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Application Note

Electromechanical Division Europe
Application Team Offenburg



CODESYS



PSD - Communication

ControlManagerAdvanced FB51 for TIA-Portal



Author: K. Woloschin
Application: PSD_Comm_AN0036
Version: V1.6
Last change: 26 November 2020



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1.1. History of modifications

Date	Change(s)
17.10.2017	V1.1 Initial version
25.07.2018	V1.2 PSD1M2/M3 support. Input iAxisNumber
26.09.2018	V1.3 Support RegMove/RegSearch function
10.01.2019	V1.4 bInMode modification
30.02.2019	V1.5 Velocity mode setpoint change whithout bStartMode possible, APA response modification
11.08.2020	v1.6 ResetPositionMode, Simulation Mode activated, gearing ratio mapped by using position and speed as numerator and denominator

2. Device supplement

2.1. With the option

- PSD1S....B2, PSD1M....B2, (PSD1S....C2 and PSD1M....C2 with PSD_ProfiDRIVE_FB)

2.2. And the master plc

- SIMATIC S7-1500
- SIMATIC S7-1200

3. PSD_ControlManagerAdv

3.1. Inputs and Outputs

```
%DB51
"PSDControlManager_ADV_DB"
%FB51
"PSDControlManager_ADV"

... — EN
false — bEnable
false — bHold
false — bStop
false — bFaultReset
false — bResetPosition
false — Mode
false — bJogP
false — bJogN
false — bExDataTransfe
false — r
1 — iAxisNumber      bEnabled — ...
16#0 — nModeWORD    bDriveErr — ...
260 — nLaddrPD      bModeRunning — ...
262 — nLaddrAPA     bInMode — ...
0 — iPosition        bPosErr — ...
0 — iVelocity        bHomingRunni
0 — iAcceleration   bHomingAttain
0 — iDeceleration   ed — ...
0 — iNumerator      bHomingErr — ...
0 — iDenominator    bCommErr — ...
... — bStartMode      bTransErr — ...
... — bChangeSetIm   bReg_detected — ...
... — mediate         stRd — ...
... — bStartHoming    ENO — ...
```

3.2. Description and Advices

This block simplifies the control of a PSD DRIVE (with PROFIdrive profile) with the S7. The block needs the commands and set values. The block distributes messages and actual values from the drive. The channels PD and APA are used in both directions.

- The function block is located in the RefProject_FBF51v1.6_1500_1200_v15 example and must be included in the user project.
- All PLC data types from RefProject_FBF51v1.6_1500_1200_v15 are necessary for the FB51.
- In the simplest case, the control bits and the movement parameters could be manipulated by using the watch table from the RefProject.



This block is only usable with PPO14 (APA_IO = 8BYTE, PD_IO = 18BYTE)

