8. Diagnostics

8.1 Error status/Warning status

Errors are shown on the drive controller display (for D1/2 display see Operation Manual) and in parallel in the DriveManager. When a new error occurs, the window below opens, indicating the error name, location and cause. In addition, the green rectangle in the "Drive Status" switches to red.

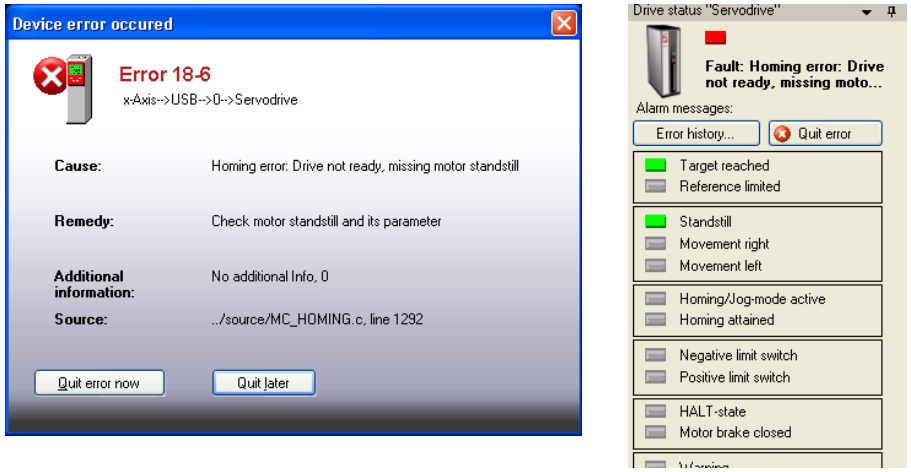


Figure 8.1 Current error display

Clicking the "Error" button in the "Drive Status" window calls up a buffer memory log listing the last 20 errors . When the 21st error occurs, the oldest error in the list is overwritten.

1	Error 11-1	2455760h	External error at digital input detected	
2	Error 18-8	2275817h	Homing/Jogging error: Drive not ready, wrong control m	Switch to supported control mode
3	Error 0-0	0h		
4	Error 0-0	0h		

Figure 8.2 Error history; storage of last 20 errors

8.1.1 Error reactions

Each of the errors listed in parameter **P 0033** (sub-ID 0-47) can be assigned one of the error reactions listed below. However, not every error has every selection option.

P.no.	Parameter name/ Settings	Description in DM 5	Error reactions
P 0033 Sub Id 0-46	ErrorReactions	Programmable reaction in case of failure	Error response
(0)	Ignore	Ignore error	The error is ignored
(1)	Specific1	Notify error, reaction is forced by internal PLC function block	A specific error reaction can be programmed via PLC
(2)	Specific 2	Notify error, reaction is forced by external control unit	Error reaction external
(3)	FaultReactionOption-Code	Notify error, reaction as given by fault reaction option codes	The error reaction is based on the value set in object 605Eh "Fault reaction" option code.

P.no.	Parameter name/ Settings	Description in DM 5	Error reactions
(4)	ServoStop	Notify error, execute quick stop and wait for restart of control	Quick stop, waiting for restart of control
(5)	ServoStopAndLock	Notify error, execute quick stop, disable power stage, protect against restart	Quick stop, block power stage, secure against switching on
(6)	ServoHalt	Notify error, disable power stage	Block power stage
(7)	ServoHaltAndLock	Notify error, block power stage, protect against restart	Block power stage, block enable
(8)	WaitERSAndReset	Notify error, block power stage and reset only via switching off/ on control voltage (24 V)	Block power stage, reset only by switching the 24 V control voltage off and back on

8.1.2 Error details/Alarm & warning details

P.no. P 0030	Error name/Error location	Description of error	Emergency code DS 402	Error-register DS 402	Error code SERCOS
(0)	(0) no error	No error	0xFF00	1	0x8000
(1)	(1) RunTimeError	Runtime error	0x6010	1	0x1
	(2) RunTimeError_DynamicModules	Internal error in device initialization	0x6010	1	0x1
	(3) RunTimeError_ Flashmemory	Error in flash initialization	0x6010	1	0x1
	(4) RunTimeError_PLC	PLC runtime error	0x6010	1	0x1
(2)	ParaList		0x6320	1	0x1
	(1) ParameterInit	Error in parameter initialization	0x6320	1	0x1
	(2) ParameterVirginInit	Basic parameter initialization (factory setting)	0x6320	1	0x1
	(3) ParameterSave	Parameter data backup	0x5530	1	0x1
	(4) ParameterAdd	Registration of a parameter	0x6320	1	0x1
	(5) ParameterCheck	Check of current parameter list values	0x5530	1	0x1
	(6) ParameterListAdmin	Management of parameter list	0x6320	1	0x1
	(7) ParaList_PST	Non-resetable errors from PowerStage : EEPROM data error	0x5400	1	0x1
	(8) ParaList_PST_VL	Error in power stage initialization; selected device voltage not supported	0x6320	1	0x1
(3)	OFF				
	(1) Off_MON_Device	Undervoltage	0x3120	1	0x200
(4)	OverVoltage				
	(1) OverVoltage_MON_ Device	Overvoltage	0x3110	1	0x100
(5)	OverCurrent				
	(1) OverCurrent_HardwareTrap	Overcurrent shut-off by hardware	0x2250	1	0x80
	(2) OverCurrent_Soft	Overcurrent shut-off (fast) by software	0x2350	1	0x80
	(3) OverCurrent_ADC	Measuring range of AD converter exceeded	0x2350	1	0x80
	(4) OverCurrent_WireTest	Short-circuit test on initialization	0x2350	1	0x80

P.no. P 0030	Error name/Error location	Description of error	Emergency code DS 402	Error-register DS 402	Error code SERCOS
	(5) OverCurrent_DC	(Fast) Overcurrent shut-off "below 5 Hz"	0x2350	1	0x80
	(6) OverCurrent_Zero,	Total current monitoring	0x2350	1	0x80
	(7) OverCurrent_I2TS	Fast I^2xt at high overload	0x2350	1	0x80
(6)	OvertempMotor				
	(1) OvertempMotor_ MON_MotTemp	Calculated motor temperature above threshold value	0x4310	1	0x4
	(2) OvertempMotor_ MON_Device_DIN1	PTC to DIN1	0x4310	1	0x4
	(3) OvertempMotor_ MON_Device_DIN2	PTC to DIN2	0x4310	1	0x4
	(4) OvertempMotor_ MON_Device_DIN3	PTC to DIN3	0x4310	1	0x4
(7)	OvertempInverter				
	(1) OvertempInverter_ MON_Device	Heat sink temperature too high	0x4210	1	0x2
(8)	OvertempDevice				
	(1) OvertempDevice_ MON_Device	Interior temperature evaluation	0x4210	1	0x40
(9)	I2tMotor				
	(1) I^2tMotor_MON_I2t	I^2xt integrator has exceeded motor protection limit value (permissible current/time area)	0x2350	1	0x1
(10)	PowerAmplifier				
	(1) I^2tPowerAmplifier_ MON_Device	I^2xt power stage protection limit value exceeded	0x2350	1	0x1
(11)	External				
	(1) External_MPRO_INPUT	External error message	0xFF0	1	0x8000

P.no. P 0030	Error name/Error location	Description of error	Emergency code DS 402	Error-register DS 402	Error code SERCOS
(12)	CAN				
	(1) ComOptCan_BusOff	CAN option: BusOff error	0x8140	1	0x8000
	(2) ComOptCan_Guarding	CAN option: Guarding error	0x8130	1	0x8000
	(3) ComOptCan_MsgTransmit	CAN option: Unable to send message	0x8100	1	0x8000
	(4) ComOptCan_HeartBeat	CAN option: Heartbeat error	0x8130	1	0x8000
	(5) ComOptCan_Addr	CAN option: Invalid address	0x8110	1	0x8000
	(6) ComOptCan_ PdoMappingError	Mapping error	0x8200	1	0x8000
	(7) ComOptCan_SyncTimeoutError	CAN option: Synchronization error	0x8140	1	0x8000
(13)	SERCOS				
	(1) ComOptSercos_HardwareInit	SERCOS: Hardware initialization	0xFF00	1	0x1000
	(2) ComOptSercos_IllegalPhase	SERCOS: Invalid communication phase	0xFF00	1	0x1000
	(3) ComOptSercos_CableBreak	SERCOS: Cable break	0xFF00	1	0x1000
	(4) ComOptSercos_DataDisturbed	SERCOS: Disturbed data transmission	0xFF00	1	0x1000
	(5) ComOptSercos_MasterSync	SERCOS: Faulty synchronization	0xFF00	1	0x1000
	(6) ComOptSercos_MasterSync	SERCOS: Data telegrams missing	0xFF00	1	0x1000
	(7) ComOptSercos_ Address- Double	SERCOS: Duplicate address	0xFF00	1	0x1000

