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PROLINK®S7D 7.0x

Siemens SIMATIC S7-Protocol Driver

User Manual

TABLE of CONTENTS

Page

PREFACE

It is assumed that the user of this manual is familiar with USDATA's Factorylink® software package incl. PROLINK®ECI Enhanced Communication Interface and, especially with the **SIMATIC NET** installation and configuration using the **PG/PC** and **COML-S7** (Configuration Management Local) tools supplied with the **SOFTNET-S7** library as well as the **NCM S7** and **STEP 7** programming tools from Siemens.

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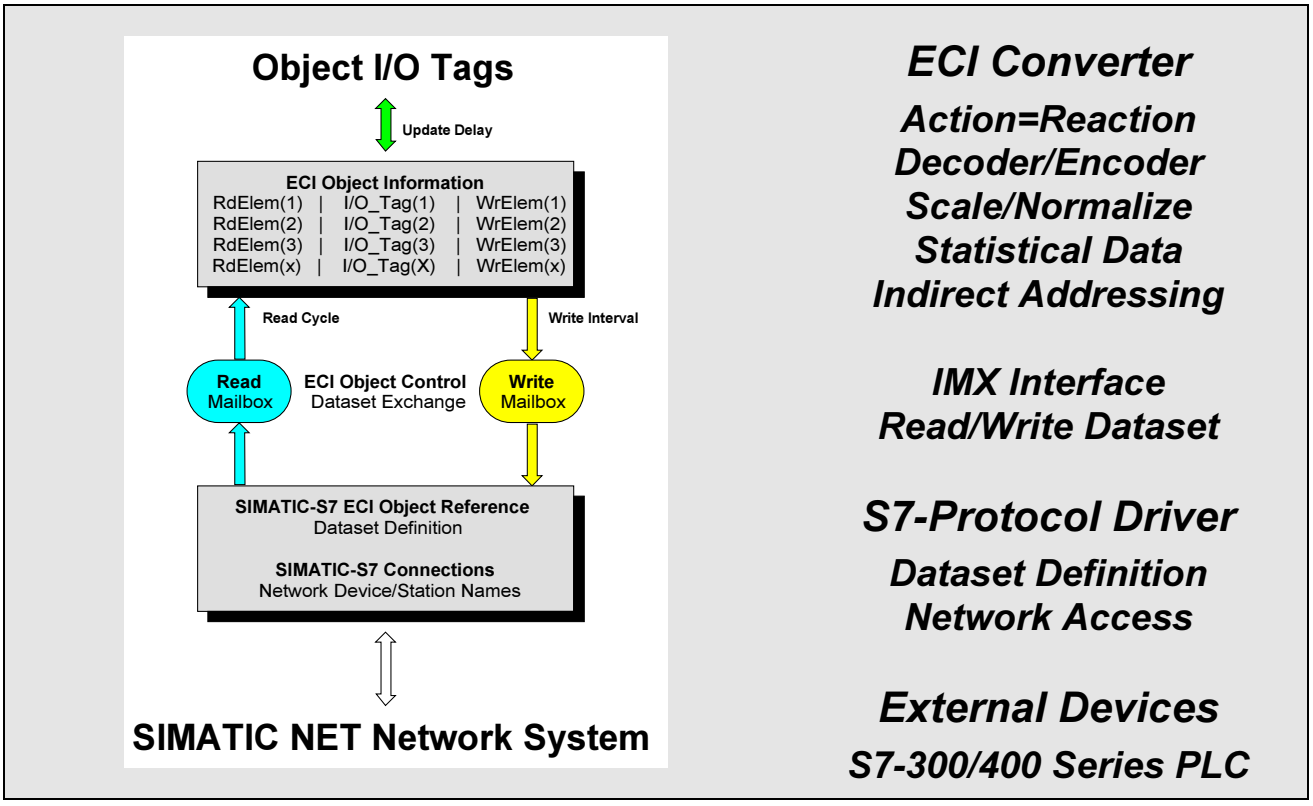
INTRODUCTION

The PROLINK®S7D Siemens SIMATIC S7-Protocol Driver supports communication between the FactoryLink and **Siemens S7-300/400** series PLC through **SIMATIC NET** using the **Siemens S7-Protocol**. An ordinary 3COM Ethernet card is required to communicate through **Industrial Ethernet TCP/IP** or **ISO**, a Siemens Profibus adapter is used for the **Multipoint Interface MPI** or **PROFIBUS**. Data is conducted through PROLINK®ECI using the IMX Intertask Mail eXchange interface.