4. Setting up

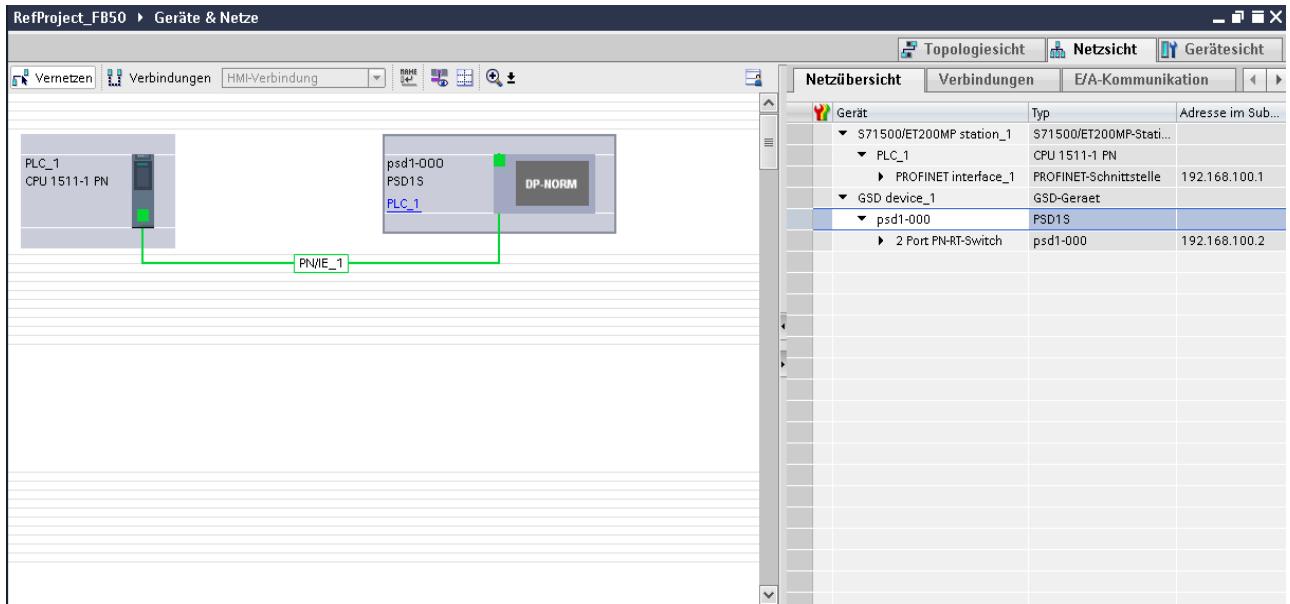
4.1. PSD configuration

Object mapping and fieldbus configuration:

Settings	
Drive Profile	PROFIdrive
Axis1 operation mode	2 Positioning mode (AC3) with submode MDI (Manual Data Input)
Acyclic Parameter Access (APA)	ParameterChannel_4words
Error reaction 0x7583: Fieldbus Timeout	Ramp_down_with_quick_down_ramp_Disable_control_loops
Edit Mapping	
Process Data Size	
Axis 1 RxPDO 1	9 16 bit words
Axis 1 TxPDO 1	9 16 bit words
Communication Parameters	
APA_IO	4 16 bit words
A1_PD_IO	9 16 bit words
Output mapping RxPDO1 (0x1600)	
Entry 1 @ ByteOffset 8	0x6040.0 Control word 1 (STW1, PNU 967) [16b]
Entry 2 @ ByteOffset 10	0x607A.0 MDI target position (MDI_TARPOS) [incr] [32b]
Entry 3 @ ByteOffset 14	0x6081.0 MDI velocity (MDI_VELOCITY) [incr/s] [32b]
Entry 4 @ ByteOffset 18	0x6083.0 MDI acceleration [incr/s ²] [32b]
Entry 5 @ ByteOffset 22	0x6084.0 MDI deceleration [incr/s ²] [32b]
Input mapping TxPDO1 (0x1A00)	
Entry 1 @ ByteOffset 8	0x6041.0 Status word 1 (ZSW1, PNU 968) [16b]
Entry 2 @ ByteOffset 10	0x6064.0 Position actual value A (XIST_A) [incr] [32b]
Entry 3 @ ByteOffset 14	0x606C.0 Speed actual value B (NIST_B) [incr/s] [32b]
Entry 4 @ ByteOffset 18	0x603F.0 Last added (newest) fault code of actual fault situation (PNU 945x) [16b]
Entry 5 @ ByteOffset 20	0x3322.2 Active current (ITIST) 16bit [mA] [16b]
Entry 6 @ ByteOffset 22	0x0007.0 DummyObj_32Bit [32b]

