	Constant.WORD_Const.Y4	Fixed value W4
3000	30,2	Constant.Float_Const.Y1	Floating-point constant 0.0
3001	30,2	Constant.Float_Const.Y2	Floating-point constant 1.0
3002	30,2	Constant.Float_Const.Y3	Floating-point constant 2.0
3003	30,2	Constant.Float_Const.Y4	Floating-point constant 0.5
3004	30,2	Constant.Float_Const.Y5	Floating-point constant -1.0
3012	60,5	SYNCO2.SlaveNnenn.Y	Rated speed, slave
3013	70,4	SYNCO2.MasterNnenn.Y	Rated speed, master
3014	60,8	SYNCO2.n_Slave.Y	Speed, slave
3015	60,7	SYNCO2.Master.Y	Speed, master
3016	60,8	SYNCO2.Slave.YP	Position, slave
3017	60,8	SYNCO2.Master.YP	Position, master
3018	60,8	SYNCO2.Slave.Y	Speed, slave normalized
3019	60,7	SYNCO2.Master.Y	Speed, master normalized
3040	500,3	MUXsoll.MUX_Uebersetzung.Y	Output multiplexer ratio
3043	30,7	SYNCO1.CONST_UEB.Y1	Fixed value ratio
3044	80,4	SYNCO1.UE4PRO.Y	Ratio with supplementary ratio and relative ratio
3047	80,1	SYNCO1.CONST_UEB.Y3	Fixed value supplementary ratio
3048	500,5	MUXsoll.MUX_RelUebersetz.Y	Output multiplexer relative ratio
3049	30,7	SYNCO1.CONST_UEB.Y2	Fixed value relative ratio
3050	500,4	MUXsoll.MUX_Versatz.Y	Output multiplexer displacement setpoint
3051	110,2	SYNCO2.Q_Versatz.Y	Displacement setpoint before the ramp-function generator
3056	110,4	SYNCO2.HLG_Versatz.Y	Displacement setpoint after the ramp-function generator
3060	80,2	SYNCO1.CONST_UEB.Y4	Value for ratio (without rel. ratio; without supplementary ratio)
3061	80,2	SYNCO1.CONST_UEB.Y5	Value for relative ratio
3062	100,7	SYNCO1.DREFSS.Y	Direction of rotation-dependent displacement
3066	30,7	SYNCO1.FixVersatz.Y	Fixed value displacement
3070	500,8	MUXsoll.MUX_Leitsollwert.Y	Output, multiplexer master setpoint
3073	30,7	SYNCO1.fixLeitsoll.Y	Fixed value, master setpoint
3074	115,7	SYNCO1.SREFSM.Y	Master setpoint, smoothed
3076	115,2	SYNCO1.Leitsollwert.Y	Master setpoint
3080	500,7	MUXsoll.MUX_BAusgleich.Y	Output, multiplexer inertia compensation
3085	120,8	SYNCO1.DT1_BAusgleich.Y	DT1 (n_set)
3091	100,8	SYNCO2.Displace.CVP	Correction pulses (to correct the position difference)
3094	100,8	SYNCO2.Displace.DV	Displacement actual value
3095	100,8	SYNCO2.Displace.DVD	Displacement - position difference
3117	60,8	SYNCO2.Slave.YDP	Inverse position difference
3118	60,8	SYNCO2.YDP_neg.Y	Position difference
3120	110,8	SYNCO2.PT_Angle.Y	Angular controller output
3121	110,5	SYNCO2.AngleControl.YE	System deviation of the angular controller
3122	110,7	SYNCO2.AngleControl.YI	I component of the angular controller
3123	110,4	SYNCO2.AngleKP.Y	KP angular controller
3124	60,8	SYNCO2.LageDifferenz.Y	Position difference smoothed
3129	115,7	SYNCO1.HLG_Speed.Y	speed septpoint after the ramp-function generator

TC	Chart	Path Name	Significance
3130	115,2	CONTR.TIPPEN.Y	Jog setpoint (fixed value)
3136	115,4	SYNCO1.SREFR.Y	Setpoint speed, slave
3137	120,2	SYNCO2.NsollLimit.Y	Speed setpoint limited
3145	120,6	SYNCO2.SpeedControl.YI	Integral component of the speed controller
3146	60,8	SYNCO2.NslaveFilter.Y	Speed, slave smoothed
3150	120,8	SYNCO2.SpeedControl.Y	Speed controller output
3151	120,4	SYNCO2.SpeedControl.YE	Speed controller system deviation
3152	115,8	SYNCO2.SetpSwitch.Y	Setpoint for the basic drive (n_set or Mset)
3153	120,7	SYNCO2.SpeedKP.Y	KP speed controller
3176	115,7	SYNCO1.Tippen-Schalter.Y	Jog setpoint
3186	60,2	SYNCO2.Pos_Slave_Abs.Y	Absolute position actual value of the slave
3199	70,8	SYNCO2.Pos_Master_Abs.Y	Absolute value (position, master)
3223	50,6	T400_EA.AE1_FILT.Y	AE1 smoothed
3225	50,6	T400_EA.AE2_FILT.Y	AE2 smoothed
3227	50,6	T400_EA.AE3_FILT.Y	AE3 smoothed
3229	50,6	T400_EA.AE4_FILT.Y	AE4 smoothed
3234	100,5	SYNCO2.Displ_Ist.Y	Differential position value to determine the displacement
3304	570,6	MUX_Peer.MUX_Peer_W2.Y	Output multiplexer for 1st floating-point value, send peer
3305	570,8	MUX_Peer.MUX_Peer_W3.Y	Output multiplexer for 2nd floating-point value, send peer
3330	300,3	IF_Peer.PZD2_PZD3.YR	Peer float 1 (receive)
3332	300,3	IF_Peer.PZD4_PZD5.YR	Peer float 2 (receive)
3446	550,3	MUX_CB.MUX_CB_W2.Y	Output, multiplexer word2 CB
3447	550,5	MUX_CB.MUX_CB_W3.Y	Output, multiplexer word3 CB
3448	550,6	MUX_CB.MUX_CB_W5.Y	Output, multiplexer word5 CB
3449	550,8	MUX_CB.MUX_CB_W6.Y	Output, multiplexer word6 CB
3450	410,7	IF_COM.Sollwert_W2.Y	Setpoint1 CB
3452	410,7	IF_COM.Sollwert_W3.Y	Setpoint2 CB
3454	410,7	IF_COM.Sollwert_W5.Y	Setpoint3 CB
3456	410,7	IF_COM.Sollwert_W6.Y	Setpoint4 CB
3551	170,7	IF_CU.Istwert_W2.Y	Actual value1 CU
3553	170,7	IF_CU.Istwert_W3.Y	Actual value2 CU
3555	170,7	IF_CU.Istwert_W5.Y	Actual value3 CU
3570	170,7	IF_CU.CU_DI_R.Y	CU DW_R (double word as floating-point value)
3589	170,7	IF_CU.CU_N4_R.Y	CU N4_R (double word in the N4 normalization ⇒ floating-point)
3591	170,7	IF_CU.CU_I_R.Y	CU actual value_I_R
3604	490,5	Free_FBs.I_R1.Y	I_R1 (output, integer ⇒ floating-point converter)
3618	510,4	MUX_AnaOut.MUX_DAC_1.Y	Output, multiplexer DAC1
3619	510,7	MUX_AnaOut.MUX_DAC_2.Y	Output, multiplexer DAC2
3666	51,3	T400_EA.Filt_DAC1.Y	Analog output 1
3667	51,3	T400_EA.Filt_DAC2.Y	Analog output 2
3706	460,2	Free_FBs.Switch1.Y	Switch1 (output, free changeover switch)
3716	460,4	Free_FBs.Switch2.Y	Switch2 (output, free changeover switch)
3740	480,2	Free_FBs.FreePT1.Y	PT1_out (output, free lowpass filter)
3742	480,5	Free_FBs.SperrFilt.Y	Output, bandstop
3747	480,8	Free_FBs.Begrenzer.Y	Output, free limiter
3753	480,3	Free_FBs.Kennlin.Y	Output, free 2-point characteristic
3763	490,7	Free_FBs.Free_N4_R.Y	DW_float (output, double word ⇒ floating-point converter)
3765	490,5	Free_FBs.Free_N2_R.Y	Word_float (output, word ⇒ floating-point converter)
3786	470,4	Free_FBs.ADD1.Y	ADD_1 (output, free adder)
3789	470,4	Free_FBs.ADD2.Y	ADD_2 (output, free adder)
3792	470,2	Free_FBs.SUB1.Y	SUB_1 (output, free subtractor)
3794	470,4	Free_FBs.SUB2.Y	SUB_2 (output, free subtractor)
3796	470,6	Free_FBs.MUL1.Y	MUL_1 (output, free multiplier)
3799	470,6	Free_FBs.MUL2.Y	MUL_2 (output, free multiplier)
3802	470,6	Free_FBs.DIV1.Y	DIV_1 (output, free divider)

TC	Chart	Path Name	Significance
3804	470,6	Free_FBs.DIV2.Y	DIV_2 (output, free divider)
3818	410,7	IF_COM.Sollw_IR.Y	Setpoint I_R CB
3819	480,7	Free_FBs.Integrator.Y	Output, free integrator
3821	410,7	IF_COM.Sollw_N4.Y	Setpoint DW CB
3825	460,6	Free_FBs.Switch3.Y	Switch3 (output, free changeover switch)
3827	460,8	Free_FBs.Switch4.Y	Switch4 (output, free changeover switch)
3990	30,5	Constant.Const_Float.Y1	Fixed value1 R1 (floating-point)
3991	30,5	Constant.Const_Float.Y2	Fixed value1 R2 (floating-point)
3992	30,5	Constant.Const_Float.Y3	Fixed value1 R3 (floating-point)
3993	30,5	Constant.Const_Float.Y4	Fixed value1 R4 (floating-point)
3994	30,5	Constant.Const_Float.Y5	Fixed value1 R5 (floating-point)
3995	30,5	Constant.Const_Float.Y6	Fixed value1 R6 (floating-point)
3996	30,5	Constant.Const_Float.Y7	Fixed value1 R7 (floating-point)
3997	30,5	Constant.Const_Float.Y8	Fixed value1 R8 (floating-point)
4114	72,2	IN_AENC.S_AENC.Y	Speed actual value AENC1, slave
4115	72,2	IN_AENC.S_AENC.YP	Position counter AENC1, slave
4116	72,2	IN_AENC.S_AENC.YRC	Revolution counter AENC1, slave
4125	72,2	IN_AENC.S_POS.Y	Position actual value AENC1, slave [length units]
4214	72,2	IN_AENC.M_AENC.Y	Speed actual value AENC2, master
4215	72,2	IN_AENC.M_AENC.YP	Position counter AENC2, master
4216	72,2	IN_AENC.M_AENC.YRC	Revolution counter AENC2, master
4225	72,2	IN_AENC.M_POS.Y	Position actual value AENC2, master [length units]
4300	72,5	IN_AENC.DELTA_Pos.Y	Differential position master – slave [length units]
5000	30,2	Constant.DINT_Const.Y8	Double word, constant 0
5001	30,2	Constant.DINT_Const.Y7	Double word, constant 1
5086	80,4	Constant.DINT_Const.Y1	Fixed value fine ratio, numerator
5087	80,4	Constant.DINT_Const.Y2	Fixed value fine ratio, denominator
5088	80,7	SYNCO1.FEIN_NM.Y	Ratio, numerator
5089	80,7	SYNCO1.FEIN_DN.Y	Ratio, denominator
5330	300,7	IF_Peer.PZD2_PZD3.YDI	Peer DW1 (receive)
5332	300,7	IF_Peer.PZD4_PZD5.YDI	Peer DW2 (receive)
5567	170,6	IF_CU.W_DW.Y	Output of the word ⇒ double word conversion for PZD from the CU
5814	470,2	Free_FBs.MULI_1.YDI	MULI_1 (double word output, free multiplier type int)
5816	490,6	Free_FBs.WDW1.Y	W_DW1 (output, word ⇒ double word converter)
5981	30,8	Constant.DINT_Const.Y3	Fixed value DI1 (double word)
5982	30,8	Constant.DINT_Const.Y4	Fixed value DI2
5983	30,8	Constant.DINT_Const.Y5	Fixed value DI3
5984	30,8	Constant.DINT_Const.Y6	Fixed value DI4

5 Start-up

WARNING

Only start to commission the system, if adequate and effective measures have been made to ensure that the system and drive can be safely electrically and mechanically used.

Ensure that all of the safety- and EMERGENCY OFF signals are connected and effective and that the drive can be powered-down at any time.

5.1 Commissioning, general

The principal commissioning sequence is shown as follows:

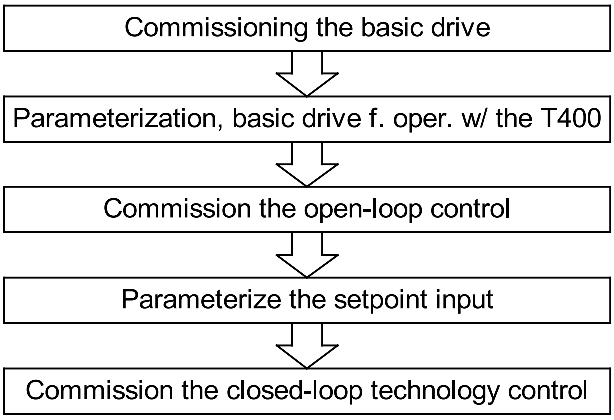


Fig. 5-1 Commissioning sequence

We recommend that the sequence, shown in Fig. 5-1, is maintained when starting-up the equipment, so that possible problems which occur, can be more easily pinpointed.

Commissioning, basic drive

The basic drive should be commissioned according to the Operating Instructions of the drive converter (e.g. Lit.[1]).

Parameterization, basic drive for use with T400

In order to be able to use the SPA440 standard software package, the parameters, listed in **Table 2-1** and **Table 2-2** must be set on the basic drive for the setpoint/actual value channels and for the CU control.

All of the enable signals, used in the standard software package, are listed in **Table 5-1**, and should be switched-in or set according to the particular application.

Control	Parameter	Explanation
Enable:		
• Synchronizing	H174	
• Angular controller	H172, H118	External and internal enable
• Speed controller	H140 = 1	Speed controller activated on T400
• COMBOARD	H409	Enable COMBOARD communications
• Peer-to-peer	H309	Enable peer communications
• Jog	H171	Enable Jog
Reset:		
• Position (master/slave)	H173	
• Displacement calculation	H170	

Table 5-1 Control signals

The enabling and appropriate input for particular functions must be set.

Notes

An **oscilloscope** should be used to evaluate the control quality and, if required, to check the pulse encoder signals. Further, the displacement can be easily visualized by plotting the synchronizing marks (zero pulses) in 2 channels. When setting displacement values, a storage oscilloscope or a stroboscope is extremely helpful.

Flowcharts

The flowcharts in Fig. 5-1 show the sequence when commissioning the three main functions - speed controller, angular controller and synchronization.

Information on the following flowcharts:

Signficance:
Additional information under n) at the transition to the particular flowchart

5.2 Commissioning, closed-loop speed control

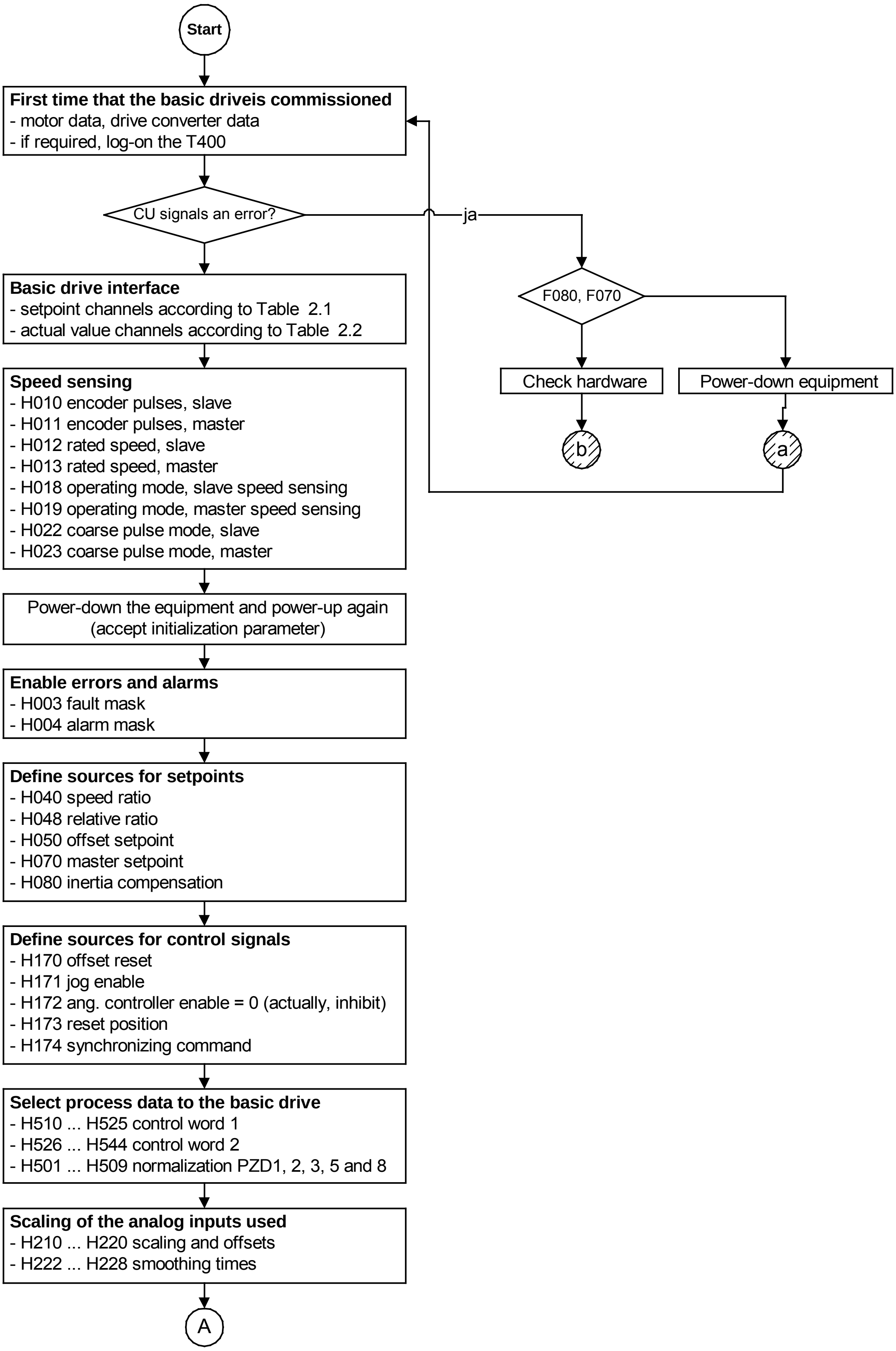


Fig. 5-2 Start-up, closed-loop speed control (start-A): ***Speed actual value sensing, setpoint***

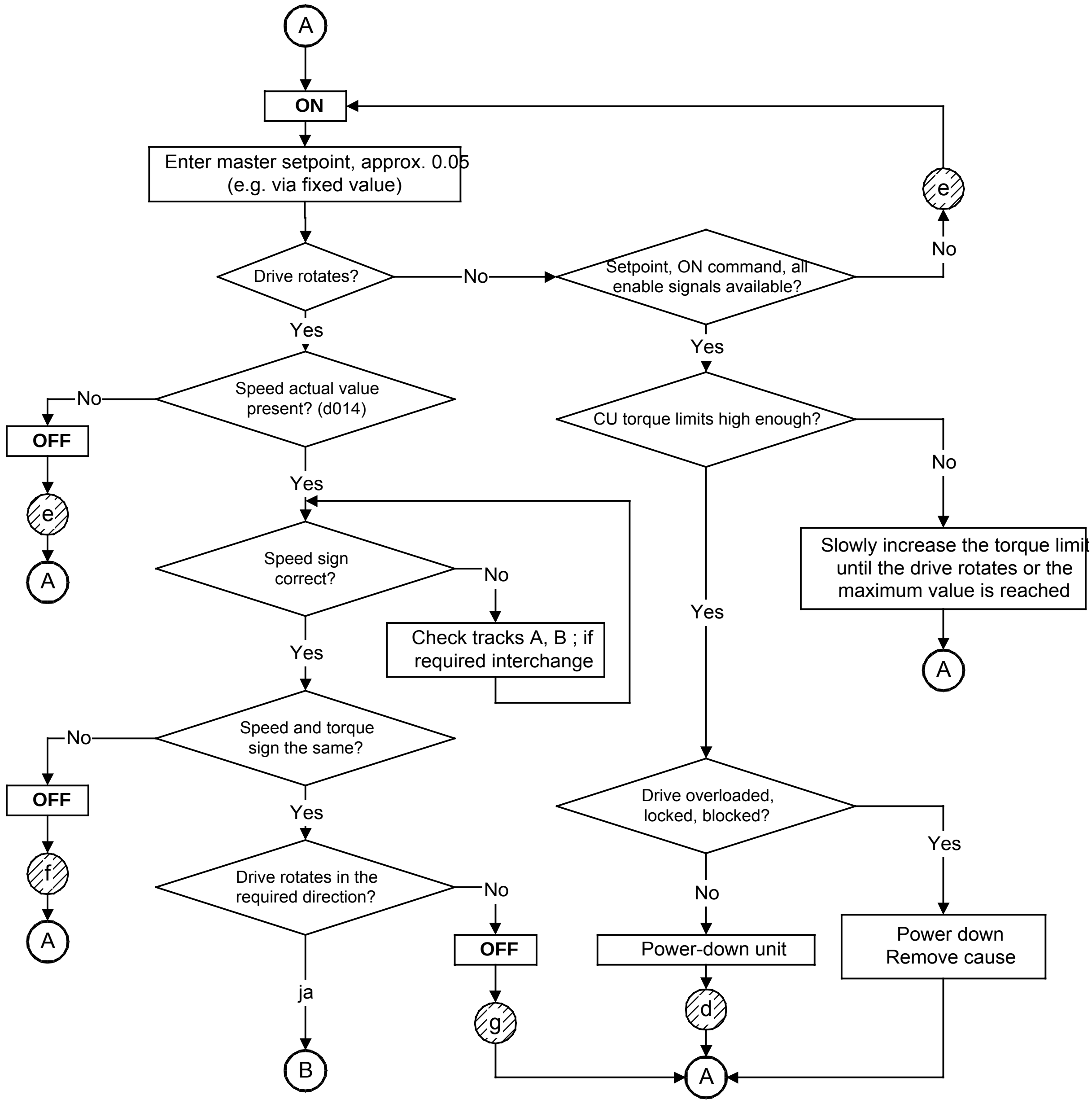


Fig. 5-3 Commissioning the closed-loop speed control (A-B): Drive rotates, torque

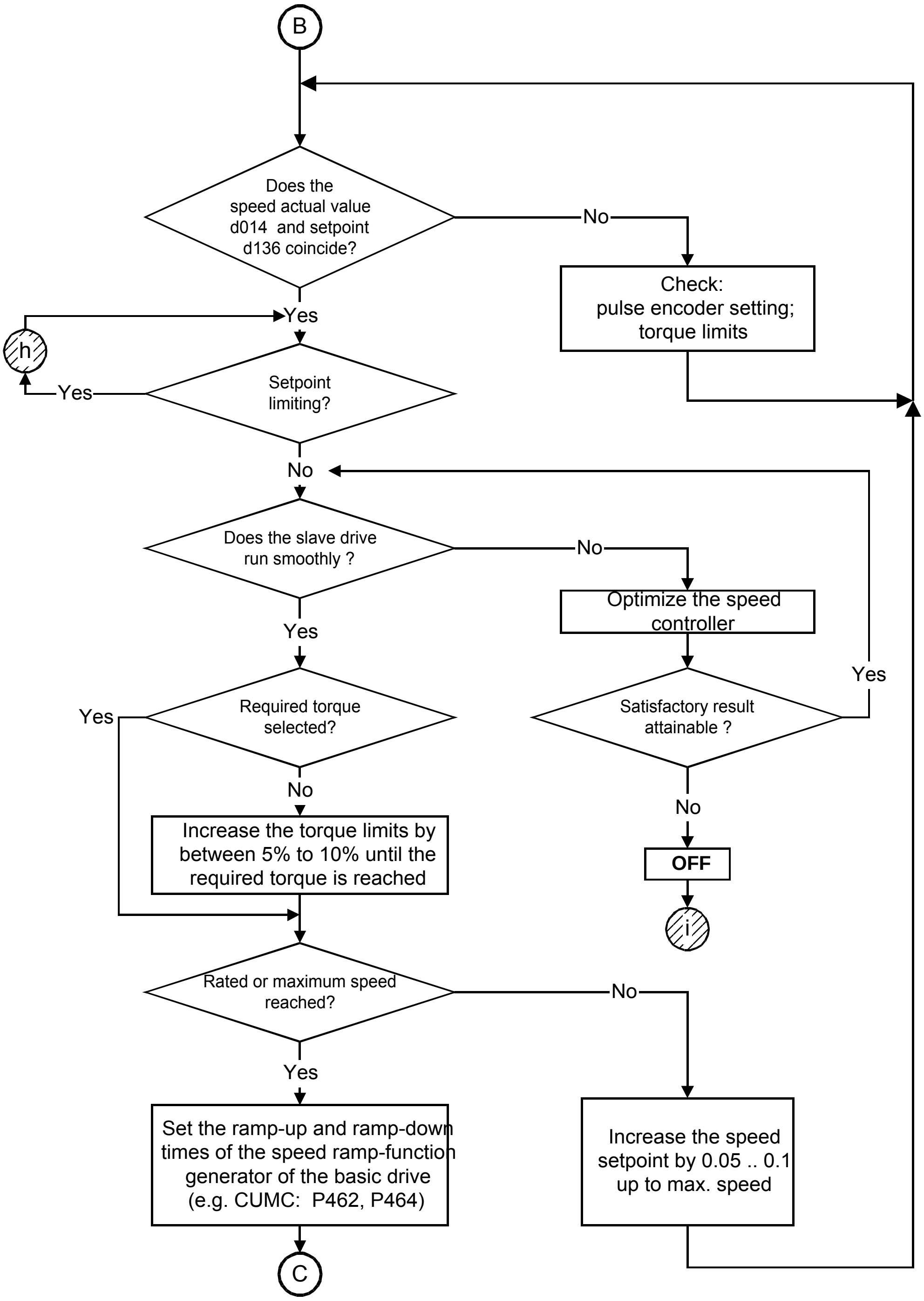


Fig. 5-4 Commissioning the closed-loop speed control (B-C): ***Speed controller optimization, torque limit***

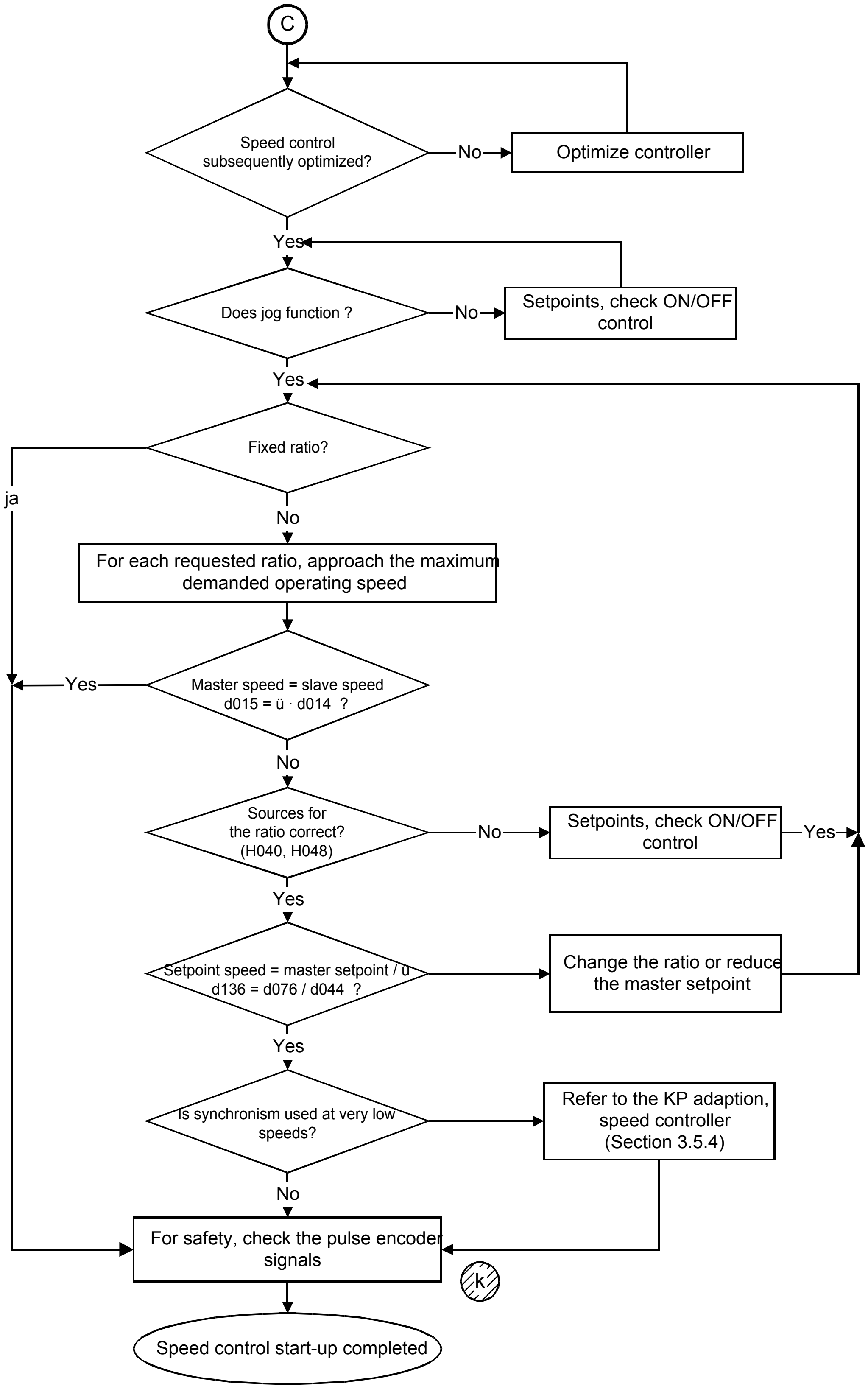


Fig. 5-5 Commissioning the closed-loop speed control (C-end): ***Ratio***

The fault/error causes specified here represent help when troubleshooting the **closed-loop speed control**; however, other causes are conceivable. The following table provides an overview of frequently required basic drive parameters when troubleshooting. Also refer to the setpoint- and actual value channels in Table 2-1 and Table 2-2.

Parameter		CU 2	CU MC	CU VC	DC-Master
T400 log-on		P090	Automatic		
COMBOARD log-on		P091	Automatic		
Configuration, serial interface		P682 ...	P700 ...		
Configuration, CB1 /CBP		P695 ...	P711 ...		
Control word 1		r550	r550		r650
Control word 2		r551	r551		r652
Status word 1		r552	r552		r653
Status word 2		r553	r553		r654
Closed-loop control mode (V/Hz, ..)		P163	P367		
Speed limit values	n_max n_min	P452 P453,P457	P452 P453		P642, P632 P643, P633
Torque limit values	M_max / M1 M_min / M2	P492 P498	P263 P264		
Maximum current			P128		
Speed ramp-funct. gener.	ramp-up time ramp-down time	P462 P464	P462 P464		
Reference speed			P353		
Reference torque		P485	P354		
Establish factory setting		P052			
Motor identification routine		P052			

Table 5-2 List of important parameters for troubleshooting in the basic drive

a) Basic drive signals fault F080:

T400 correctly inserted, correct slot? T400 defective? SPA440 standard software package on T400? Does T400 have to be logged-on? CB correctly inserted, correct slot? CB defective?

b) Basic drive signals fault F070:
If parameterized (P91=3), correct interface module type? SCB1/2 inserted correctly for the selected protocol (P682)? Correct slot? Hardware defective? If required, replace the module

c) Drive does not rotate when an ON command is output and a setpoint is present:
Check whether all of the required control word enable signals are present (setpoint-, inverter-, ramp-function generator enabled, clockwise/counter-clockwise direction of rotation, etc.): Control word = 16#9C7F
Setpoint available (d074)? Ratio correctly entered (d136)? Setpoint channel correctly set in the basic drive? Correct frequency limits?

d) Drive does not rotate, although all of the enable signals present:
Can the drive be operated V/Hz-controlled or closed-loop frequency controlled?

If required, establish the factory setting and carry-out a motor identification routine.

e) <u>No speed actual value:</u>
Wiring correct (ground connections)?
For the slave drive: Are the speed encoder cables correctly connected to the CU (for VC: Connector X132)?
For the master drive: T400 connecting cables O.K.?
Power supply voltage at the pulse encoder?
Are all of the signals available with respect to ground and do they have the correct phase position (oscilloscope!)?
Yes: Defective technology module? Replace the technology module
No: Check the pulse encoder and cables

f) <u>Polarity of the torque setpoint- and speed actual value different:</u>
Prerequisite: The motor is <u>not driven:</u>
If the drive converter and pulse encoder are correctly connected, for a positive torque setpoint, the motor must turn clockwise (when viewing the drive side), and a positive speed actual value must be obtained. Otherwise, tracks A and B of the pulse encoder must be interchanged (slave), or a negative value entered at H012 (rated speed, slave) (this is accepted by powering-down and powering-up the unit!).
Note: For motors running under no-load conditions or under low conditions, fluctuations can occur, also in the polarity (sign).

g) <u>The drive does not rotate in the required direction:</u>
Power-down the unit, change the phase sequence at the motor/drive converter (point f) check!),
Reverse the direction of rotation, speed actual value by
- interchanging pulse encoder track A/B or,
- reverse the polarity at H012 (rated speed, slave)

h) <u>Setpoint limiting is effective:</u>
The quotient of the master setpoint (d074) and the ratio (d044) may not exceed or fall below the setpoint limits, min/max frequency.

i) <u>Poor optimization:</u>
Execute the motor identification run and optimize the speed controller.
Are all of the units which are used O.K.?
Have all of the cables (especially the pulse encoder cables) been carefully routed and shielded, especially the long encoder cables?
Does the subordinate (lower level) closed-loop torque control operate perfectly (test parameterization, motor data, etc.)?
Is the driven load mechanically O.K. (no play, elasticity, etc.)?
Is the pulse encoder mechanically O.K.?

k) <u>Checking the **pulse encoder signals**:</u>
The pulse encoder signals must be perfectly received (no noise) when using the angular synchronous control. We therefore urgently recommend that the following measurements are made using an oscilloscope (directly at the terminals of the T400; refer to Function Charts 60 and 70):

1) At all speeds, the phase shift between tracks A and B of an encoder must be 1 μs.