The PROLINK®ECI task is used to scale and convert Object I/O data from and to so called Datasets which are transmitted through the IMX interface. Consider a Dataset being a number of words or bytes (Elements) in a particular PLC. Then, Object I/O data is represented by words, bytes or bits in the PLC and, by individual Database Elements in FactoryLink. Objects may be specified for Read-only, Write-only, Read/Write from/to the same or different Datasets. For a simple system, the following items are required:

- ✔ ***FactoryLink® Foundation System including PROLINK®ECI Converter Task***
- ✔ ***PROLINK®S7D Protocol Driver including PC adaptor for PROFIBUS or Industrial Ethernet***
- ✔ ***Siemens SOFTNET-S7/WindowsNT SAPI-S7 Library for PROFIBUS or Industrial Ethernet***

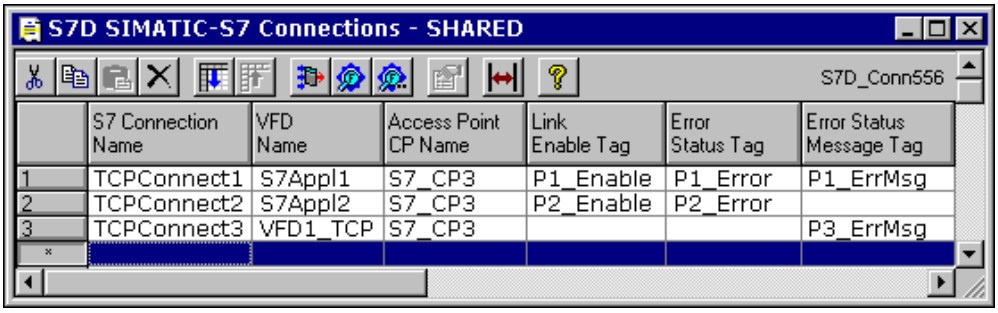
CONFIGURATION TABLES

It is assumed that the SIMATIC NET configuration is studied and planned prior FactoryLink configuration. This especially applies for names and addresses referenced. It is therefore recommended to get familiar with the COML-S7 (Configuration Management Local) and PG/PC Interface set-up tools supplied with the SOFTNET-S7 library from Siemens. Unless the Multipoint Interface MPI is applied, you must additionally setup the PLC(s) Communication Processor with the NCM S7 and STEP 7 programming tools.

In the FactoryLink Configuration Explorer/Manager select the S7D Siemens SIMATIC S7-Protocol Driver option in the SHARED folder/domain. Then select the desired panel(s) in order to configure or modify the PLC communication links and its ECI Object References.

SIEMENS SIMATIC-S7 CONNECTIONS

The S7D Connections Table reflects the S7 connection list specified by the COML-S7 tool. A particular link is defined as the connection of a Virtual Field Device VFD (PLC side) to an Access Point or Communication Processor CP (FactoryLink side) as follows: **S7 Connection = Virtual Field Device ⇔ Access Point / CP**



	S7 Connection Name	VFD Name	Access Point CP Name	Link Enable Tag	Error Status Tag	Error Status Message Tag
1	TCPConnect1	S7Appl1	S7_CP3	P1_Enable	P1_Error	P1_ErrMsg
2	TCPConnect2	S7Appl2	S7_CP3	P2_Enable	P2_Error	
3	TCPConnect3	VFD1_TCP	S7_CP3			P3_ErrMsg
*						