4.2. SIMATIC - HW Config

Add PSD device from Hardware catalog



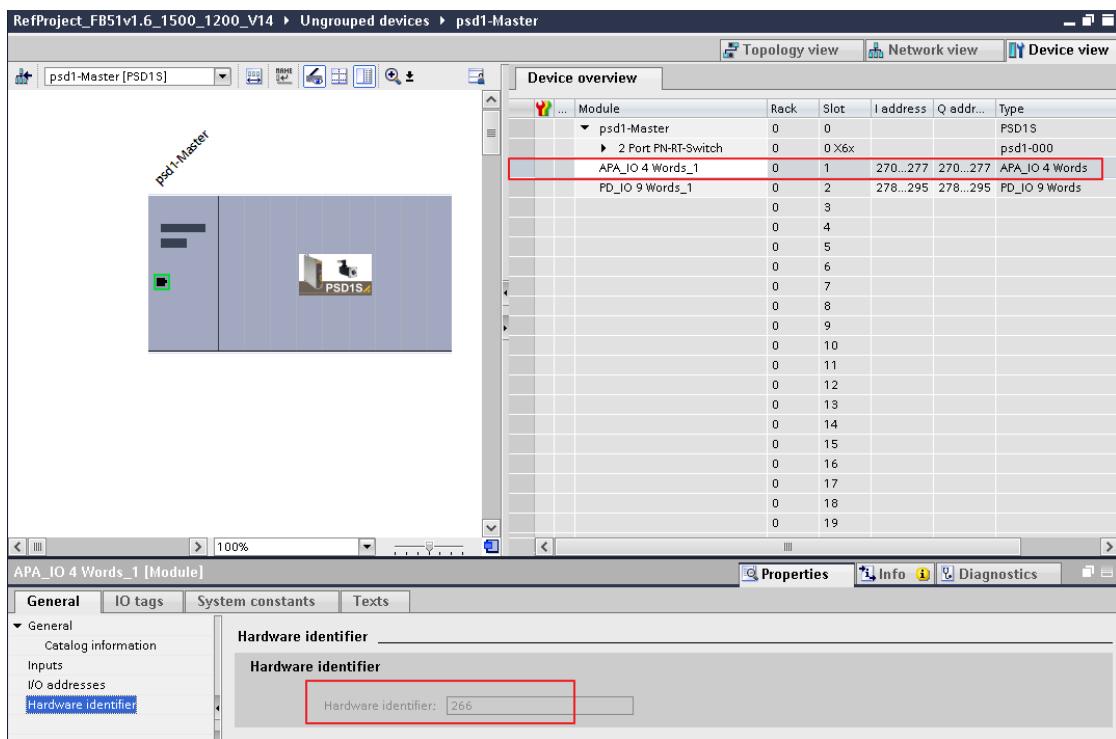
Assign IP-address and device name.

Check device module configuration (APA_IO = 4 words, PD_IO = 9 words).

Baugruppe	Baugr...	Steck...	E-Adres...	A-Adres...	Typ
psd1-000	0	0	0 X6x		PSD1S
2 Port PN-RT-Switch	0				psd1-000
APA_IO 4 Words_1	0	1	270..277	270..277	APA_I...
PD_IO 9 Words_1	0	2	278..295	278..295	PD_IO...
	0	3			
	0	4			
	0	5			
	0	6			
	0	7			
	0	8			
	0	9			
	0	10			
	0	11			
	0	12			

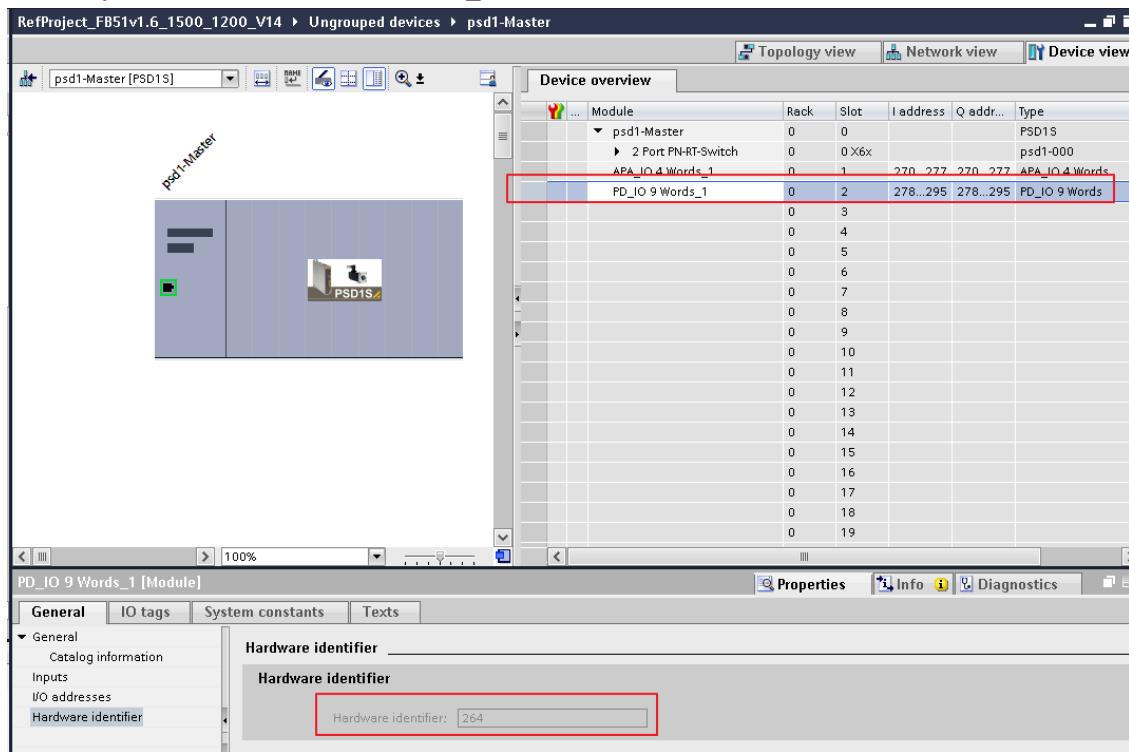
Check hardware identifier for APA_IO in the device view