P.no. P 0030	Error name/Error location	Description of error	Emergency code DS 402	Error-register DS 402	Error code SERCOS
	(8) ComOptSercos_Phase SwitchUp	SERCOS: Faulty phase switching (Up shift)	0xFF00	1	0x1000
	(9) ComOptSercos_Phase SwitchDown	SERCOS: Faulty phase switching (Down shift)	0xFF00	1	0x1000
	(10) ComOptSercos_Phase SwitchAck	SERCOS: Faulty phase switching (missing acknowledgement)	0xFF00	1	0x1000
	(11) ComOptSercos_InitParaList	SERCOS: Faulty initialization of SERCOS parameter lists	0xFF00	1	0x1000
	(12) ComOptSercos_RunTimeError	SERCOS: Various runtime errors	0xFF00	1	0x1000
	(13) ComOptSercos_Watchdog	SERCOS: Hardware watchdog	0xFF00	1	0x1000
	(14) ComOptSercos_Para	SERCOS: Error in parameterization (selection of OP mode, IP times, etc...)	0xFF00	1	0x1000
(14)	EtherCat:				
	(1) ComOptEtherCat_Sm Watchdog0	EtherCat: Sync-Manager0 - Watchdog	0x8130	1	0x8000
	(2) ComOptEtherCat_Wrong EepData	EtherCat: Parameter error, parameter data implausible	0x8130	1	0x8000
	(3) ComOptEtherCat_RamError	EtherCat: Internal RAM error‘	0x8130	1	0x8000
(15)	Parameters				
	(1) Parameter_MON_Device_Current	Error in current monitoring initialization	0x2350	1	0x8000
	(2) Parameter_MON_I2t	Motor protection	0x2350	1	0x8000

P.no. P 0030	Error name/Error location	Description of error	Emergency code DS 402	Error-register DS 402	Error code SERCOS
	(3) Parameter_CON_ICOM	Autocommutation: Plausibility tolerance exceeded	0xFF00	1	0x8000
	(4) Parameter_CON_FM	Field model	0xFF00	1	0x8000
	(5) Parameter_CON_Timing	Basic initialization of control	0xFF00	1	0x8000
	(6) Parameter_MPRO_FG	Error calculating user units	0x6320	1	0x8000
	(7) Parameter_ENC_RATIO	Error initializing encoder gearing	0x6320	1	0x8000
	(8) Parameter_Nerf	Speed detection / observer	0x8400	1	0x8000
	(9) Parameter_ObsLib	Error in matrix library	0xFF00	1	0x8000
	(10) Parameter_CON_CCON	Current control	0x8300	1	0x8000
	(11) Parameter_reserved1	Not used/reserved	0xFF00	1	0x8000
	(12) Parameter_Inertia	Moment of inertia is zero	0xFF00	1	0x8000
	(13) Parameter_MPRO	PARA_WatchDog in open-loop control via DM5	0xFF00	1	0x8000
	(14) Parameter_DV_INIT	DV_INIT: Error in system initialization	0xFF00	1	0x8000
(16)	SpeedDiff				
	(1) SpeedDiff_MON_SDiff	Speed tracking error above threshold value	0x8400	1	0x8000
	(2) SpeedDiff_MON_NAct	Current speed above maximum speed of motor	0x8400	1	0x8000
(17)	PositionDiff				
	(1) PositionDiff_MON_ActDelta	Position tracking error too large	0x8611	1	0x8000
(18)	Motion control				

P.no. P 0030	Error name/Error location	Description of error	Emergency code DS 402	Error-register DS 402	Error code SERCOS
	(1) MotionControl_ MC_HOMING_Limit SwitchInterchanged	Homing: Limit switches interchanged	0x8612	1	0x8000
	(2) MotionControl:MC_ HOMING: Unexpec-ted home switch event	Homing: Limit switch tripped unexpectedly	0x8612	1	0x8000
	(3) MotionControl_MC_ HOMING_ErrorLi-mitSwitch	Homing: Limit switch error	0x8612	1	0x8000
	(4) MotionControl_MC_ HOMING_Unknown-Method	Homing: Wrong homing method, homing method not available	0xFF00	1	0x8000
	(5) MotionControl_MC_ HOMING_Method-Undefined	Homing: Homing method available but not defined	0xFF00	1	0x8000
	(6) MotionControl_MC_ HOMING_DriveNot-ReadyHoming	Homing: Drive not ready for homing	0xFF00	1	0x8000
	(7) MotionControl_MC_ HOMING_DriveNot-ReadyJogging	Homing: Drive not ready for jog mode	0xFF00	1	0x8000
	(8) MotionControl_MC_ HOMING_Wrong-ConMode	Homing: Control mode does not match homing method	0xFF00	1	0x8000
	(9) MotionControl_ MC_HOMING_En-coderInitFailed	Homing: Encoder initialization error	0xFF00	1	0x8000
	(10) MotionControl_ MC_HOMING_Max-DistanceOverrun	Homing: Homing travel exceeded	0xFF00	1	0x8000
	(11) MotionControl_ MPRO_REF_Enable-dOperationFailed	Max. permissible tracking error on "Start control" exceeded	0xFF00	1	0x8000

P.no. P 0030	Error name/Error location	Description of error	Emergency code DS 402	Error-register DS 402	Error code SERCOS
	(12) MotionCont-rol_MPRO_REF_SSP_ StackOverflow	Memory overflow for table values	0xFF00	1	0x8000
	(13) MotionControl_ MC_HOMING_Res-toreBackupPos,	Error initializing last actual position after restart.	0xFF00	1	0x8000
(19)	FatalError	Non-resettable error			
	(1) FatalError_PowerSta-ge_Limit_Idx	PST: Data index too large	0x5400	1	0x8000
	(2) FatalError_PowerSta-ge_SwitchFreq	PST: Error in switching frequency-dependent data	0x5400	1	0x8000
	(3) FatalError_PowerSta-ge_DataInvalid	PST: Invalid EEPROM data	0x5400	1	0x8000
	(4) FatalError_PowerSta-ge_CRC	PST: CRC error	0x5400	1	0x8000
	(5) FatalError_PowerSta-ge_ErrorReadAccess	PST: Error reading power stage data	0x5400	1	0x8000
	(6) FatalError_PowerSta-ge_ErrorWriteAccess	PST: Error writing power stage data	0x5400	1	0x8000
	(7) FatalError_MON_ Chopper	Current in braking resistor even though transistor swit-ched off	0x5420	1	0x8000
	(8) FatalError_HW_Iden-tification	Hardware identification error	0x5300	1	0x8000
	(9) FatalError_FlashMe-mory	Error in flash memory	0x5300	1	0x8000
(20)	HardwareLimitSwitch				
	(1) HardwareLimitS-witch_Inter- chan-ged	Limit switches interchanged	0x8612	1	0x8000

P.no. P 0030	Error name/Error location	Description of error	Emergency code DS 402	Error-register DS 402	Error code SERCOS
	(2) HardwareLimitSwitch_LCW	Hardware limit switch LCW	0x8612	1	0x8000
	(3) HardwareLimitSwitch_LCCW	Hardware limit switch LCCW	0x8612	1	0x8000
(21)	EncoderInit	General encoder initialization (locations which cannot be assigned to a channel)			
	(1) EncoderInit_CON_ ICOM_Eps Delta	Encoder general initialization: Excessive motion	0x7300	1	0x20
	(2) EncoderInit_CON_ ICOM_ Tolerance	Encoder general initialization: Excessive tolerance	0x7300	1	0x20
(22)	Encoder CH1Init	Encoder channel 1 initialization			
	(1) EncCH1Init_Sincos_Lines	Encoder channel 1 initialization, Sincos: Plausibility check ‚Lines' from PRam_ENC_CH1_Lines	0x7305	1	0x20
	(2) EncCH1Init_Sincos_ ABSquareSum	Encoder channel 1 initialization, Sincos: Getting ABSquareSum, Timeout	0x7305	1	0x20
	(3) EncCH1Init_Sincos_ EncObs	Encoder channel 1 initialization, SinCos: Encoder monitoring Sincos	0x7305	1	0x20
	(4) EncCH1Init_ EnDat2.1_ NoEnDat2.1	Encoder channel 1 initialization, EnDat2.1: No EnDat2.1 encoder (encoder may be SSI)	0x7305	1	0x20
	(5) EncCH1Init_ EnDat2.1_Line5	Encoder channel 1 initialization, EnDat2.1: Plausibility check ‚Lines' from encoder	0x7305	1	0x20
	(6) EncCH1Init_ EnDat2.1_ Multiturn	Encoder channel 1 initialization, EnDat2.1: Plausibility check ‚Multiturn' from encoder	0x7305	1	0x20
	(7) EncCH1Init_ EnDat2.1_ Singleturn	Encoder channel 1 initialization, EnDat2.1: Plausibility check ‚Singleturn' from encoder	0x7305	1	0x20
	(8) EncCH1Init_ EnDat2.1_CrcPos	Encoder channel 1 initialization, EnDat2.1: CRC error position transfer	0x7305	1	0x20
	(9) EncCH1Init_ EnDat2.1_ CrcData	Encoder channel 1 initialization, EnDat2.1: CRC error data transfer	0x7305	1	0x20
	(10) EncCH1Init_ EnDat2.1_ WriteToProt	Encoder channel 1 initialization, EnDat2.1: An attempt was made to write to the protection cells in the encoder!	0x7305	1	0x20
	(11) EncCH1Init_ EnDat2.1_ SscTimeout	Encoder channel 1 initialization, EnDat2.1: Timeout on SSC transfer	0x7305	1	0x20
	(12) EncCH1Init_ EnDat2.1_ StartbitTimeout	Encoder channel 1 initialization, EnDat2.1: Timeout, no start bit from encoder	0x7305	1	0x20
	(13) EncCH1Init_EnDat2.1_ PosConvert	Encoder channel 1 initialization, EnDat2.1: Position data not consistent	0x7305v	1	0x20
	(14) EncCH1Init_SSI_Lines	Encoder channel 1 initialization, SSI: Plausibility check ‚Lines' from encoder	0x7305	1	0x20
	(15) EncCH1Init_SSI_ Multiturn	Encoder channel 1 initialization, SSI: Plausibility check ‚Multiturn' from encoder	0x7305	1	0x20
	(16) EncCH1Init_SSI_Singleturn	Encoder channel 1 initialization, SSI: Plausibility check ‚Singleturn' from encoder	0x7305	1	0x20