2) Noise spikes (duration > 0.5 μs) may not be present in the vicinity of the switching threshold of the pulse encoder input circuit, i.e. not in the

range B:

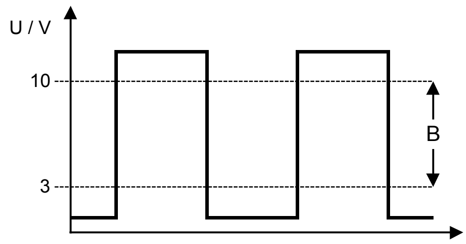


Fig. 5-6: Signals of an incremental encoder with HTL signal level

3) If a synchronizing pulse is used, we recommend that an oscillogram plot is made of it.

5.3 Commissioning the angular control

The fault causes, specified here are intended to help troubleshoot the **angular control**; however, other causes are conceivable.

a) The differential position actual value quickly moves away from 0 after the actual value sensing has been enabled (angular controller):
The pre-control has been correctly set, if the differential position actual value only very slowly drifts away from zero without the angular controller intervening. The prerequisites for this are:
- the master drive runs smoothly (speed controller optimization),
- the master setpoint corresponds to the master drive speed,
- the slave drive runs smoothly (speed controller optimization),
- when the master setpoint is entered as analog signal, the adaption is correct

b) If the differential position actual value is too high, possible causes could be:
- Speed controller goes to its limit?
  Yes: ⇒ correctly select the torque limits, remove the overload condition
- Angular controller goes to its limit?
  Yes: ⇒ ensure that
  frequency limit > [speed setpoint (d136) + angular controller limit (H112)] !
- If required adapt the enable threshold of the angular controller, H118

c) Check the ratio which has been set and the data on the present ratio.
If possible, check, for example, the synchronizing pulses and a connected process or material web. For example, does it continually move away from the required position?

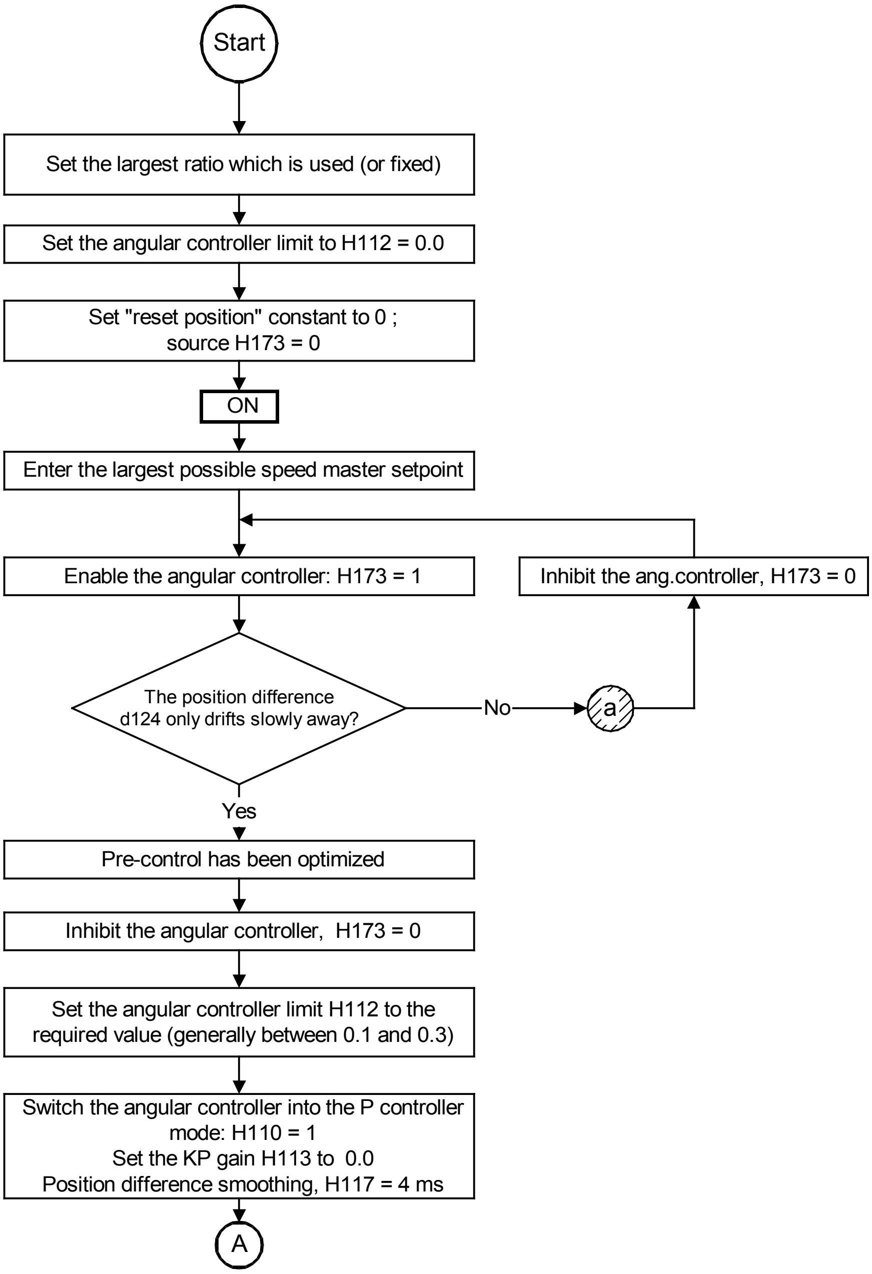


Fig. 5-7: Commissioning the angular control (start-A): ***Basic setting***

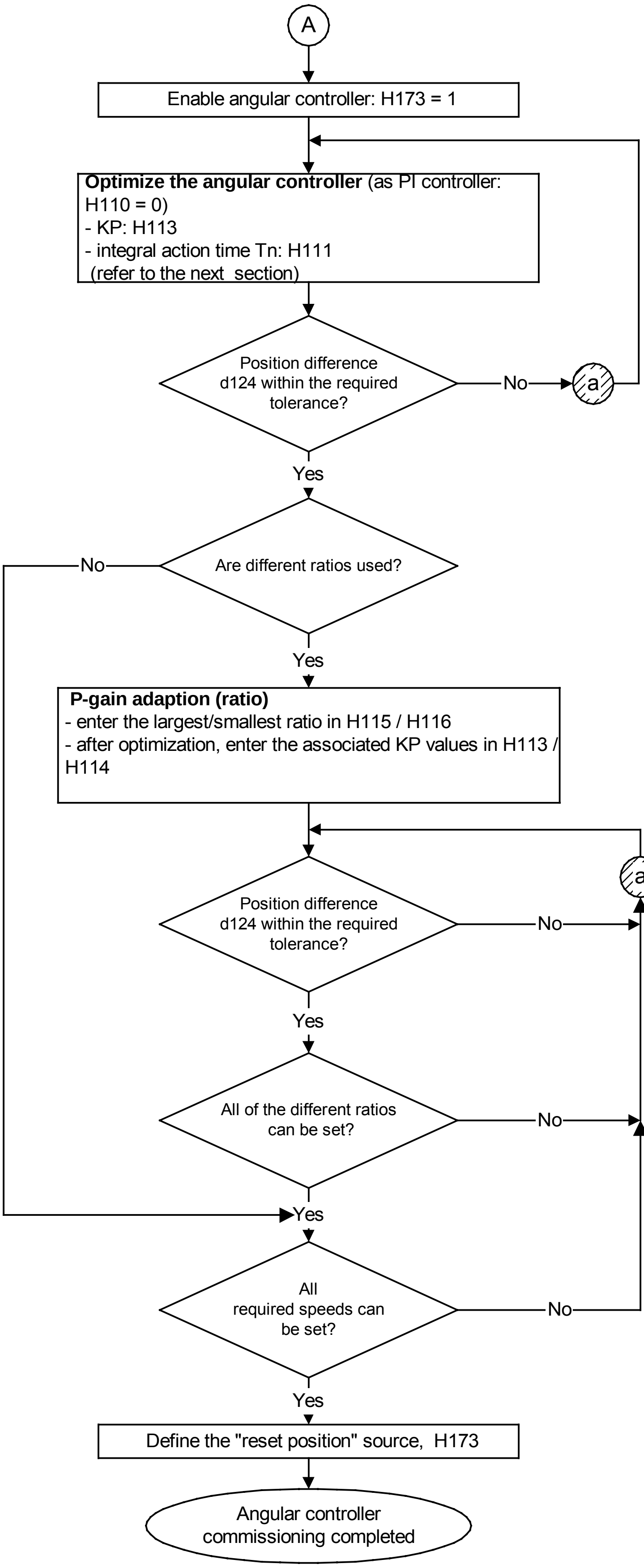


Fig. 5-8 Commissioning the angular control (A-end): ***Ratio***

5.3.1 Information regarding optimizing the angular controller

Procedure:

1. If there are low to average demands placed on the control quality:
Set the experience value:
A **KP of between 2 and 6** provides, for many applications, adequate precision and dynamic performance.

2. For average up to high demands on the dynamic performance, or if the experience value does not result in a satisfactory result:

- Enter a master setpoint of 0

- Increase the P gain in steps of 2 until the slave drive starts to oscillate. The speed actual value can be monitored at analog output 1 (terminals 97 / 99). If the slave drive remains absolutely steady for a P gain > 2, then it is necessary to excite oscillation by deflecting the motor from its quiescent position. This can be realized, for example, by entering a jog setpoint (H130, approx. 0.01; enable H171).

- Reduce the P gain H113 in steps of between 0.5 to 1 until oscillation stops. Then multiply the value which was reached, by 0.5 to 0.7 and save H113.

3. For **high demands** placed on the control quality:

- For high demands placed on the control quality, the **speed actual value** must be extremely accurate, e. g. via analog output 1 (terminals 97 / 99) trace the signal using a fast plotter or a storage oscilloscope. In this case, the speed actual value is compensated by offset value H160 and the analog output gain can be adapted using H161 so that the speed ripple can be easily monitored.

- For average slave drive speeds, excite using the jog setpoint (parameter H130 = 0.01), and monitor the transfer characteristic. The simplest solution is to write an enable signal using a switch connected to a digital input. Vary the P gain until a good result is achieved.

- Under certain circumstances, the optimization result can be improved by increasing the **position difference smoothing** (H117). However, generally the default value of 4 ms should be used.

4. **Angular errors**

- If the master setpoint is inaccurate, (e. g. if fed via an analog input or if incorrectly adapted (rated speed)), the P control results in an angular error which is dependent on the P gain. If this error causes disturbances, the angular controller must be parameterized as PI controller (H110 = 0). The integral action time should be set using parameter H111. Starting with high values of Tn (approx. 5 s), the system should be optimized and Tn changed towards lower values.

- If the ratio was incorrectly set, an enabled integral component would ”drift away”, i. e. would go to its limit.

5.4 Commissioning synchronization

Prerequisite

When commissioning the synchronization, the speed- and angular control must have been completely commissioned. The synchronizing function must be inhibited (H174 = 0) if synchronization is not required.

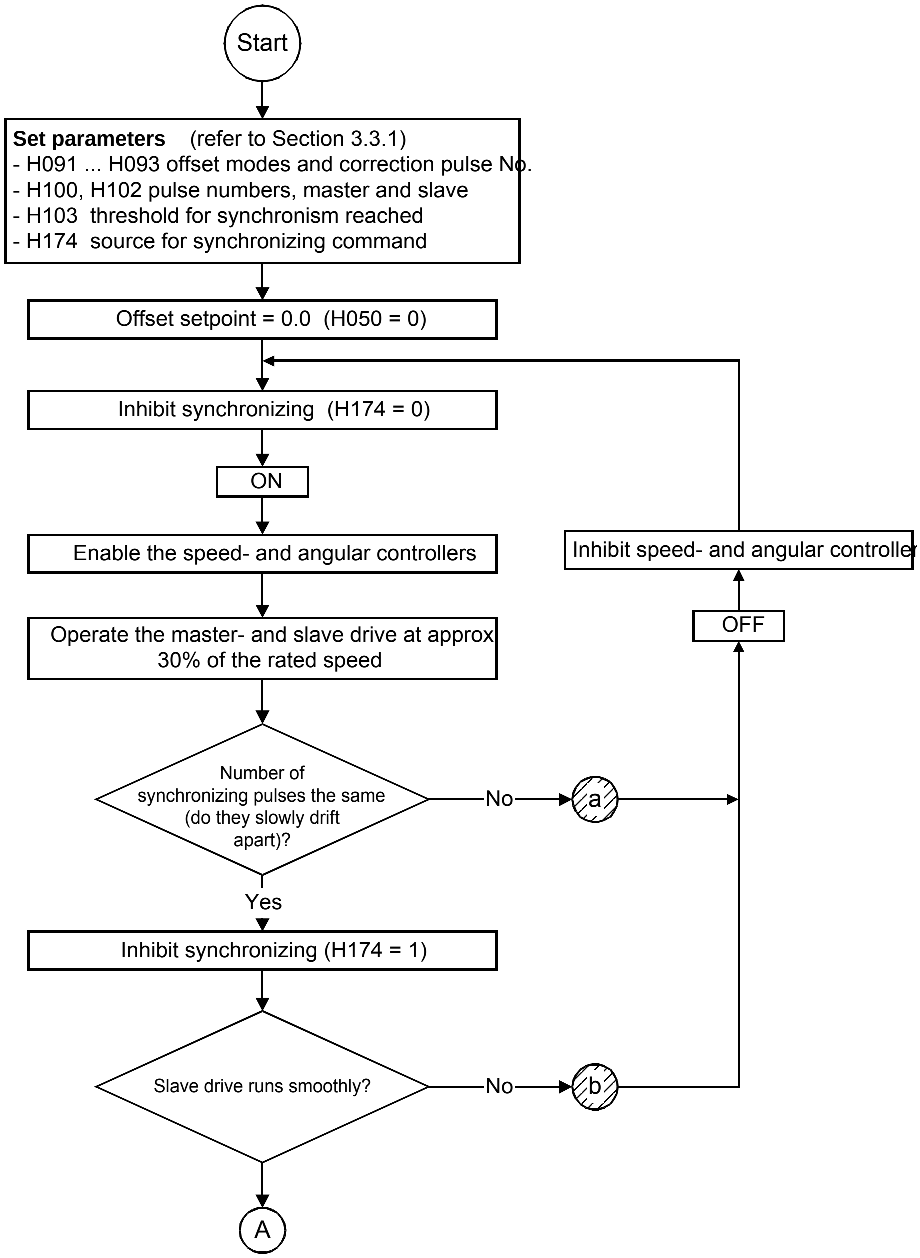


Fig. 5-9 Commissioning synchronizing (start-A)

Caution

The synchronizing function is only possible when the **synchronizing pulses** are perfect (e. g. zero pulses). The cable routing should be checked so that it provides immunity against noise and disturbances, and is sufficiently shielded; the synchronizing pulse shapes must be checked using an oscilloscope.

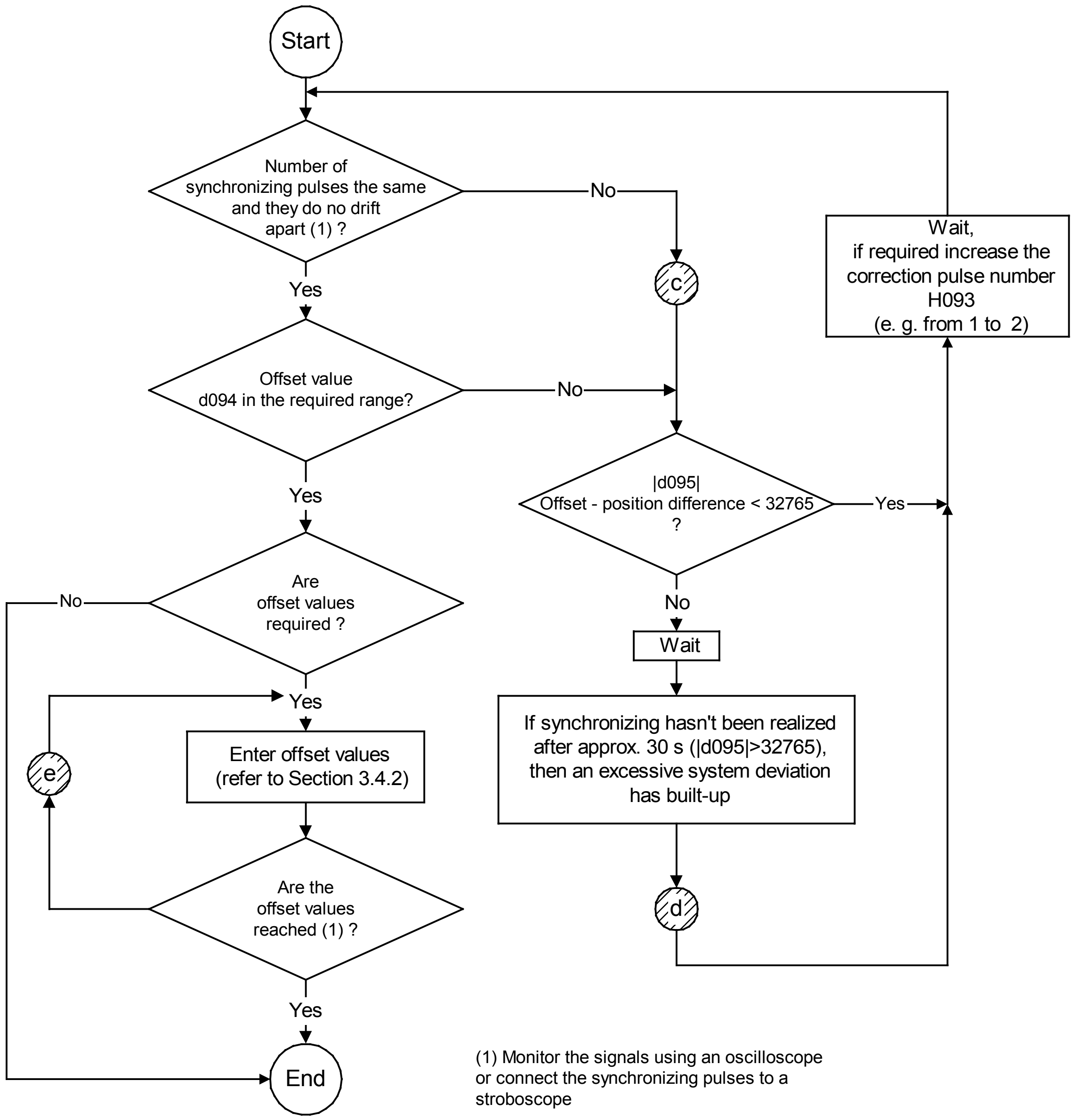


Fig. 5-10 Commissioning synchronizing (A-end)

The **synchronizing** troubleshooting information represents a help when troubleshooting; however, other causes are conceivable.

a) The number of synchronizing pulses from the master and slave are not equal in any time unit:

- Check the master setpoint
- Check the ratio (ü · n_{set} slave ≅ n_{act}

master d015)
- Check the synchronizing pulses/signal encoder

b) The slave drive does not run smoothly after synchronizing has been enabled:

- If possible, reduce the correction pulse number H093 (minimum = 1),
- Check the synchronizing pulse trains
- Check the speed- and angular controller optimization; if required, re-optimize.
- Check the master drive; if required, re-optimize the master drive
- Investigate the mechanical system for play, torsional oscillations etc.

c) The number of synchronizing pulses from the master and slave are not equal after synchronizing has been enabled, in any time unit:

- Check the synchronizing pulses/signal encoder
  - Check the displacement parameters (H050 to H067 and H090 to H107) Especially check the synchronizing pulse numbers

d) Synchronization has not been completed (absolute displacement actual value - position difference > 32765)

- Refer to c)
  - If displacement d094 has an increasing trend, then the correcting influence of the synchronizing is probably too low ⇒ slightly increase H093 (e.g. from 1 to 2); commence again at the start

e) Displacement setpoints are not reached:

- Check the parameterization (H050 to H067 and H090 to H107) (displacement setpoint limiting reached?)
- Check the mechanical design and if required change
- Check the response threshold H103

5.5 Trace function with “symTrace-D7”

With “symTrace-D7”, a product from the company “sympat”, it is possible to establish a connection to an application based on D7-SYS (e.g. the axial winder SPW420). With “symTrace-D7” you are able to trace every value in your CFC-application.The trace offers you two different options: online and offline trace. With the online trace you can trace values in intervals of a few ten-milliseconds. This is only practical for slowly changing values, e.g. the diameter actual value.

If you want to trace quickly-changing values you need the offline trace. With this option you can trace values within the shortest cycle-time. Therefore the values must be saved in a buffer. Some special function blocks have been placed in the project for that reason. You will find them in the plan “TRACE”.

With the parameter **L400** you are able to change the length of the trace-buffer. The standard setting is 2048 (double words). Furtheron with the **c401** and **c402** two display parameters show you the state of the trace coupling (-> see parameter list).

For more information please read the online help in “symTrace-D7”.

6 Literature

1. Instruction Manual for SIMOVERT Master Drives -- Vector Control (VC), types of construction A to D, Order No.: 6SE7080-0Ad20, 1995.

2. Instruction Manual for SIMOVERT Master Drives -- Communications module CB1, Order No.: 6SE7087-6CX84-0AK0, 1994.

3. Configuring Communications D7-SYS- SIMADYN D Manual, Order No. 6DD1987-1AA1, Oct. 1997.

4. Hardware - SIMADYN D Manual, Order No. 6DD1987-1BA1, 1997.

5. SIMADYN D, Function Block Library, Reference Manual, Order No. 6DD1987-1CA1, October 97.

7 Appendix

Para.	Factory set	Units	Start-up value	Significance	Type
H000	0			Language selection	I
d001	440			Software type (identification)	i
d002	2.1			Software version	I
H003	16#0000			Fault message enable	W
H004	16#0000			Alarm message enable	W
d005				Status word, angular synchronism	W
d006				Error bits	W
d007				Alarm bits	W
H008	0			TechBoard parameter type (1= floating point)	BO
H009	0			T400 = baseboard	BO
H010	1024	Pulse		Encoder pulse number, slave (pulse number)	I
H011	1024	Pulse		Encoder pulse number, master (pulse number)	I
H012	1500.0	RPM		Rated speed, slave	R
H013	1500.0	RPM		Rated speed, master	R
d014				Speed actual value, slave / H012	R
d015				Speed actual value, master / H013	R
d016		Pulse		Position actual value, slave	R
d017		Pulse		Position actual value, master	R
H018	16#7FE2			Slave speed sensing mode	W
H019	16#7F02			Master speed sensing mode	W
d020				Error code, slave speed sensing	W
d021				Error code, master speed sensing	W
H022	16#0000			Coarse pulse mode, slave sensing	W
H023	16#0000			Coarse pulse mode, master sensing	W
H024	0			COMBOARD parameter type (1= floating point)	BO
d025				Status of the digital inputs	W
d026				Control word1 for the basic drive converter	W
d027				Control word2 for the basic drive converter	W
d028 .. d039				Free visualization parameter. Selecting the source using parameters L028 .. L039	I
H040	1			Multiplexer selection, ratio	I
H041	3047			Source for the supplementary ratio	I
H043	1.0			Fixed value, ratio	R
d044				Actual ratio	R
d045		Pulse		Ratio, numerator	R
d046		Pulse		Ratio, denominator	R
H047	0.0			Fixed value, supplementary ratio	R
H048	1			Multiplexer, relative ratio	I
H049	1.0			Fixed value, relative ratio	R
H050	1			Multiplexer, displacement setpoint	I
H051	3050			Source for the displacement setpoint	I
H052	2.5	ms		Ramp-up time, displacement setpoint	SD
H053	2.5	ms		Ramp-down time, displacement setpoint	SD
H054	+2048	Pulse		Maximum value, displacement setpoint (positive)	R
H055	-2048	Pulse		Maximum value, displacement setpoint (negative)	R
d056		Pulse		Actual displacement setpoint	R
H057	0175			Source, setting signal for the displacem.ramp-function gener.	I

Para.	Factory set	Units	Start-up value	Significance	Type
H058	3012			Source for the normalization factor, slave speed	I
H059	3013			Source for the normalization factor, master speed	I
d060				Ratio_1 (refer to Chart 80)	R
d061				Relative ratio	R
H062	0.0	Pulse		Synchronizing displacem. setpoint n_master ≥ 0, n_slave ≥ 0	R
H063	0.0	Pulse		Synchronizing displacem. setpoint n_master < 0, n_slave ≥ 0	R
H064	0.0	Pulse		Synchronizing displacem. setpoint n_master ≥ 0, n_slave < 0	R
H065	0.0	Pulse		Synchronizing displacem. setpoint n_master < 0, n_slave < 0	R
H066	0.0	Pulse		Fixed value, displacement setpoint	R
H067	3040			Source for the ratio	I
H068	3048			Source for the relative ratio	I
H070	15			Multiplexer for the master speed setpoint	R
H071	3070			Source for the master speed setpoint	I
H072	10	ms		Smoothing, master speed setpoint	SD
H073	0.0			Fixed value, master speed setpoint	R
d074				Actual master speed setpoint, smoothed	R
d076				Master speed setpoint (before smoothing)	R
H077	5088			Source for numerator (ratio to determine the displacement)	I
H078	5089			Source for the denominator (ratio to determine the displacement)	I
H079	3129			Source for input DT1 (inertia compensation)	I
H080	1			Multiplexer selection, inertia compensation	I
H082	100	ms		Smoothing time, inertia compensation	SD
H083	4	ms		Differentiating time, inertia compensation	R
d085				Output DT1 (inertia compensation)	R
H086	1000			Fine setting, ratio, numerator	DI
H087	1000			Fine setting, ratio, denominator	DI
H088	0			Enable fine setting, ratio	BO
H090	1			Position correction mode	BO
H091	0			RETRIGGER synchronizing	BO
H092	0			Synchronizing command, edge-controlled	BO
H093	1.0	Pulse		Correction pulse number	R
d094		Pulse		Displacement actual value	R
d095		Pulse		Displacement actual value - differential position actual value	R
d096				Error identification, displacement sensing	W
H097	0108			Source 2 for reset, position and displacement	I
H098	0101			Source for the synchronizing command 2	I
H100	4096	Pulse		Synchronizing pulse number, master	DI
H101	0105			Source to end start synchronization	I
H102	4096	Pulse		Synchronizing pulse number, slave	DI
H103	20.0	Pulse		Response threshold ”synchronism reached”	R
H104	0109			Source for controller enable	I
H105	500	Pulse		Enable threshold, synchronizing, slave	R
H107	500	Pulse		Enable threshold, synchronizing, master	R
H108	3044			Source for the input KP characteristic angular controller	I
d109				Angular controller enable status	BO
H110	1			Angular controller as P controller	BO

Para.	Factory set	Units	Start-up value	Significance	Type
H111	500	ms		Integral action time, angular controller	SD
H112	0.3			Limit value, angular controller	R
H113	1.0			P gain, angular controller KP_UE	R
H114	1.0			P gain, angular controller KP_UE_0	R
H115	0.0			Limit value ue_KP	R
H116	0.0			Limit value ue_KP_0	R
H117	4.0	ms		Smoothing, differential position actual value	SD
H118	0.1			Source for the angular controller enable (n_slave)	R
H119	0.1			Source for monitoring the master speed	R
d120				Output, angular controller	R
d121		Pulse		System deviation, angular controller	R
d122				I component, angular controller	R
d123				KP angular controller	R
d124		Pulse		Differential position actual value, smoothed	R
H125	1.0			Upper limit, speed ramp-function generator	R
H126	-1.0			Lower limit, speed ramp-function generator	R
H127	0	ms		Ramp-up time, speed setpoint	R
H128	0	ms		Ramp-down time, speed setpoint	R
d129		ms		Speed setpoint after the ramp-function generator	R
H130	0.0			Jog setpoint (fixed value)	R
H131	0172			Source, angular controller enable 1	I
H132	1.0			Speed setpoint limiting positive	R
H133	-1.0			Speed setpoint limiting negative	R
H134	1.0			Speed controller output limiting positive	R
H135	-1.0			Speed controller output limiting negative	R
d136				Actual speed setpoint	R
d137				Speed setpoint limited	R
H138	0	ms		Smoothing time constant, angular controller output	R
H139	0193			Source, angular controller enable 2	I
H140	0			Compute speed controller on T400	BO
H141	10.0			P gain, speed controller KP	R
H142	10.0			P gain, speed controller KP_O	R
H143	0.0			Limit value n_KP	R
H144	0.0			Limit value n_KP_0	R
H145	200	ms		Integral action time, speed controller	R
H146	4.0	ms		Smoothing, speed actual value	R
d147				Control word 1 for the basic drive	W
d148				Control word 2 for the basic drive	W
H149	10	ms		Pulse extension, synchronizing pulse master	SD
d150				Speed controller output	R
d151				System deviation, speed controller	R
d152				Actual basic drive setpoint (n or M)	R
d153				KP speed controller	R
H154	3186			Source, slave position (synchronizing enable)	I
H155	10000			Resolution for the ratio	R
H156	3056			Source, actual value1 for the angular controller	I
H157	3000			Source, actual value2 for the angular controller	I
H158	3124			Source, setpoint1 for the angular controller	I
H159	3000			Source, setpoint2 for the angular controller	I
H160	0.0			Offset, analog output 1	R

Para.	Factory set	Units	Start-up value	Significance	Type
H161	1.0			Scaling, analog output 1	R
H162	0.0			Offset, analog output 2	R
H163	1.0			Scaling, analog output 2	R
H164	0			Erase change memory	BO
H165	0			Key, change memory	I
d166				Status, change memory	BO
H167	0173			Source, position reset 1	I
H168	1000	ms		Delay start synchronization	SD
H169	0			Enable start synchronization	BO
H170	0			Multiplexer, displacement reset	I
H171	0			Multiplexer, jog enable	I
H172	0			Multiplexer, angular controller enable	I
H173	0			Multiplexer, reset position	I
H174	0			Multiplexer, synchronizing command	I
d175				Actual value, displacement reset	BO
d176				Actual value, jog enable	BO
d177				Actual value, angular controller enable (control signal)	BO
d178				Actual value, reset position	BO
d179				Actual value, synchronizing command	BO
H180	0154			Source, enable synchronization, slave	I
H181	0097			Source, reset the slave position	I
H182	5088			Source, numerator of the ratio (slave)	I
H183	5089			Source, denominator of the ratio (slave)	I
H184	0098			Source, enable position difference correction	I
H185	0108			Source to reset, position difference 1	I
H186	3016			Source, slave position for absolute value	I
H187	0170			Source to reset, position difference 2	I
H188	0190			Source, enable synchronization, master	I
H189	0097			Source, reset the master position actual value	I
H190	3199			Source, position (synchronizing enable, master)	I
H191	0174			Source, synchronizing command	I
H192	3014			Source, actual speed (plausibility, slave speed)	I
H193	3136			Source, setpoint speed (plausibility, slave speed)	I
H195	3015			Source, actual speed (plausibility, master speed)	I
H196	3076			Source, setpoint speed (plausibility, master speed)	I
H197	5086			Source, fine ratio, numerator	I
H198	5087			Source, fine ratio, denominator	I
H199	3017			Source, position (absolute position, master)	I
H200	3137			Source, setpoint speed 1 (speed controller)	I
H201	3000			Source, setpoint speed 2 (speed controller)	I
H202	3146			Source, actual speed 1 (speed controller)	I
H203	3000			Source, actual speed 2 (speed controller)	I
H204	3129			Source, input KP characteristic (speed controller)	I
H205	3129			Source, setp. speed 1, ramp-funct.gen. (speed controller)	I
H206	3120			Source, setp. speed 2, ramp-funct.gen. (speed controller)	I
H207	3130			Source, jog setpoint	I
H208	0171			Source, jog enable	I
H209	10.0	ms		Pulse extension, slave synchronizing pulse	I
H210	1.0			Scaling, analog input 1	R
H211	0.0			Offset, analog input 1	R

Para.	Factory set	Units	Start-up value	Significance	Type
d212				Actual value, analog input 1	R
H213	1.0			Scaling, analog input 2	R
H214	0.0			Offset, analog input 2	R
d215				Actual value, analog input 2	R
H216	1.0			Scaling, analog input 3	R
H217	0.0			Offset, analog input 3	R
d218				Actual value, analog input 3	R
H219	1.0			Scaling, analog input 4	R
H220	0.0			Offset, analog input 4	R
d221				Actual value, analog input 4	R
H222	500	ms		Smoothing time, analog input 1	SD
d223				Actual value, analog input 1, smoothed	R
H224	0	ms		Smoothing time, analog input 2	SD
d225				Actual value, analog input 2, smoothed	R
H226	0	ms		Smoothing time, analog input 3	SD
d227				Actual value, analog input 3, smoothed	R
H228	0	ms		Smoothing time, analog input 4	SD
d229				Actual value, analog input 4, smoothed	R
H230	0000			Source, zero setting function, analog input 1	I
H231	0000			Source, zero setting function, analog input 2	I
H232	0000			Source, zero setting function, analog input 3	I
H233	0000			Source, zero setting function, analog input 4	I
H234	3118			Source, position difference (displacement calculation)	I
H235	3062			Source, position difference correction (displacem. calculation)	I
H236	0097			Source, resetting the displacement calculation	I
H237	3051			Source, displacement setpoint 1	I
H238	3062			Source, displacement setpoint 2	I
H239	3044			Source, ratio (n_set)	I
H240	3136			Source, slave setpoint speed 1	I
H241	3176			Source, slave setpoint speed 2	I
H242	3137			Source f.the setting value of the I comp.(speed controller)	I
H243	0000			Source, setting signal I component of the speed controller	I
H244	3080			Source for the pre-control value of the speed controller	I
H245	0140			Source, enable pre-control (speed controller)	I
d246				Status word 1 CU	
d300				Peer word 1 send	W
H303	2			Multiplexer for peer word 1 send	I
H304	1			Multiplexer for peer float 1 send	I
H305	0			Multiplexer for peer float 2 send	I
H306	0			Fixed value for peer word 1 send	W
H307	0.0			Fixed value for peer float 1 send	R
H308	0.0			Fixed value for peer float 2 send	R
H309	1			Enable peer-to-peer	BO
H310-H325				Sources for status word1, bits 0-15	BO
d327				Status word1 peer	W
d329-d333				PZD1 peer to PZD5 peer	W
H334	2329			Source for control word (send peer)	I
H335	2000			Source PZD2 (send peer)	I