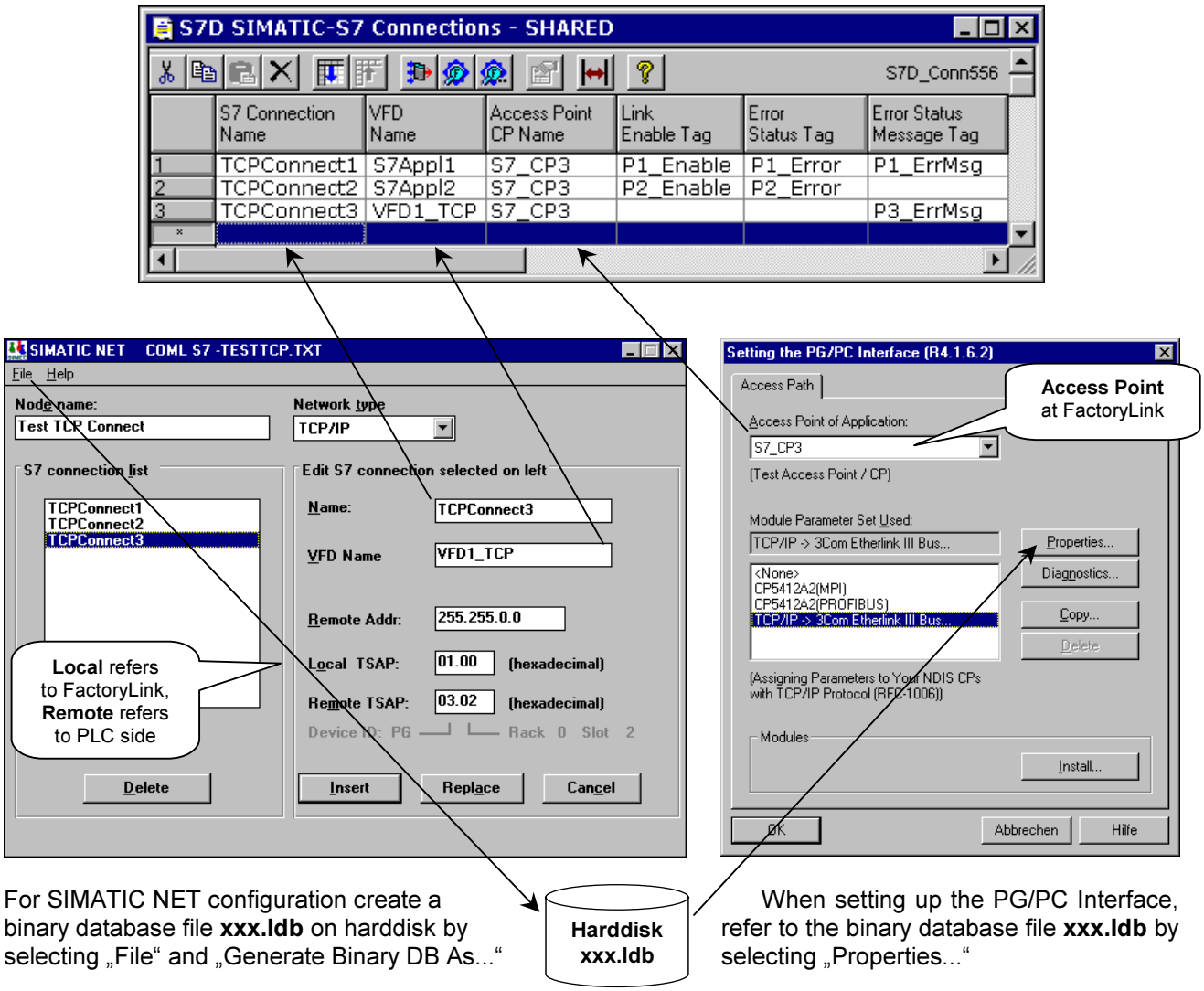
For configuration, enter an **S7 Connection Name** and its associated **VFD Name** (PLC side) and the local **Access Point** or **CP Name** (FactoryLink side) to the appropriate columns. Note, all these names are referenced only and defined at SIMATIC NET configuration as illustrated overleaf. Optionally you may specify a tag name for **Link Enable, Error/Status** or **Error/Status Message** in order to indicate appropriate information for each particular link.

S7D SIMATIC-S7 Connections (summary of table entries)	
S7 Connection Name (PLC ⇔ FactoryLink)	**Symbolic name of the communication link.** The name of up to 32 char is configured by the SIMATIC NET COML-S7 tool (➲ see overleaf and corresponding Siemens documentation). It must be unique and represents a pair of VFD and Access Point / CP.
VFD Name (PLC side)	**Name of the Virtual Field Device**. The name of up to 32 char is required and configured by the SIMATIC NET COML-S7 tool (➲ see overleaf and corresponding Siemens documentation). Note that pairs of VFD and Access Point / CP must be unique.
Access Point or **CP Name** (FactoryLink side)	**Name of Access Point or Communication Processor**. The name of up to 32 char is required and specified by the SIMATIC NET configuration when setting up the PG/PC interface (➲ see overleaf and corresponding Siemens documentation). Note, pairs of Access Point / CP and VFD must be unique.
Link Enable Tag	**Digital Tag** (optional) to enable the link if ON
Error Status Tag	**Analog Tag** (optional) containing Error/Status number For values displayed see ERROR and STATUS INFORMATION
Error Status Message Tag	**Message Tag** (optional) containing Error/Status information For message displayed see ERROR and STATUS INFORMATION

For each S7 Connection you can specify one or several ECI Objects as described below. Press Enter and then select the S7D ECI Object Reference Table.