P.no. P 0030	Error name/Error location	Description of error	Emergency code DS 402	Error-register DS 402	Error code SERCOS
	(17) EncCH1Init_SSI_ParityPos	Encoder channel 1 initialization, SSI: Parity error position transfer	0x7305	1	0x20
	(18) EncCH1Init_SSI_SscTimeout	Encoder channel 1 initialization, SSI: Timeout on SSC transfer	0x7305	1	0x20
	(19) EncCH1Init_SSI_PosConvert	Encoder channel 1 initialization, SSI: Position data not consistent	0x7305	1	0x20
	(20) EncCH1Init_SSI_EncObs	Encoder channel 1 initialization, SSI: Encoder monitoring bit	0x7305	1	0x20
	(21) EncCH1Init_Hiperface_ NoHiperface	Encoder channel 1 error initializing Hiperface interface	0x7305	1	0x20
	(22) EncCH1Init_Hiperface_ Common	Encoder channel 1 initialization, Hiperface: Interface, gen. Error	0x7305	1	0x20
	(23) EncCH1Init_Hiperface_ Timeout	Encoder channel 1 initialization, Hiperface: Interface, Timeout	0x7305	1	0x20
	(24) EncCH1Init_Hiperface_ CommandMismatch	Encoder channel 1 initialization, Hiperface: Encoder, impossible COMMAND in response	0x7305	1	0x20
	(25) EncCH1Init_Hiperface_ EStatResp_Crc	Encoder channel 1 initialization, Hiperface: CRC error in error status response	0x7305	1	0x20
	(26) EncCH1Init_Hiperface_ EStatResp_Com	Encoder channel 1 initialization, Hiperface: Error status response returns communication error	0x7305	1	0x20

P.no. P 0030	Error name/Error location	Description of error	Emergency code DS 402	Error-register DS 402	Error code SERCOS
	(27) EncCH1Init_Hiperface_ EStatResp_Tec	Encoder channel 1 initialization, Hiperface: Error status response returns technology or process error	0x7305	1	0x20
	(28) EncCH1Init_Hiperface_ EStatResp_None	Encoder channel 1 initialization, Hiperface: Error status response returns no error(!)	0x7305	1	0x20
	(29) EncCH1Init_Hiperface_ Response_Crc	Encoder channel 1 initialization, Hiperface: CRC error in response	0x7305	1	0x20
	(30) EncCH1Init_Hiperface_ Response_Com	Encoder channel 1 initialization, Hiperface: Response with error bit: Status returns communication error	0x7305	1	0x20
	(31) EncCH1Init_Hiperface_ Response_Tec	Encoder channel 1 initialization, Hiperface: Response with error bit: Status returns technology or process error	0x7305	1	0x20
	(32) EncCH1Init_Hiperface_ Response_None	Encoder channel 1 initialization, Hiperface: Response with error bit: Status returns no error	0x7305	1	0x20
	(33) EncCH1Init_Hiperface_ Status_Com	Encoder channel 1 initialization, Hiperface: Status telegram reports communication error	0x7305	1	0x20
	(34) EncCH1Init_Hiperface_ Status_Tec	Encoder channel 1 initialization, Hiperface: Status telegram returns technology or process error	0x7305	1	0x20
	(35) EncCH1Init_Hiperface_ TypeKey	Encoder channel 1 initialization, Hiperface: Type identification of encoder unknown	0x7305	1	0x20

P.no. P 0030	Error name/Error location	Description of error	Emergency code DS 402	Error-register DS 402	Error code SERCOS
	(36) EncCH1Init_Hiperface_ WriteToProt	Encoder channel 1 initialization, Hiperface: An attempt was made to write to the protection cells in the encoder!	0x7305	1	0x20
	(37) EncCH1Init_TTL_ IncompatibleHardware	Encoder channel 1 initialization, TTL: Control pcb does not support TTL evaluation	0x7305	1	0x20
	(38) EncCH1Init_ EnDat2.1_ PositionBits	Encoder channel 1 initialization, EnDat2.1: Plausibility check ‚Position Bits' from encoder	0x7305	1	0x20
	(39) EncCH1Init_ EnDat2.1_ TransferBits	Encoder channel 1 initialization, EnDat2.1: Plausibility check ‚Transfer Bits' of transfer	0x7305	1	0x20
	(40) EncCH1Init_Np_ NominalIncrement	Encoder channel 1 initialization, NP: Plausibility check ‚Lines' and "Nominal-Increment"	0x7305	1	0x20
	(41) EncCh1Init_ Endat21_Common	Encoder channel 1 initialization, Endat21: Interface gen. Error	0x7305	1	0x20
	42) EncCh1Init_SSI_ Common	Encoder channel 1 initialization, SSI: Interface gen. error	0x7305	1	0x20
	43) EncCh1Init_Sincos_ Common	Encoder channel 1 initialization, Sincos: Interface gen. error	0x7305	1	0x20
(23)	EncChannel2Init				
	(1) EncCH2Init_Res_Lines	Encoder channel 2 initialization, Res: Plausibility check ‚Lines' from PRam_ENC_CH1_ Lines	0x7306	1	0x20
	(2) EncCH2Init_Res_ ABSquareSum_TimeOut	Encoder channel 2 initialization, Res: Getting ABSquareSum, Timeout	0x7306	1	0x20
	(3) EncCH2Init_Res_EncObs	Encoder channel 2 initialization, Res: Encoder monitoring resolver	0x7306	1	0x20
(24)	EncCH3Init				
	(1) EncCH3Init_Module IdentificationFailed	Encoder channel 3 initialization: No module inserted or wrong module	0x7307	1	0x20
	(2) EncCH3Init_Common_EO_ Error	Encoder channel 3 initialization: General EO error (encoder option)	0x7307	1	0x20
	(3) EncCH3Init_SSI_ EncObs_20c	Encoder channel 3 initialization: Encoder monitoring	0x7307	1	0x20
	(4) EncCH3Init_ EnDat2.1_ NoEnDat2.1	Encoder channel 3 initialization, EnDat2.1: No EnDat2.1 encoder (encoder may be SSI)	0x7307 0x7307	1	0x20
	(5) EncCH3Init_ EnDat2.1_Lines	Encoder channel 3 initialization, EnDat2.1: Plausibility check ‚Lines' from encoder	0x7307	1	0x20
	(6) EncCH3Init_ EnDat2.1_ Multiturn	Encoder channel 3 initialization, EnDat2.1: Plausibility check ‚Multiturn' from encoder	0x7307	1	0x20y
	(7) EncCH3Init_ EnDat2.1_ Singleturn	Encoder channel 3 initialization, EnDat2.1: Plausibility check ‚Singleturn' from encoder	0x7307	1	0x20
	(8) EncCH3Init_ EnDat2.1_CrcPos	Encoder channel 3 initialization, EnDat2.1: CRC error position transfer	0x7307	1	0x20
	(9) EncCH3Init_ EnDat2.1_CrcData	Encoder channel 3 initialization, EnDat2.1: CRC error data transfer	0x7307	1	0x20

P.no. P 0030	Error name/Error location	Description of error	Emergency code DS 402	Error-register DS 402	Error code SERCOS
	(10) EncCH3Init_ EnDat2.1_ WriteToProt	Encoder channel 3 initialization, EnDat2.1: An attempt was made to write to the protection cells in the encoder!	0x7307	1	0x20
	(11) EncCH3Init_ EnDat2.1_ SscTimeout	Encoder channel 3 initialization, EnDat2.1: Timeout on SSC transfer	0x7307	1	0x20
	(12) EncCH3Init_ EnDat2.1_ StartbitTimeout	Encoder channel 3 initialization, EnDat2.1: Timeout, no start bit from encoder	0x7307	1	0x20
	(13) EncCH3Init_ EnDat2.1_ PosConvert	Encoder channel 3 initialization, EnDat2.1: Position data not consistent	0x7307	1	0x20
	(14) EncCH3Init_SSI_Lines	Encoder channel 3 initialization, SSi: Error initializing SSI interface	0x7307	1	0x20
	(15) EncCH3Init_SSI_ Multiturn	Encoder channel 3 initialization, SSi: Plausibility check ‚Multiturn' from encoder	0x7307	1	0x20
	(16) EncCH3Init_SSI_Singleturn	Encoder channel 3 initialization, SSi: Plausibility check ‚Singleturn' from encoder	0x7307	1	0x20
	(17) EncCH3Init_SSI_ParityPos	Encoder channel 3 initialization, SSi: Parity error position transfer	0x7307	1	0x20
	(18) EncCH3Init_SSI_SscTimeout	Encoder channel 3 initialization, SSi: Timeout on SSC transfer	0x7307	1	0x20
	(19) EncCH3Init_SSI_ PosConvert	Encoder channel 3 initialization, SSi: Position data not consistent	0x7307	1	0x20
	(20) EncCH3Init_SSI_EncObs	Encoder channel 3 initialization, SSi: Encoder monitoring bit	0x7307	1	0x20