Then adjust hardware identifier for APA_IO in <nLaddrAPA> (DB51.DBW8)



Check hardware identifier for PD_IO in the device view

Then adjust hardware identifier for PD_IO in <nLaddrPD> (DB51.DBW6).



4.3. Application interface of "PSDControlManagerAdv"

4.3.1. Schematic drawing for in- and output

Areas of FB51 / DB51

in input	out output	in_out In- and Output	stat Static Memory
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DB51

	EN	ENO	
DBX0.0	bEnable	bEnabled	DBX34.0
DBX0.1	bHold	bDriveErr	DBX34.1
DBX0.2	bStop	bModeRunning	DBX34.2
DBX0.3	bFaultReset	bInMode	DBX34.3
DBX0.4	bResetPositionMode		
DBX0.5	bJogP	bPosErr	DBX34.4
DBX0.6	bJogN	bHomingRunning	DBX34.5
DBX0.7	bExDataTransfer	bHomingAttained	DBX34.6
DBW2.0	iAxisNumber	bReg_detected	DBX35.2
DBW4.0	nModeWord	bHomingErr	DBX34.7
DBW6.0	nLaddrPD	bCommErr	DBX35.0
DBW8.0	nLaddrAPA		
DBD10.0	iPosition		
DBD14.0	iVelocity		
DBD18.0	iAcceleration		
DBD22.0	iDeceleration		
DBD26.0	iNumerator		
DBD30.0	iDenominator		
DBX48.0	bStartMode		
DBX48.1	bChangeSetImmediate	stRd.iPositionValue	DBD36
DBX48.2	bStartHoming	stRd.iVelocityValue	DBD40
DBD50	iInPosWindowAbs	stRd.nActualError	DBW44
DBW54	nCmd	stRd.ActiveCurrent	DBW46
DBW56	nObjectIndex	bTransErr	DBX35.1
DBW58	nObjectSubindex		
DBD60	iParameterValue		
DBD64	TonTimer1	iParameterValue	DBD60
DBD68	TonTimer2		
DBD72.0	stPSD_AP_A_In_Dint		
DBD80.0	stPSD_AP_A_Out_Dint		

4.3.2. Declaration of In- and Output

Parameter	Declaration	Data type	description
nMode	IN	BOOL	=1 absolute, =2 relative, =4 velocity, =8 gearing =16 RegMove, =32 RegSearch
bEnable	IN	BOOL	=1 enable =0 disable
bExDataTransfer	IN	BOOL	=0 internal DP interface with DPWR_DAT/DPRD_DAT (internal Master in S7 CPU) =1 external DP interface with FC2/FC1 (external Master CP 342-5)
bFaultReset	IN	BOOL	Acknowledge with rising edge, after that it is necessary to activate <bEnable> (caused by the edge detection it is needed to be set to 0 first)
bHold	IN	BOOL	=1 Temporary stop (the movement function is still available), =0 continue
bJogN	IN	BOOL	manual negative: JOG – movement within positioning end limits as long as true
bJogP	IN	BOOL	manual positive: JOG – movement within positioning end limits as long as true
bResetPositionMode	IN	BOOL	=0 Normal-, =1 Reset mode selected (for nMode 1 or 2)
bStop	IN	BOOL	=1 Stop (movement function cancelled)
bChangeSetImmediate	IN_OUT	BOOL	With the Rising edge, a new position profile is activated; <bChangeSetImmediate> is reseted from the block itself. This command is acknowledged from the block with <bModeRunning>. A new command is also accepted if the actual movement is not finished (<bInMode> =1).
bStartHoming	IN_OUT	BOOL	Rising edge starts referencing movement, if permitted, neg. edge stops referencing movement, bStartHoming may only be reseted with <bHomingAttained>.
bStartMode	IN_OUT	BOOL	With the Rising edge a new profile is activated, <bStartMode> is reseted from the block itself. This command is acknowledged from with <bModeRunning>. A new command is not accepted if the actual movement is not finished (<bInMode> =1).
bCommErr	OUT	BOOL	=1 communication failure (Failure from DPWR_DAT / DPRD_DAT) (all other messages are invalid), Wrong hardware identifier selected.