SAMPLE CONFIGURATION USING COML-S7 AND PG/PC TOOLS

Example of **referenced names** in the S7D SIMATIC-S7 Connections table:



For SIMATIC NET configuration create a binary database file **xxx.ldb** on harddisk by selecting „File“ and „Generate Binary DB As...“

When setting up the PG/PC Interface, refer to the binary database file **xxx.ldb** by selecting „Properties...“

Make sure to assign a valid Module Parameter Set to create an Access Point i.e. DO NOT inadvertently press OK when the <None> option is selected in the PG/PC Interface panel. Note that the SIMATIC NET Node Name is for documentation only while the **Remote Address** depends on the **Network type** selected:

PROFIBUS	Profibus/MPI Address = **Station Address 0..126** (at PLC side)
ETHERNET (ISO)	Ethernet Address = **6 Pairs of hex numbers** e.g. 08.00.06.01.00.00 (at PLC side)
TCP/IP	IP Address = **4 Groups of 0..255 decimal** e.g. 255.255.0.13 (at PLC side)

A SIMATIC NET **Transport Service Access Point** TSAP consists of exactly two groups in hex separated by a period. You may try different numbers or consult Siemens to locate the Rack/Slot for the Remote TSAP:

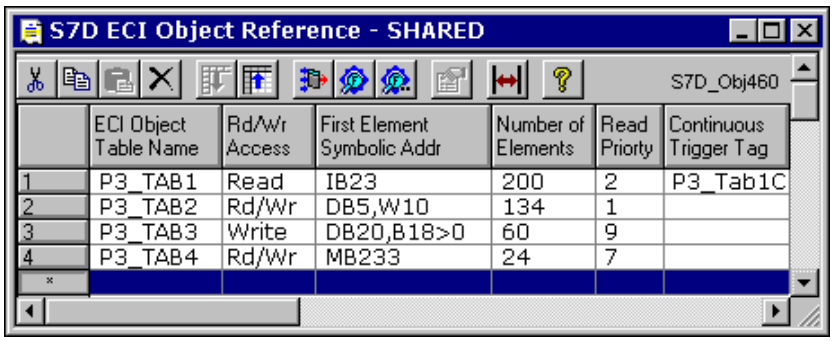
Local TSAP	First group = **Device ID normally set 01**, second group **must be 00** (for FactoryLink)
Remote TSAP	First group = **Device ID normally set 03**, second group = **Rack/Slot of CPU** (not CP !)

Please note that the Remote TSAP refers to the PLC's CPU and NOT to its Communication Processor.

☞ For SIMATIC NET installation/setup refer to ➲ **Siemens CD Manuals for SIMATIC NET NCM S7** PROFIBUS or Industrial Ethernet chapter 1 (Communication) and chapter 2 (Installation/Commissioning).
Important! for the S7-Protocol no PLC programming (Send/Receive) is required.

ECI OBJECT REFERENCE

The ECI Object Reference Table is used to specify one or several ECI Objects by addressing coherent blocks (Datasets) of elements with contiguous addresses for the particular S7 Connection indicated at the bottom of the panel. The table is displayed when selecting „Open inGrid“:



	ECI Object Table Name	Rd/Wr Access	First Element Symbolic Addr	Number of Elements	Read Priorty	Continuous Trigger Tag
1	P3_TAB1	Read	IB23	200	2	P3_Tab1C
2	P3_TAB2	Rd/Wr	DB5,W10	134	1	
3	P3_TAB3	Write	DB20,B18>0	60	9	
4	P3_TAB4	Rd/Wr	MB233	24	7	

The first entry must be identical with the **ECI Object Table** where the specified Dataset (block of data) is being scaled and converted to/from individual FactoryLink Database Elements. Because ECI can handle partial Datasets (groups of Elements) as well as independent Read- and Write-Datasets for a particular Object, the Reference Table accepts multiple entries for the same ECI Object (see examples). Objects may be defined for Read-only, Write-only, Read/Write from/to the same Dataset as well as Read/Write from/to different Datasets by specifying the corresponding **Rd/Wr Access**. Move the cursor to the appropriate column and enter a name from the list as follows:

S7 Functions *(any number allowed per table)*	***Read***	***Read** only (polling by ECI or Timer)*
	Write	***Write** only (Exception, Block or Dataset)*
	Rd/Wr	***Read** and/or **Write** (any type as above)*
Statistics Functions *(one of each type allowed per table or one only for all tables, respectively)*	***SRD***	***S**tatistics **R**ead specific **D**evice*
	SRDC	***S**tatistics **R**ead specific **D**evice and **C**lear*
	SRS	***S**tatistics **R**ead **S**um of all Devices*
	SRSC	***S**tatistics **R**ead **S**um of all Devices and **C**lear*

The statistics functions provide quality and performance information on a particular or on all Symbolic Devices. The information includes number of bytes read/written, CRC errors, jobs in queue etc. Data is polled by triggering and displayed by 17 elements. It is decoded as shown for the Sample Configuration a) in the next chapter or, you may dump the information to a LongAna array using the ARY Function of ECI. Functions SRD and SRS use internal totalizers/counters which are set zero (cleared) only at shutdown of the system. Functions SRDC and SRSC clear the counters after each poll request, i.e. the values indicate the counts measured for a poll interval. This can e.g. be used to display the number of bytes transmitted every 10 sec.