Para.	Factory set	Units	Start-up value	Significance	Type
H336	2000			Source PZD3 (send peer)	I
H337	5000			Source, double word 1(send peer)	I
H338	3304			Source, float 1 (send Peer)	I
H339	2			Send type for PZD2 + PZD3 (send peer)	I
H340	2000			Source PZD4 (send peer)	I
H341	2000			Source PZD5 (send peer)	I
H342	5000			Source, double word 2 (send peer)	I
H343	3305			Source, float 2 (send peer)	I
H344	2			Send type for PZD4 + PZD5 (send peer)	I
H345	2303			Source PZD1 (send peer)	I
d346				Peer control word (receive)	W
H360	20000	ms		Power-on no time limit peer	SD
H361	100	ms		Time limit peer in operation	SD
H362	16#FFFF			Mask peer status	W
H363	19200	Baud		Baud rate peer-to-peer	DI
d364				Peer status, receive block	W
H381	2026			Source, PZD1 for the basic drive	I
H382	2500			Source, PZD2 for the basic drive	I
H383	2502			Source, PZD3 for the basic drive	I
H384	2027			Source, PZD4 for the basic drive	I
H385	2504			Source, PZD5 for the basic drive	I
H386	2506			Source, PZD6 for the basic drive	I
H387	2510			Source, PZD7 for the basic drive	I
H388	2508			Source, PZD8 for the basic drive	I
H401	1.0			Normalization, COMBOARD actual value1 send	R
H403	1.0			Normalization, COMBOARD actual value2 send	R
H405	1.0			Normalization, COMBOARD actual value3 send	R
H407	1.0			Normalization, COMBOARD actual value4 send	R
H409	1			Enable COMBOARD communications	BO
H410-H425	0			Status word 1 bits 0-15 fixed values	BO
H426-H441	0			Status word 2 bits 0-15 fixed values	BO
H442	0			Multiplexer COMBOARD word 1 send	I
H443	0			Fixed value COMBOARD word 1 send	W
H444	0			Multiplexer COMBOARD word 4 send	I
H445	0			Fixed value COMBOARD word 4 send	W
H446	1			Multiplexer COMBOARD word 2 send	I
H447	0			Multiplexer COMBOARD word 3 send	I
H448	0			Multiplexer COMBOARD word 5 send	I
H449	0			Multiplexer COMBOARD word 6 send	I
d450				COMBOARD setpoint1 receive	R
H451	1.0			COMBOARD normalization setpoint1 receive	R
d452				COMBOARD setpoint2 receive	R
H453	1.0			COMBOARD normalization setpoint2 receive	R
d454				COMBOARD setpoint3 receive	R
H455	1.0			COMBOARD normalization setpoint3 receive	R
d456				COMBOARD setpoint4 receive	R
H457	1.0			COMBOARD normalization setpoint4 receive	R
d458				COMBOARD word 1 send	W
d459				COMBOARD word 4 send	W

Para.	Factory set	Units	Start-up value	Significance	Type
d460				COMBOARD control word 1 receive	W
d461				COMBOARD control word 2 receive	W
H462	20000	ms		Power-on time limit COMBOARD	SD
H463	100	ms		Time limit COMBOARD operational	SD
H464	16#FFFF			Mask COMBOARD receive status	W
d465				Receive status COMBOARD	W
d466				Status word1 COMBOARD	W
d467				Status word2 COMBOARD	W
H470	0.0			Fixed value, COMBOARD send word 2	R
H471	0.0			Fixed value, COMBOARD send word 3	R
H472	0.0			Fixed value, COMBOARD send word 5	R
H473	0.0			Fixed value, COMBOARD send word 6	R
H480	3			Slave address COMBOARD (only for SRT400)	I
H481	0			COMBOARD parameter 1 (only for SRT400)	I
H482	2			COMBOARD parameter 2 (only for SRT400)	I
H483.. H493	0			COMBOARD parameter 3..13 (only for SRT400)	I
H495	1			COMBOARD parameters valid (only for SRT400)	BO
d496				Status COMBOARD for operation in the SRT400	W
H498	3000			Source, setpoint for double word output	I
H499	1.0			Setpoint normalization according to H498	R
H500	3152			Source for the 1st setpoint to the basic drive	I
H501	1.0			Normalization, 1st setpoint for the basic drive	R
H502	3000			Source for the 2nd setpoint for the basic drive	I
H503	1.0			Normalization, 2nd setpoint for the basic drive	R
H504	3120			Source for the 3rd setpoint for the basic drive	I
H505	1.0			Normalization, 3rd setpoint for the basic drive	R
H506	3153			Source for the 4th setpoint for the basic drive	I
H507	1.0			Normalization, 4th setpoint for the basic drive	R
H508	3080			Source for the 5th setpoint for the basic drive	I
H509	1.0			Normalization, 5th setpoint for the basic drive	R
H510	0650			Source, control word 1 for the basic drive, bit0	BO
H511	0651			Source, control word 1 for the basic drive, bit1	BO
H512	0652			Source, control word 1 for the basic drive, bit2	BO
H513	0653			Source, control word 1 for the basic drive, bit3	BO
H514	0654			Source, control word 1 for the basic drive, bit4	BO
H515	0655			Source, control word 1 for the basic drive, bit5	BO
H516	0656			Source, control word 1 for the basic drive, bit6	BO
H517	0657			Source, control word 1 for the basic drive, bit7	BO
H518	0658			Source, control word 1 for the basic drive, bit8	BO
H519	0659			Source, control word 1 for the basic drive, bit9	BO
H520	0660			Source, control word 1 for the basic drive, bit10	BO
H521	0661			Source, control word 1 for the basic drive, bit11	BO
H52	0662			Source, control word 1 for the basic drive, bit12	BO
H523	0663			Source, control word 1 for the basic drive, bit13	BO
H524	0664			Source, control word 1 for the basic drive, bit14	BO
H525	0665			Source, control word 1 for the basic drive, bit15	BO
H526- H541	0			Source, control word 2 for the basic drive, bits0 .. 15 (with the exception of H535)	BO
H535	0546			Source, control word 2 for the basic drive, bit9	BO
H542	16#0004			Mask to identify CU operational readiness	W

Para.	Factory set	Units	Start-up value	Significance	Type
H543	0			Test enable for the speed controller in the basic drive	BO
H544	1			Multiplexer for speed controller enable	I
d545				Computation utilization for T1 (fastest time sector)	R
d546				Computation utilization for T2	R
d547				Computation utilization for T3	R
d548				Computation utilization for T4	R
d549				Computation utilization for total CPU load	R
H550	1.0			Normalization actual value1, receive from the basic drive	R
d551				Actual value1, receive from the basic drive	R
H552	1.0			Normalization actual value2, receive from the basic drive	R
d553				Actual value2, receive from the basic drive	R
H554	1.0			Normalization actual value3, receive from the basic drive	R
d555				Actual value3, receive from the basic drive	R
d556				Control word from the basic drive	W
H557				Source, control word from the basic drive	W
H558	2571			Source for status word 1 from the basic drive	I
H559	2574			Source for status word 2 from the basic drive	I
d560				Status word 1 from the basic drive	W
d561				Status word 2 from the basic drive	W
d562				Receive status, basic drive interface	W
H563	2572			Source for actual value1 from the basic drive	I
H564	2573			Source for actual value2 from the basic drive	I
H565	2575			Source for actual value3 from the basic drive	I
H567	2582			Source for double word (high) from the basic drive	I
H568	2581			Source for double word (low) from the basic drive	I
H569	5567			Source for double word from the basic drive	I
d570				Double word from the basic drive, normalized	R
d571-d585				14 process data from the basic drive	W
H587	5567			Source for double word for type conversion (N4 ➔R)	I
H588	1.0			Normalization factor for H587	R
d589				Double word from CU after type conversion (N4➔R)	R
H590	2577			Source for PZD for type conversion (I➔R)	I
d591				Result of type conversion (I➔R) from H590	R
H592	2571			Source to evaluate the operational readiness	I
H593	0547			Source for operational readiness, basic drive	I
d601				Digital output, terminal 46 ”synchronism reached”	BO
d602				Digital output, terminal 47 ”angular controller at its limit”	BO
d603				Digital output, terminal 48 ”angular controller enabled”	BO
d604				Digital output, terminal 49 ”fault”	BO
d607				Coarse pulse input 1, terminal 84	BO
d608				Coarse pulse input 2, terminal 65	BO
H609	16#0000			Mask to invert digital inputs	W
d610				Digital input 1, terminal 53	BO
d611				Digital input 2, terminal 54	BO
d612				Digital input 3, terminal 55	BO
d613				Digital input 4, terminal 56	BO
d614				Digital input 5, terminal 57	BO
d615				Digital input 6, terminal 58	BO
d616				Digital input 7, terminal 59	BO
d617				Digital input 8, terminal 60	BO

Para.	Factory set	Units	Start-up value	Significance	Type
H618	1			Multiplexer for analog output 1	I
H619	0			Multiplexer for analog output 2	I
H620	3618			Source for analog output 1	I
H621	0000			Source to inhibit, analog output 1	I
H622	3619			Source for analog output 2	I
H623	0000			Source to inhibit, analog output 2	I
H631	0105			Source for the bi-directional digital output 1	I
H632	0116			Source for the bi-directional digital output 2	I
H633	0109			Source for the bi-directional digital output 3	I
H634	0003			Source for the bi-directional digital output 4	I
H635	0004			Source for the digital output 1	I
H636	0000			Source for the digital output 2	I
H637	1			Enable bi-directional digital output 1	I
H638	1			Enable bi-directional digital output 2	I
H639	1			Enable bi-directional digital output 3	I
H640	1			Enable bi-directional digital output 4	I
H650	0			Multiplexer for control word 1, bit 0	I
H651	1			Multiplexer for control word 1, bit 1	I
H652	1			Multiplexer for control word 1, bit 2	I
H653	1			Multiplexer for control word 1, bit 3	I
H654	1			Multiplexer for control word 1, bit 4	I
H655	1			Multiplexer for control word 1, bit 5	I
H656	1			Multiplexer for control word 1, bit 6	I
H657	0			Multiplexer for control word 1, bit 7	I
H658	0			Multiplexer for control word 1, bit 8	I
H659	0			Multiplexer for control word 1, bit 9	I
H660	1			Multiplexer for control word 1, bit 10	I
H661	1			Multiplexer for control word 1, bit 11	I
H662	1			Multiplexer for control word 1, bit 12	I
H663	0			Multiplexer for control word 1, bit 13	I
H664	0			Multiplexer for control word 1, bit 14	I
H665	1			Multiplexer for control word 1, bit 15	I
d666				Analog output 1	R
d667				Analog output 2	R
H668	0	ms		Smoothing time constant, analog output 1	R
H669	0	ms		Smoothing time constant, analog output 2	R
H700	1			Enable USS slave	BO
H701	9600			Baud rate USS slave	DI
H703	0			Address USS slave	I
H704	0			USS slave, 4-wire operation	BO
d705				Status USS slave	W
d706				PZD1 receive USS	W
d707				PZD2 receive USS	W
H708	2000			Source for 1st PZD send USS	I
H709	2000			Source for 2nd PZD send USS	I
d801 – d810				PZD1 to PZD10 from COMBOARD	W
H811	2801			Source for control word 1 from CB	I
H812	2804			Source for control word 2 from CB	I
H813	2802			Source for setpoint 1 from CB	I
H814	2803			Source for setpoint 2 from CB	I

Para.	Factory set	Units	Start-up value	Significance	Type
H815	2805			Source for setpoint 3 from CB	I
H816	2806			Source for setpoint 4 from CB	I
H817	2807			Source for setpoint integer ➔ REAL from CB	I
d818				Result integer ➔ REAL from CB	R
H819	2809			Source, high word of the double word from CB	I
H820	2810			Source, low word of the double word from CB	I
d821				Double word from CB (N4 format) as REAL value	R
H822	3446			Source for the 1st actual value at CB	I
H823	3447			Source for the 2nd actual value at CB	I
H824	3448			Source for the 3rd actual value at CB	I
H825	3449			Source for the 4th actual value at CB	I
H826	3000			Source for the actual value (REAL ➔ integer) at CB	I
H828	3000			Source for the 5th actual value at CB(word o.double word)	I
H829	1.0			Normalization for H828 (REAL ➔ N4)	R
H831	2442			Source for PZD1 at CB	I
H832	2822			Source for PZD2 at CB	I
H833	2823			Source for PZD3 at CB	I
H834	2444			Source for PZD4 at CB	I
H835	2824			Source for PZD5 at CB	I
H836	2825			Source for PZD6 at CB	I
H837	2827			Source for PZD7 at CB	I
H838	2000			Source for PZD8 at CB	I
H839	2828			Source for PZD9 at CB	I
H840	2829			Source for PZD10 at CB	I
H841	1.0			Normalization for double word from CB	R
H900	0000			Source for fault message F125	I
H901	0000			Source for fault message F126	I
H902	0000			Source for fault message F127	I
H903	0000			Source for fault message F128	I
H904	0000			Source for fault message F129	I
H905	0000			Source for fault message F130	I
H906	0000			Source for fault message F131	I
H907	0000			Source for alarm A106	I
H908	0000			Source for alarm A107	I
H909	0000			Source for alarm A108	I
H910	0000			Source for alarm A109	I
H911	0000			Source for alarm A110	I
H912	0000			Source for alarm A111	I
H913	0000			Source for alarm A112	I
d921 – d930				PZD1 to PZD10 for output at CB	W
H960	0			Fixed value 1, integer type	I
H961	0			Fixed value 2, integer type	I
H962	0			Fixed value 3, integer type	I
H963	0			Fixed value 4, integer type	I
H964	0			Fixed value 5, integer type	I
H965	0			Fixed value 6, integer type	I
H971	16#0000			Fixed value 1, word type	W
H972	16#0000			Fixed value 2, word type	W
H973	16#0000			Fixed value 3, word type	W
H974	16#0000			Fixed value 4, word type	W

Para.	Factory set	Units	Start-up value	Significance	Type
H981	0			Fixed value 1, double word type	W
H982	0			Fixed value 2, double word type	W
H983	0			Fixed value 3, double word type	W
H984	0			Fixed value 4, double word type	W
H990	0.0			Fixed value 1, REAL type	R
H991	0.0			Fixed value 2, REAL type	R
H992	0.0			Fixed value 3, REAL type	R
H993	0.0			Fixed value 4, REAL type	R
H994	0.0			Fixed value 5, REAL type	R
H995	0.0			Fixed value 6, REAL type	R
H996	0.0			Fixed value 7, REAL type	R
H997	0.0			Fixed value 8, REAL type	R
d998	134			Identification of SIMADYN D components	I
d999	121			Identification of software for SIMOVIS	I
L028	3234			Source for the 1st display parameter, REAL type (d028)	I
L029	3330			Source for the 2nd display parameter, REAL type (d029)	I
L030	3332			Source for the 3rd display parameter, REAL type (d030)	I
L031	3819			Source for the 4th display parameter, REAL type (d031)	I
L032	0193			Source for the 1st display parameter, BOOL type (d032)	I
L033	0196			Source for the 2nd display parameter, BOOL type (d033)	I
L034	0105			Source for the 3rd display parameter, BOOL type (d034)	I
L035	0116			Source for the 4th display parameter, BOOL type (d035)	I
L036	2500			Source for the 1st display parameter, integer type (d036)	I
L037	2502			Source for the 2nd display parameter, integer type (d037)	I
L038	2605			Source for the 1st display parameter, word type (d038)	I
L039	2606			Source for the 2nd display parameter, word type (d039)	I
L098-L112, c114-c119, L120-L123, c125, L200-L212, c214-c219, L220-L223, c225, c300, L301-L302				new parameters, refers to Chapter 3.2.3	
L400	2048			Length buffer	I
c401				Coupling Trace	BO
c402				Status Trace	W
L605	5000			Source, double word quantity (conversion into 2 words)	I
L606	2000			Source, input 1 for integer adder 1	I
L607	2000			Source, input 2 for integer adder 1	I
L608	2000			Source, input 1 for integer subtractor 1	I
L609	2000			Source, input 2 for integer subtractor 1	I
L646	2000			Source for integer ➔ REAL conversion	I
L647	3000			Source for REAL ➔ integer conversion	I
L698	0000			Source for setting input; flipflop 1	I
L699	0000			Source for reset input; flipflop 1	I

Para.	Factory set	Units	Start-up value	Significance	Type
L700	0001			Source, 1st input AND logic gate 1	I
L701	0001			Source, 2nd input AND logic gate 1	I
L702	0001			Source, 3rd input AND logic gate 1	I
L703	0001			Source, 1st input AND logic gate 2	I
L704	0001			Source, 2nd input AND logic gate 2	I
L705	0001			Source, 3rd input AND logic gate 2	I
L706	3000			Source, input 0 of changeover switch 1	I
L707	3000			Source, input 1 of changeover switch 1	I
L708	0000			Source, select input of changeover switch 1	I
L709	0000			Source of the 1st edge evaluation block	I
L710	0000			Source, 1st input OR logic gate 1	I
L711	0000			Source, 2nd input OR logic gate 1	I
L712	0000			Source, 3rd input OR logic gate 1	I
L713	0000			Source, 1st input OR logic gate 2	I
L714	0000			Source, 2nd input OR logic gate 2	I
L715	0000			Source, 3rd input OR logic gate 2	I
L716	3000			Source, input 0 of changeover switch 2	I
L717	3000			Source, input 1 of changeover switch 2	I
L718	0000			Source, select input of changeover switch 2	I
L728	0000			Source, power-on delay 1	I
L729	100.0	ms		Duration, power-on delay 1	SD
L730	0000			Source, power-off delay 1	I
L731	100.0	ms		Duration, power-off delay 1	SD
L732	0000			Source for the 1st inverter	I
L733	0000			Source for the 2nd inverter	I
L734	0000			Source for setting input; flipflop 2	I
L735	0000			Source for reset input; flipflop 2	I
L738	0000			Source to inhibit the 1st PT1 element	I
L739	2.0			Quality of the bandstop filter	R
L740	3000			Source for the 1st PT1 element	I
L741	20.0	ms		Filter time constant for the 1st PT1 element	SD
L742	3000			Source for the input signal of the bandstop filter	I
L743	3002			Source for the bandstop frequency of the bandstop filter	I
L744	3000			Source for the X input of the comparator	I
L745	3000			Source for the Y input of the comparator	I
L746	3001			Source for the upper limit value of the limiter	I
L747	3000			Source for the input quantity of the limiter	I
L748	3001			Source for the lower limit value of the limiter	I
L749	3000			Source for the input, comparator with hysteresis	I
L750	3001			Source for the range, comparator with hysteresis	I
L751	0.1			Hysteresis of the comparator with hysteresis	R
L752	3003			Source for comparison value comparator with hysteresis	I
L753	3000			Source for input, free 2-point characteristic	I
L754	0.0			X1 value 2-point characteristic	R
L755	0.0			Y1 value 2-point characteristic	R
L756	1.0			X2 value 2-point characteristic	R
L757	1.0			Y2 value 2-point characteristic	R
L760	2000			Source for word 1 (word ➔ bits)	I
L761	2000			Source for high word (double word ➔ REAL)	I
L762	2000			Source for low word (double word ➔ REAL)	I

Para.	Factory set	Units	Start-up value	Significance	Type
L763	1.0			Normalization factor for L761, L762	R
L764	2000			Source for word ➔ REAL conversion	I
L765	1.0			Normalization to L764	R
L766	3000			Source for REAL ➔ N2 conversion	I
L767	1.0			Normalization to L766	R
L786	3000			Source, 1st input, REAL adder 1	I
L787	3000			Source, 2nd input, REAL adder 1	I
L788	3000			Source, 3rd input, REAL adder 1	I
L789	3000			Source, 1st input, REAL adder 2	I
L790	3000			Source, 2nd input, REAL adder 2	I
L791	3000			Source, 3rd input, REAL adder 2	I
L792	3000			Source, 1st input, REAL subtractor 1	I
L793	3000			Source, 2nd input, REAL subtractor 1	I
L794	3000			Source, 1st input, REAL subtractor 2	I
L795	3000			Source, 2nd input, REAL subtractor 2	I
L796	3001			Source, 1st input, REAL multiplier 1	I
L797	3001			Source, 2nd input, REAL multiplier 1	I
L798	3001			Source, 3rd input, REAL multiplier 1	I
L799	3001			Source, 1st input, REAL multiplier 2	I
L800	3001			Source, 2nd input, REAL multiplier 2	I
L801	3001			Source, 3rd input, REAL multiplier 2	I
L802	3001			Source, 1st input, REAL divider 1	I
L803	3001			Source, 2nd input, REAL divider 1	I
L804	3001			Source, 1st input, REAL divider 2	I
L805	3001			Source, 2nd input, REAL divider 2	I
L810	2000			Source for word 2 (word ➔ bits)	I
L812	2001			Source, 1st input, integer divider 1	I
L813	2001			Source, 2nd input, integer divider 1	I
L814	2001			Source, 1st input, integer multiplier 1	I
L815	2001			Source, 2nd input, integer multiplier 1	I
L816	2000			Source, high word (word ➔ double word)	I
L817	2000			Source, low word (word ➔ double word)	I
L818	3000			Source, input free integrator	I
L819	1.0			Upper limit, integrator	R
L820	-1.0			Lower limit, integrator	R
L821	3000			Source, setting value integrator	I
L822	1000	ms		Integration time, integrator	SD
L823	0000			Source for the integrator setting signal	I
L824	3000			Source, input 1 of the changeover switch 3	I
L825	3000			Source, input 2 of the changeover switch 3	I
L826	0000			Source, select input of changeover switch 3	I
L827	3000			Source, input 1 of the changeover switch 4	I
L828	3000			Source, input 2 of the changeover switch 4	I
L829	0000			Source, select input of changeover switch 4	I
L830	0000			Source, AND-OR logic 1 (OR)	I
L831	0000			Source, AND-OR logic 1 (AND 1)	I
L832	0001			Source, AND-OR logic 1 (AND 2)	I
L833	0000			Source, AND-OR logic 2 (OR)	I
L834	0000			Source, AND-OR logic 2 (AND 1)	I
L835	0001			Source, AND-OR logic 2 (AND 2)	I

8 Changes

Edition 11/98

1. Parameters d129, H138, H668, H669 supplemented in the Documentation
2. Factory setting, parameters H544, H651-H656, H660-H662
3. Pulse ratio no longer used (this is now automatically generated)
4. Definition, speed ratio inverted

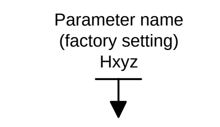
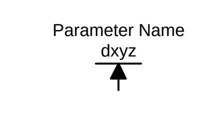
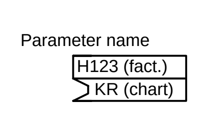
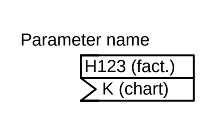
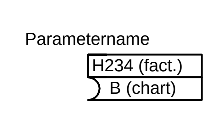
Edition 06/99

1. Can be freely wired using BICO technology (many new parameters!).
2. Digital input quantities, also available inverted.
3. Bi-directional outputs can be de-activated.
4. Possible to inhibit analog inputs and outputs.
5. Freely-available blocks.
6. The ratio resolution can be changed.
7. Different data types for the peer-to-peer interface.
8. Double words can be received and sent.
9. Monitoring parameters are not identical with version 2.01 (are in some instances used as parameter which can be changed).

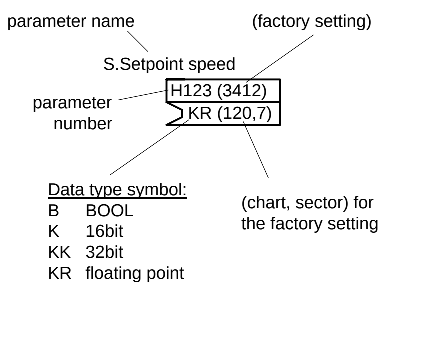
Edition 05/01

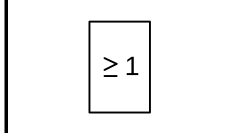
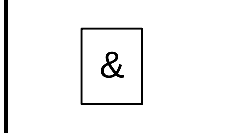
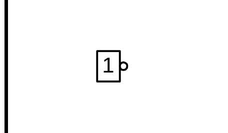
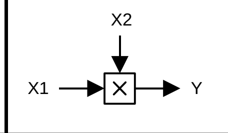
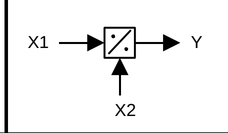
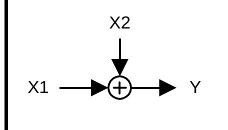
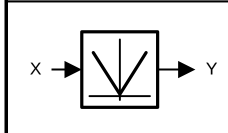
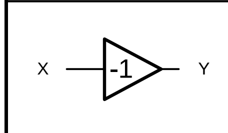
1. For release V2.1: Angular synchronism can also be implemented using **2 absolute value encoders** by comparing the two position actual values

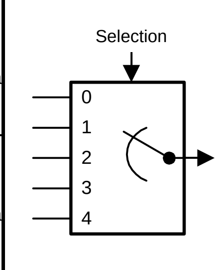
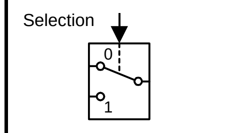
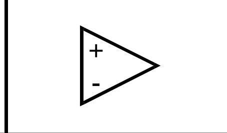
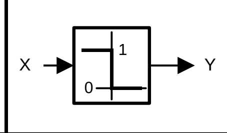
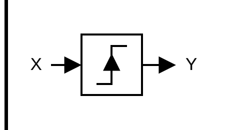
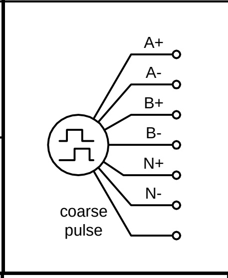
Function charts for the standard software package Angular Synchronous Control SPA440

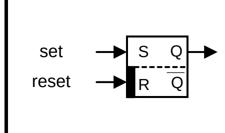
Technology parameters	
Symbol	Explanations
	technology parameter e.g. H231
	dsiplay parameter e.g. d123
	Connection to a floating-point source (fact.) which can be modified with H123
	Connection to a integer source (fact.) which can be modified with H123
	Connection to a boolean source (fact.) which can be modified with H234

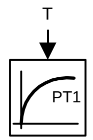
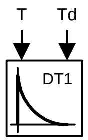
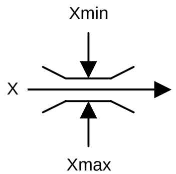
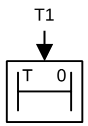
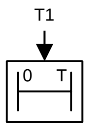
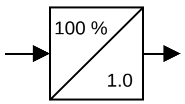
Excample:

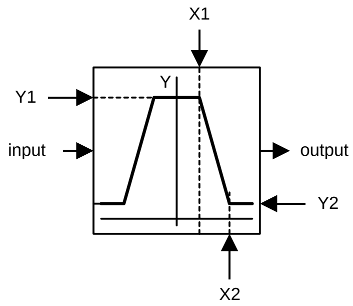
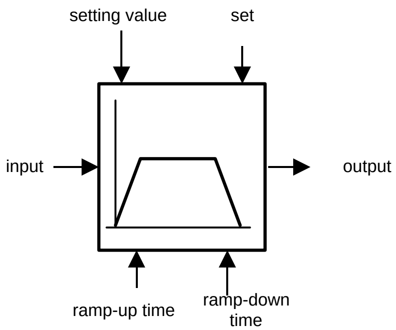


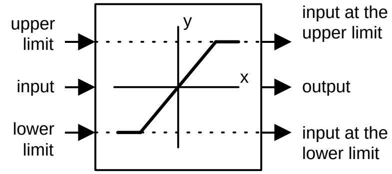
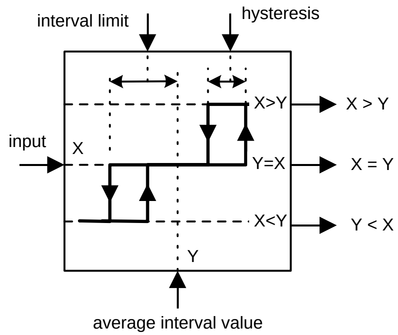
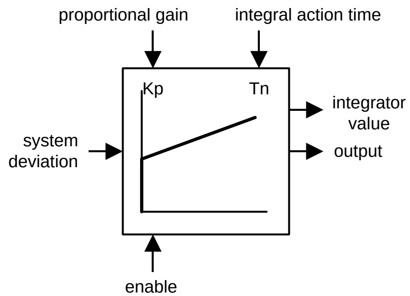
Logic and arithmetic	
Symbol	Explanations
	OR operation Inputs and outputs may be of binary or vector data type
	AND operation Inputs and outputs may be of binary or vector data type
	Logical inversion
	Multiplication Y = X1 * X2
	Dividor $Y = \frac{X1}{X2}$
	Adder Y = X1 + X2
	Absolute value Y = | X |
	Negation Y = - X

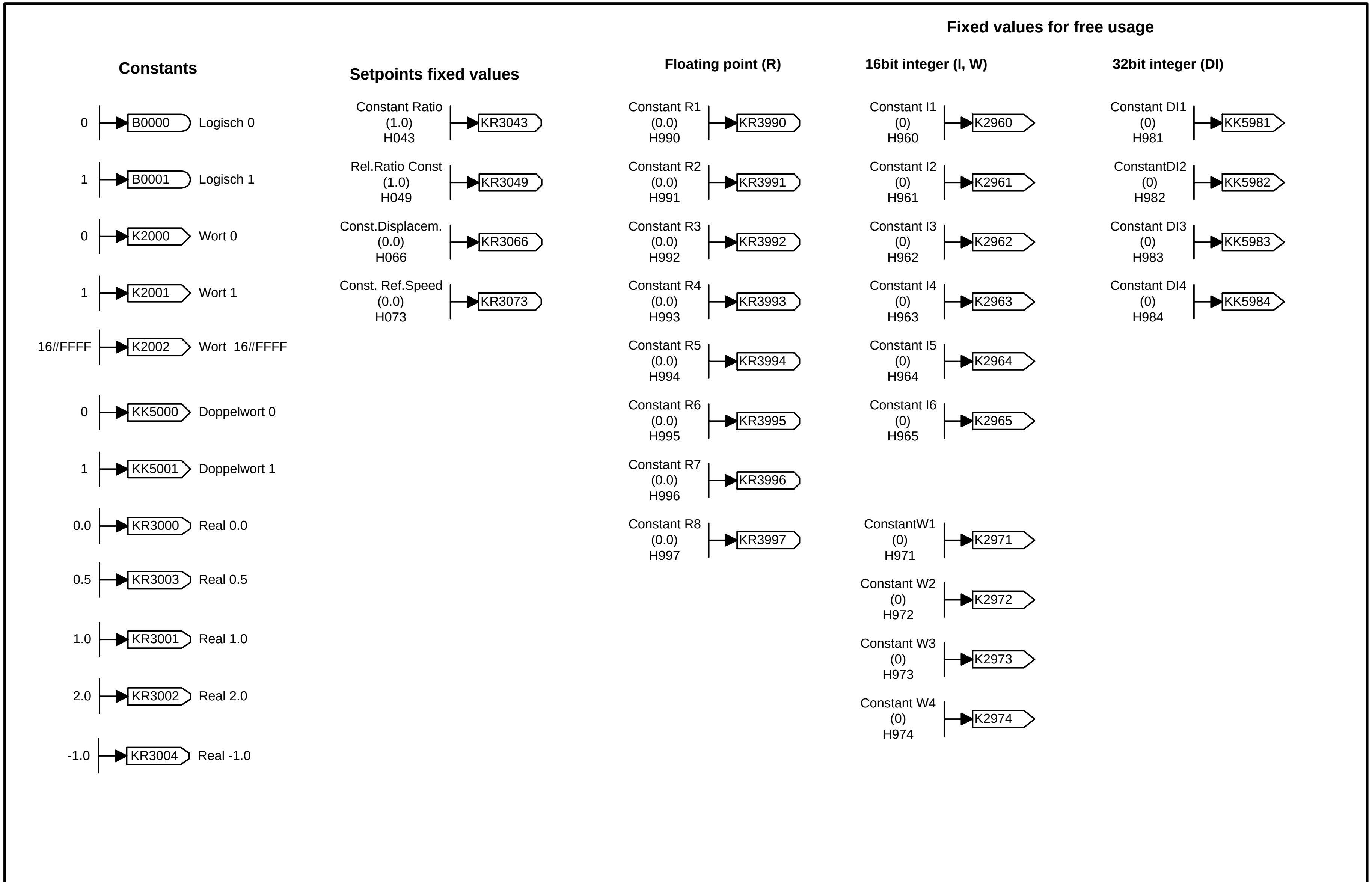
Miscellaneous	
Symbol	Explanations
	Multiplexer e.g. with 5 inputs
	Switch selection with 2 inputs
	Operational amplifier
	Sign determination Y = sign (X)
	Edge detector Generats a pulse for the positive edge of X
	Pluse encoder Here: 2 tracks A, B and zero pulse N; interface RS422

	R-S-Flip-Flop

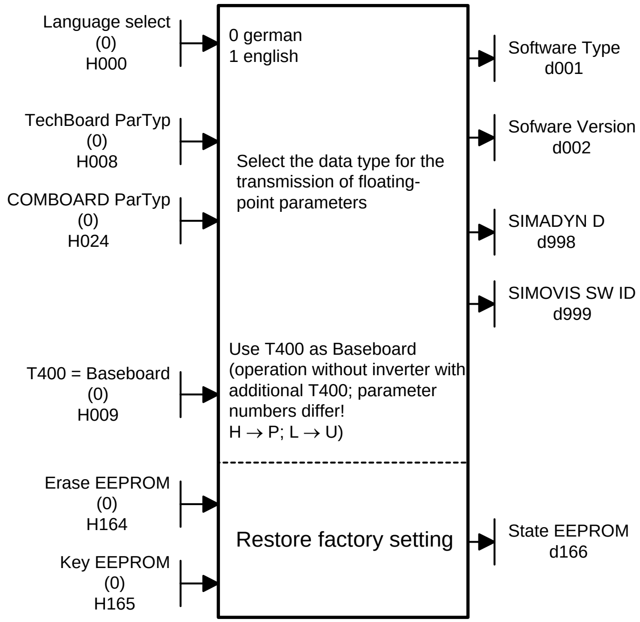
Symbol	Explanations
	Low pass filter T time constant
	High pass filter T = smoothing time constant Td = derivative action time constant
	Limiter function Xmin <= X <= Xmax
	Switch on delay T1
	Switch off delay T1
	Converter here: fixed point to floationg point (100% converted to 1.0)

Symbol	Explanations
	Curve defined by 2 points (X1,Y1) and (X2,Y2) symmetrical to the Y-axis
	Ramp function with setting function

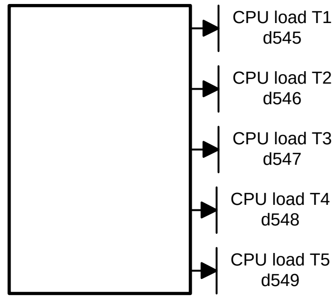
Symbol	Explanations
	Limiter signalling if the input quantity exceeds the limits
	Limit value monitor with hysteresis
	PI controller