Parameter	Declaration	Data type	description
bDriveErr	OUT	BOOL	=1 failure from PSD (device / motor)
bEnabled	OUT	BOOL	=1 Axis enabled =0 Axis disabled
bHomingAttained	OUT	BOOL	=1 reference ok.
bHomingErr	OUT	BOOL	=1 watchdog/ timeout for Reference -run (occasionally TonTimer2 correct)
bHomingRunning	OUT	BOOL	=1 reference run active
bInMode	OUT	BOOL	=1 axis in target position, in gear, in velocity
bPosErr	OUT	BOOL	=1 watchdog timeout for position -order (occasionally TonTimer1 correct)
bModeRunning	OUT	BOOL	=1 active
bTransErr	OUT	BOOL	=1 format-, commando failure at transfer from / to PSD
iAcceleration	IN	DINT	acceleration in UINT32 -Format
iDeceleration	IN	DINT	deceleration in UINT32 -Format
iInPosWindowAbs	STATIC	DINT	Position window in additional monitoring of <bInPosition> with absolute positioning. The actual position value compared with the position set value. That is only possible with absolute positioning (<bAbsoluteRelative> = false) and position Reset mode (<bPositionResetMode> = false) is not activated.
iParameterValue	STATIC	DINT	PSD object value (source and destination) - write-/read value of the Parameters
iPosition	IN	DINT	target position / distance in increments
iVelocity	IN	DINT	speed in increments
iNumerator	IN	DINT	Gear numerator
iDenominator	IN	DINT	Gear denominator (only positive values)
stRd.iPositionValue	OUT	DINT	actual position in increments
stRd.iVelocityValue	OUT	DINT	actual speed in increments
stRd.iActiveCurrent	OUT	INT	Active current in mA
nCmd	STATIC	INT	PSD object transfer: command: 1 read 2 write WORD 3 write DWORD
nObjectIndex	STATIC	INT	PSD object index
nObjectSubindex	STATIC	INT	PSD object subindex
TonTimer1	STATIC	TIME	time value for timeout of Positioning
TonTimer2	STATIC	TIME	time value for timeout Reference run
nLaddrPD	IN	WORD	= Hardware identifier of the (PD_IO) Process Data module.
nLaddrAPA	IN	WORD	= Hardware identifier of the APA_IO (Acyclic Parameter Access) data module.

Parameter	Declaration	Data type	description
stRd.nActualError	STATIC	WORD	Actual Failure (see PSD - Manual) =1 no Error!
stPSDPKWInDint.nPKE	STATIC	Word 4	Local PKW - input area for external CP
stPSDPKWOutDint.nPKE	STATIC	Word 4	Local PKW - output area for external CP
stPSDPZDIn.nStatus	STATIC	Word 9	Local PZD - input area for external CP
stPSDPZDOut.nControl	STATIC	Word 9	Local PZD - output area for external CP

4.3.3. Sequence of process data

4.3.3.1. Settings of the static Operands at the Block

1. $\langle nLaddrPD \rangle$ and $\langle nLaddrAPA \rangle$
 - Parameter from (*System constants*): HW-ID of the IO-device for PD and APA channel.
 - Forward the values to $\langle nLaddrPD \rangle$ and $\langle nLaddrAPA \rangle$.

2. $\langle bExDataTransfer \rangle$
 - Low: settings for CPU with integrated Master
 - High: settings for CPU with external Master

3. $\langle iInPosWindowAbs \rangle$
 - additional control window for the message $\langle bInPosition / bInMode \rangle$

4. $\langle TonTimer1 \rangle$
 - Time value for watchdog positioning, if this time is too short there is shown the error message $\langle bPosError \rangle$.

5. $\langle TonTimer2 \rangle$
 - Time value for watchdog homing, if this time is too short there is shown the error message $\langle bHomingErr \rangle$.