Before accessing data in a PLC, carefully check whether all desired areas and addresses are available else, you must allocate the required data first. This especially applies for Counters and Timers which are not automatically created with consecutive addresses.

Although a Dataset consists of Bytes, Words or Doublewords, you may access any bit, nibble, byte, short, long, float, message or array as specified in the ECI Information Table for both, read and write. Apart from Block and Dataset Write commands, PROLINK-S7D also supports Exception Write commands for any data type including Bit 0..7 for bytes of DB, DI, MB and OB.

Consider a Dataset being a number of Elements (Bytes, Words or Doublewords) which are transmitted by one or several data blocks. In the **First Element Symbolic Addr** column specify the data area, type and address ## of the first element for a coherent block of data being identified as a particular Dataset:

S7 Data Area / Data Type (Element Size →)	**DOUBLEWORD** (4 Bytes)	**WORD** (2 Bytes)	**BYTE** (1 Byte)
***D**ata **B**lock (standard recommended)*	***DB##,D##***	***DB##,W##***	***DB##,B##***
***D**ata **I**nstance*	***DI##,D##***	***DI##,W##***	***DI##,B##***
***M**emory Flag (Merker)*	***MD##***	***MW##***	***MB##***
***I**nput (Eingang)*	***ID##***	***IW##***	***IB##***
***O**utput (Ausgang)*	***OD##***	***OW##***	***OB##***
***P**eriphery **I**nput*		***PIW##***	
***P**eriphery **O**utput*		***POW##***	
***C**ounter 0..999 Integer (read only)*		***CW##***	
***T**imer 0..999 Integer (read only)*		***TW##***	

Read/Write Element Addr in ECI normally correspond to the SIMATIC-S7 addresses ## for any data type. I.e. Word *12* uses byte addresses *12..13* or Doubleword *40* uses byte addresses *40..43* etc. while Counters and Timers use word addresses. **For relative addressing (First Addr = 0 in ECI), append an arrow right sign followed by a zero „>0“** e.g. *DB20,B18>0* will shift *DB20* byte *18* to address *0* in ECI. You can force the Dataset Element size (called Boundary) so that addresses become e.g. words as used for SIMATIC-S5 DB's ➲ ECI Rd/Wr Mode = *H2*. The shaded fields above indicate the preferred symbolic expressions for the particular areas. Note, Write commands for Bit 0..7 ➲ ECI Wr CDE = *0..7* are allowed for DB, DI, MB and OB of Datasets with a byte boundary.

In the **Number of Elements** column enter the length of the coherent block of Doublewords, Words or Bytes to be accessed as a Dataset. Note, the size of a Dataset in bytes is expressed by the element size times the number of elements entered and may not exceed the S7-PDU (Protocol Data Unit) size which depends on the S7 PLC type and interface applied. Datasets larger than the allowed S7-PDU size will be truncated e.g. at 212 bytes for MPI. Check file ➲ %flapp%\shared\log\S7D.log after start up of the driver to see the negotiated S7-PDU size and allow for a 18 byte Read - or a 28 byte Write data header (to be subtracted). Note that for ECI, a Dataset may be of any size between a single Element and 64 kBytes.

In the **Read Priority** column specify a number 1..9 which is valid for read access only. Note, priority 1 (default) provides 9 times faster polling than priority 9 if jobs are queued due to a high demand. An optional **Continuous Trigger Tag** (Analog) may be applied for continuous polling while simultaneously controlling the priority level. If the Analog tag's value is zero, continuous polling is disabled, while a value of 1..9 enables polling with the corresponding priority.