Fixed values for free usage
Constants
Setpoints fixed values
Floating point (R)
16bit integer (I, W)
32bit integer (DI)
0 B0000 Logisch 0
1 B0001 Logisch 1
0 K2000 Wort 0
1 K2001 Wort 1
16#FFFF K2002 Wort 16#FFFF
0 KK5000 Doppelwort 0
1 KK5001 Doppelwort 1
0.0 KR3000 Real 0.0
0.5 KR3003 Real 0.5
1.0 KR3001 Real 1.0
2.0 KR3002 Real 2.0
-1.0 KR3004 Real -1.0
Constant Ratio (1.0) H043 KR3043
Rel.Ratio Const (1.0) H049 KR3049
Const.Displacem. (0.0) H066 KR3066
Const. Ref.Speed (0.0) H073 KR3073
Constant R1 (0.0) H990 KR3990
Constant R2 (0.0) H991 KR3991
Constant R3 (0.0) H992 KR3992
Constant R4 (0.0) H993 KR3993
Constant R5 (0.0) H994 KR3994
Constant R6 (0.0) H995 KR3995
Constant R7 (0.0) H996 KR3996
Constant R8 (0.0) H997 KR3997
Constant I1 (0) H960 K2960
Constant I2 (0) H961 K2961
Constant I3 (0) H962 K2962
Constant I4 (0) H963 K2963
Constant I5 (0) H964 K2964
Constant I6 (0) H965 K2965
ConstantW1 (0) H971 K2971
Constant W2 (0) H972 K2972
Constant W3 (0) H973 K2973
Constant W4 (0) H974 K2974
Constant DI1 (0) H981 KK5981
ConstantDI2 (0) H982 KK5982
Constant DI3 (0) H983 KK5983
Constant DI4 (0) H984 KK5984

General settings



CPU load



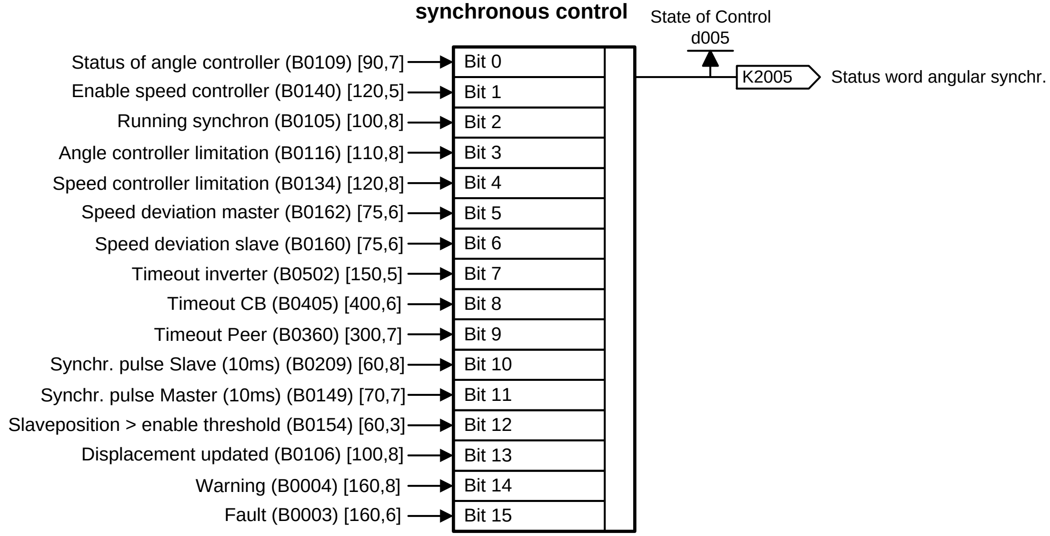
Restore factory settings:

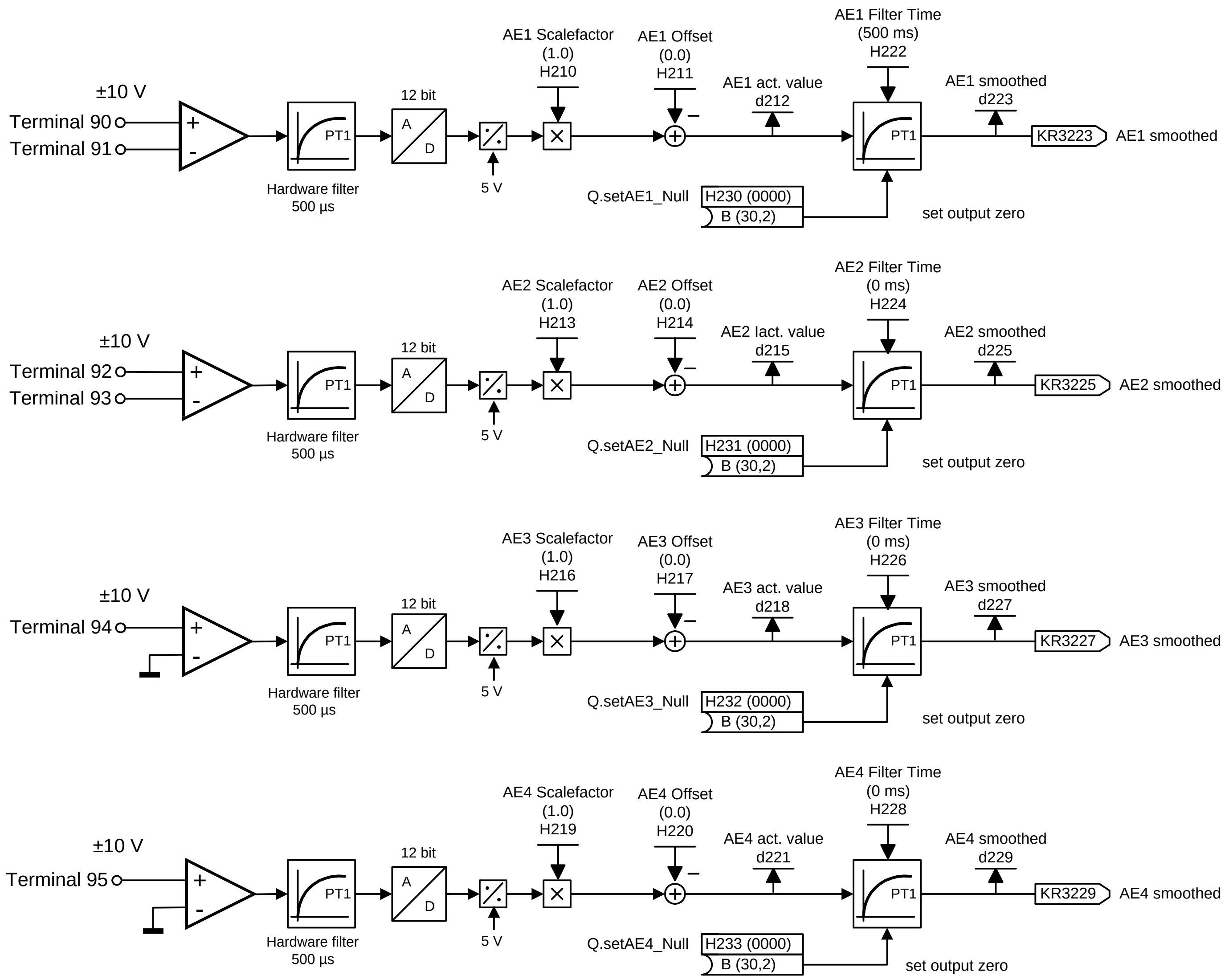
Set
H165 = 165
H164 = 1

All parameter changes are deleted and set to the original factory setting.

This operation can not be canceled !

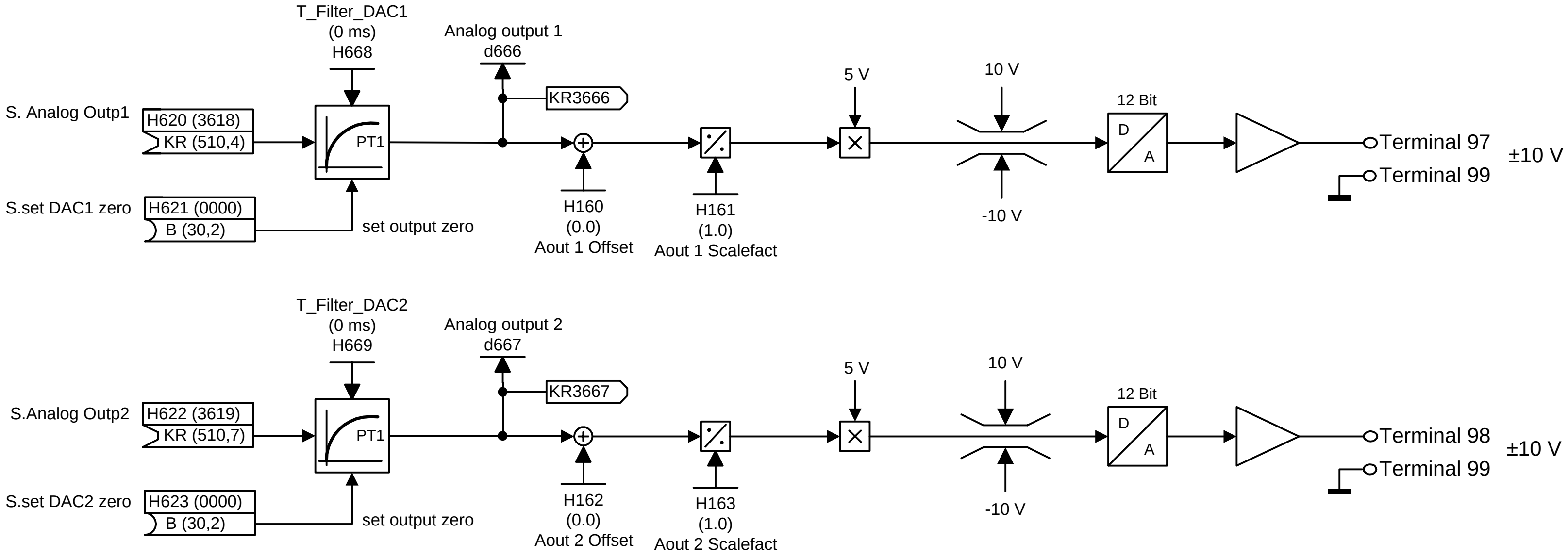
Status word angular synchronous control



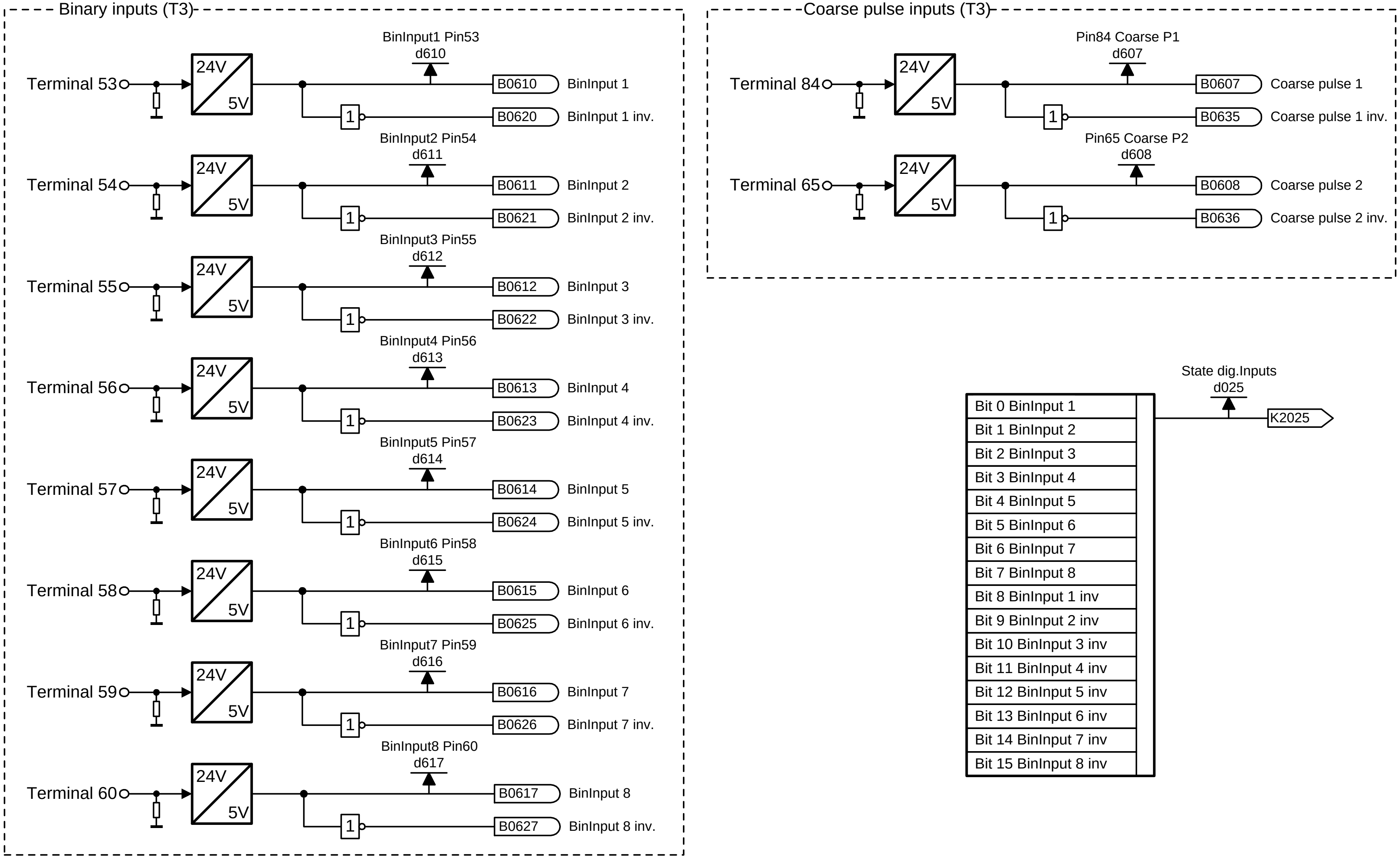


Task cycle time:

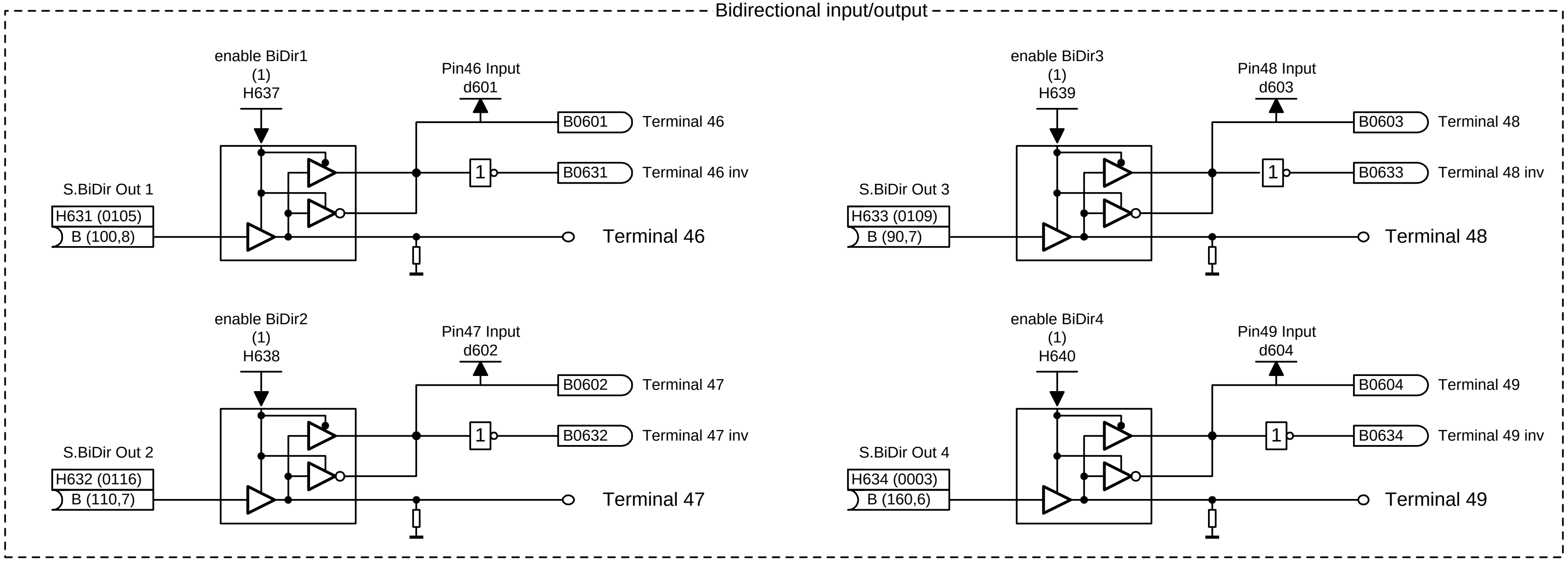
Input	**Task**	**cykle time**
AE1	T1	1,2 ms
AE2	T2	4,8 ms
AE3	T2	4,8 ms
AE4	T2	4,8 ms

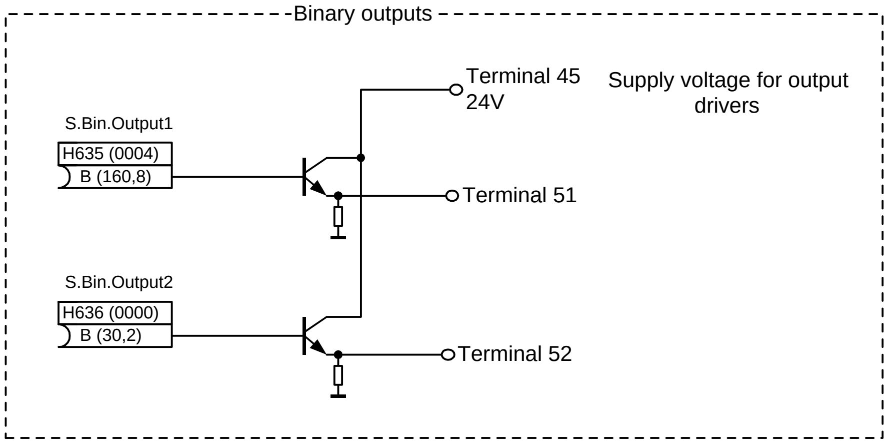

T_Filter_DAC1
(0 ms)
H668
Analog output 1
d666
KR3666
S. Analog Outp1
H620 (3618)
KR (510,4)
PT1
5 V
10 V
12 Bit
D
A
Terminal 97
Terminal 99
±10 V
-10 V
S.set DAC1 zero
H621 (0000)
B (30,2)
set output zero
H160
(0.0)
Aout 1 Offset
H161
(1.0)
Aout 1 Scalefact
T_Filter_DAC2
(0 ms)
H669
Analog output 2
d667
KR3667
S.Analog Outp2
H622 (3619)
KR (510,7)
PT1
5 V
10 V
12 Bit
D
A
Terminal 98
Terminal 99
±10 V
-10 V
S.set DAC2 zero
H623 (0000)
B (30,2)
set output zero
H162
(0.0)
Aout 2 Offset
H163
(1.0)
Aout 2 Scalefact

1	2	3	4	5	6	7	8


Binary inputs (T3)
BinInput1 Pin53
d610
Terminal 53
24V
5V
1
B0610
BinInput 1
B0620
BinInput 1 inv.
BinInput2 Pin54
d611
Terminal 54
B0611
BinInput 2
B0621
BinInput 2 inv.
BinInput3 Pin55
d612
Terminal 55
B0612
BinInput 3
B0622
BinInput 3 inv.
BinInput4 Pin56
d613
Terminal 56
B0613
BinInput 4
B0623
BinInput 4 inv.
BinInput5 Pin57
d614
Terminal 57
B0614
BinInput 5
B0624
BinInput 5 inv.
BinInput6 Pin58
d615
Terminal 58
B0615
BinInput 6
B0625
BinInput 6 inv.
BinInput7 Pin59
d616
Terminal 59
B0616
BinInput 7
B0626
BinInput 7 inv.
BinInput8 Pin60
d617
Terminal 60
B0617
BinInput 8
B0627
BinInput 8 inv.
Coarse pulse inputs (T3)
Pin84 Coarse P1
d607
Terminal 84
B0607
Coarse pulse 1
B0635
Coarse pulse 1 inv.
Pin65 Coarse P2
d608
Terminal 65
B0608
Coarse pulse 2
B0636
Coarse pulse 2 inv.
State dig.Inputs
d025
K2025
Bit 0 BinInput 1
Bit 1 BinInput 2
Bit 2 BinInput 3
Bit 3 BinInput 4
Bit 4 BinInput 5
Bit 5 BinInput 6
Bit 6 BinInput 7
Bit 7 BinInput 8
Bit 8 BinInput 1 inv
Bit 9 BinInput 2 inv
Bit 10 BinInput 3 inv
Bit 11 BinInput 4 inv
Bit 12 BinInput 5 inv
Bit 13 BinInput 6 inv
Bit 14 BinInput 7 inv
Bit 15 BinInput 8 inv

1	2	3	4	5	6	7	8

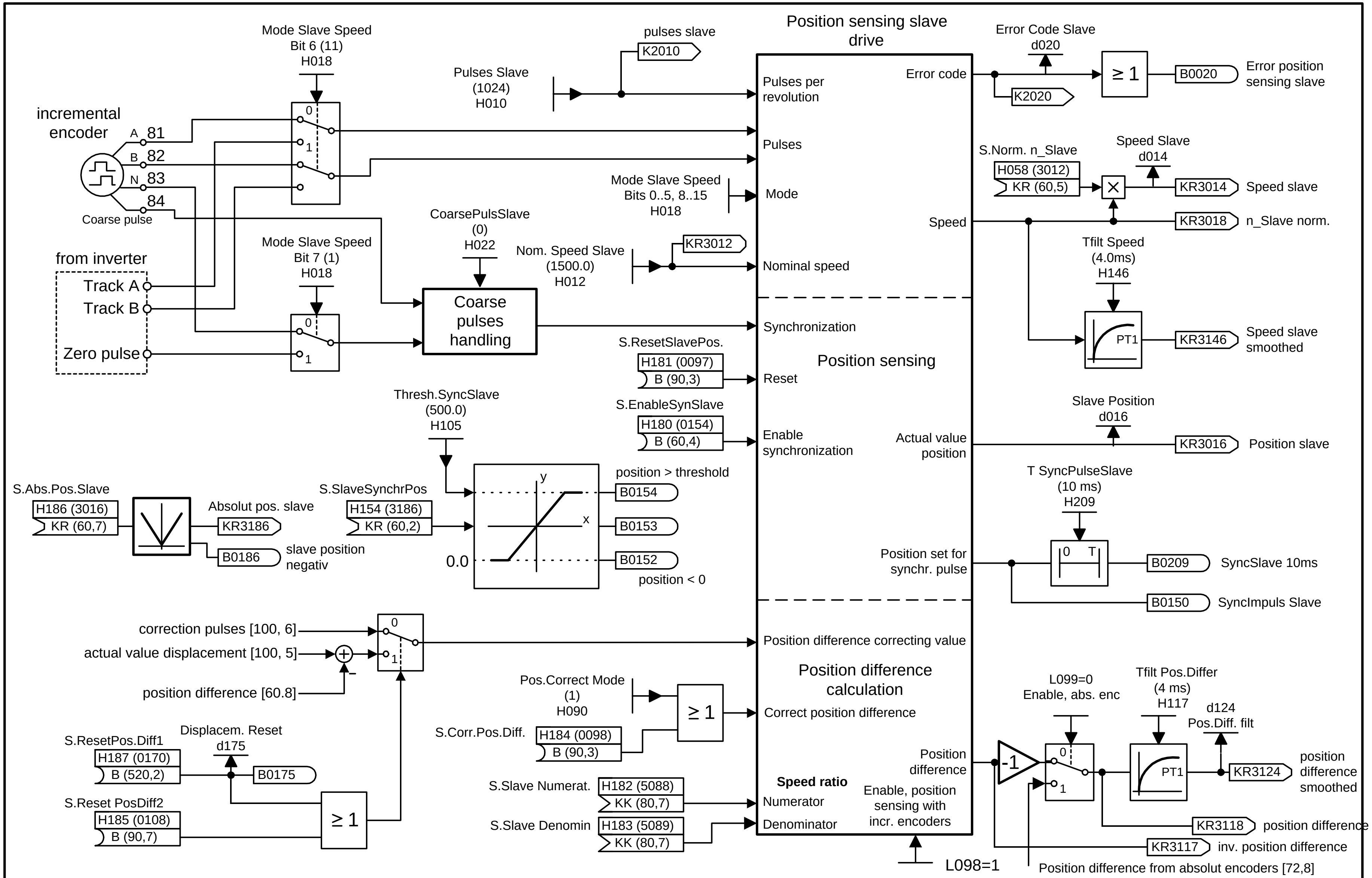




Warning:

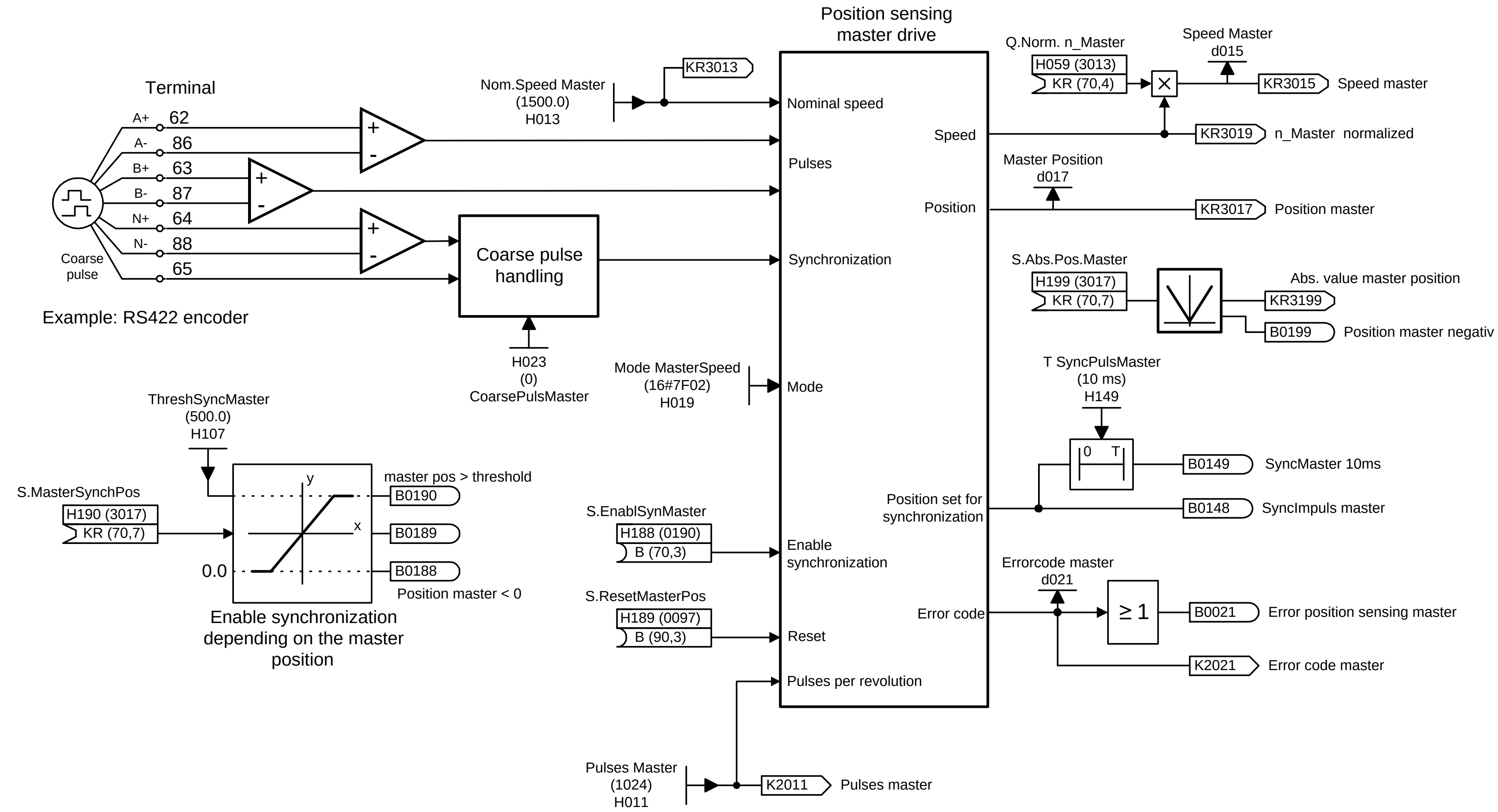
H637 ... H640 are initialization parameters. Modification takes places after the next power on.

If bidirectional outputs are enabled as output the corresponding input value is inverted!
E.g.: H640 = 1 $\rightarrow$ d604 displays the inverse level to terminal 49



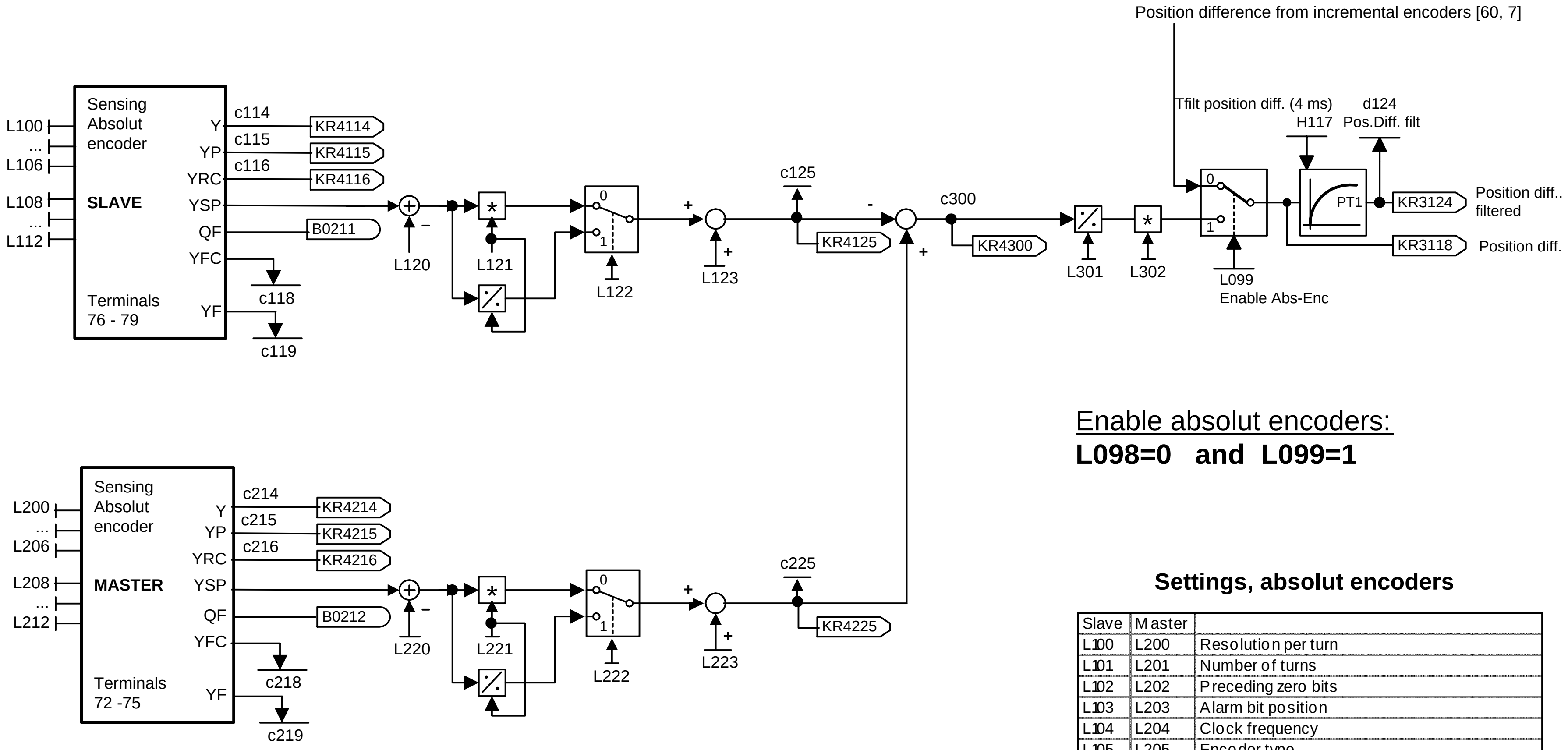
1	2	3	4	5	6	7	8

Speed and position sensing		FPlan_english.vsd	Function diagram	- 60 -
Slave		05.01	Angular Synchr. Control SPA440	



1	2	3	4	5	6	7	8

Speed and position sensing	FPlan_english.vsd	Function diagram	- 70 -
Master	05.01	Angular Synchr. Control SPA440	



Enable absolut encoders:

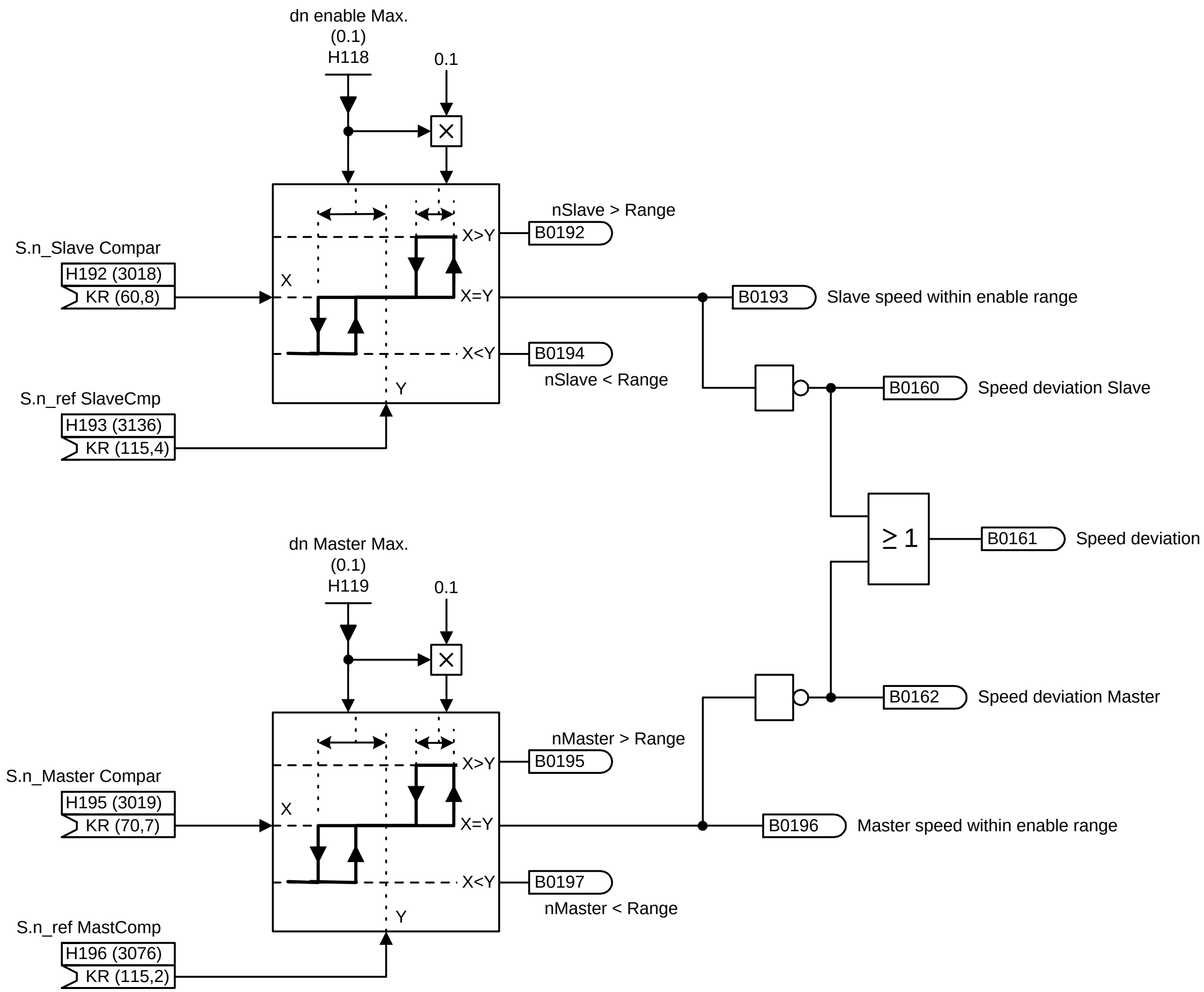
L098=0 and L099=1

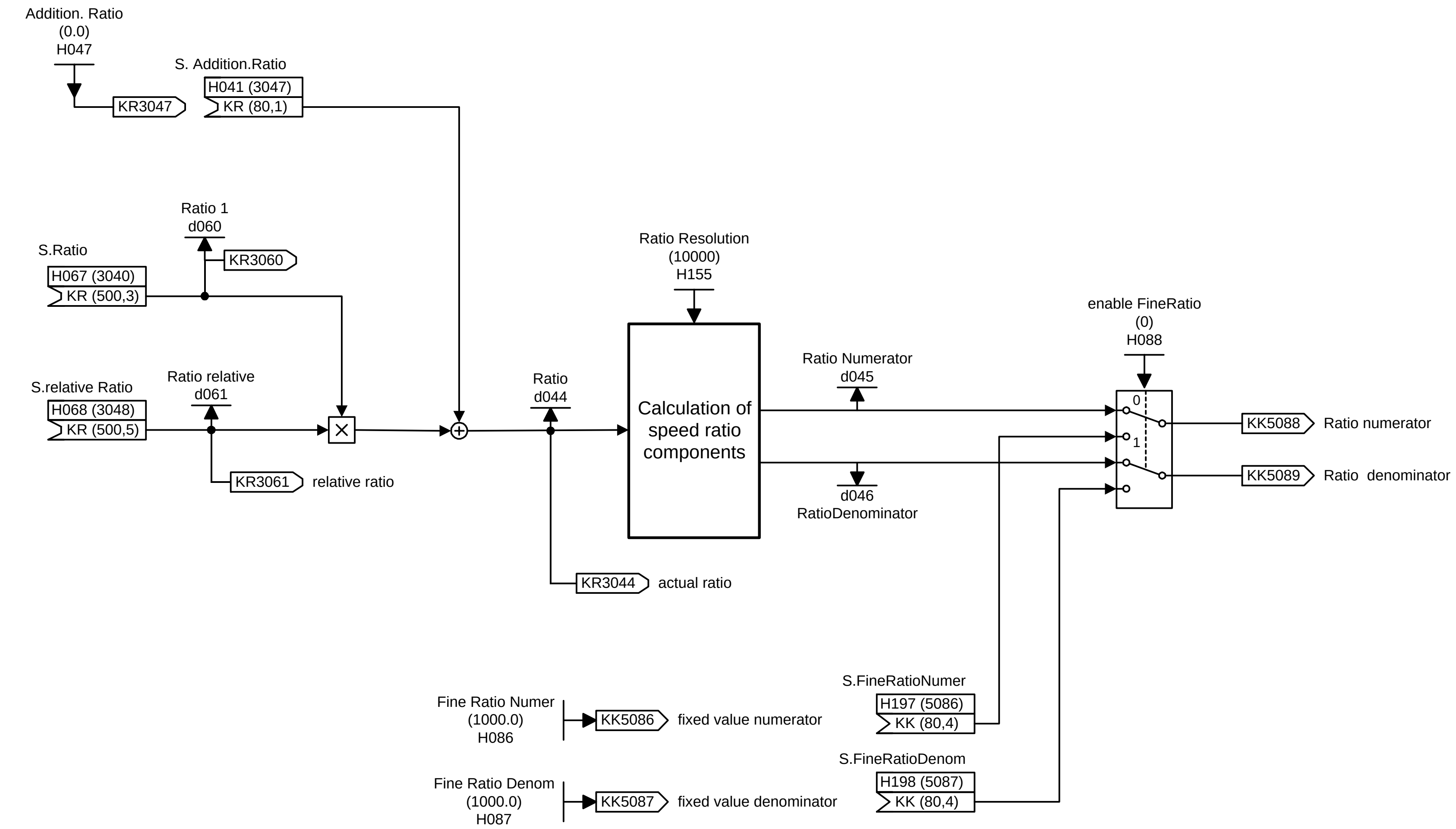
Only useful for linear axis!
(no range overflow)

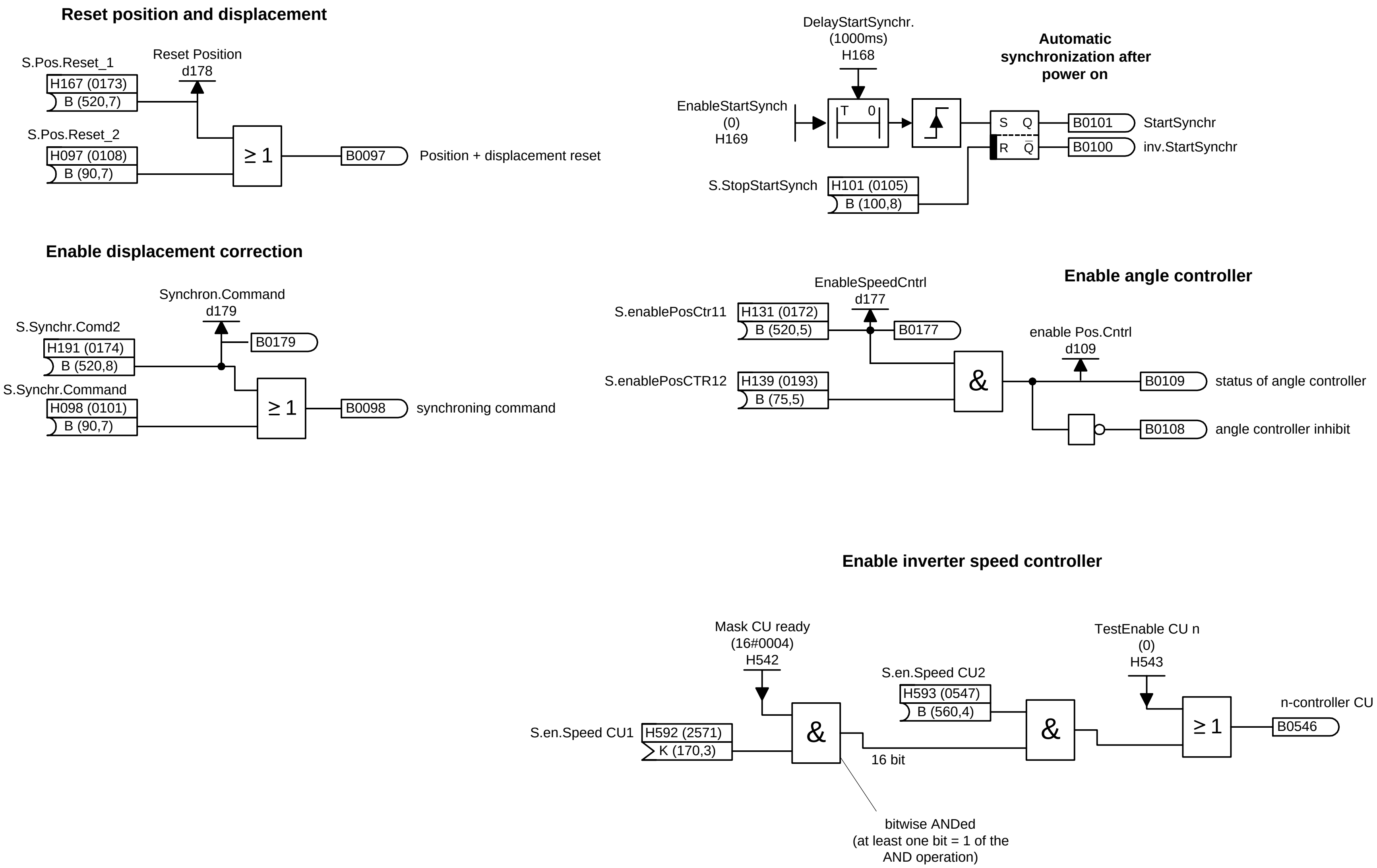
Slave	Master	
c114	c214	Speed actual value
c115	c215	Position counter
c116	c216	Number of rotations
c118	c218	Error code
c119	c219	Error status

Settings, absolut encoders

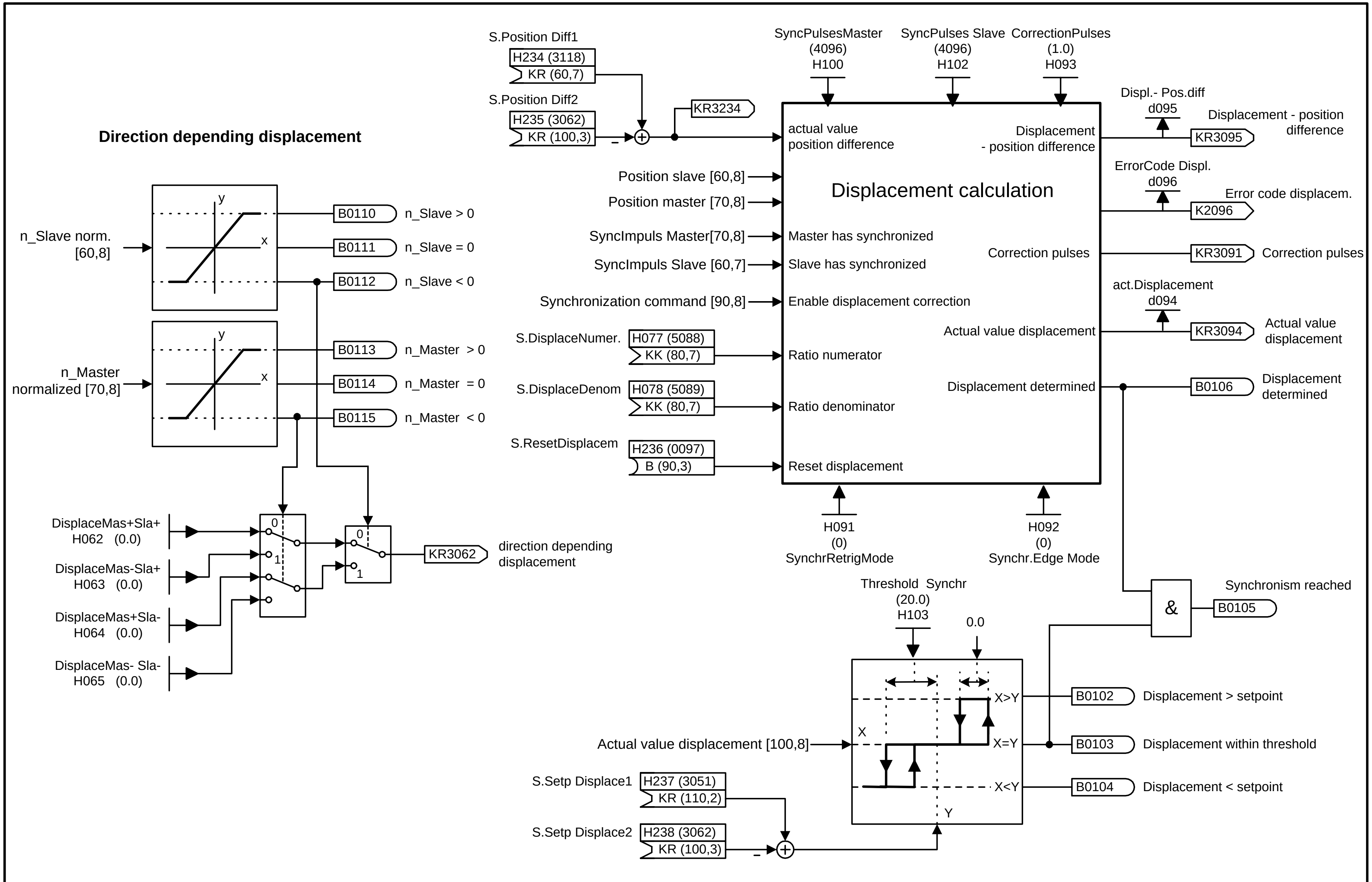
Slave	Master	
L100	L200	Resolution per turn
L101	L201	Number of turns
L102	L202	Preceding zero bits
L103	L203	Alarm bit position
L104	L204	Clock frequency
L105	L205	Encoder type
L106	L206	Data coding
L107	L207	Control word
L108	L208	Gearbox ratio
L109	L209	Normalization position
L110	L210	Normalization speed
L111	L211	Position offset
L112	L212	Upper limit speed
L120	L220	Offset, number of rotations
L121	L221	Scaling, positon actual value
L122	L222	Selection MUL/DIV
L123	L223	Scaling, positon actual value


dn enable Max.
(0.1)
H118
0.1
nSlave > Range
X>Y
B0192
S.n_Slave Compar
H192 (3018)
KR (60,8)
X
X=Y
B0193
Slave speed within enable range
X<Y
B0194
nSlave < Range
Y
S.n_ref SlaveCmp
H193 (3136)
KR (115,4)
B0160
Speed deviation Slave
≥ 1
B0161
Speed deviation
dn Master Max.
(0.1)
H119
0.1
B0162
Speed deviation Master
nMaster > Range
X>Y
B0195
S.n_Master Compar
H195 (3019)
KR (70,7)
X
X=Y
B0196
Master speed within enable range
X<Y
B0197
nMaster < Range
Y
S.n_ref MastComp
H196 (3076)
KR (115,2)

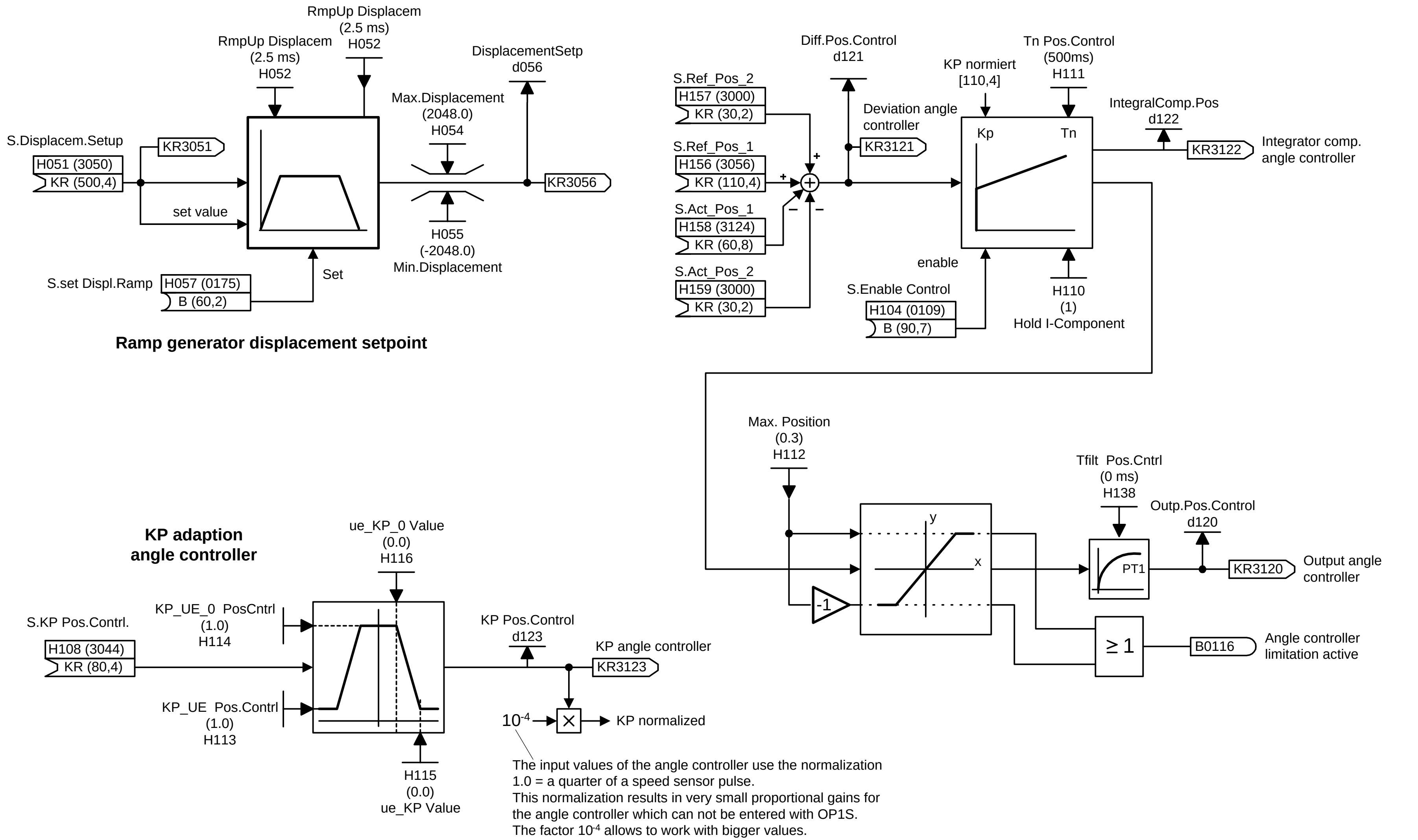

Addition. Ratio
(0.0)
H047
KR3047
S. Addition.Ratio
H041 (3047)
KR (80,1)
Ratio 1
d060
KR3060
S.Ratio
H067 (3040)
KR (500,3)
Ratio Resolution
(10000)
H155
enable FineRatio
(0)
H088
Ratio Numerator
d045
S.relative Ratio
Ratio relative
d061
H068 (3048)
KR (500,5)
Ratio
d044
Calculation of speed ratio components
0
1
KK5088
Ratio numerator
KK5089
Ratio denominator
KR3061
relative ratio
d046
RatioDenominator
KR3044
actual ratio
S.FineRatioNumer
H197 (5086)
KK (80,4)
Fine Ratio Numer
(1000.0)
H086
KK5086
fixed value numerator
S.FineRatioDenom
H198 (5087)
KK (80,4)
Fine Ratio Denom
(1000.0)
H087
KK5087
fixed value denominator



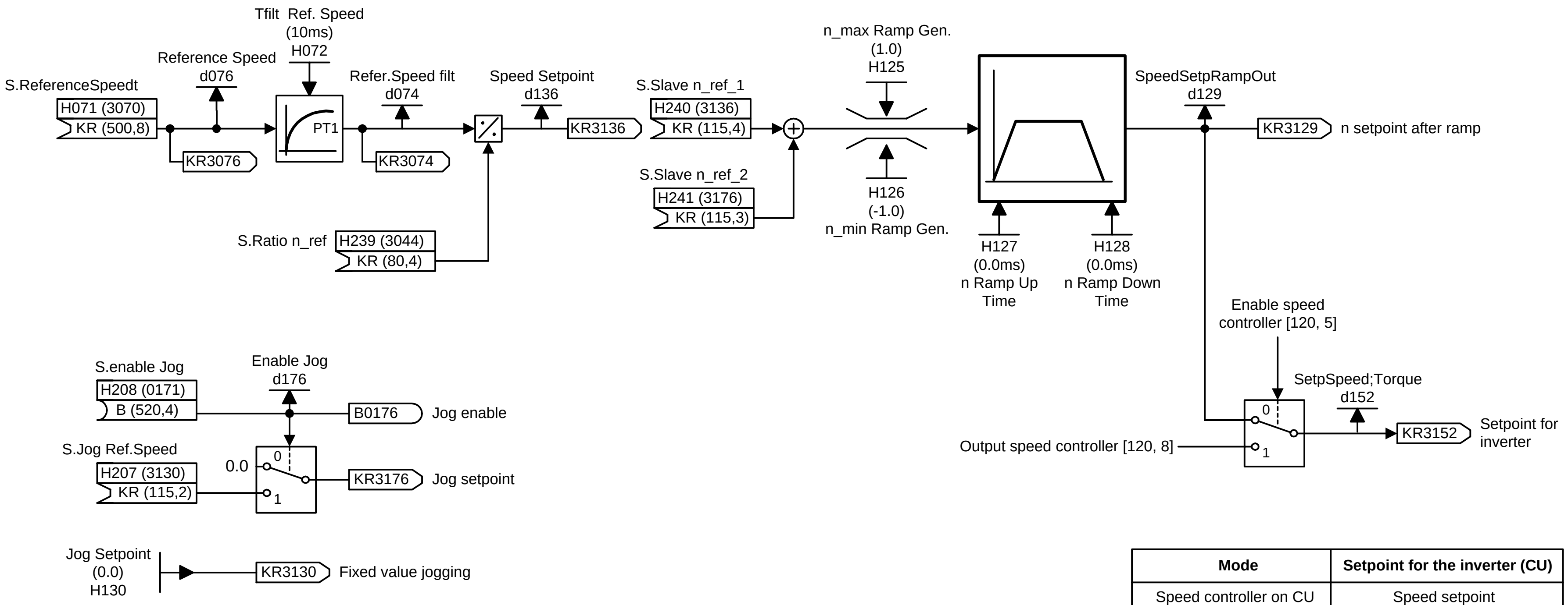
1	2	3	4	5	6	7	8
Control					FPlan_english.vsd	Function diagram	- 90 -
Conrol bits					05.01	Angular Synchr. Control SPA440	


Direction depending displacement
n_Slave norm. [60,8]
n_Master normalized [70,8]
y
x
B0110 n_Slave > 0
B0111 n_Slave = 0
B0112 n_Slave < 0
B0113 n_Master > 0
B0114 n_Master = 0
B0115 n_Master < 0
DisplaceMas+Sla+ H062 (0.0)
DisplaceMas-Sla+ H063 (0.0)
DisplaceMas+Sla- H064 (0.0)
DisplaceMas- Sla- H065 (0.0)
0
1
KR3062 direction depending displacement
S.Position Diff1
H234 (3118)
KR (60,7)
S.Position Diff2
H235 (3062)
KR (100,3)
KR3234
SyncPulsesMaster (4096) H100
SyncPulses Slave (4096) H102
CorrectionPulses (1.0) H093
Displacement calculation
actual value position difference
Position slave [60,8]
Position master [70,8]
SyncImpuls Master[70,8]
SyncImpuls Slave [60,7]
Synchronization command [90,8]
Master has synchronized
Slave has synchronized
Enable displacement correction
S.DisplaceNumer.
H077 (5088)
KK (80,7)
Ratio numerator
S.DisplaceDenom
H078 (5089)
KK (80,7)
Ratio denominator
S.ResetDisplacem
H236 (0097)
B (90,3)
Reset displacement
Displacement - position difference
Correction pulses
Actual value displacement
Displacement determined
H091 (0) SynchrRetrigMode
H092 (0) Synchr.Edge Mode
Displ.- Pos.diff d095
KR3095 Displacement - position difference
ErrorCode Displ. d096
K2096 Error code displacem.
KR3091 Correction pulses
act.Displacement d094
KR3094 Actual value displacement
B0106 Displacement determined
&
B0105 Synchronism reached
Threshold Synchr (20.0) H103
0.0
X>Y
X=Y
X<Y
X
Y
Actual value displacement [100,8]
B0102 Displacement > setpoint
B0103 Displacement within threshold
B0104 Displacement < setpoint
S.Setp Displace1
H237 (3051)
KR (110,2)
S.Setp Displace2
H238 (3062)
KR (100,3)

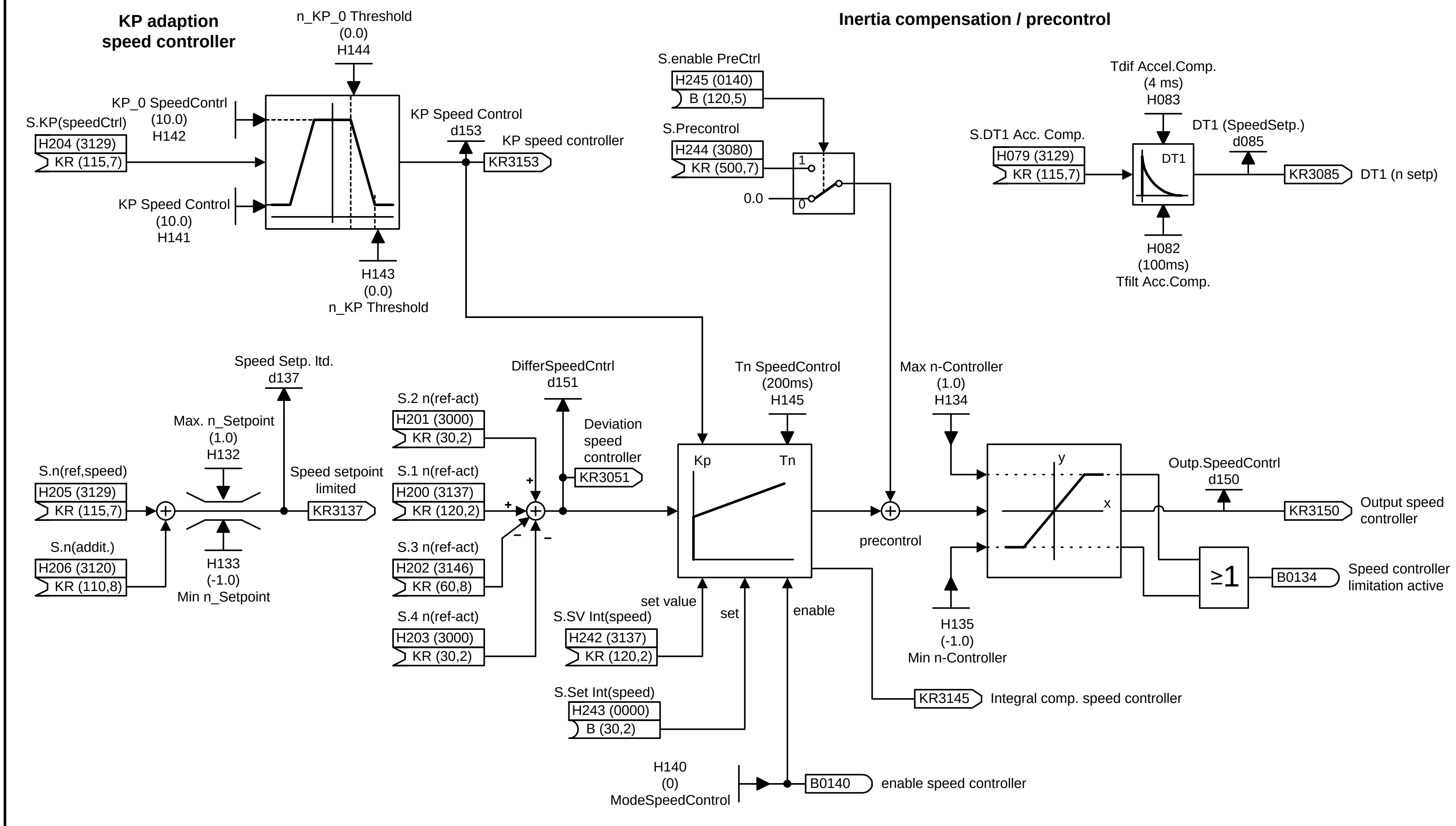
1	2	3	4	5	6	7	8


RmpUp Displacem
(2.5 ms)
H052
RmpUp Displacem
(2.5 ms)
H052
DisplacementSetp
d056
Max.Displacement
(2048.0)
H054
S.Displacem.Setup
H051 (3050)
KR (500,4)
KR3051
set value
KR3056
H055
(-2048.0)
Min.Displacement
S.set Displ.Ramp
H057 (0175)
B (60,2)
Set
Ramp generator displacement setpoint
Diff.Pos.Control
d121
Tn Pos.Control
(500ms)
H111
KP normiert
[110,4]
S.Ref_Pos_2
H157 (3000)
KR (30,2)
Deviation angle
controller
KR3121
IntegralComp.Pos
d122
Kp
Tn
KR3122
Integrator comp.
angle controller
S.Ref_Pos_1
H156 (3056)
KR (110,4)
S.Act_Pos_1
H158 (3124)
KR (60,8)
S.Act_Pos_2
H159 (3000)
KR (30,2)
enable
S.Enable Control
H104 (0109)
B (90,7)
H110
(1)
Hold I-Component
Max. Position
(0.3)
H112
Tfilt Pos.Cntrl
(0 ms)
H138
Outp.Pos.Control
d120
y
x
-1
PT1
KR3120
Output angle
controller
≥ 1
B0116
Angle controller
limitation active
KP adaption
angle controller
ue_KP_0 Value
(0.0)
H116
KP_UE_0 PosCntrl
(1.0)
H114
S.KP Pos.Contrl.
H108 (3044)
KR (80,4)
KP Pos.Control
d123
KP angle controller
KR3123
KP_UE Pos.Contrl
(1.0)
H113
10-4
KP normalized
H115
(0.0)
ue_KP Value
The input values of the angle controller use the normalization
1.0 = a quarter of a speed sensor pulse.
This normalization results in very small proportional gains for
the angle controller which can not be entered with OP1S.
The factor 10-4 allows to work with bigger values.