P.no. P 0030	Error name/Error location	Description of error	Emergency code DS 402	Error-register DS 402	Error code SERCOS
	(38) EncCH3Init_ EnDat2.1_ PositionBits	Encoder channel 3 initialization, EnDat2.1: Plausibility check ‚Position Bits' from encoder	0x7307	1	0x20
	(39) EncCH3Init_ EnDat2.1_ TransferBits	Encoder channel 3 initialization, EnDat2.1: Plausibility check ‚Transfer Bits' of transfer	0x7307	1	0x20
	(40) EncCH3Init_Np_ NominalIncrement	Encoder channel 3 initialization, NP: Plausibility check ‚Lines' and "Nominal-Increment"	0x7307	1	0x20
	(41) EncCH3Init_ Endat21_Common	Encoder channel 3 initialization, EnDat21: Interface, gen. rror	0x7307	1	0x20
	(42) EncCH3Init_SSI_ Common	Encoder channel 3 initialization, SSi: Interface, gen. error	0x7307	1	0x20
	(43) EncCH3Init_Sincos_Common	Encoder channel 3 initialization, Sincos: Interface, gen. error	0x7307	1	0x20
	(50) EncCH3Init_TOPT_ cfg	Encoder channel 3 initialization, interface, gen. error	0x7307		0x20
(25)	EncoderCycl	Encoder cyclus			
	(1) EncoderCycl_CON_ ICOM_Epsdelta	Encoder general cyclic: Autocommutation: Excessive motion	0xFF00	1	0x20
	(2) EncoderCycl_CON_ ICOM_Tolerance	Encoder general cyclic: Autocommutation: Excessive tolerance	0xFF00	1	0x20
(26)	EncCh1Cycl				
	(1) EncCH1Cycl_Np_Distance	Encoder channel 1 cyclic, NP: Plausibility, CounterDistance'	0x7305	1	0x20
	(2) EncCH1Cycl_Np_ DeltaCorrection	Encoder channel 1 cyclic, NP: Delta correction not possible	0x7305	1	0x20

P.no. P 0030	Error name/Error location	Description of error	Emergency code DS 402	Error-register DS 402	Error code SERCOS
	(3) EncCH1Cycl_Np_Delta	Encoder channel 1 cyclic, NP: Plausibility ‚CounterDelta'	0x7305	1	0x20
(27)	EncCh2Cycl				
	(1) EncCH2Cycl_NoLocation	Not used	0x7306	1	0x20
(28)	EncCh3Cycl				
	(1) EncCH3Cycl_NoLocation	Not used	0x7307	1	0x20
(29)	TC (TriCore)				
	(1) TC_ASC	TriCore ASC	0x5300	1	0x8000
	(2) TC_ASC2	TriCore ASC2	0x5300	1	0x8000
	(3) TC_FPU	TriCore floating point error	0x5300	1	0x8000
	(4) TC_FPU_NO_RET_ADDR	riCore floating point error, no return address available	0x5300	1	0x8000
(30)	InitCon				
	(1) InitCon_AnaInput	Initialization error analog input	0x5300	1	0x8000
	(2) InitCon_FM_GetKM	Initialization error calculating motor torque constant	0x5300	1	0x8000
	(3) InitCon_FM_ASM	Initialization error asynchronous motor	0x5300	1	0x8000
	(4) InitCon_FM_ASM_FW	Initialization error asynchronous motor in field-weakening	0x5300	1	0x8000
(31)	PLC				
	(1) PLC_Location 0...65536	User-specific: Errors generated in PLC program	0xFF00		0x8000
(32)	Profibus				
	(1) ComOptDp_Timeout	PROFIBUS DP: Process data Timeout	0xFF00	1	0x8000
(33)	Timing	Task overflow			
	(1) Timing_ADCTask_ReEntry	ADC task automatically interrupted	0x5300	1	0x8000
	(2) Timin_ControlTask	Control task exceeded scan time	0x5300	1	0x8000
(34)	PowerFail	Power failure detection			
	PowerFail	Power failure detection; supply voltage error	0x3220	1	0x8000
(35)	EncObs	Encoder cable break			
	(1) EncObs_CH1_Sincos	Cable break: Encoder channel 1	0xFF00	1	0x20
	(2) EncObs_CH2_Resolver	Cable break: Encoder channel 2	0xFF00	1	0x20
	(3) EncObs_CH3_Sincos	Cable break: Encoder channel 3	0xFF00	1	0x20
	(4) EncObs_CH1_SSI	Cable break: Encoder channel 1	0xFF00	1	0x20
(36)	VARAN				
	(1) ComOptVARAN_InitHwError	Error in hardware initialization: VARAN option	0x5300	1	0x8000
	(2) ComOptVARAN_BusOffError	"Bus off" error; no bus communication: VARAN option	0x5300	1	0x8000
(37)	Synchronization controller				
	(1) RatioError	The ratios between interpolation, synchronization and/or speed control time do not match	0x6100	1	0x8000

P.no. P 0030	Error name/Error location	Description of error	Emergency code DS 402	Error-register DS 402	Error code SERCOS
(38)	Braking chopper monitoring				
	(1) BC_Overload	Braking chopper overload	0x4210	1	0x0000
(39)	TwinWindow	Monitoring of speed and torque			
	(1) TwinWindow_Speed	Speed deviation between Master and Slave			
	(2) TwinWindow_Torque	Torque deviation between Master and Slave			
(40)	Twin-Sync-Module	Communication fault TECH option			
	(1) TOPT_TWIN_Comm-Lost	Error in "Twin Sync" technology option	0x7300	1	0x8000
	(2) TOPT_TWIN_Switch-Freq		0x7300	1	0x8000
	(3) TOPT_TWIN_Mode-Conflict		0x7300	1	0x8000
	(4) TOPT_TWIN_Remo-teError		0x7300	1	0x8000
(41)	DC link fast discharge	Maximum period for fast discharge			
	(1) FastDischarge_Ti-meout	Maximum period for fast discharge exceeded (35s)	0x7300	1	0x8000
(42)	EtherCAT Master Implementation	Error EtherCat Master			
	(1) Location can't specified CommError	Communication error EtherCat Master	0x6100	1	0x8000
(43)	Ethernet interface	Error in Ethernet configuration			
	(1) Ethernet_Init	Initialization error TCP/IP communication	0x6100	1	0x8000
(44)	Cable break detected				
	(1) WireBreak_Motor-Brake	No consumer on output X13 (motor holding brake)	0x6100	1	0x8000
(45)	LERR_LockViolate				
	(1)	Movement requested which was limited by reversing lock, limit switch or reference setpoint limitation	0x8612	1	0x8000
	(2)	Movement requested which was limited by reversing lock, limit switch or reference setpoint limitation. Lock active in both directions	0x8612	1	0x8000
46	LERR_positionLimit				
(1)	Position Limit_neg.	Negative software limit switch approached	0x8612	1	0x2000
(2)	Position Limit_pos	Positive software limit switch approached	0x8612	1	0x2000
(3)	Position Limit_Overtravel	Reference setpoint outside software limit switches	0x8612	1	0x2000
47	LERR_FSAFE	Reserved			

8.1.3 Warnings

In order to get timely information on excessive or inadequate values via an external controller or the drive's internal PLC, warning thresholds can be freely parameterized with **P 0730** . Each warning is assigned on and off thresholds. This enables parameterization of a hysteresis.

When a warning is triggered, the corresponding bit is entered in parameter **P 0034-ERR_WRN_State** . The binary value enables a status interrogation. Warnings can also be programmed onto digital outputs (see section 6, I/O's). The following warning thresholds are supported by the parameter:

P 0034	Warning thresholds
BIT number	
0	I^2xt integrator (motor) warning threshold exceeded
1	Heat sink temperature
2	Motor temperature
3	Interior temperature
4	Reserved for SERCOS
5	Overspeed
6	Reserved for SERCOS
7	Reserved for SERCOS
8	Reserved for SERCOS
9	Undervoltage
10	Reserved for SERCOS
11	Reserved for SERCOS
12	Reserved for SERCOS
13	Reserved for SERCOS
14	Reserved for SERCOS
15	Reserved for SERCOS
16	I^2xt integrator (device) exceeded
17	Monitoring of apparent current
18	Overvoltage
19	Protection of braking chopper, warning threshold exceeded
20	Overtorque
21	Reserve
22	Reserve
23	Reserve
24	Speed reference limitation active
25	Current reference limitation
26	Right limit switch active
27	Left limit switch active
28	External warning via input
29	Reserve
30	Reserve
31	Reserve

The ON and OFF options enable suitable on and off thresholds (switching hysteresis) to be defined for the following warnings.

P 0730 Index	Parameter name MON Warning Level	Meaning of Warning Level	Warnings
0	UnderVoltage_ON	DC link undervoltage	Undervoltage
1	UnderVoltage_OFF	DC link undervoltage	
2	OverVColtage_ON	DC link overvoltage	Overvoltage
3	OvervVoltage_OFF	DC link overvoltage	
4	Current_ON	Motor current	Motor current
5	Current_OFF	Motor current	

P 0730 Index	Parameter name MON Warning Level	Meaning of Warning Level	Warnings
6	Device I2t_ON	I^2t internal device protection	I^2xt device protection
7	Device I2t_OFF	I^2t internal device protection	
8	Motor I^2_ON	I^2t Motor protection	I^2xt motor protection
9	Motor I^2_OFF	I^2t Motor protection	
10	Torque ON	Motor torque	Torque limit reached
11	Torque OFF	Motor torque	
12	Speed On	Motor actual speed	Speed limit reached
13	Speed OFF	Motor actual speed	
14	TC ON	Cooler (power electronics) temperature	Heat sink temperature reached
15	TC OFF	Cooler (power electronics) temperature	
16	Tint ON	Internal (control electronics) temperature	Housing internal temperature reached
17	Tint OFF	Internal (control electronics) temperature	
18	MotorTemp ON	Motor temperature	Motor temperature reached
19	MotorTemp OFF	Motor temperature	

9. Field bus systems

9.1 CANopen

CANopen functionality of the ServoOne
The CANopen Communication Profile is documented in the CiA DS-301, and regulates "how" communication is executed. It differentiates between Process Data Objects (PDOs) and Service Data Objects (SDOs). The communication profile additionally defines a simplified network management system. Based on the communication services of DS-301 (Rev. 4.01) the device profile for variable-speed drives DSP402 was created. It describes the operation modes and device parameters supported.