S7D ECI Object Reference (summary of entries)	
ECI Object Table Name	**Name of ECI Object Table** used for decoding/encoding The entry of up to 15 char is the reference to an ECI Control table.
Rd/Wr Access	**Type of data transmission** See list of functions or see table above
First Element Symbolic Address	**Symbolic name of first element transmitted** of Dataset Syntax as specified by SIMATIC S7-Protocol
Number of Elements	**Maximum number of elements transmitted** by a single Read or Write request (see above) where an element is either a Byte, a Word or a Doubleword. Consider the max. S7-PDU size in bytes and allow for 2 bytes per Word or 4 bytes per Doubleword.
Read Priority	**1..9** Priority (1=highest)
Continuous Trigger Tag	**Analog Tag** (option): Value 0=No continuous polling, Value 1..9=Priority for continuous polling

SAMPLE CONFIGURATION OF COMMUNICATION OBJECTS

A) Four ECI Objects for Statistics, Read, Write and Read/Write

Sample **ECI Information Table** for Object ***SIM1_STAT*** displaying satistical data by ***17*** LongAna elements. Note, for statistics functions, the first element address is set zero and addressing is defined for doublewords:

ECI Object Information - SHARED

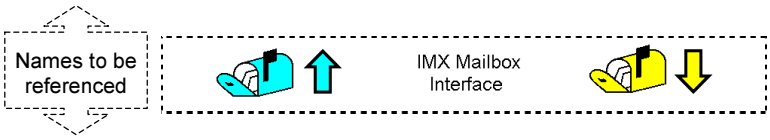
Alternate ReadTag	Elem Addr	Rd CDE	Object I/O Tag	Wr CDE	Elem Addr	Alternate WriteTag	R/W Range Function
	0	***L0***	***Jobs_in_Write_Queue***	***-***	***-1***		
	1	***L0***	***Jobs_in_Read_Queue***	***-***	***-1***		
	2	***L0***	***Number_of_Bytes_written***	***-***	***-1***		
	3	***L0***	***Number_of_Bytes_read***	***-***	***-1***		
	4	***L0***	***Total_number_of_Bytes_transmitted***	***-***	***-1***		
	5	***L0***	***Read_CRC_Errors***	***-***	***-1***		
	6	***L0***	***Write_CRC_Errors***	***-***	***-1***		
	7	***L0***	***Read_Timout_Errors***	***-***	***-1***		
	8	***L0***	***Write_Timout_Errors***	***-***	***-1***		
	9	***L0***	***Write_Jobs_cancelled***	***-***	***-1***		
	10	***L0***	***Write_retries***	***-***	***-1***		
	11	***L0***	***Read_retries***	***-***	***-1***		
	12	***L0***	***Unexpected_Answers***	***-***	***-1***		
	13	***L0***	***Total_number_of_Errors***	***-***	***-1***		
	14	***L0***	***Read_Telegrams***	***-***	***-1***		
	15	***L0***	***Write_Telegrams***	***-***	***-1***		
	16	***L0***	***Total_number_of_Telegrams***	***-***	***-1***		

Sample **ECI Control Table** with four Objects using Read and Exception Write (Wr at Ch=***X***). Note, data for above table is updated when the Dataset IdxTag ***RdS1_STAT*** is forced ON (Read Trigger):

ECI Object Control - SHARED

Object Table Name	Read MailboxTag	Read Ds IdxTag		Write EncArr MailboxTag	Write Ds IdxTag	Wr Idx	Wr Mode	Wr Tr	Wr Ch
SIM1_STAT	***ReadMbx***	***RdS1_STAT***				***-1***	***H1***	***N***	***N***
SIM1_OBJ10	ReadMbx	RdS1Obj10				-1	H1	N	N
SIM1_OBJ11				WriteMbx	WrS1Obj11	-1	H1	N	X
SIM1_OBJ12	ReadMbx	RdS1Obj12		WriteMbx	WrS1Obj12	-1	H1	N	X

see ⇗



☜ Mailboxes and Datasets are automatically referenced by S7D

S7D ECI Object Reference Table with four individual Communication Objects. Note, element addressing in ECI correspond with S7 regardless of the element size specified by symbolic addressing:

S7D ECI Object Reference

ECI Object Table Name	R/W Access	First Element Symbolic Addr	Nr of Elements	Read Prio	Comment
SIM1_STAT	***SRD***	***MD0***	***17***	*(n/a)*	***S**tatistics **R**ead **D**evice, **M**emory**D**Word **0**, **17** DWords* ***see*** ⇗
SIM1_OBJ10	Read	IB34	5	1	**Read** Input **B**yte **34**, **5** bytes with Priority **1**
SIM1_OBJ11	Write	DB230, B131	120	(n/a)	**Write D**ata**B**lock **230**, **B**yte **131**, **120** bytes (Prio not applicable)
SIM1_OBJ12	Rd/Wr	DB27,W44	20	9	**Read/Write D**ata**B**lock **27**, **W**ord **44**, **20** words with Priority **9**

Note, the ECI Information Tables for Objects STA1_OBJ10..12 are not displayed.