1	2	3	4	5	6	7	8



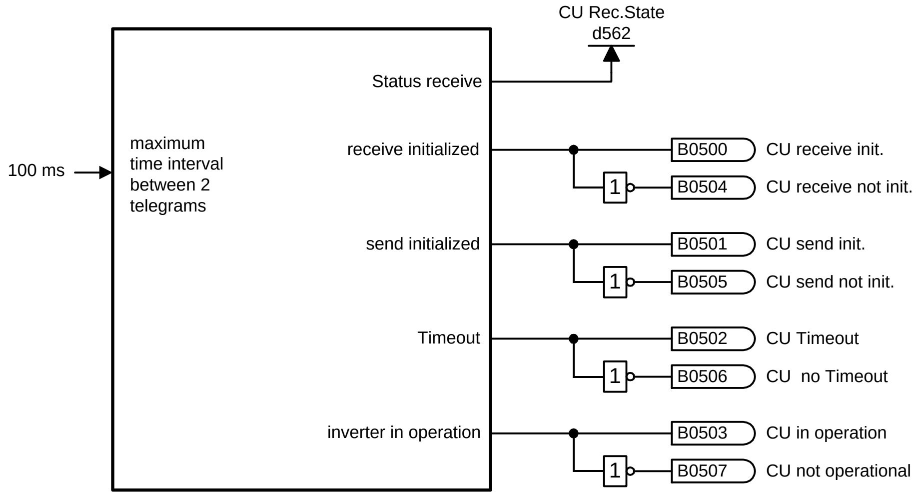
Mode	**Setpoint for the inverter (CU)**
Speed controller on CU	Speed setpoint
Speed controller on T400	Torque setpoint

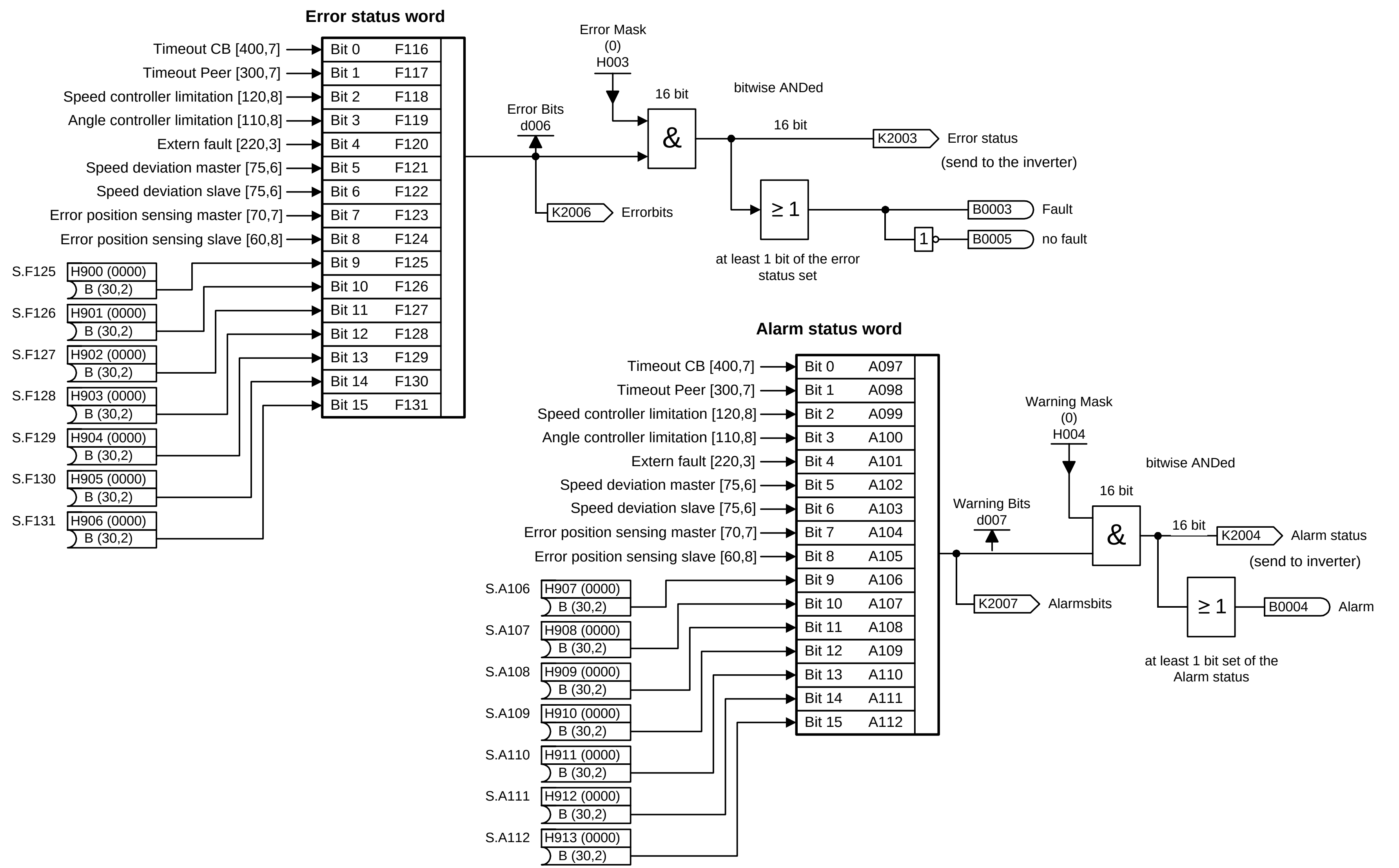


1	2	3	4	5	6	7	8

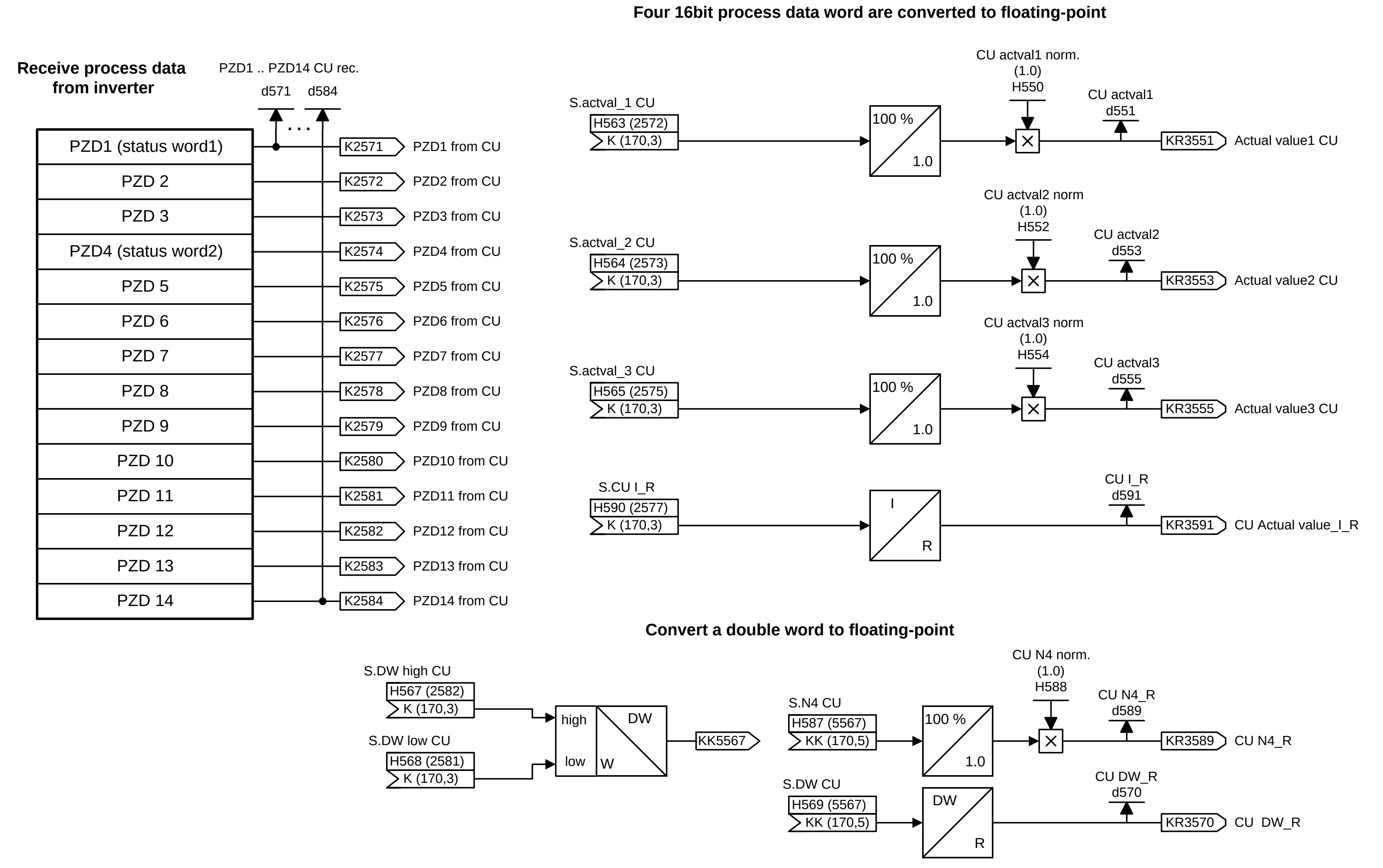
Control		FPlan_english.vsd	Function diagram	- 120 -
Speed controller on T400		05.01	Angular Synchr. Control SPA440	

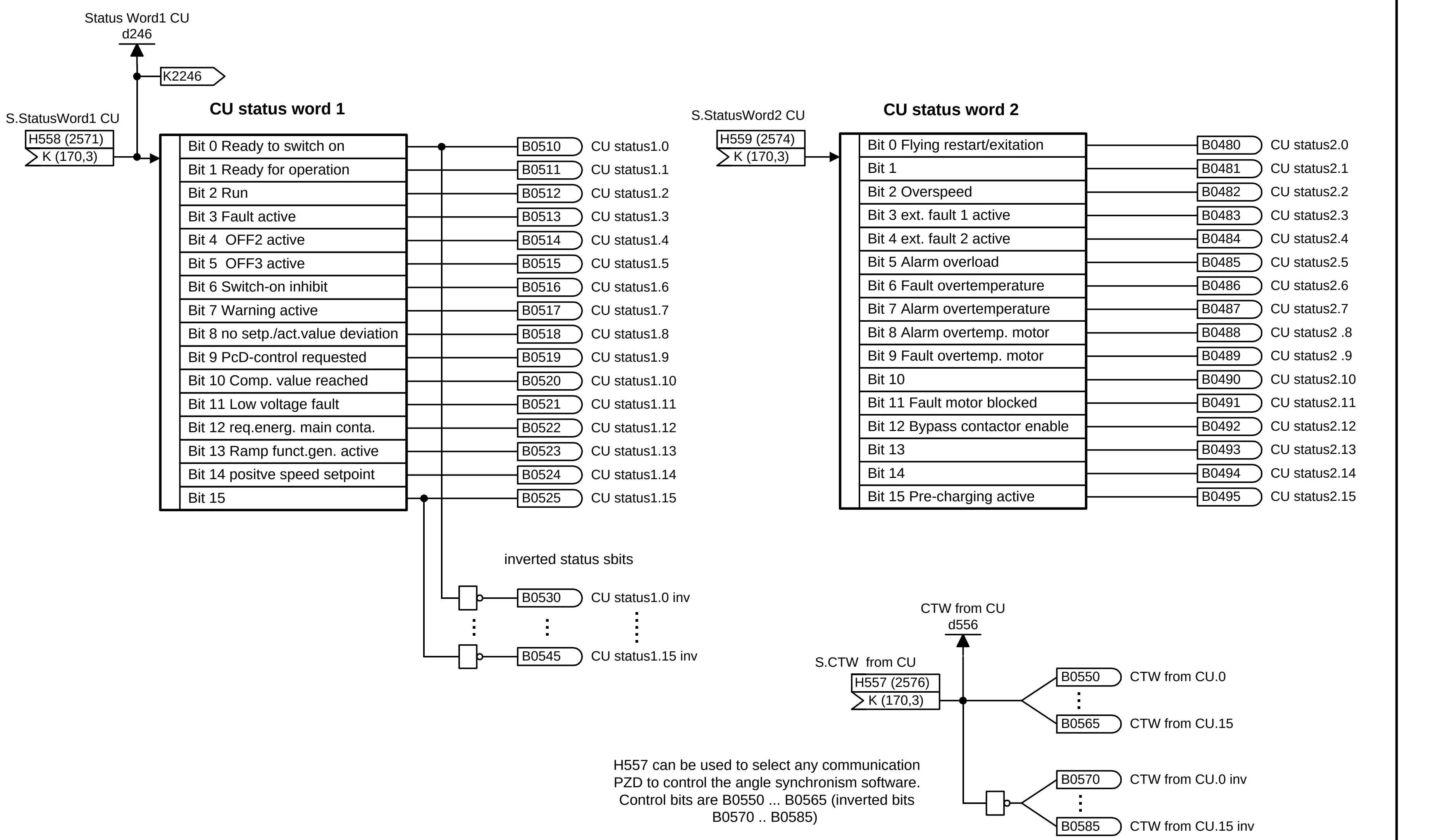
Control and monitoring functions for the inverter interface



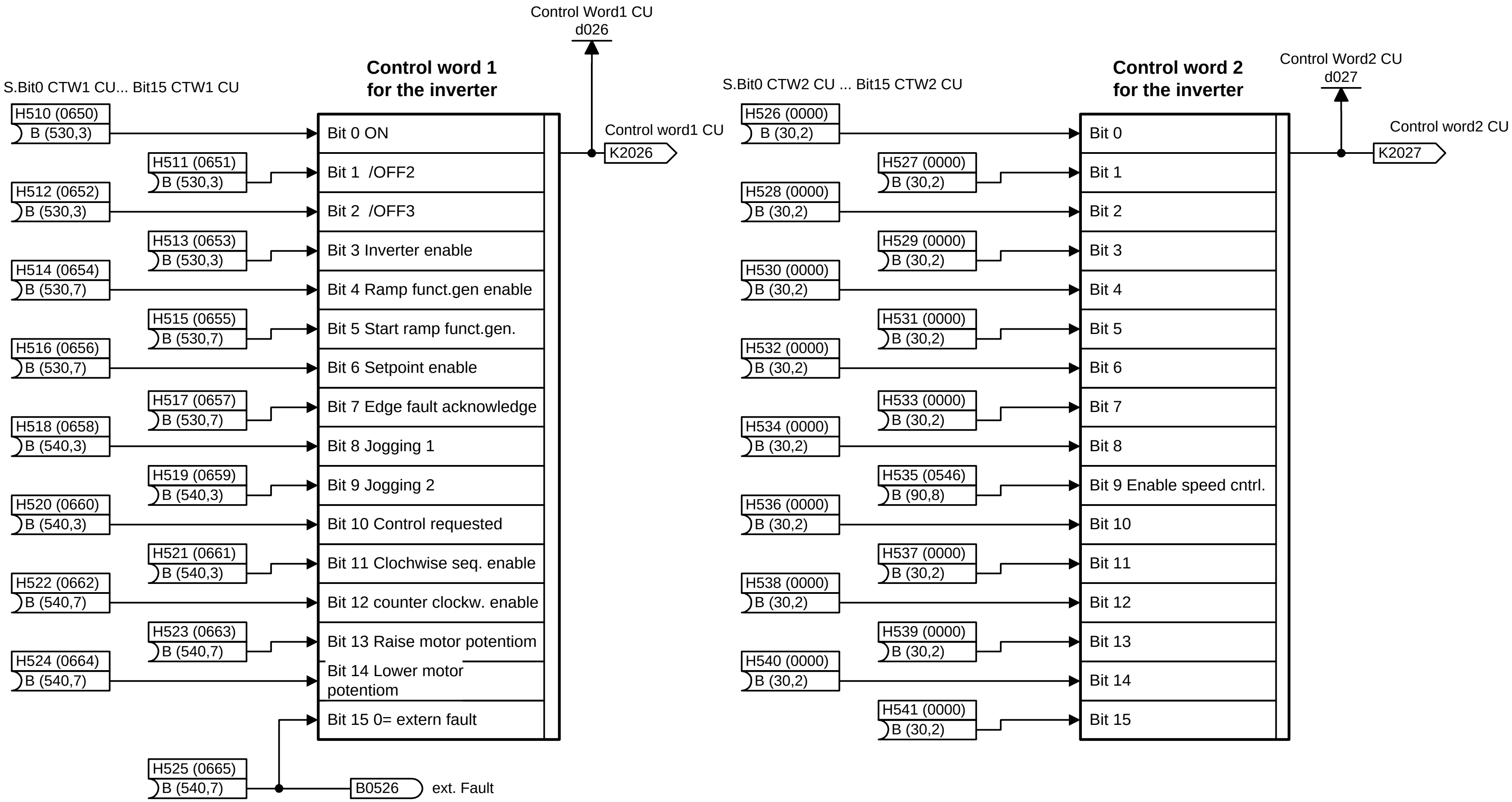


1	2	3	4	5	6	7	8
Inverter interface					FPlan_english.vsd	Function diagram	- 160 -
Errors and alarms					05.01	Angular Synchr. Control SPA440	

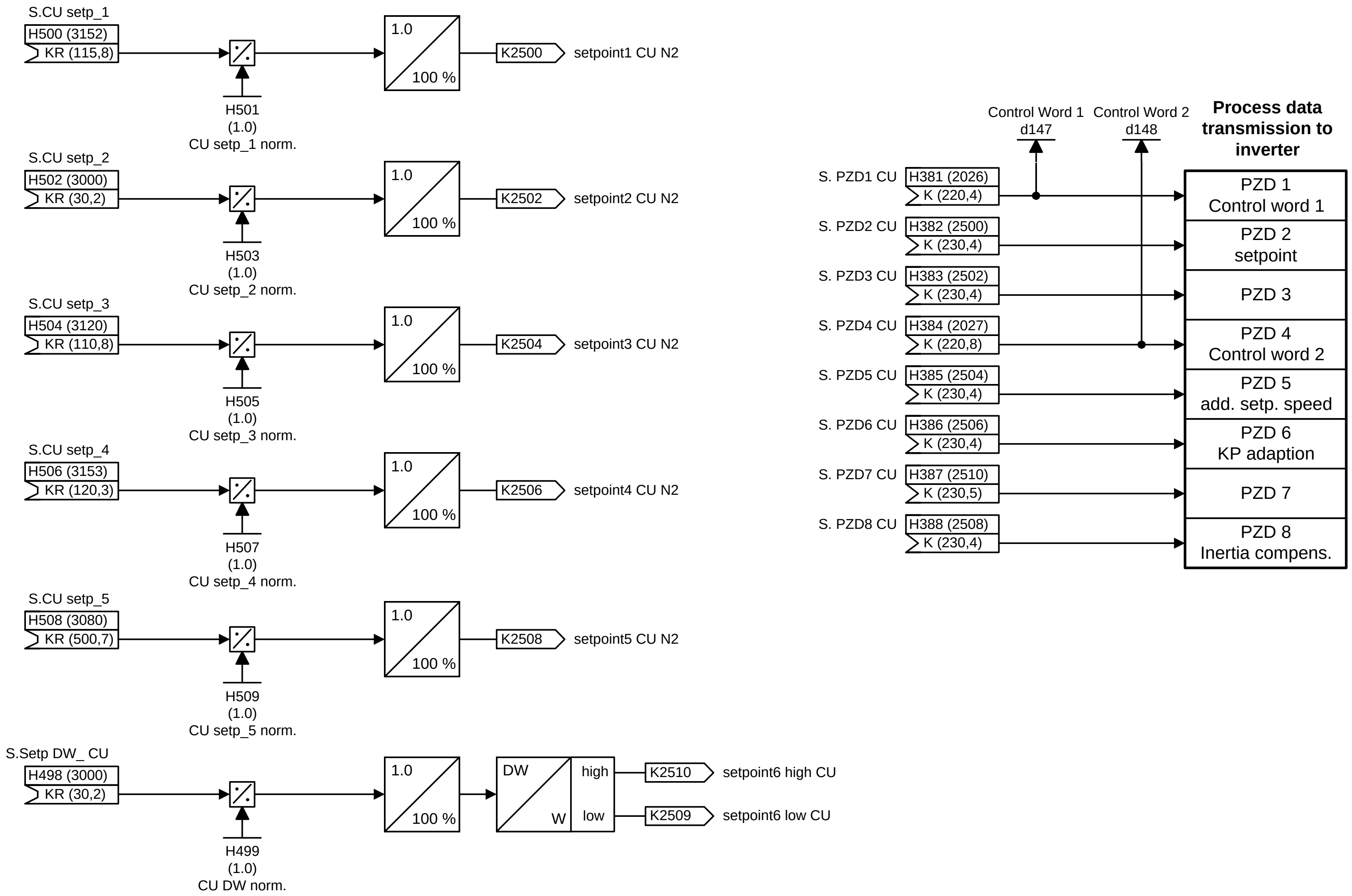

Four 16bit process data word are converted to floating-point
Receive process data from inverter
PZD1 .. PZD14 CU rec.
d571
d584
PZD1 (status word1)
PZD 2
PZD 3
PZD4 (status word2)
PZD 5
PZD 6
PZD 7
PZD 8
PZD 9
PZD 10
PZD 11
PZD 12
PZD 13
PZD 14
K2571 PZD1 from CU
K2572 PZD2 from CU
K2573 PZD3 from CU
K2574 PZD4 from CU
K2575 PZD5 from CU
K2576 PZD6 from CU
K2577 PZD7 from CU
K2578 PZD8 from CU
K2579 PZD9 from CU
K2580 PZD10 from CU
K2581 PZD11 from CU
K2582 PZD12 from CU
K2583 PZD13 from CU
K2584 PZD14 from CU
S.actval_1 CU
H563 (2572)
K (170,3)
100 %
1.0
CU actval1 norm.
(1.0)
H550
CU actval1
d551
KR3551 Actual value1 CU
S.actval_2 CU
H564 (2573)
K (170,3)
CU actval2 norm
(1.0)
H552
CU actval2
d553
KR3553 Actual value2 CU
S.actval_3 CU
H565 (2575)
K (170,3)
CU actval3 norm
(1.0)
H554
CU actval3
d555
KR3555 Actual value3 CU
S.CU I_R
H590 (2577)
K (170,3)
I
R
CU I_R
d591
KR3591 CU Actual value_I_R
Convert a double word to floating-point
S.DW high CU
H567 (2582)
K (170,3)
S.DW low CU
H568 (2581)
K (170,3)
high
low
DW
W
KK5567
S.N4 CU
H587 (5567)
KK (170,5)
CU N4 norm.
(1.0)
H588
CU N4_R
d589
KR3589 CU N4_R
S.DW CU
H569 (5567)
KK (170,5)
DW
R
CU DW_R
d570
KR3570 CU DW_R

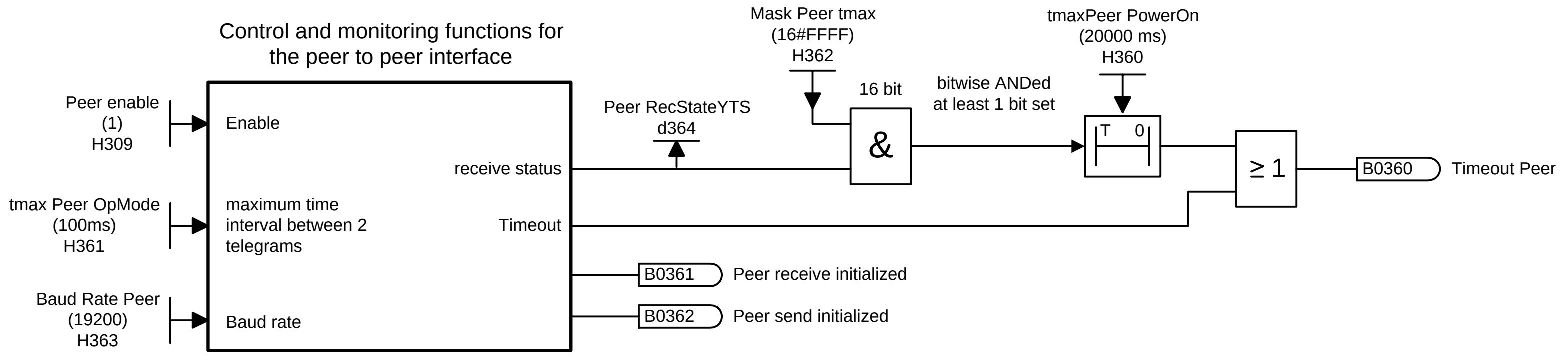


1	2	3	4	5	6	7	8
Inverter interface					FPlan_english.vsd	Function diagram	- 180 -
Status words					05.01	Angular Synchr. Control SPA440	



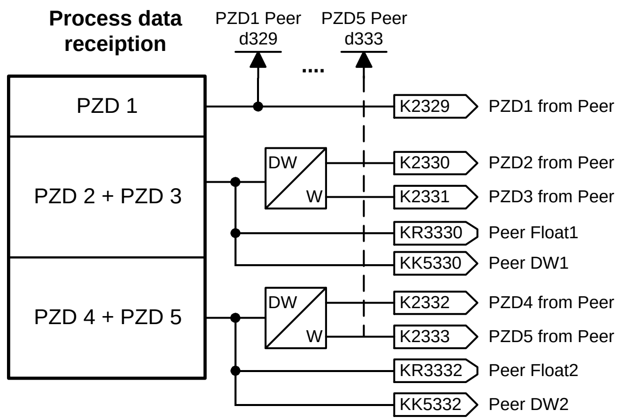
1	2	3	4	5	6	7	8
Inverter interface					FPlan_english.vsd	Function diagram	- 220 -
Control words					05.01	Angular Synchr. Control SPA440	

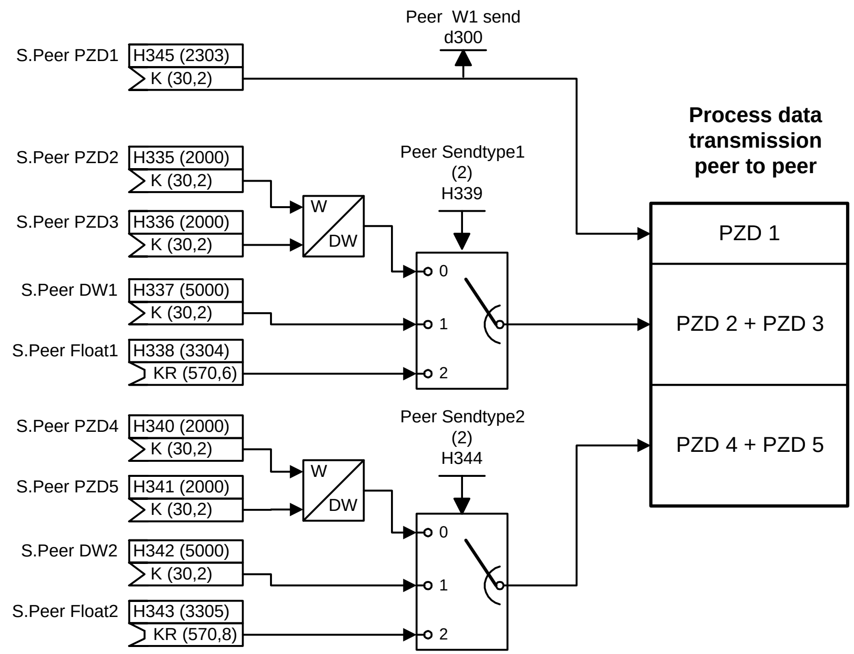

S.CU setp_1
H500 (3152)
KR (115,8)
H501
(1.0)
CU setp_1 norm.
1.0
100 %
K2500
setpoint1 CU N2
S.CU setp_2
H502 (3000)
KR (30,2)
H503
(1.0)
CU setp_2 norm.
1.0
100 %
K2502
setpoint2 CU N2
S.CU setp_3
H504 (3120)
KR (110,8)
H505
(1.0)
CU setp_3 norm.
1.0
100 %
K2504
setpoint3 CU N2
S.CU setp_4
H506 (3153)
KR (120,3)
H507
(1.0)
CU setp_4 norm.
1.0
100 %
K2506
setpoint4 CU N2
S.CU setp_5
H508 (3080)
KR (500,7)
H509
(1.0)
CU setp_5 norm.
1.0
100 %
K2508
setpoint5 CU N2
S.Setp DW_ CU
H498 (3000)
KR (30,2)
H499
(1.0)
CU DW norm.
1.0
100 %
DW
W
high
low
K2510
setpoint6 high CU
K2509
setpoint6 low CU
Control Word 1
d147
Control Word 2
d148
Process data transmission to inverter
S. PZD1 CU
H381 (2026)
K (220,4)
S. PZD2 CU
H382 (2500)
K (230,4)
S. PZD3 CU
H383 (2502)
K (230,4)
S. PZD4 CU
H384 (2027)
K (220,8)
S. PZD5 CU
H385 (2504)
K (230,4)
S. PZD6 CU
H386 (2506)
K (230,4)
S. PZD7 CU
H387 (2510)
K (230,5)
S. PZD8 CU
H388 (2508)
K (230,4)
PZD 1
Control word 1
PZD 2
setpoint
PZD 3
PZD 4
Control word 2
PZD 5
add. setp. speed
PZD 6
KP adaption
PZD 7
PZD 8
Inertia compens.



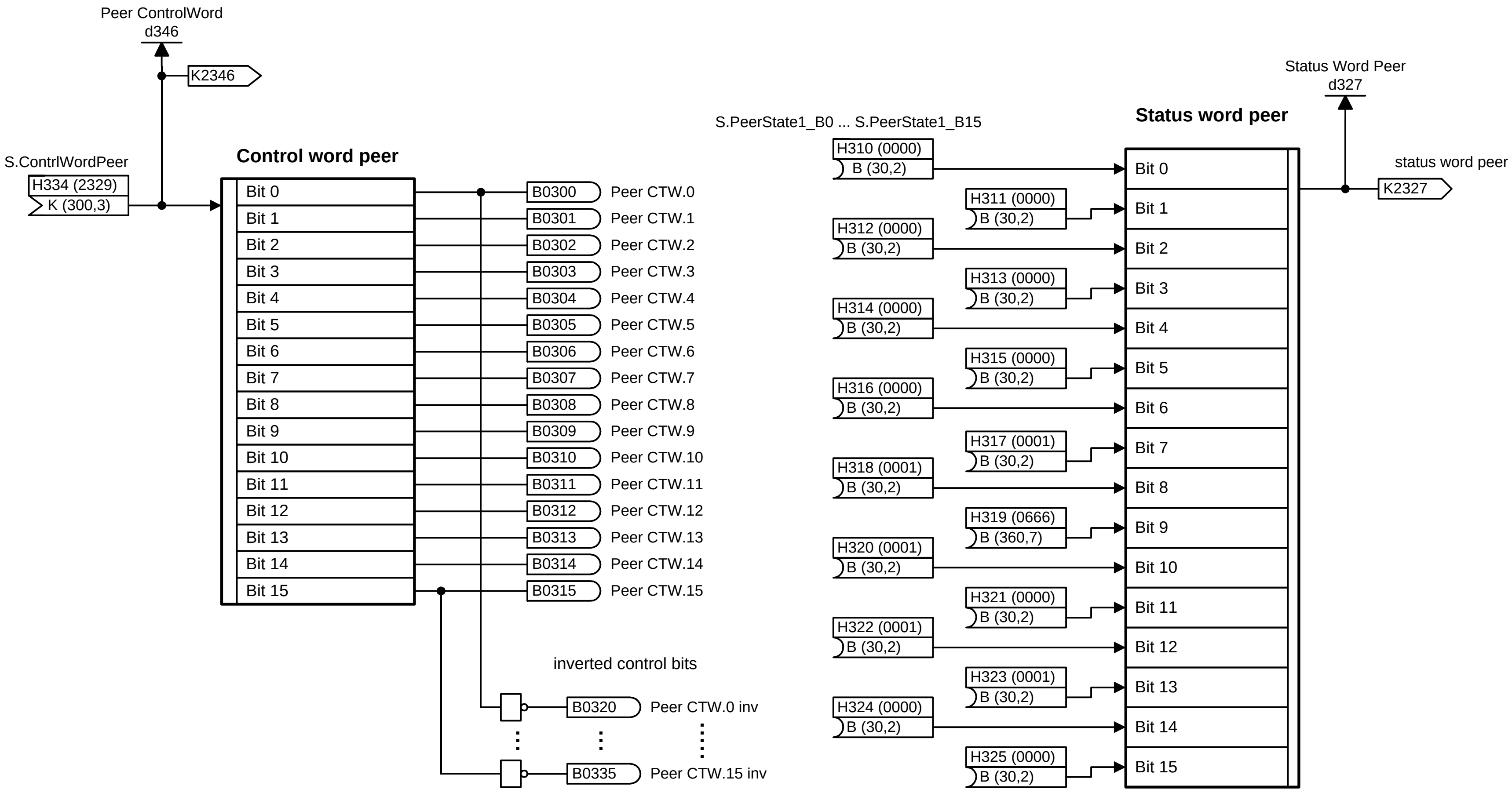
Process data words PZD2, PZD3 and PZD4, PZD5 may be transmitted as word, double word or floating point values.

The **floating-point** connectors KR3330 and KR3332 must not be used if there is no floating point value transmission!

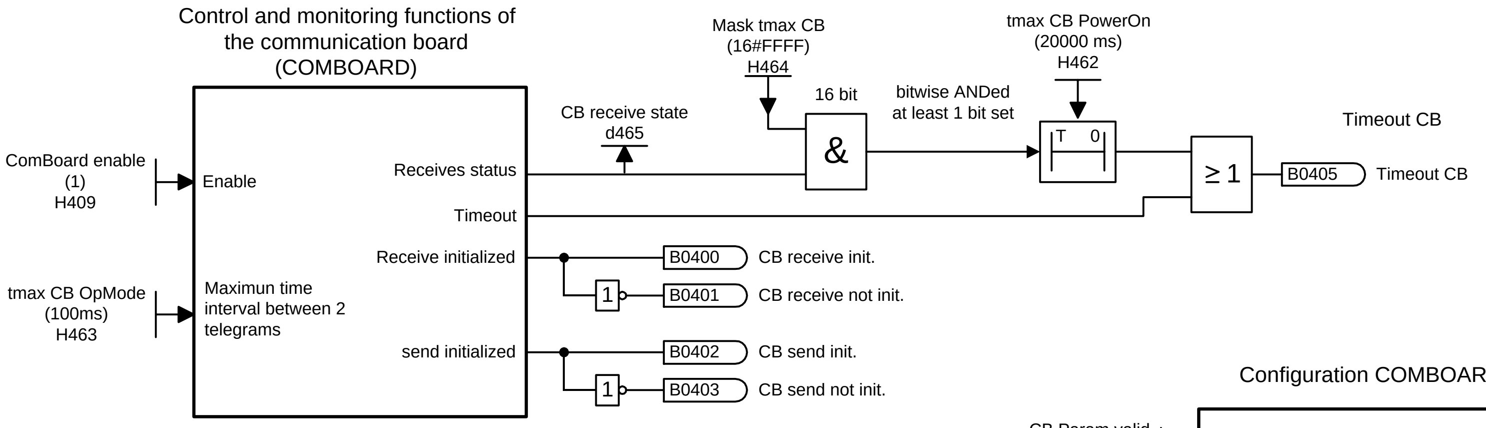




1	2	3	4	5	6	7	8



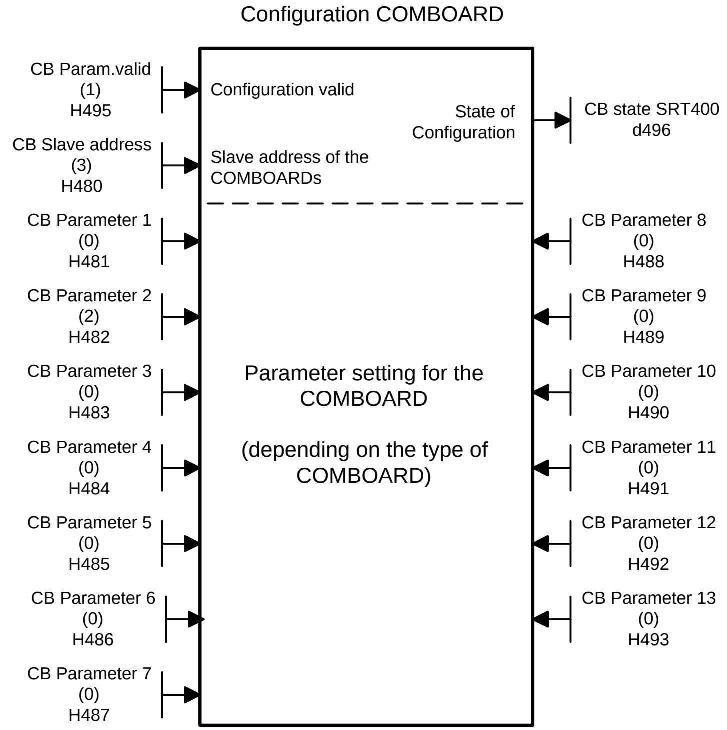
1	2	3	4	5	6	7	8
Communication					FPlan_english.vsd	Function diagram	- 310 -
Peer to peer control and status word					05.01	Angular Synchr. Control SPA440	

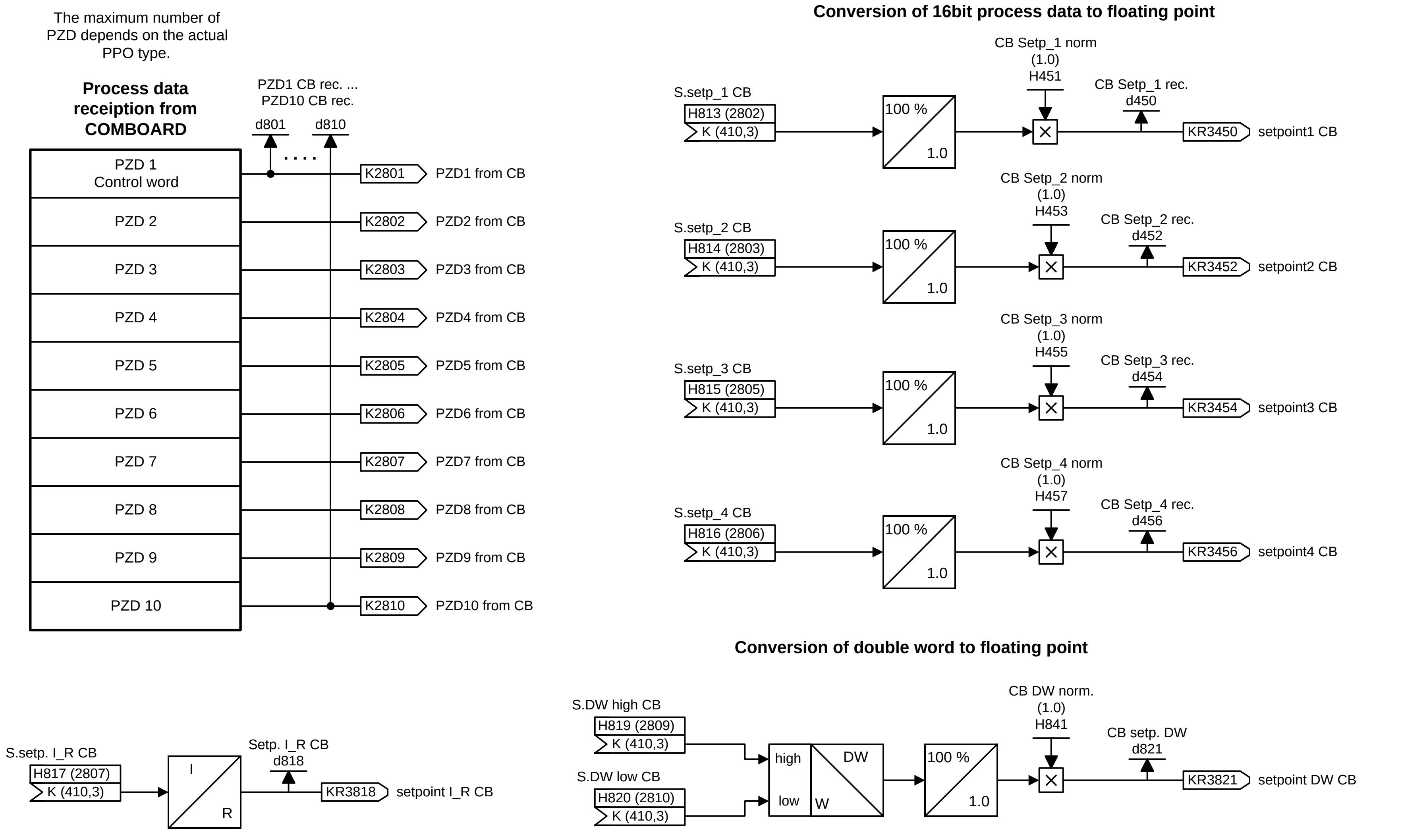


Configuration of the COMBOARD:

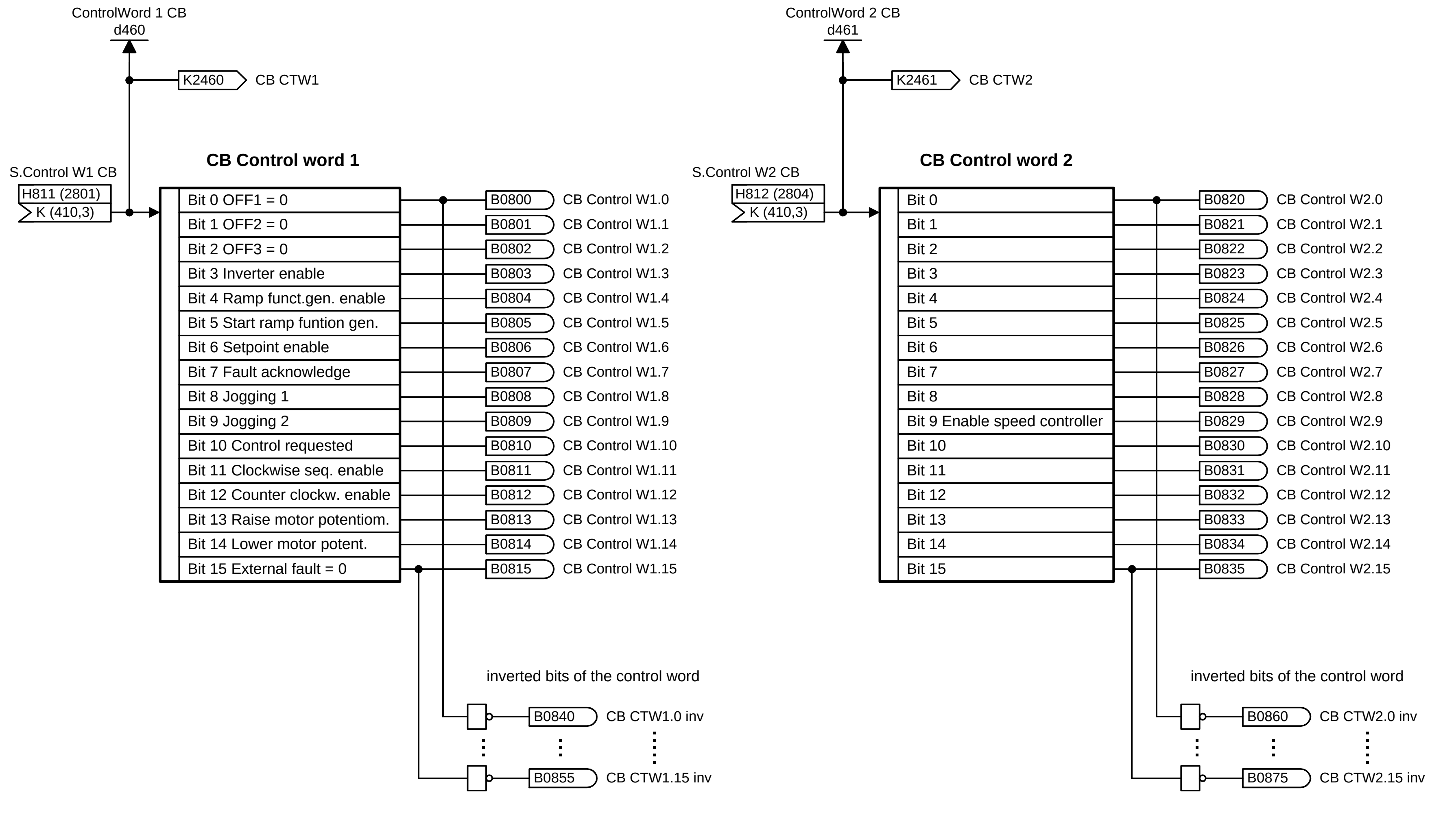
These parameters are reserved for a COMBOARD in SRT400 applications.

If the T400 is placed in the electronic box of the inverter the configuration of the COMBOARD is done by inverter parameters (e.g. P918 for the bus address with Masterdrives MC).

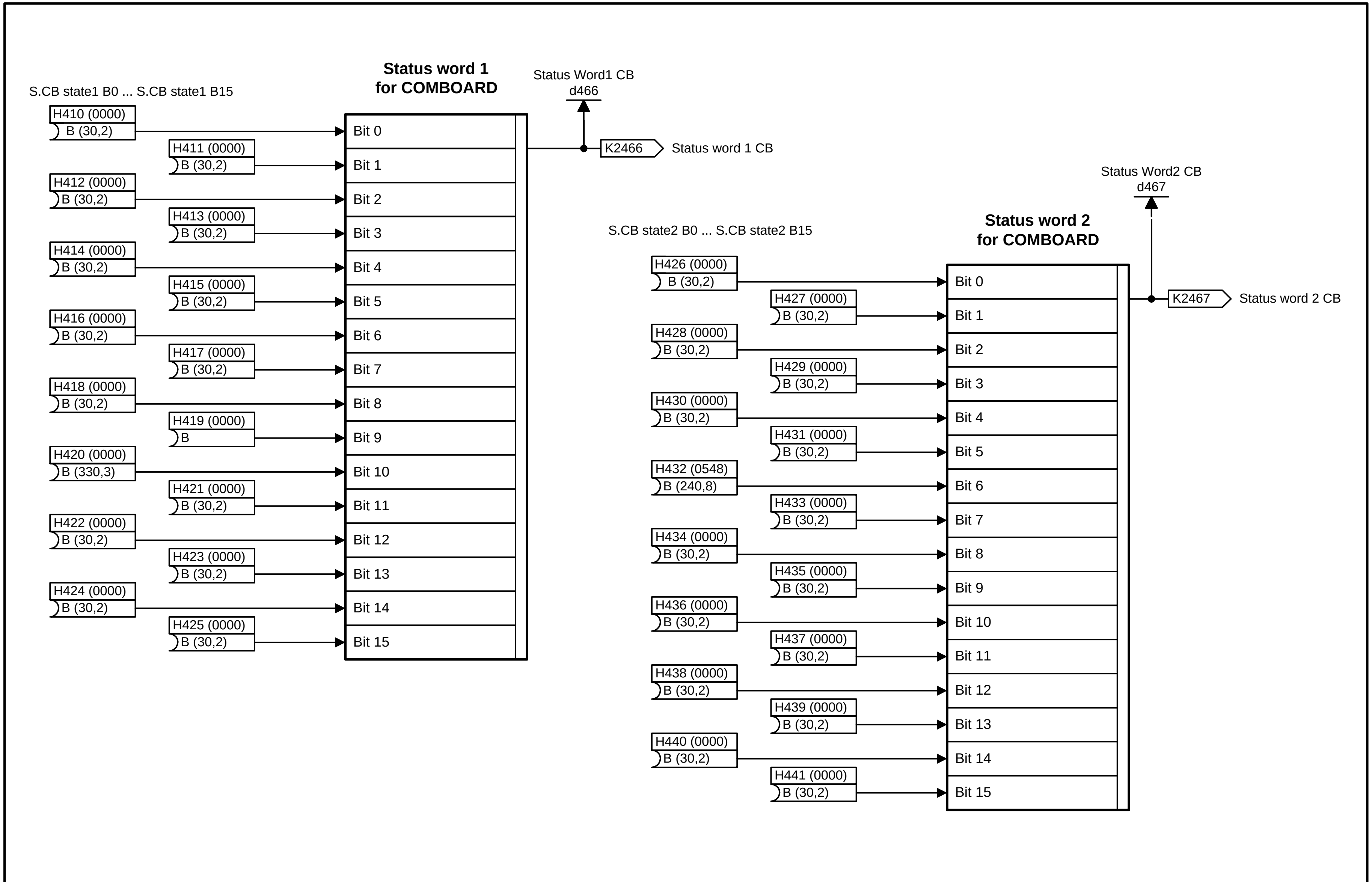




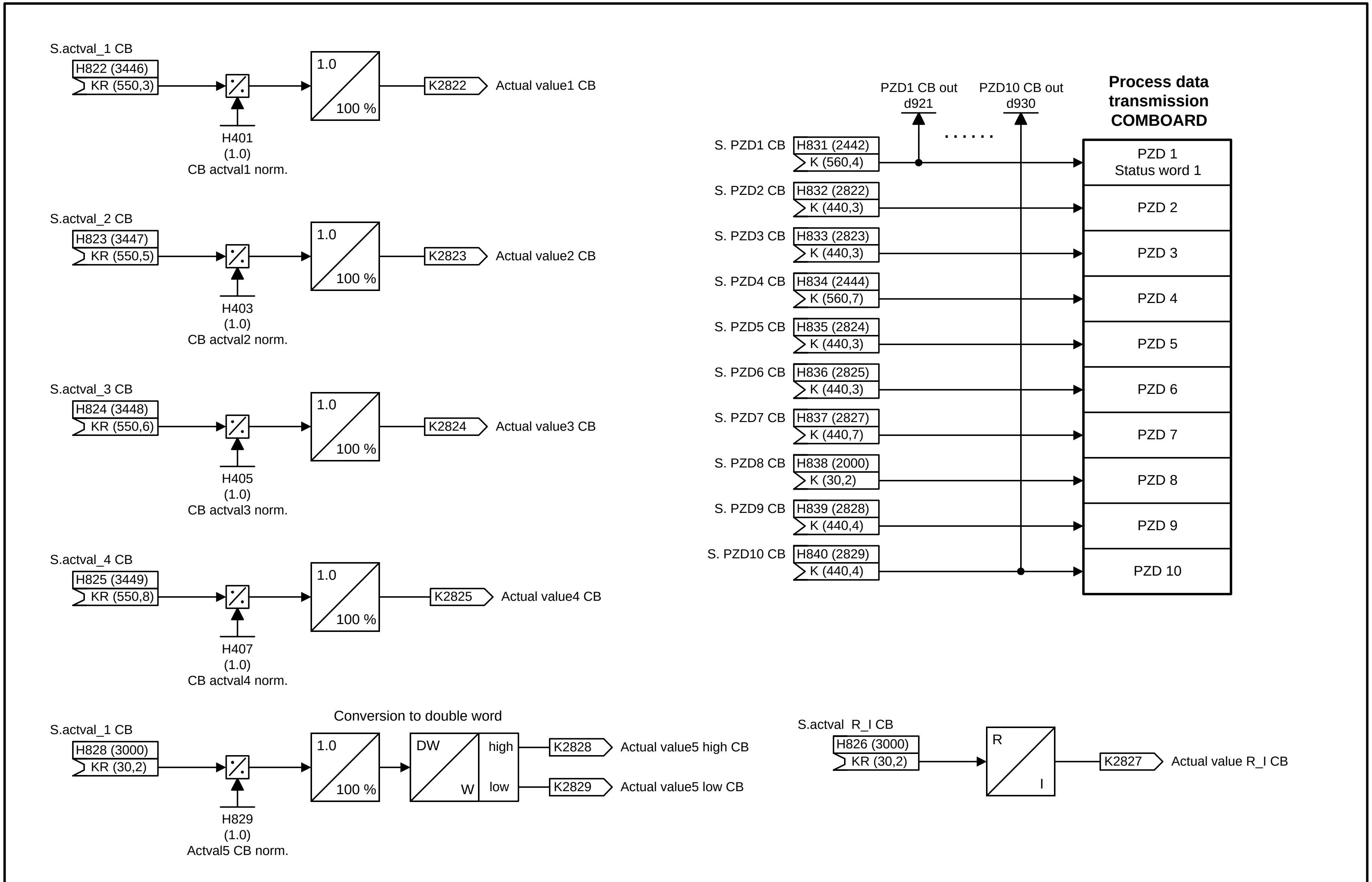
1	2	3	4	5	6	7	8
Communication					FPlan_english.vsd	Function diagram	- 410 -
COMBOARD receiption					05.01	Angular Synchr. Control SPA440	



1	2	3	4	5	6	7	8
Communication					FPlan_english.vsd	Function diagram	- 420 -
COMBOARD control words					05.01	Angular Synchr. Control SPA440	



1	2	3	4	5	6	7	8
Communication					FPlan_english.vsd	Function diagram	- 430 -
COMBOARD status words					05.01	Angular Synchr. Control SPA440	



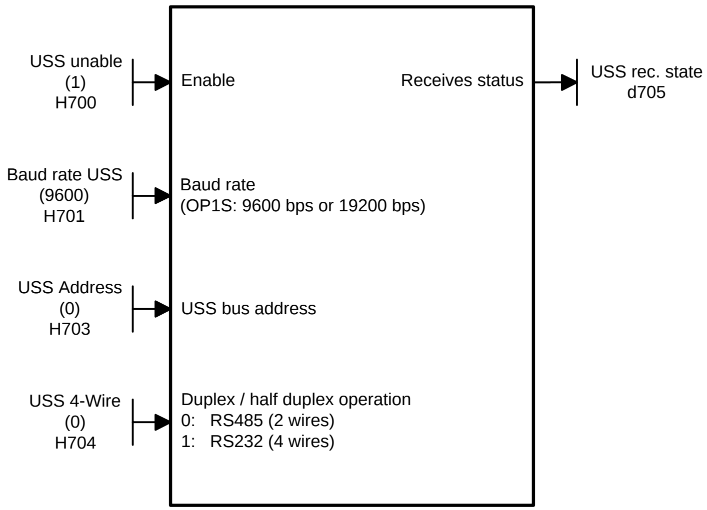
1	2	3	4	5	6	7	8
Communication					FPlan_english.vsd	Function diagram	- 440 -
COMBORAD transmission					05.01	Angular Synchr. Control SPA440	

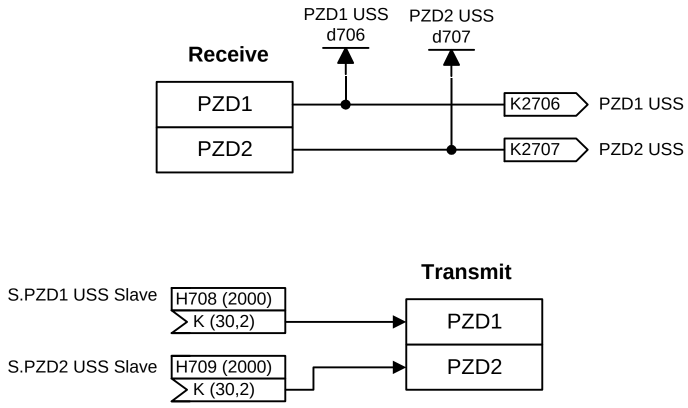
USS slave operation

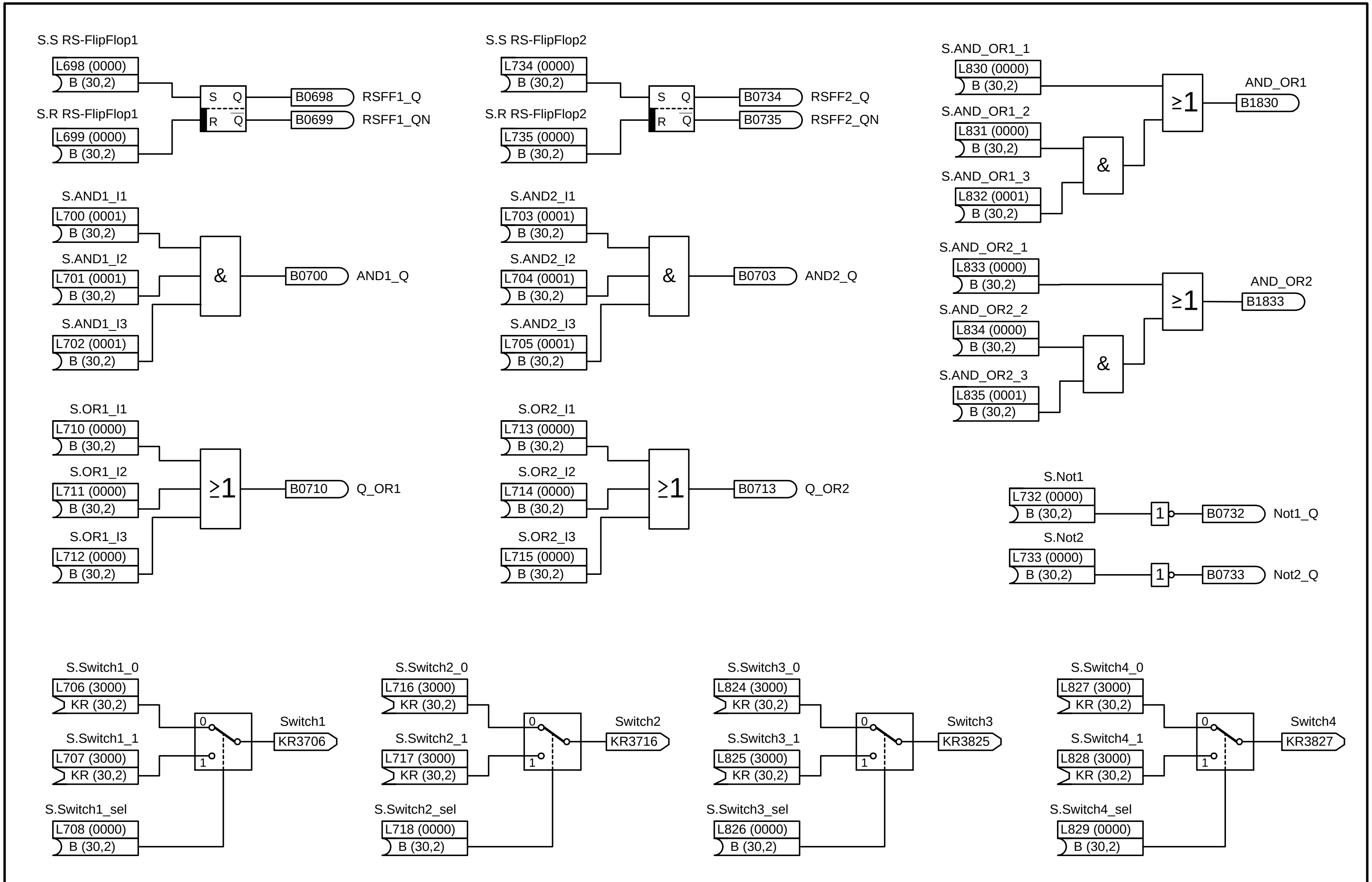
The USS slave coupling is required for visualizing or changing parameters using OP1S or SIMOVIS only if the T400 is working stand alone in the SRT400 rack.

For enabling set T400 switch S1/8 = ON. The switching becomes valid after the next power on. Online communication with other service tools using the same interface (e.g. CFC) will be disabled!

If there is no access with OP1S caused by not supported parameter setting (e.g. wrong baud rate) set S1/8 = OFF and use the Service-IBS program to correct the parameters.

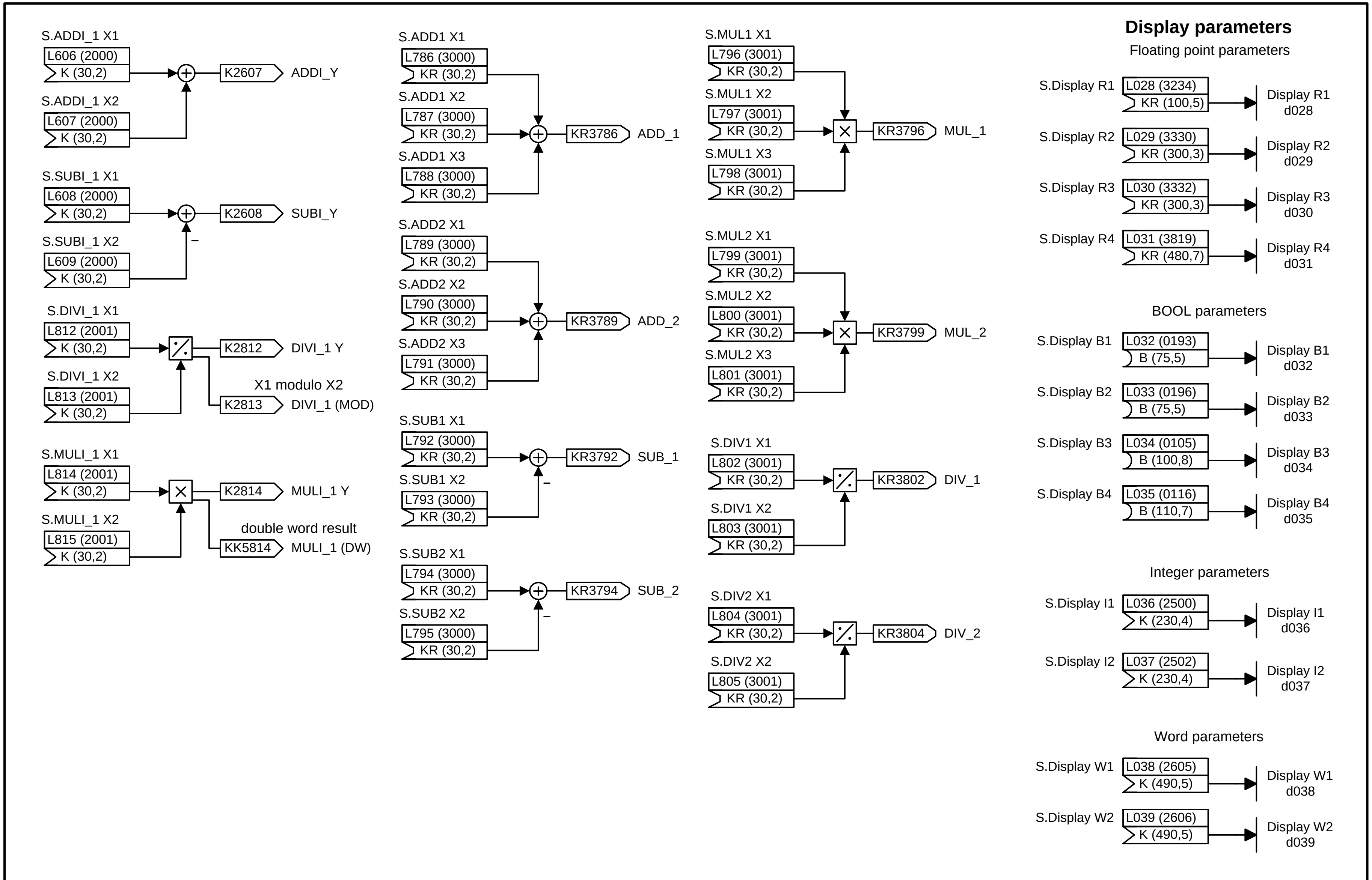






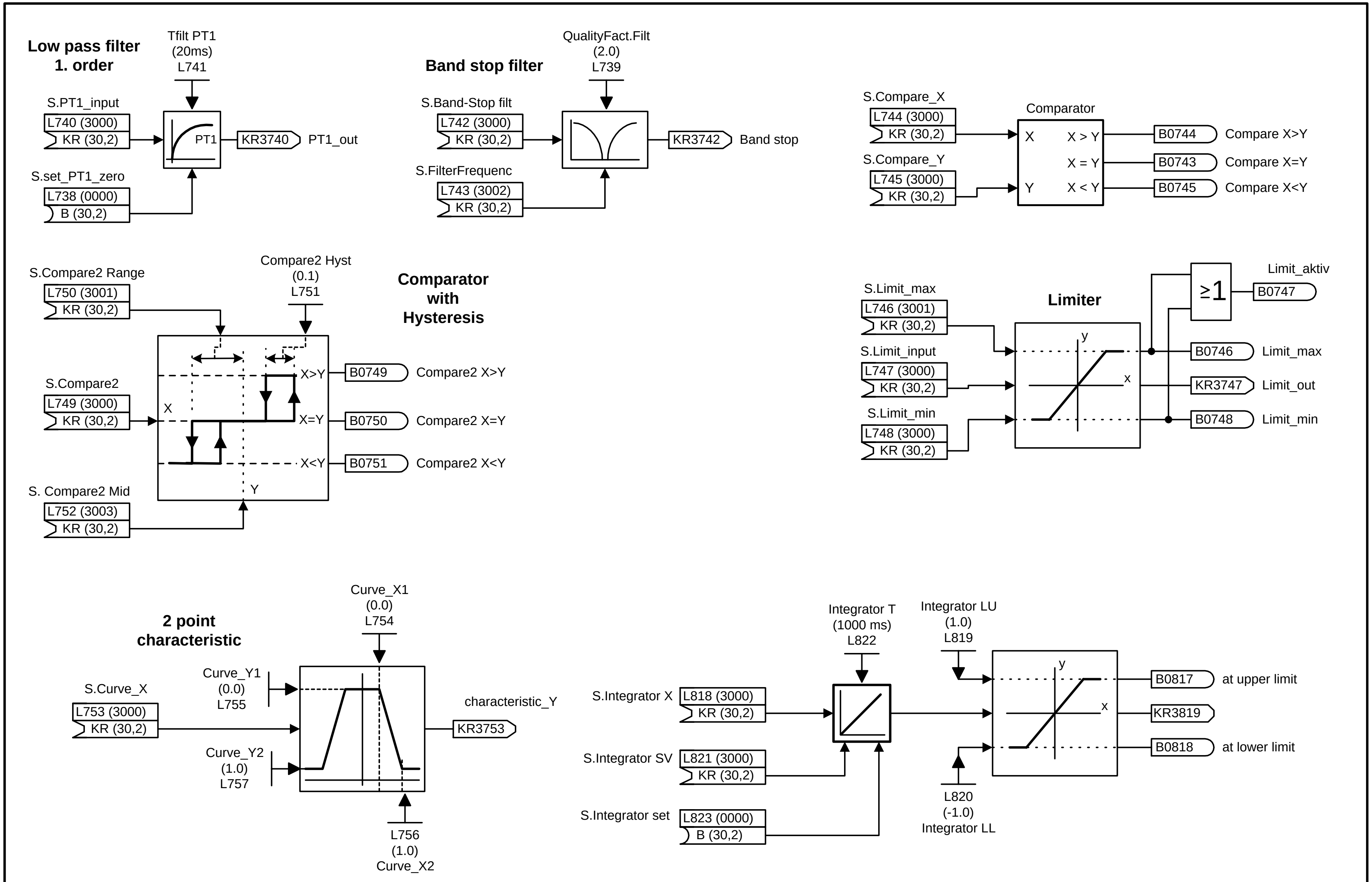
1	2	3	4	5	6	7	8

Free function blocks		FPlan_english.vsd	Function diagram	- 460 -
Logical gates		05.01	Angular Synchr. Control SPA440	

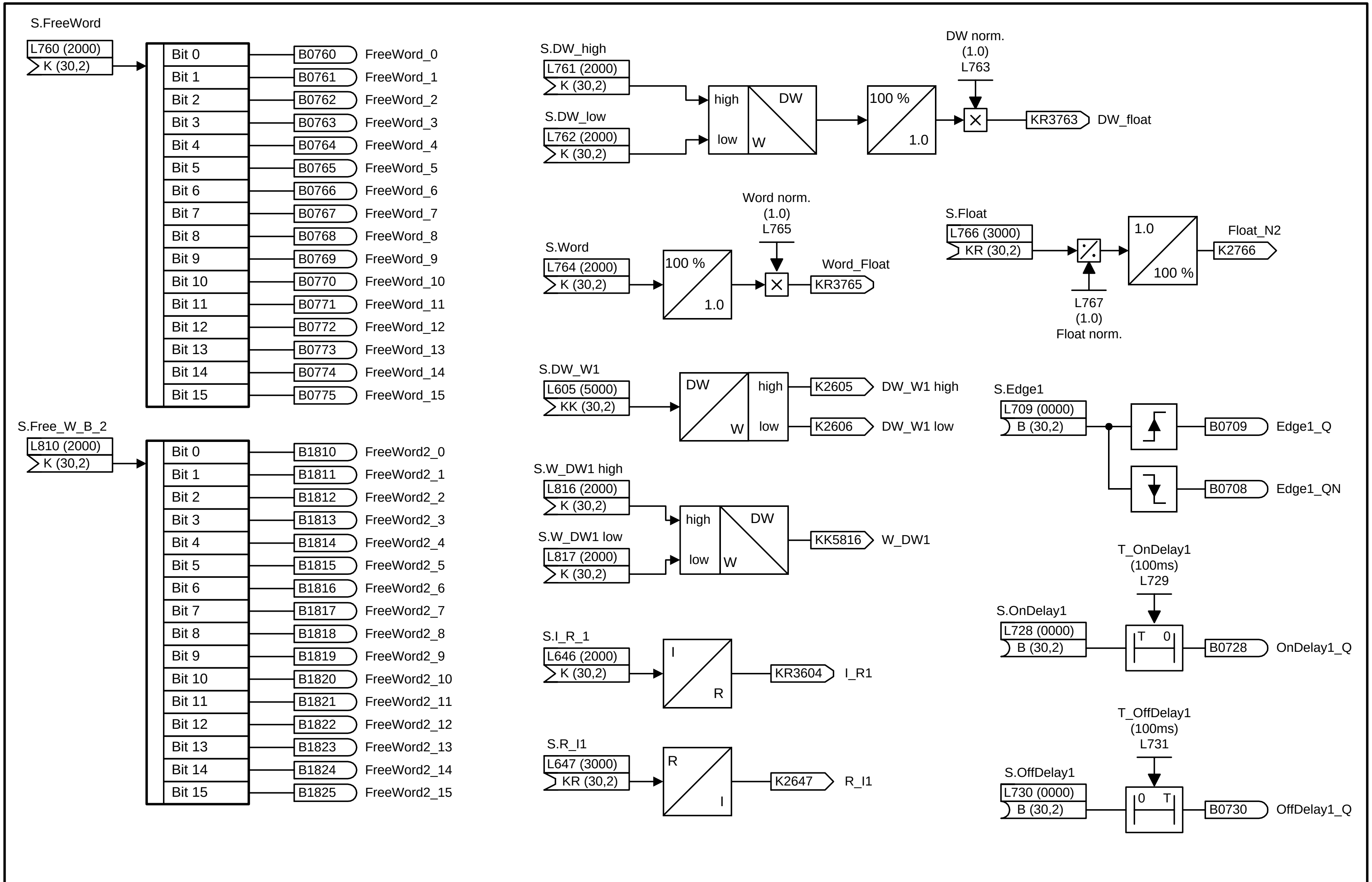


Display parameters
Floating point parameters
S.ADDI_1 X1
L606 (2000)
K (30,2)
K2607
ADDI_Y
S.ADDI_1 X2
L607 (2000)
K (30,2)
S.SUBI_1 X1
L608 (2000)
K (30,2)
K2608
SUBI_Y
S.SUBI_1 X2
L609 (2000)
K (30,2)
S.DIVI_1 X1
L812 (2001)
K (30,2)
K2812
DIVI_1 Y
S.DIVI_1 X2
L813 (2001)
K (30,2)
X1 modulo X2
K2813
DIVI_1 (MOD)
S.MULI_1 X1
L814 (2001)
K (30,2)
K2814
MULI_1 Y
S.MULI_1 X2
L815 (2001)
K (30,2)
double word result
KK5814
MULI_1 (DW)
S.ADD1 X1
L786 (3000)
KR (30,2)
S.ADD1 X2
L787 (3000)
KR (30,2)
KR3786
ADD_1
S.ADD1 X3
L788 (3000)
KR (30,2)
S.ADD2 X1
L789 (3000)
KR (30,2)
S.ADD2 X2
L790 (3000)
KR (30,2)
KR3789
ADD_2
S.ADD2 X3
L791 (3000)
KR (30,2)
S.SUB1 X1
L792 (3000)
KR (30,2)
KR3792
SUB_1
S.SUB1 X2
L793 (3000)
KR (30,2)
S.SUB2 X1
L794 (3000)
KR (30,2)
KR3794
SUB_2
S.SUB2 X2
L795 (3000)
KR (30,2)
S.MUL1 X1
L796 (3001)
KR (30,2)
S.MUL1 X2
L797 (3001)
KR (30,2)
KR3796
MUL_1
S.MUL1 X3
L798 (3001)
KR (30,2)
S.MUL2 X1
L799 (3001)
KR (30,2)
S.MUL2 X2
L800 (3001)
KR (30,2)
KR3799
MUL_2
S.MUL2 X3
L801 (3001)
KR (30,2)
S.DIV1 X1
L802 (3001)
KR (30,2)
KR3802
DIV_1
S.DIV1 X2
L803 (3001)
KR (30,2)
S.DIV2 X1
L804 (3001)
KR (30,2)
KR3804
DIV_2
S.DIV2 X2
L805 (3001)
KR (30,2)
S.Display R1
L028 (3234)
KR (100,5)
Display R1
d028
S.Display R2
L029 (3330)
KR (300,3)
Display R2
d029
S.Display R3
L030 (3332)
KR (300,3)
Display R3
d030
S.Display R4
L031 (3819)
KR (480,7)
Display R4
d031
BOOL parameters
S.Display B1
L032 (0193)
B (75,5)
Display B1
d032
S.Display B2
L033 (0196)
B (75,5)
Display B2
d033
S.Display B3
L034 (0105)
B (100,8)
Display B3
d034
S.Display B4
L035 (0116)
B (110,7)
Display B4
d035
Integer parameters
S.Display I1
L036 (2500)
K (230,4)
Display I1
d036
S.Display I2
L037 (2502)
K (230,4)
Display I2
d037
Word parameters
S.Display W1
L038 (2605)
K (490,5)
Display W1
d038
S.Display W2
L039 (2606)
K (490,5)
Display W2
d039