4.3.3.2. Settings of dynamic Operands at the Block

1. Switch on
 - Set $\langle bEnable \rangle$: the block notifies $\langle bEnabled \rangle$
 - Set $\langle bStartHoming \rangle$, the block notifies $\langle bHomingRunning \rangle$. If the homing finished, the block notifies $\langle bHomingAttained \rangle$.
 - Now reset $\langle bStartHoming \rangle$.
 - At reaching home position, the message $\langle bInPosition \rangle$ is set.
 - With some home modes (e.g. MN-M 35/37) or high velocity $\langle bHomingRunning \rangle$ is set so short, that is not visible.
 - If there is a motor with absolute multiturn position feedback (Hiperface DSL®), it is only one time needed to activate homing. $\langle bHomingAttained \rangle$ remains at True even if the drive is switch off and on again.
 - With $bJogP$ or $bJogN$ an jog movement can be tested

2. Select mode

- Set nMode:
1 = MoveAbsolute
2 = MoveRelative
4 = MoveVelocity
8 = Gearing
16=RegMove
32=RegSearch

3. Positioning

- Set Parameters for Positioning
- $<nMode=1\ or\ 2>$
- $<iPosition>$
- $<iVelocity>$
- $<iAcceleration>$
- $<iDeceleration>$
- Start the positioning with activating: $<bStartMode>$
- $<bStartMode>$ is reseted by the block itself
- The block notifies $<bModeRunning>$
- With reaching the target position, die message $<bInMode>$ is set.
- A new target position is only possible after $<bInMode>$ was set.

4. Velocity mode

- Set Parameters for Velocity mode
- $<nMode=4>$
- $<iVelocity>$
- $<iAcceleration>$
- Start velocity mode with activating: $<bStartMode>$
- $<bStartMode>$ is reseted by the block itself
- The block notifies $<bModeRunning>$
- With reaching the target velocity, die message $<bInMode>$ is set.

5. Gearing mode (see additional configuration information in the PSD_help)

- Set Parameters for Gearing mode
- $<nMode=8>$
- $<iNumenator>$
- $<iDenumenator>$
- Start gearing mode with activating: $<bStartMode>$
- $<bStartMode>$ is reseted by the block itself
- The block notifies $<bModeRunning>$ during acceleration state
- With reaching the target velocity, die message $<bInMode>$ is set.

6. RegMove mode (see additional configuration information in the PSD_help)

- Set Parameters for RegMove mode
- $<nMode=16>$
- $<iPosition>$
- $<iVelocity>$

- *<iAcceleration>*
 - *<iDeceleration>*
 - Start the positioning with activating: *<bStartMode>*
 - *<bStartMode>* is reseted by the block itself
7. RegSearch mode (see additional configuration information in the PSD_help)
- Set Parameters for RegSearch mode (after RegMove was commanded)
 - *<nMode=32>*
 - *<iPosition>*
 - *<iVelocity>*
 - *<iAcceleration>*
 - *<iDeceleration>*
 - Start the positioning with activating: *<bStartMode>*
 - *<bStartMode>* is reseted by the block itself
 - The block notifies *<bModeRunning>*
 - When configuren "Reg" input is detected then *<bReg_detected>* is set.
 - With reaching the target position, die message *<bInMode>* is set.

4.3.3.3. Other Operands at Block

- *<bFaultReset>* acknowledgement of failures of function block (watchdog) or drive.
- *<bStop>* stops a (mode) movement with rising edge
- *<bHold>* interrupt of positioning command, as long as Bit it is *true*; positioning will be finished when the bit is *false* again.
- *<bJogN>* manual mode negative direction, as long as Bit it is *true*.
- *<bJogP>* manual mode positive direction, as long as Bit it is *true*.

4.3.3.4. Messages and display

- *<bCommErr>* communication with PSD not possible
- *<bDriveErr>* PSD is in failure status
- *<stRd.nActualError>* actual Failure number of PSD (see PSD Help)
- *<stRd.iPositionValue>* actual position
- *<stRd.iVelocityValue>* actual velocity

4.3.3.5. Read and write drive objects

- the objects are selected with *<nObjectIndex>* and *<nObjectSubindex>*
- the value is at *<iParameterValue>*
- *nCmd* is the command for the transfer
 - 1 command for read (word and double word)
 - 2 command for write word object (16 Bit)
 - 3 command for write double word object (32 Bit)
- Datatype 16 Bit or 32 Bit is shown in the object info "Datatype".
- *<bTransErr>* shows if there is failure with the data transfer.