B) Single ECI Object consisting of three partial Datasets

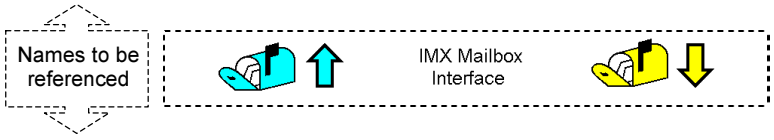
The **ECI Information Table** for Object ***SIM1_OBJ3*** below has a total of ***30***+***12***+***20*** Read Elements specified by three blocks of ***Bytes*** in the S7D's Object Reference. Note that the Read Element Addressing is therefore in bytes. The 2nd block is Read/Write and is transmitted bi-directionally for word ***150***..*151*, Write_only for word ***152***..*151* or, Read/Write with different locations for doubleword ***188***..*191*/***154***..*157* etc. As an example, the ***Last_Float_of_3rd_Block*** is written to address ***158***..*161* however, the feedback is taken from bytes ***204***..*207*. This may be used to write a setpoint (*158..)* to an Object I/O Tag which is simultaneously used to indicate the actual value (*204..)* from the plant.

ECI Object Information - SHARED							
Alternate ReadTag	Elem Addr	Rd CDE	Object I/O Tag	Wr CDE	Elem Addr	Alternate WriteTag	R/W Range Function
	120	*S0*	*First_Word_of_1st_Block*	*-*	*-1*		
	122	*S0*	*2nd_Word_of_1st_Block*	*-*	*-1*		
	etc.	*S0*	*etc.*	*-*	*-1*		
	148	*S0*	*Last_Word_of_1st_Block*	*-*	*-1*		
	150	*S0*	*First_Word_of_2nd_Block*	*S0*	*150*		
	-1	*LSB*	*Write_only_Word_of_2nd_Block*	*S0*	*152*		
	etc.	*S0*	*etc.*	*-*	*-1*		
	158	*S0*	*Last_Word_of_2nd_Block*	*-*	*-1*		
			Note that Elements (bytes) 160 through 187 are never updated (all Read values = zero)				
	188	*UL0*	*First_DoubleWord_of_3rd_Block*	*UL0*	*154*		
	192	*L0*	*2nd_DoubleWord_of_3rd_Block*	*-*	*-1*		
	etc.	*S0*	*etc.*	*-*	*-1*		
	204	*F0*	*Last_Float_of_3rd_Block*	*F0*	*158*		

Sample **ECI Control Table** for triggered Block Write (Wr by Tr=***B***) and/or Exception Write (Wr at Ch=**X**). Note, the Wr Mode is set to ***H1*** for **H**igh_to_Low format (SIMATIC) and **1** byte element size (byte boundary):

ECI Object Control - SHARED										
Object Table Name	Read MailboxTag	Read Ds IdxTag	Interv Ch/Cont	Upd Delay	Write EncArr MailboxTag	Write Ds IdxTag	Wr Idx	Wr Mode	Wr Tr	Wr Ch
SIM1_OBJ3	*ReadMbx*	*RdS1Obj3*	*1/5*	*3*	*WriteMbx*	*WrS1Obj3*	*-1*	*H1*	*B*	*X*

see 🖉



☜ Mailboxes and Datasets are automatically referenced by S7D

S7D ECI Object Reference Table with three entries for the same Communication Object. Note, object ***SIM1_OBJ3*** is split in 3 groups of elements (***Bytes***) with individual R/W Access and Read Priority:

S7D ECI Object Reference - SHARED					Comment
ECI Object Table Name	R/W Access	First Element Symbolic Addr	Nr of Elements	Read Prio	
SIM1_OBJ3	*Read*	*DB231,B120*	*30*	*4*	***Read** DataBlock **231**, Byte **120**, **30** bytes with Priority **4***
SIM1_OBJ3	*Rd/Wr*	*DB231,B150*	*12*	*1*	***Read/Write** DataBlock **231**, Byte **150**, **12** bytes with Priority **1***
SIM1_OBJ3	*Read*	*DB231,B188*	*20*	*9*	***Read** DataBlock **231**, Byte **188**, **20** bytes with Priority **9***

Note that data is read (updated) when triggering the ECI ➲ Read Dataset IdxTag. There are several methods to trigger this tag: Interval Timer, Math&Logic or simply enter an interval to the ECI Read Interv Ch/Cont column. Entering e.g. 1/5 will cause ECI to continuously trigger the tag every 5 sec while it will speed-up to 1 sec whenever you change (write) an I/O tag of the ECI Information table. This may be handy as ECI automatically speeds-up communication whenever an operator changes a value within a particular table.