Note: For a detailed description of the CANopen field bus system refer to the separate "CANopen User Manual".

9.2 PROFIBUS-DP

Short description of ServoOne PROFIBUS DP interface
Reference to PROFIdrive specification
The implementation in the ServoOne is based on the PROFIdrive profile "PROFIBUS PROFdrive-Profile Version 4.0".

Key features

- Data transfer using two-wire twisted pair cable (RS 485)
- Optionally 9.6 K, 19.2 K, 45.45 K, 93.75 K, 187.5 K, 500 K, 1.5 M, 3 M, 6 M or 12 MBaud
- Automatic baud rate detection
- PROFIBUS address can be set using the rotary coding switches or alternatively using the addressing parameters
- Cyclic data exchange reference and actual values using DPV0
- Acyclic data exchange using DPV1
- Synchronization of all connected drives using freeze mode and sync mode
- Reading and writing drive parameters using the PKW channel or DPV1

Note: For a detailed description of the PROFIBUS field bus system refer to the separate "Profibus User Manual".

9.3 SERCOS

Short description of ServoOne SERCOS interface
The basis for implementing SERCOS in the ServoOne is the document titled "Specification SERCOS Interface Version 2.2"

Key features

- Data transfer by fibre-optic cable
- Optionally 2, 4, 8 or 16 MBaud
- Automatic baud rate detection
- Transmission power adjustable by DIP switches

- SERCOS address programmable via buttons and display
- Cyclic data exchange of references and actual values with exact time equidistance
- SERCOS sampling time of 125 µs to 65 ms (multiples of 125 µs programmable)
- Multi-axis synchronization between reference action times and actual value measurement times of all drives in the loop
- Full synchronization of all connected drives with the master control system
- Free configuration of telegram content
- Maximum configurable data volume in MDT: 20 bytes
- Maximum configurable data volume in DT: 20 bytes
- Programmable parameter weighting and polarity for position, speed, acceleration and torque
- Modulo weighting
- Additive speed and torque references
- Fine-interpolation (linear or cubic) inside the drive
- Optionally master control-side (external) or in-drive generation of rotation speed and acceleration pre-control
- Service channel for parameter setting and diagnosis
- Support for touch probes 1 and 2
- Support for configurable real-time status and control bits
- Support for configurable signal status and control word
- Supported commands:
- S-0-0099 Reset state class 1
- S-0-0127 Preparation for switch to phase 3
- S-0-0128 Prepare switch to phase 4
- S-0-0148 Drive-controlled homing
- S-0-0152 "Position spindle" command
- S-0-0170 "Touchprobe" command
- S-0-0262 "Parameter initialization to defaults" command
- S-0-0263 "Parameter initialization to backup values" command
- S-0-0264 "Save current parameter values" command

Note: For a detailed description of the SERCOS field bus system refer to the separate "SERCOS User Manual".

10. Technology option

10.1 General

It is possible to use one of the following encoder types by way of option slot 3.

- SinCos module
- TTL module
- SSI module

10.2 SinCos module

The SinCos module enables evaluation of high-resolution encoders. A track signal period is interpolated at a 12-bit resolution (fine interpolation).

Note: For more information refer to the "SinCos Module" specification, ID no.: 1108.01B.0-00.

10.3 SSI module

Using SSI Encoder Simulation, the current actual position of the drive controlled by the ServoOne can be read by a higher-level control system. The ServoOne then behaves like an SSI encoder in relation to the control. SSI Encoder Simulation uses the technology board slot (X8). The technology board is automatically detected.

- Parameterizable number of multi-turn and single-turn bits
- Binary transfer
- Clock rates between 200 kBit/s and 1500 kBit/s are supported
- Fastest possible sampling time: 125 µs
- Optional transfer with parity bit (Odd/Even)
- Optional synchronization of control to read cycle
- Display of synchronization status
- Encoder monoflop time: ~25 µs
- Clear parameter structure for quick and easy commissioning

Note: For more information refer to the "SSI Module" specification, ID no.: 1108.01B.0-00.

10.4 TTL module

With the TTL module the following operation modes are possible:

- Evaluation of a TTL encoder
- Simulation of a TTL encoder (signals from other encoders are converted into TTL signals and made available as output signals [for a slave axis])
- TTL repeater (evaluation and transmission of incoming TTL signals for additional axes)

Note: For more information refer to the "TTL Module" specification, ID no.: 1108.01B.0-00.

10.5 TWINsync module

This document describes the TWINsync technology option for the ServoOne. The TWINsync technology option is based on an optional communication interface available for the ServoOne for option slot 2 via which two ServoOne devices can be interconnected at a time. Consequently, use of the TWINsync option is intended for applications in which, for example, synchronism of two drives is specified or in which one drive is to use I/O or encoder interfaces of another drive. Using the TWINsync option, any process data can be exchanged between two drives. The data are exchanged bidirectionally with the sampling time of the speed control. The TWINsync communication interface incorporates a synchronization mechanism.

The ServoOne configured as the TWINsync master generates a cyclic signal pulse synchronized to its own control cycle on the SYNC OUT line of the interface. The ServoOne configured as the TWINsync slave receives the synchronization signal on its SYNC IN line and synchronizes its own control cycle to the TWINsync master.

Note: For more information refer to the "TWINsync Module" specification, ID no.: 1106.03B.0-00.

11. Process controller

11.1 Function, controller structure, setup

The process controller function enables a measured process variable to be controlled to a reference (setpoint) value. Examples of applications are print/dancer controls etc.

- Process controller calculation in speed controller cycle
- Process controller as PI controller with Kp adaptation
- Process controller actual value selectable via selector
- Filtering and offset correct of reference and actual values
- Process controller output can be connected to different points in the general control structure
- Process controller is usable in all control modes