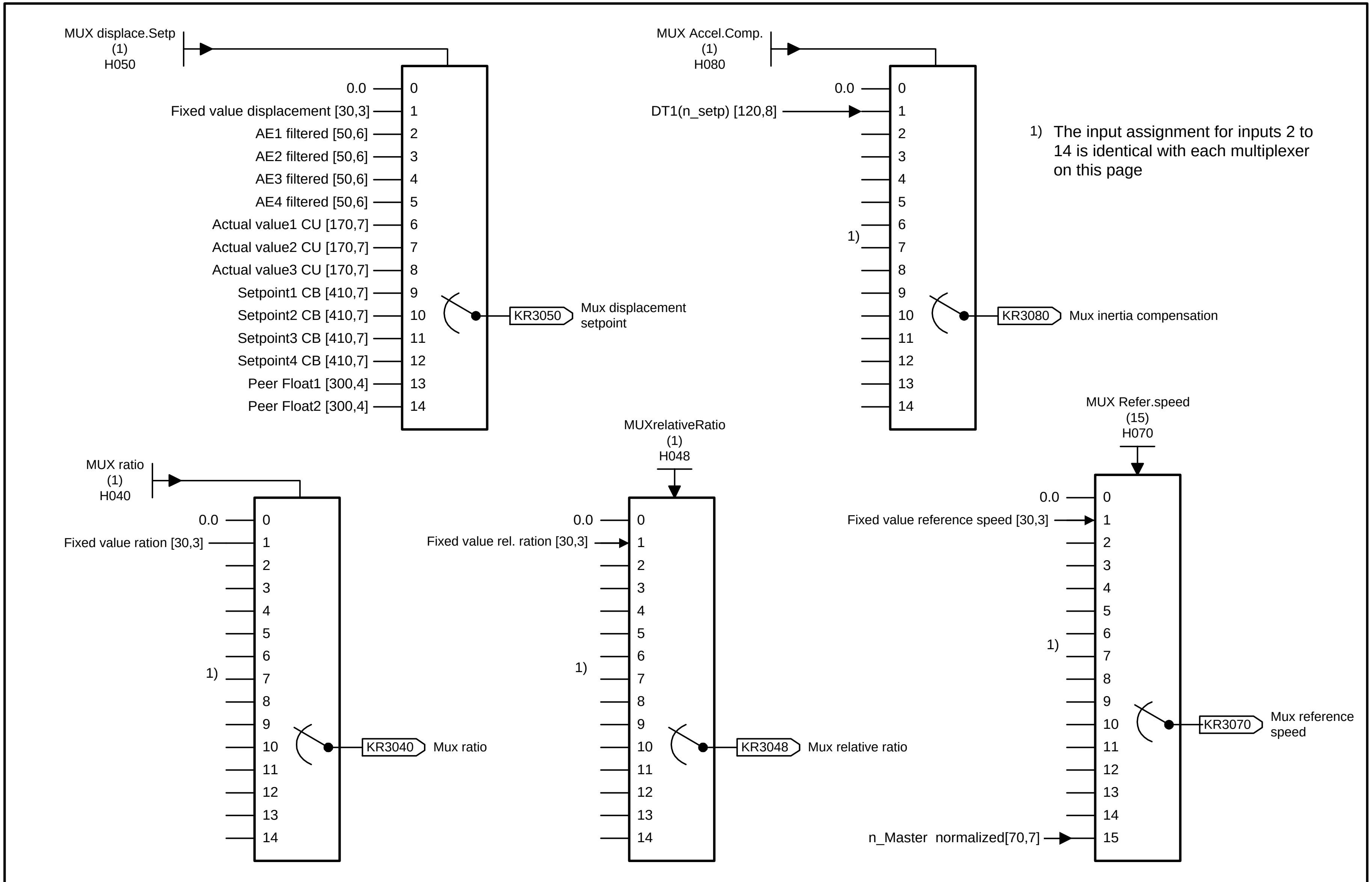
1	2	3	4	5	6	7	8



Low pass filter
1. order
Tfilt PT1
(20ms)
L741
S.PT1_input
L740 (3000)
KR (30,2)
PT1
KR3740
PT1_out
S.set_PT1_zero
L738 (0000)
B (30,2)
Band stop filter
QualityFact.Filt
(2.0)
L739
S.Band-Stop filt
L742 (3000)
KR (30,2)
KR3742
Band stop
S.FilterFrequenc
L743 (3002)
KR (30,2)
S.Compare_X
L744 (3000)
KR (30,2)
Comparator
X
X > Y
X = Y
X < Y
Y
B0744
Compare X>Y
B0743
Compare X=Y
B0745
Compare X<Y
S.Compare_Y
L745 (3000)
KR (30,2)
S.Compare2 Range
L750 (3001)
KR (30,2)
Compare2 Hyst
(0.1)
L751
Comparator
with
Hysteresis
S.Compare2
L749 (3000)
KR (30,2)
X
X>Y
X=Y
X<Y
Y
B0749
Compare2 X>Y
B0750
Compare2 X=Y
B0751
Compare2 X<Y
S. Compare2 Mid
L752 (3003)
KR (30,2)
Limit_aktiv
≥1
B0747
S.Limit_max
L746 (3001)
KR (30,2)
Limiter
y
x
B0746
Limit_max
S.Limit_input
L747 (3000)
KR (30,2)
KR3747
Limit_out
S.Limit_min
L748 (3000)
KR (30,2)
B0748
Limit_min
2 point
characteristic
Curve_X1
(0.0)
L754
S.Curve_X
L753 (3000)
KR (30,2)
Curve_Y1
(0.0)
L755
Curve_Y2
(1.0)
L757
characteristic_Y
KR3753
L756
(1.0)
Curve_X2
Integrator T
(1000 ms)
L822
Integrator LU
(1.0)
L819
S.Integrator X
L818 (3000)
KR (30,2)
y
x
B0817
at upper limit
KR3819
B0818
at lower limit
S.Integrator SV
L821 (3000)
KR (30,2)
L820
(-1.0)
Integrator LL
S.Integrator set
L823 (0000)
B (30,2)

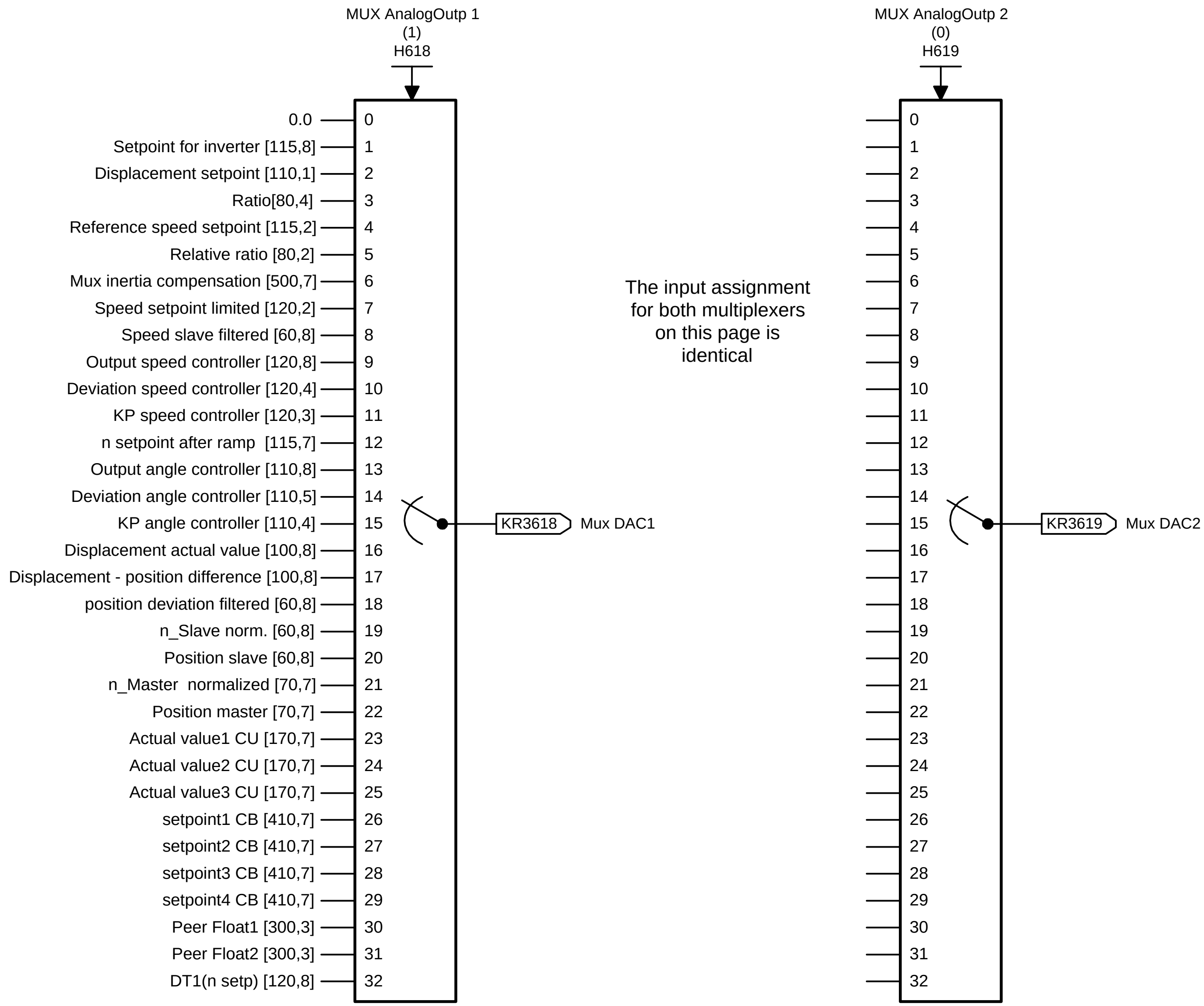


1	2	3	4	5	6	7	8
Free function blocks					FPlan_english.vsd	Function diagram	- 490 -
Type conversion					05.01	Angular Synchr. Control SPA440	



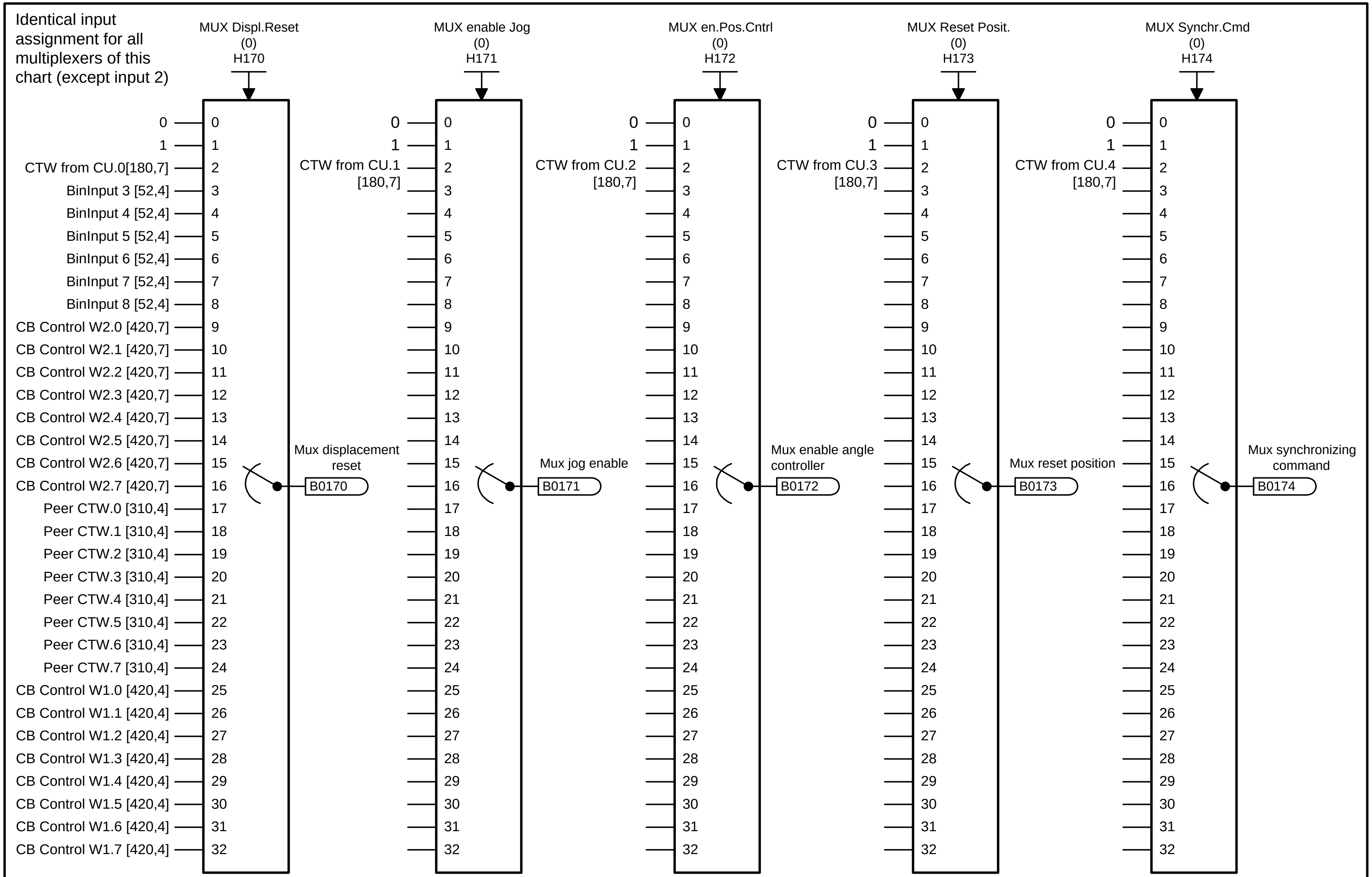
1	2	3	4	5	6	7	8

Multiplexer		FPlan_english.vsd	Function diagram	- 500 -
Setpoint channels		05.01	Angular Synchr. Control SPA440	



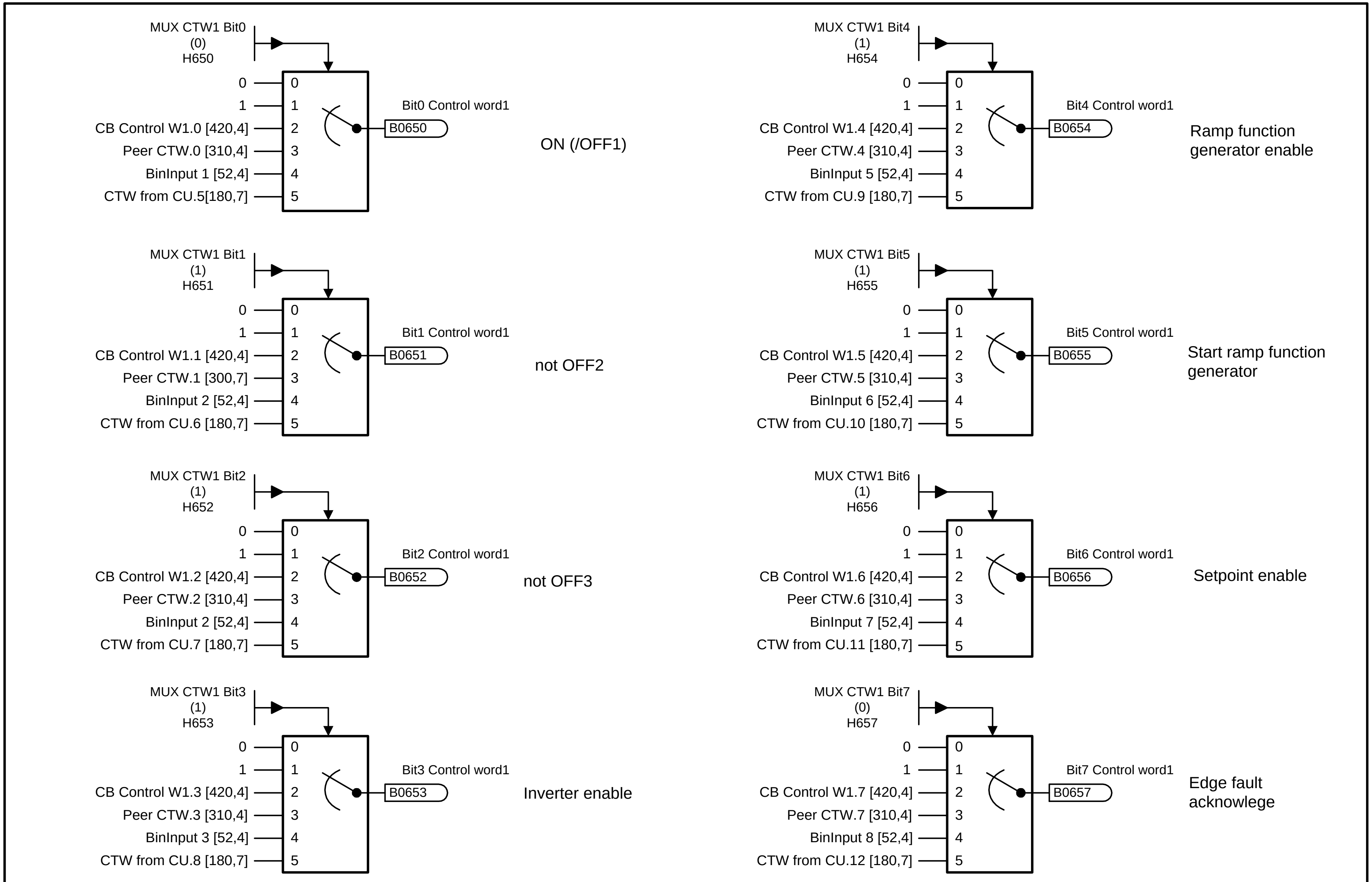
1	2	3	4	5	6	7	8

Multiplexer		FPlan_english.vsd	Function diagram	- 510 -
Analog outputs		05.01	Angular Synchr. Control SPA440	



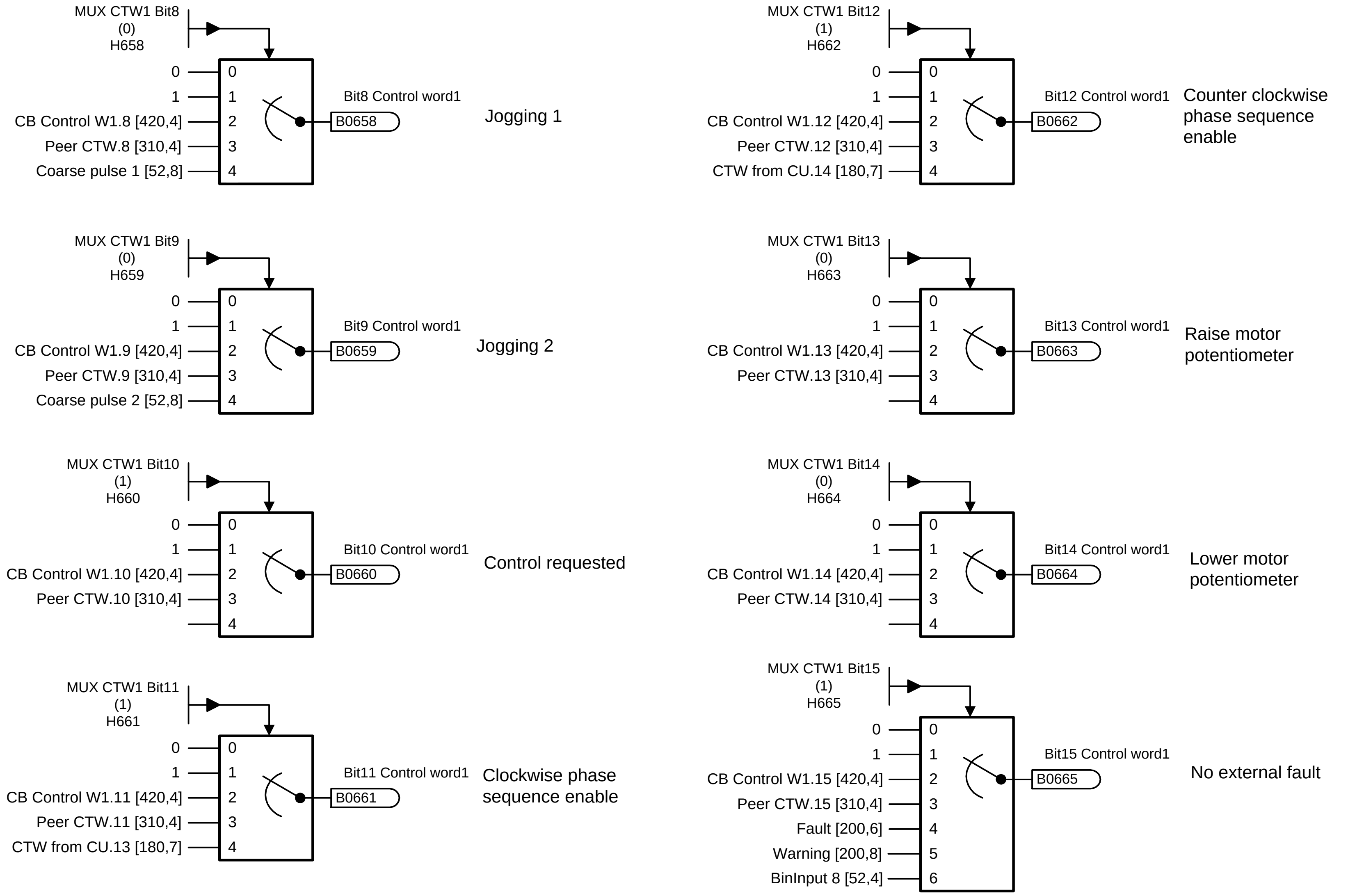
1	2	3	4	5	6	7	8

Multiplexer		FPlan_english.vsd	Function diagram	- 520 -
Binary control		05.01	Angular Synchr. Control SPA440	



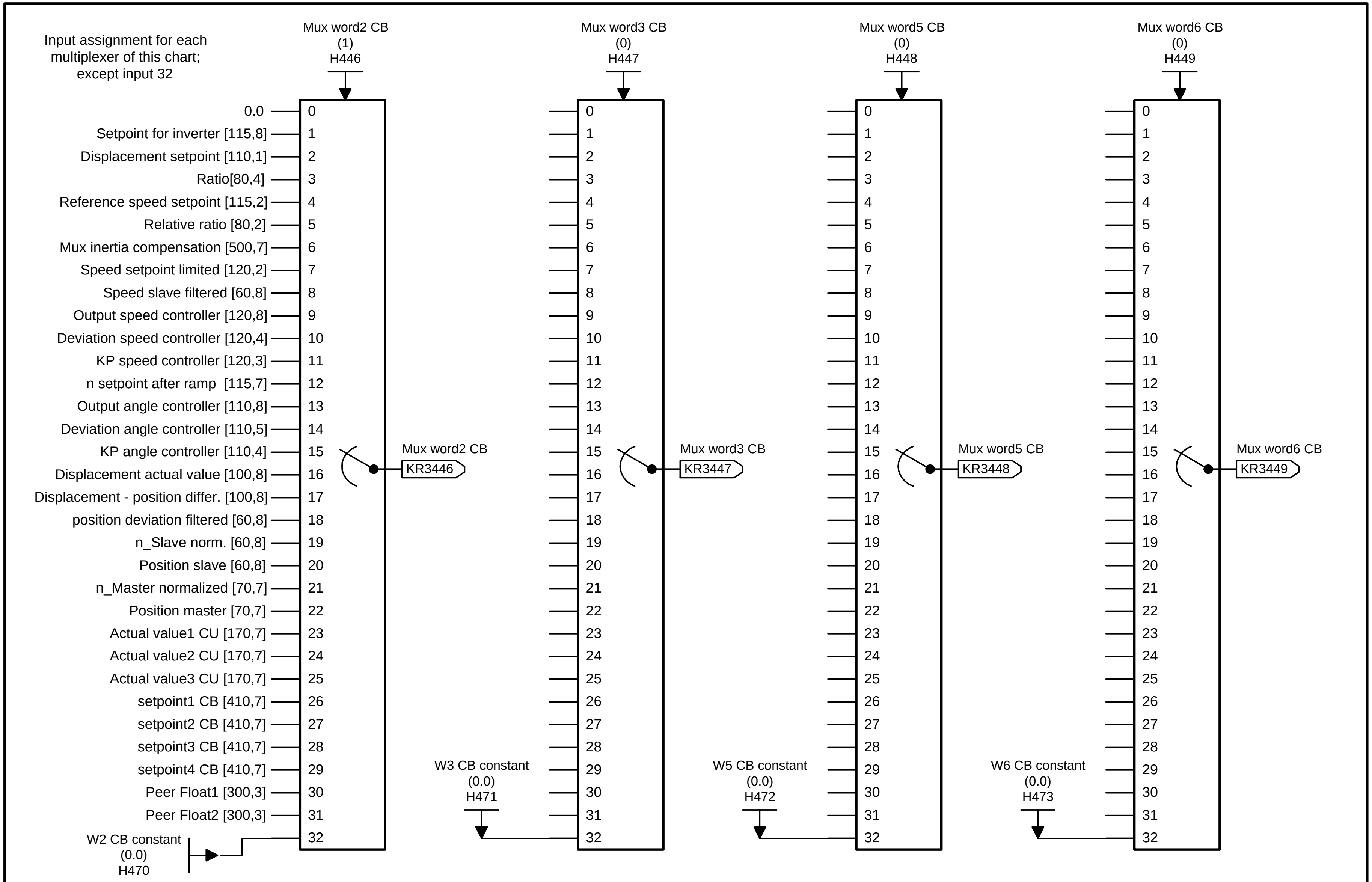
MUX CTW1 Bit0
(0)
H650
0
1
CB Control W1.0 [420,4]
Peer CTW.0 [310,4]
BinInput 1 [52,4]
CTW from CU.5[180,7]
0 1 2 3 4 5
Bit0 Control word1
B0650
ON (/OFF1)
MUX CTW1 Bit1
(1)
H651
0
1
CB Control W1.1 [420,4]
Peer CTW.1 [300,7]
BinInput 2 [52,4]
CTW from CU.6 [180,7]
0 1 2 3 4 5
Bit1 Control word1
B0651
not OFF2
MUX CTW1 Bit2
(1)
H652
0
1
CB Control W1.2 [420,4]
Peer CTW.2 [310,4]
BinInput 2 [52,4]
CTW from CU.7 [180,7]
0 1 2 3 4 5
Bit2 Control word1
B0652
not OFF3
MUX CTW1 Bit3
(1)
H653
0
1
CB Control W1.3 [420,4]
Peer CTW.3 [310,4]
BinInput 3 [52,4]
CTW from CU.8 [180,7]
0 1 2 3 4 5
Bit3 Control word1
B0653
Inverter enable
MUX CTW1 Bit4
(1)
H654
0
1
CB Control W1.4 [420,4]
Peer CTW.4 [310,4]
BinInput 5 [52,4]
CTW from CU.9 [180,7]
0 1 2 3 4 5
Bit4 Control word1
B0654
Ramp function generator enable
MUX CTW1 Bit5
(1)
H655
0
1
CB Control W1.5 [420,4]
Peer CTW.5 [310,4]
BinInput 6 [52,4]
CTW from CU.10 [180,7]
0 1 2 3 4 5
Bit5 Control word1
B0655
Start ramp function generator
MUX CTW1 Bit6
(1)
H656
0
1
CB Control W1.6 [420,4]
Peer CTW.6 [310,4]
BinInput 7 [52,4]
CTW from CU.11 [180,7]
0 1 2 3 4 5
Bit6 Control word1
B0656
Setpoint enable
MUX CTW1 Bit7
(0)
H657
0
1
CB Control W1.7 [420,4]
Peer CTW.7 [310,4]
BinInput 8 [52,4]
CTW from CU.12 [180,7]
0 1 2 3 4 5
Bit7 Control word1
B0657
Edge fault acknowlege

1	2	3	4	5	6	7	8



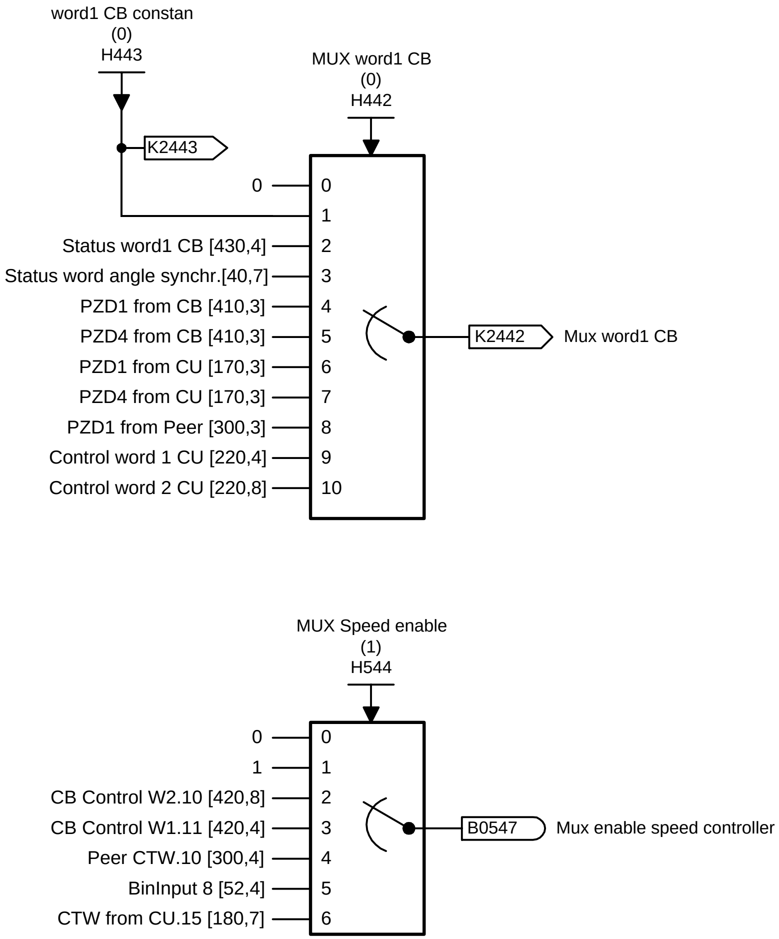
1	2	3	4	5	6	7	8

Multiplexer	FPlan_english.vsd	Function diagram	- 540 -
Control word 1 (part 2)	05.01	Angular Synchr. Control SPA440	



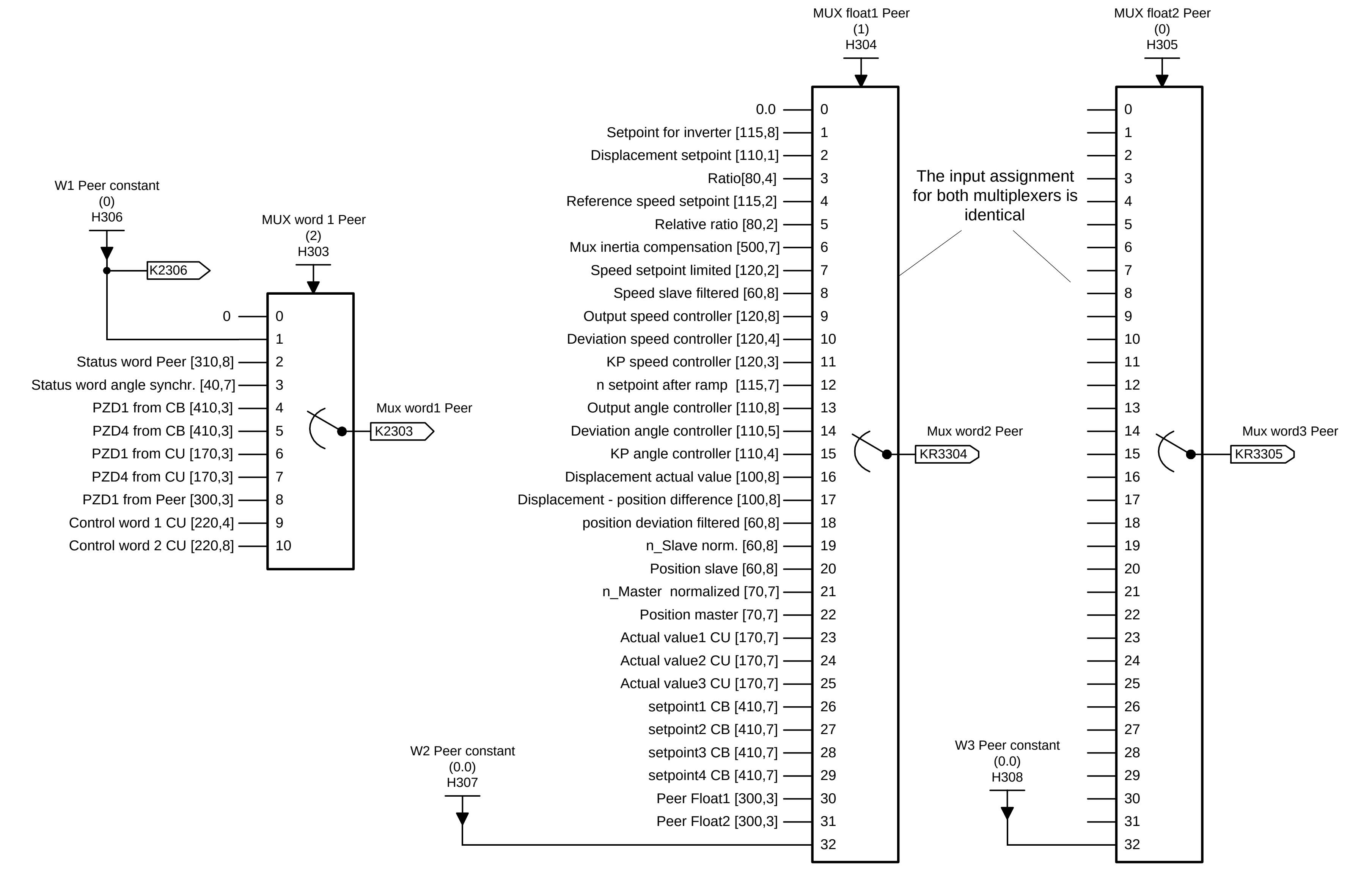
1	2	3	4	5	6	7	8

Multiplexer		FPlan_english.vsd	Function diagram	- 550 -
CB actual values		05.01	Angular Synchr. Control SPA440	



1	2	3	4	5	6	7	8

Multiplexer	FPlan_english.vsd	Function diagram	- 560 -
CB status words	05.01	Angular Synchr. Control SPA440	



1	2	3	4	5	6	7	8

Multiplexer		FPlan_english.vsd	Function diagram	- 570 -
Peer to peer		05.01	Angular Synchr. Control SPA440	