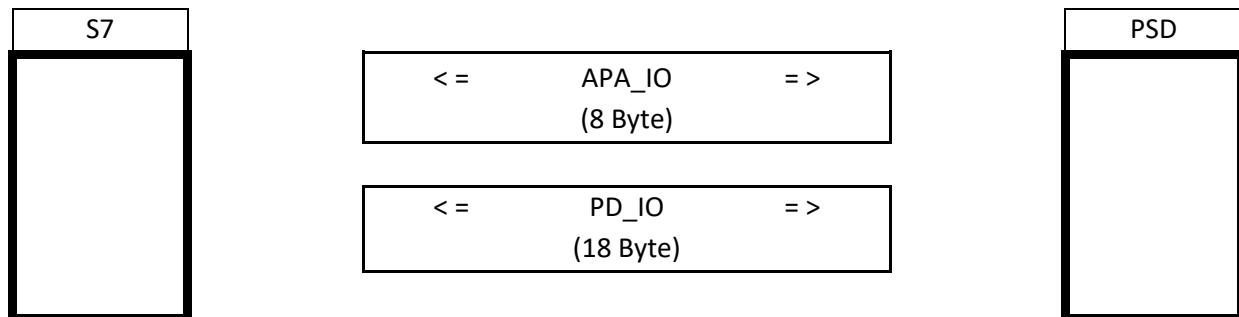


With PSD1M 2 or 3 axes, the object access (APA) may only take place on the first axis!

5. Application example

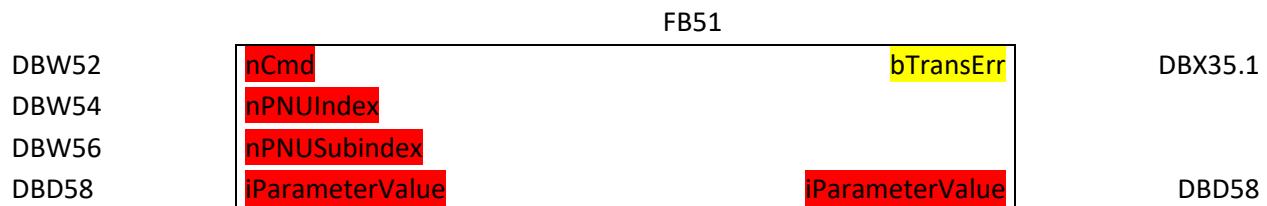
5.1. Overview of the connection:

Connection between one PLC SIMATIC S7 1500/1200 as IO-CONTROLLER and one drive PSD as IO-DEVICE.



5.2. Parameter channel

5.2.1. Used area



5.2.2. Procedure for reading and writing of current limit positive object [0x3212.01]

1. Open Object Editor → object info:

The screenshot shows the PSD ObjectEditor interface. The left pane displays a hierarchical object tree under the 'Device' category, with 'Axis 1' expanded to show sub-categories like 'PeripheryA1', 'ConfigurationA1', 'SupervisionA1', and 'LimitA1'. Under 'LimitA1', 'CurrentLA1' is expanded, showing 'PosCurrentConfigAxis1', 'NegCurrentConfigAxis1', 'CurrentLimitAxis1', and 'PosCurrentAxis1'. 'PosCurrentAxis1' is highlighted with a yellow box. The right pane shows detailed information for 'Axis1 - 0x3212.01 PosCurrentAxis1'. It includes tabs for F (File), W (Write), L (List), PSD (Protocol Specification Document), and PSD (Protocol Specification Document). The 'W' tab is selected. The 'Unit' is '%', 'Datatype' is 'INT16', and there is a note 'Takes effect: Immediately'. Below this, the 'PosCurrentAxis' section describes the object's function: setting upper motor current limits relative to rated current. It mentions that negative values become positive if the positive limit is lower than the negative threshold. The 'Object 0x3212.01' section provides a detailed description of the object's behavior and history.

2. Set requested object index and subindex:

nObjectIndex <3212>
nObjectSubindex <01>

3. Next edit the command for "read" (1) !

nCmd <1>

4. Check object value

iObjectValue e.g.<2000>

5. Next set new object value

iObjectValue e.g.<1000>

6. Edit new command for "write 16b" (2) !

nCmd <2>

7. Verify the result in PSD ServoMgr (object value 0x3212.01).



Caution:

VP and WF use system resources, which decrease the effectiveness of internal communication. This may have the effect that there occur error messages like „cycle time overrun“. So you should use these two commands not too often.

Try to use them during the axis is not energized. It would be better to change first a couple of parameters and activate them together by writing VP only one time.