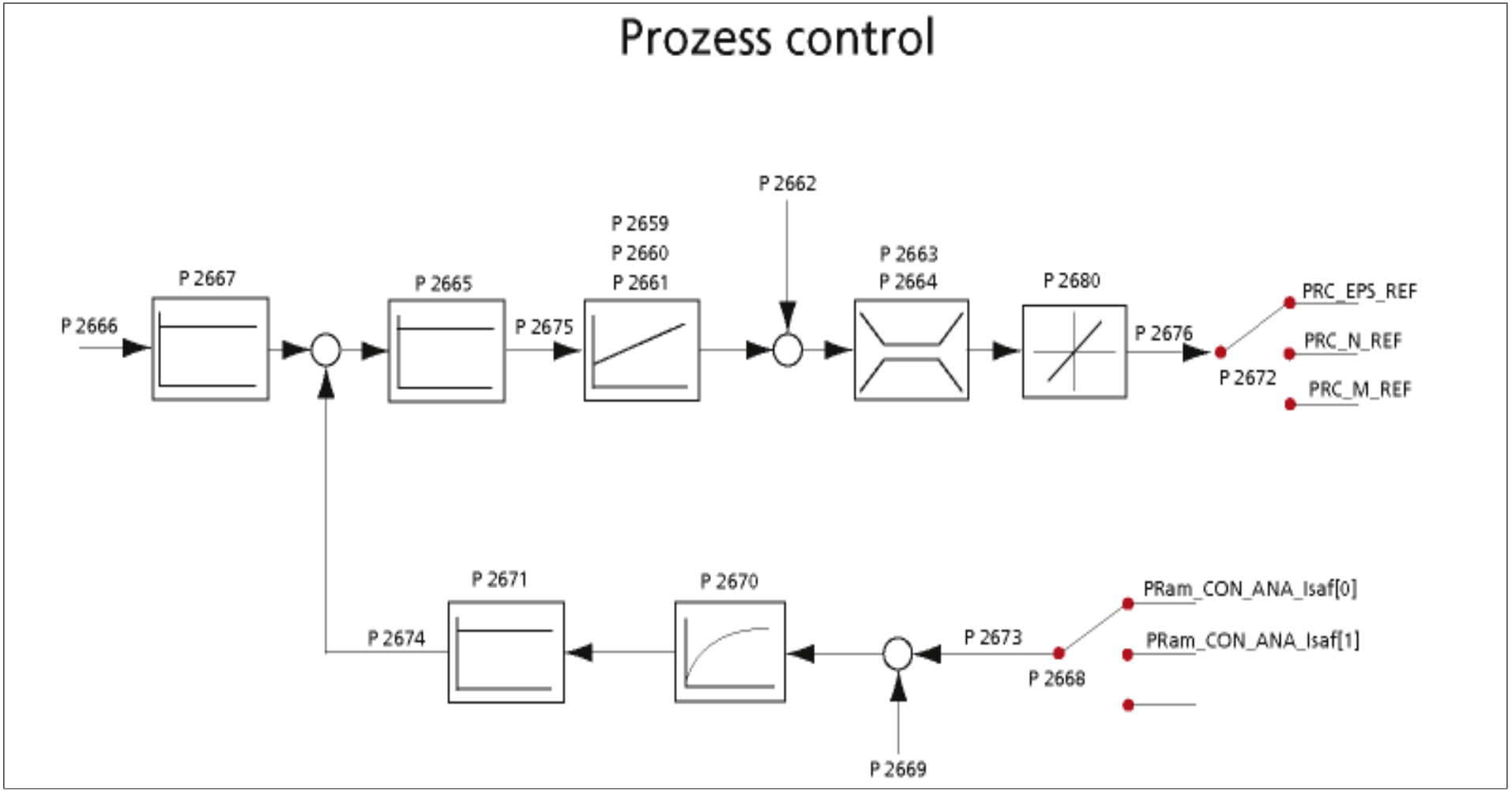


Figure 11.1 Control structure of the process controller

P. no.	Parameter name/ Settings	Function
P 2658	CON_PRC_ENABLE	Starting the process controller
P 2659	CON_PRC_Kp	P-gain of the process controller
P 2660	CON_PRC_KP_SCALE	Adaptation of the P-gain
P 2661	CON_PRC_Tn	Process controller integral-action time
P 2662	CON_PRC_REFOFFSET	Offset for the process controller output
P 2663	CON_PRC_LIMPOS	Positive process controller limitation
P 2664	CON_PRC_LIMNEG	Negative process controller limitation
P2665	CON_PRC_CDIFFSIGN	Adaptation of control difference sign
P 2666	CON_PRC_REFVAL	Process control reference value
P 2667	CON_PRC_REFSCALE	Scaling factor for the process controller reference
P 2668	CON_PRC_ACTSEL	Selection of the actual value source
(0)		Analog input 0
(1)		Analog input 1
(2)		Field bus parameter CON PRC_ACTVAL_Fieldbus-ID 2677
(3)		Actual speed [rpm]
(4)		Actual position [increments]
(5)		Reference value from speed control
P 2669	CON_PRC_ACTOFFSET	Offset for actual value calibration
P 2670	CON_PRC_ACTTF	Filter time for actual value filter
P 2671	CON_PRC_ACTSCALE	Scaling for the filtered process actual value

P. no.	Parameter name/ Settings	Function
P 2672	CON_PRC_OUTSEL	Selection parameter for the process controller output
(0)		Off
(1)		Additive torque reference
(2)		Additive speed reference
(3)		Additive position reference
(4)		Value for MotionProfile (CON_PRC_OUTSEL_MOPRO – ID 2678)
P 2673	CON_PRC_RAW_ACTVAL	Actual value of the selected actual value source
P 2674	CON_PRC_ACTVAL	Momentary actual value of the process controller after filtering and scaling
P 2675	CON_PRC_CDIFF	Control difference of the process control loop
P 2676	CON_PRC_OUTVAL	Process controller control variable
P 2677	CON_PRC_ACTVAL_FIELDBUS	Parameter to which an actual value can be written from the field bus
P 2678	CON_PRC_OUTSEL_MOPRO	Parameter to which the control variable can be written in order to be subsequently used in the motion profile.
P 2680	CON_PRC_RateLimiter	Steepness limitation of the control variable
(0)	RateLimiter	Steepness limitation in standard process controller operation; unit [X/ms]
(1)	RateLimiter	Steepness limitation to reduce the process controller I-component; unit [X/ms]
P 2681	CON_PRC_CtrlWord	Control word of the process controller
(0)	PRC_CTRL_ON	Switch on process controller
(1)	PRC_CTRL_ResetIReady	Reset I-component via ramp after parameter 2680 / subindex 1
(2) (7)	PRC_CTRL_FREE	Reserve

P. no.	Parameter name/ Settings	Function
P 2882	CON_PRC_StatWord	Status word of the process controller
(0)	PRC_STAT_On	Switch on process controller
(1)	PRC_STAT_ResetIReady	I-component of the process controller is reduced
(2) - (7)	PRC_STAT_FREE	Reserve
P 2683	CON_PRC_REFSEL	Selection of reference source
P 2684	CON_PRC_REFVAL_User	User input of process control reference

Procedure:

- **Set process controller reference:**
  P 2666 CON_PRC_REFVAL: Reference input in user units (this parameter can be written cyclically over a field bus).
- **Scaling of the process controller reference:**
  P 2667 CON_PRC_REFSCALE; The reference **P2666** can be scaled (taking into account the user units, see Application Manual, "Scaling".
- **Select actual value sources:**
  P 2668 CON_PRC_ACTSEL: The actual value source must be set to the desired reference source (e.g. field bus). The field bus writes the actual value to parameter **P 2677 CON_PRC_ACTVAL**_Fieldbus.
- **Select offset (optional)**
  P 2669 CON_PRC_ACTOFFSET: Setting of an offset for actual value calibration
- **Scaling of the process controller actual value:**
  P 2670 CON_PRC_ACTSCALE; filter time for the actual value filter [ms]. The actual value is smoothed via the integral-action time **P 2670 > 0 ms** of the PT-1 filter. (Taking into account the user units)
- **Inversion of the control difference**
  P 2665 CON_PRC_CDIFFSIGN: Adaptation of control difference sign
- **Activate process controller:**
  P 2681 CON_PRC_CtrlWord: Control word Bit 0 = 1 (process controller active)
- **Optimization of controller setup:**
  P 2659 CON_PRC_Kp: Controller gain
  P 2660 CON_PRC_KP_SCALE: Scaling of gain
  P 2661 CON_PRC_Tn: TN integral-action time: If the integral-action time is set to the permissible maximum value, the I-component of the controller is inactive (10000 ms = off).
- **Offset for the process controller output**
  P 2662 CON_PRC_REFOFFSET: Then the totalled variable is connected via a limitation to the output of the process control loop. The user can parameterize the limitation via parameter **P 2663 CON_PRC_LIMPOS** for the positive limit and **P 2664 CON_PRC_LIMNEG** for the negative limit.

RateLimiter:

Downstream of the control variable limiter there is another limitation which limits the changes to the control variable per sampling segment. By way of field parameter P 2680 CON_PRC_RateLimiter the limitation of the control variable steepness per millisecond can be parameterized. The subindex zero is for limitation in standard process controller operation. Selecting subindex 1 activates reduction of the I-component.

P. no.	Parameter name/ Settings		Function
P 2680	CON_PRC_RateLimiter		Steepness limitation of the control variable
(0)	RateLimiter		Steepness limitation in standard process controller operation; unit [X/ms]
(1)	RateLimiter		Steepness limitation to reduce the process controller I-component; unit [X/ms]
P 0270	MPRO_FG_PosNorm		Internal position resolution [incr/rev]

The process controller is to deliver an additive position reference P 2672 CON_PRC_OUTSEL = 3. Then the possible change in the control variable is to be limited by way of the rate limiter.

The control variable change each time interval by the process controller results in a speed change on the motor shaft.

Example: The amount of the process controller to change the speed on the motor shaft should not be higher than 100 revolutions per minute.

To achieve this, the value of parameter CON_PRC_RateLimiter (ID 2680) subindex 0 must be parameterized with a value corresponding to the user unit.

The unit of this parameter is x/ms. The x stands for the respective unit of the process controller output variable.

In this example the control variable (additive position reference) has the unit Increments (see also parameter P 270 MPRO_FG_PosNorm). This parameter indicates how many increments correspond to one motor revolution.

In the following the conversion of revolutions per minute into increments per millisecond is calculated:

Example:

CON_PRC_RateLimiter(0) **P 2680 [inc/ms] = 100 [rpm] * P 0270 [inc/rev] * 1/60 [min/s] * 1/1000 [s/ms]**

To reduce the I-component, the same procedure is applicable (CON_PRC_RateLimiter(1) [Inc/ms]).

If a change in control variable is not desired, CON_PRC_RateLimiter must be parameterized with the value zero.

P. no.	Parameter name/ Settings		Function
P 2672	CON_PRC_OUTSEL		Selector for the additive reference values
(0)	OFF (0)		No reference selected
(1)	Additive torque reference (1)		Additive torque reference must be given in [Nm]
(2)	Additive speed reference (2)		Additive speed reference must be given in [rpm]
(4)	Additive position reference (3)		Additive position reference must be given in [increments]
(5)	Value for MotionProfile (P 2678 CON_PRC_OUTSEL_MOPRO		P 2678 is the parameter to which the control variable can be written in order to be subsequently used in the motion profile.

Note: The scaling of internal units to user-specific units is set out in section 6, "Motion profile".

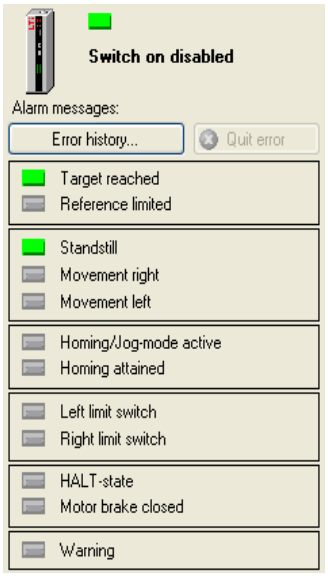
Scope signals for visualization of the process control loop:

Number	Scope variable	Description
2666	Ref_prc	Process controller reference (P 2666 CON_PRC_REFVAL)
78	Cdiff_prc	Control difference of the process controller (P 2675 CON_PRC_CDIFF)
2676	Actuating_var_prc	Control variable of the process controller (P 2676 CON_PRC_OUTVAL)
2673	Raw_actual_prc	Actual value of the selected actual value source (P 2673 CON_PRC_RAW_ACT-VAL)
2674	Actval_prc	Momentary actual value of the process controller after filtering and scaling (P 2674 CON_PRC_ACTVAL)

A Appendix

Drive status

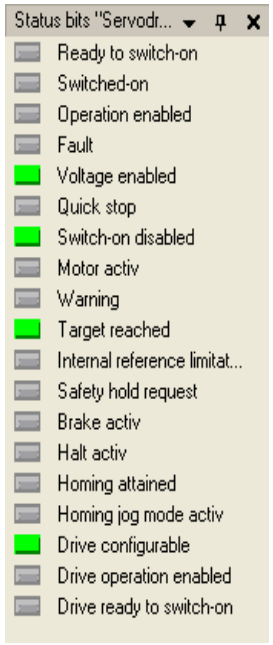
The "Drive status" window displays the current device status. In an error state the green rectangle at the top turns red. The rectangles at the bottom turn from transparent to green as soon as a condition (high) is met.



As soon as an error is detected, the status indicator at the top of the window turns red. Detailed information on the error and on previous errors can be viewed by clicking the "Error history" button.
At the bottom of the window the current states are displayed. A green light signifies active.

Figure A.1 Drive status window

Status bits



The "Status bits" window displays the current system states. The basis of those states is the DriveCom state machine. The active states are displayed in green. A schematic view is presented in figure A 3 and in figure 5.36 in the "Motion profile" section.

Figure A.2 Status bits window

State machine

State machine of the drive controller:
The system states of the controller are recorded in the bordered boxes. Blue arrows designate the individual state transitions, oriented to CiA 402. Changeable state transitions are bordered in grey.

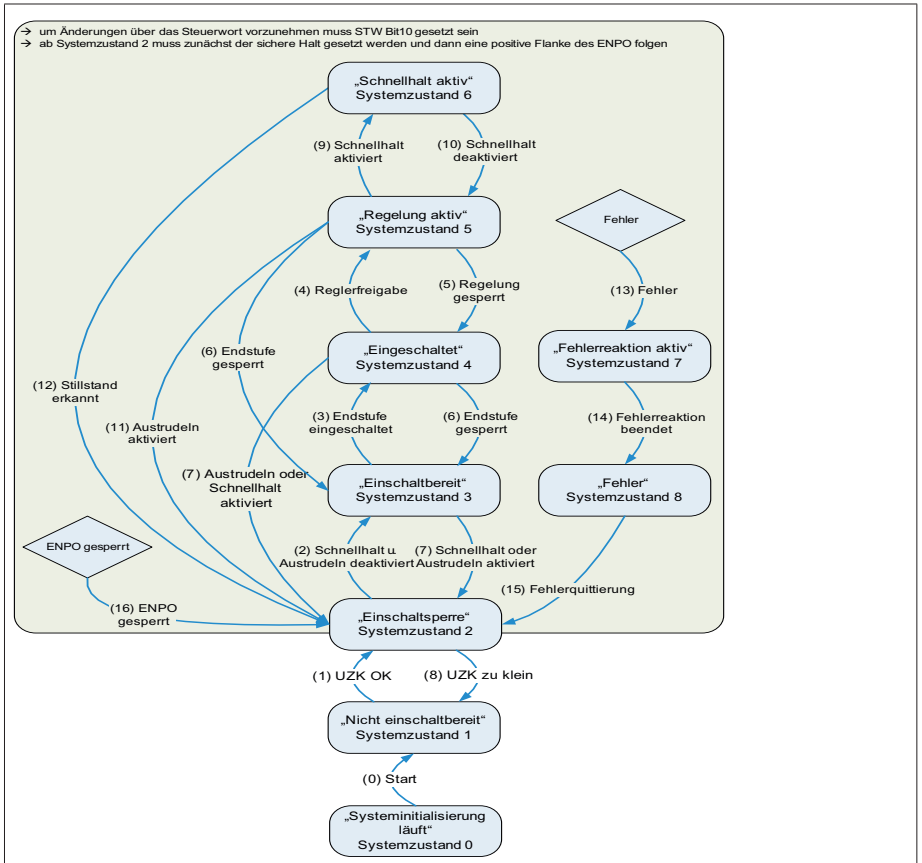


Figure A.3 State machine of the drive controller

Manual mode

Manual mode enables a controller to be controlled in different modes regardless of whether a higher-level control system is pre-installed or not. All that is required is for the hardware to be enabled first (STO and ENPO).
When the manual mode window is closed, all the original settings are restored.
The drive motion can be plotted with the scope function, permitting analysis of the control performance for example.

ATTENTION: Before this function is started, a controller must first have been commissioned into operation as specified in the Operation Manual.
When the Control window is opened the parameter settings in the connected device are automatically changed and are then restored when the window is closed. Communication should not be interrupted (such as by a power failure, unplugging the connecting cable or suchlike) while the Control window is active.

DANGER: Manual mode causes the axis to execute movements. The connected control system is not active, and cannot intervene in the movement. It must be ensured that no hazard is posed to people or machinery.

In an emergency, the drive can be stopped at any time by cancelling the hardware enable (ENPO, STO). In the case of lifting applications, it must be ensured that a mechanical brake is installed.

Note: If a drive cannot be moved by way of the Control window, check the following points:

- Controller system state
- Motor data
- Possibly safety switch
- Quick stop active
- Hardware enable via STO and ENPO

Note: For a detailed description of Manual mode, Drive description, Administration, Actual values and for information on firmware downloading refer to the separate DriveManager User Manual.

Monitoring functions

Actual values

P. no.	Parameter name/Setting	Designation in DM 5	Function
P 0276	MPRO_FG_UsrActPos	actual position in user units	Current position in user units
P 0277	MPRO_FG_UsrRefPos	reference position in user units	Reference position in user units
P 0278	MPRO_FG_UsrCmdPos	position command in user units	Position command in user units
P 0279	MPRO_FG_UsrPosDiff	tracking error in user units	Tracking error in user units
P 0280	MPRO_FG_UsrRefSpeed	reference speed in user units	Speed reference in user unit
P 0281	MPRO_FG_UsrActSpeed	actual speed in user units	Actual value in user units
P 0282	MPRO_FG_UsrCmdSpeed	speed command in user units	Speed command in user units
P 0312	CON_CCON_VMot	actual motor voltage (rms, phase to phase)	Actual motor voltage
P 0410	CON_ACT_VDC	actual DC link voltage	Actual DC link voltage
P 0412	CON_PCON_ActPosition	actual position in increments	Actual position value in increments
P 0413	CON_PCON_RefPosition	reference position in increments	Position reference in increments
P 0414	CON_PCON_PosDiff	actual position difference (RefPosition-ActPosition)	Difference between actual and reference position
P 0415	CON_SCALC_ActSpeed	actual speed	Actual speed
P 0416	CON_SCON_RefSpeed	reference speed	Reference speed
P 0417	CON_SCON_SDiff	speed difference (RefSpeed-ActSpeed)	Difference between actual and reference speed
P 0418	CON_SCON_RefTorque	reference torque	Torque reference
P 0419	CON_SCON_ActTorque	actual torque	Actual torque
P 0700	MON_CurrentRMS	actual current (r.m.s)	Actual current (mean value)
P 0702	MON_State	Device status word	Status word
P 0703	MON_PowerStage_TKK	Power stage temperature of cooling block	Heat sink temperature
P 0704	MON_Device_Tint	Power stage temperature of interior	Interior temperature
P 0734	MON_MotorTemp	motor temperature	Motor temperature
P 0742	MON_UsrPosDiffHistory	monitoring maximum position difference	Position tracking error in user units

Further actual values can be found in field parameter **P 0701**

P. no.	Parameter name Set-ting	Designation in DM 5	Function
P 0701	MON_ActValues	Monitoring, actual values of motor and inverter	Display of motor and controller actual values
	(0) I2xt_Motor	actual values of I2xt integrator for motor protection	Actual value of the I^2xt integrator for motor protection
	(1) I2xt_Inverter	actual values of I2xt integrator for inverter protection	Actual value of the I^2xt integrator for controller protection
	(2) Phasor	actual motor current amplitude	Actual value of motor current amplitude
	(3) Imag	actual magnetization (d-) current amplitude	Actual amplitude value of magnetizing current
	(4) Km	actual torque constant	Torque constant

Interpolation method

P 0370	CON_IP	Interpolation method in IP mode
(0)	N0Ip(0)	No interpolation
(1)	Lin (1)	Linear interpolation
(2)	Spline_Ext_FF(2)	Interpolation with external pre-control
(3)	Splinell(3)	Cubic spline Interpolation
(4)	NonIPSpline(4)	Cubic spline approximation

NoIP(0): No interpolation

The values are transferred 1:1 to reference processing in 1 ms cycles.

LIN(1): Linear interpolation

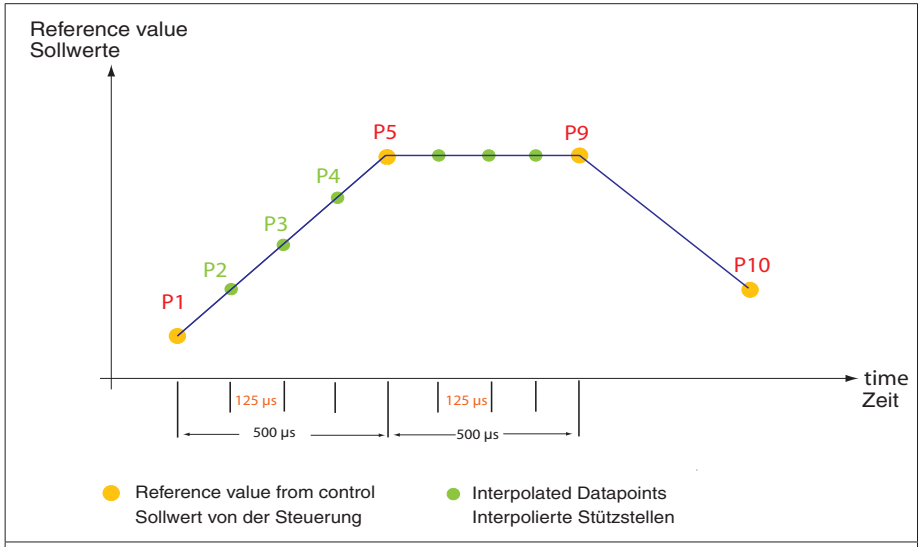


Figure A.4 Linear interpolation

With the linear interpolation method the acceleration between two points is generally zero. Pre-control of the acceleration values is thus not possible and speed jumps are always caused.

Application:
This method is used mainly for test purposes and for initial commissioning.

SplineExtFF(2): Cubic spline interpolation with ext. pre-control value:

This method enables highly accurate adaptation of the position profile. The expected result should exhibit high contouring accuracy and low reference/actual value deviation.

Application: This method is only used from firmware version V 2.0.

SplineII(3): Cubic Spline Interpolation:

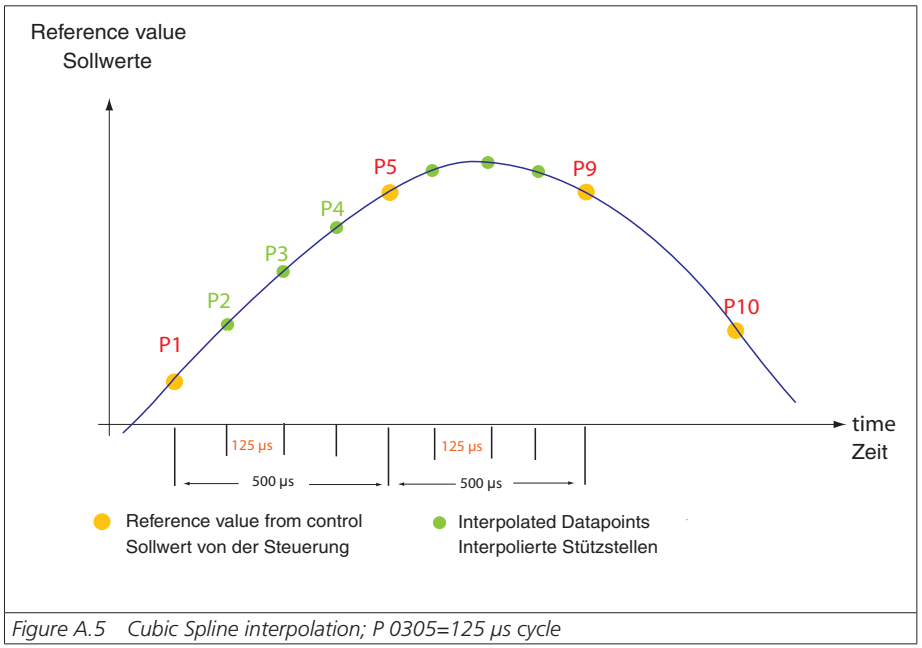


Figure A.5 Cubic Spline interpolation; P 0305=125 µs cycle

In this method interpolation is effected between the interpolation points of the control (P1, P5, P9, P10) by means of cubic splines. The trajectory is guided precisely by the control based on the specified points. This may cause a slight jerk at those points, noticeable in the form of "noise".

Application: High contouring accuracy, slight "noise" is possible. "Noise" refers to mathematical anomalies which cannot be entirely eliminated by the computing methods applied.

NonIPSpline(4): Cubic Spline Approximation:

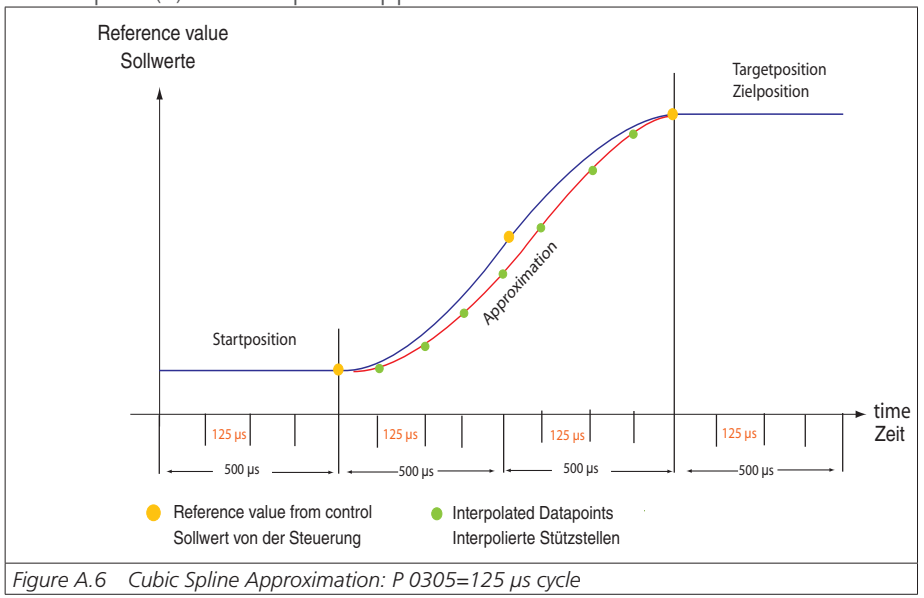


Figure A.6 Cubic Spline Approximation: P 0305=125 µs cycle

With this method the interpolation points are approximated by means of B-Splines. The trajectory normally does not run exactly through the points specified by the control. The deviation is normally negligibly small. In the interpolation points the transitions are continuous with regard to acceleration, which becomes apparent by minor "noise".

In start and target position the interpolation points always match the trajectory.

Application: Minimizing noise, smoother motion, restrictions on contouring

Note: Further information on how to generate motion commands using the field buses or internal possibilities can be found in the field bus documentation.

B Quick commissioning

Rotary motor system

Instruction	Action	P. no.
► Selection of motor (section 2.1.3 "Motor")	Decision whether to use a synchronous motor (PSM) or an asynchronous motor (ASM)	P 0450
► Selection of motor motion (section 2.1.3 "Motor")	Decision whether to use a rotary or linear motion system.	P 0490
► Motor identification (section 2.1.3 "Motor")	The identification only needs to be carried out if the motor's electrical data is missing. **Identification sequence:** Measurement of stator/rotor resistance, stray (leakage) inductance Current controller tuning Calculation of nominal flux	P 0470, P 0476, P 0471, P 0474, P 0462, P 0340
► Motor protection (section 2.2.3)	Setting of I^2xt monitoring, selection of temperature sensor, characteristic setting	P 0731 P 0732 (0), (1) P 0733 (0)-(6)

Instruction	Action	P. no.
► Encoder setup (section 3, Encoder)	The desired encoders and their channels must be selected.	
► System test via manual mode (DM5 Online Help/ Manual mode window)	Open manual mode window - Control mode Vfc (open loop) mode - Move motor at low speed - Check direction	
► Control setup	Optimize current controller (test signal generator, section 4.2) The current of the test signal generator is automatically set when the motor data is entered.	P 1503 (0), (1)
	Optimize speed controller (step responses, section 4.4)	P 0320 P 0321 P 0322
	Determine mass inertia [J] Section 4.1.1 "Basic settings"	P 1517
	Adjust speed filter: P 0351 = FS (0.6 ms) Recommended: SinCos encoder 0.2 ms - 0.6 ms Resolver 0.6 ms - 1.5 ms	P 0351
	Adjust rigidity Section 4.1.1 "Basic settings"	P 1515 P 1516
► Optional settings	Scaling, IO's, field buses, etc.	

Linear motor system

Instruction	Action	P. no.
► Selection of motor (section 2.2 "Motor")	The parameter is automatically set to PSM if parameter P 0490 = LIN(1) is set.	P 0450
► Selection of motor motion (section 2.2 "PS linear motor")	Selection for a linear motion system with P 0490 = LIN(1).	P 0490
► Motor data set calculation (section 2.2 "PS linear motor")	Data set calculation: Fill out "Calculation of control setup for linear PS motors" screen form and start calculation. (See calculated values, section 2.2)	see parameter table, section)
► Motor protection (section 2.2.3)	Setting of I^2xt monitoring, selection of temperature sensor, characteristic setting	P 0731 P 0732 (0), (1) P 0733 (0)-(6)
► Encoder setup (section 3, Encoder)	The desired encoders and their channels must be selected.	
► System test via manual mode (DM5 Online Help/ Manual mode window)	Open manual mode window - Control mode VFC (open loop) mode (section 4.7) - Move motor at low speed **Motor will jerk, as it is in "open-loop" mode!** - Check direction!	

Instruction	Action	P. no.
► Control setup	Optimize current controller (test signal generator, section 4.2) The current of the test signal generator is automatically set when the motor data is entered.	P 1503 (0), (1)
	Optimize speed controller (step responses, section 4.4)	P 0320 P 0321 P 0322
	Determine mass inertia [J] Section 4.1.1 "Basic settings"	P 1517
	Adjust speed filter: P 0351 = FS (0.6 ms) Recommended: SinCos encoder 0.2 ms - 0.6 ms Resolver 0.6 ms - 1.5 ms	P 0351
	Adjust rigidity Section 4.1.1 "Basic settings"	P 1515 P 1516
► Optional settings	Scaling, IO's, field buses, etc.	

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ID no.: 1100.22B.2-00 • 04/2010