It is recommended to read data back after writing i.e. use ECI bi-directional transmission for data to be written to a PLC. This has the advantage that data can be changed by both, FactoryLink and PLC. In this case adjust the ECI ➲ Read Update Delay e.g. to 3 sec in order to allow for a proper feedback transmitted by the 1 sec Read Interval at Change (see also ECI manual).

C) Single ECI Object with independent Read and Write Dataset

The **ECI Information Table** for Read/Write Object ***SIM1_OBJ44*** has ***55*2=110*** bytes (Read Elements) and ***15*2=30*** bytes (Write Elements) with different addresses for Read and Write. Note that not every line entry need to be bi-directional, any mix of Read-only, Write-only and Read/Write is allowed. Furthermore, Read and Write Element addresses need not to be in a consecutive order as shown they may be scattered as required. And, data may additionally be converted and scaled using the R/W Range Function column:

ECI Object Information - SHARED

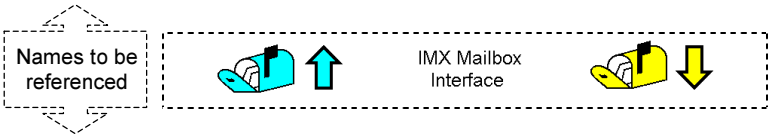
Alternate ReadTag	Elem Addr	Rd CDE	Object I/O Tag	Wr CDE	Elem Addr	Alternate WriteTag	R/W Range Function
	220	*S0*	*First_Word_bi_directional*	*S0*	*35*		
	222	*L0*	*Double_Word_read_only*	*-*	*-1*		
	226	*UB0*	*Unsigned_Byte_bi_directional*	*S0*	*37*		*0,255*
	etc.		*etc.*		*etc.*		
	-1	*LSB*	*Double_Word_write_only*	*L0*	*59*		
	328	*US0*	*Last_Word_bi_directional*	*US0*	*63*		*0;10000*

Sample **ECI Control Table** for triggered Dataset Write (Wr by Tr=***D***) and/or Exception Write (Wr at Ch=***X***) of Read/Write Object ***SIM1_OBJ44*** which is split in two independent Datasets for Read- and Write-only. Note, the Wr Mode is set to ***H1*** for **H**igh_to_Low format (SIMATIC) and **1** byte element size (byte boundary):

ECI Object Control - SHARED

Object Table Name	Read MailboxTag	Read Ds IdxTag	Rd Idx		Write EncArr MailboxTag	Write Ds IdxTag	Wr Idx	Wr Mode	Wr Tr	Wr Ch
SIM1_OBJ44	*EciRmbx*	*RdS1Obj44*	*-1*		*EciWmbx*	*WrS1Obj44*	*-1*	*H1*	*D*	*X*

see ☞



☜ Mailboxes and Datasets are automatically referenced by S7D

S7D ECI Object Reference Table for a single Communication Object ***SIM1_OBJ44*** which is split in two separate Datasets of ***W**ords* for Read-only and Write-only. Note that element addressing in ECI correspond with S7 regardless of the element size specified by symbolic addressing:

S7D ECI Object Reference - SHARED

ECI Object Table Name	R/W Access	First Element Symbolic Addr	Nr of Elements	Read Prio	Comment
SIM1_OBJ44	*Read*	*IW220*	*55*	*4*	***Read** Input **W**ord **220**, **55** words with Priority **4***
SIM1_OBJ44	*Write*	*DB175,W35*	*15*	*(n/a)*	***Write** DataBlock **175**, **W**ord **35**, **15** words (Prio not applicable)*

For a sample setup of the same Object in a redundant system, see overleaf.

Note data is read (updated) when triggering the ECI ➲ Read Dataset IdxTag. There are several methods to trigger this tag: Interval Timer, Math&Logic or simply enter an interval to the ECI Read Interv Ch/Cont column. Entering e.g. 0.5/4 will cause ECI to continuously trigger the tag every 4 sec while it will speed-up to 0.5 sec whenever you change (write) an I/O tag of the ECI Information table. This may be handy as ECI automatically speeds-up communication whenever an operator changes a value within a particular table.

It is recommended to read data back after writing i.e. use ECI bi-directional transmission for data to be written to a PLC. This has the advantage that data can be changed by both, FactoryLink and PLC. In this case adjust the ECI ➲ Read Update Delay e.g. to 3 sec in order to allow for a proper feedback transmitted by the 0.5 sec Read Interval at Change (see also ECI manual).

D) Dataset Exchange in Redundant System using PROLINK®VRN

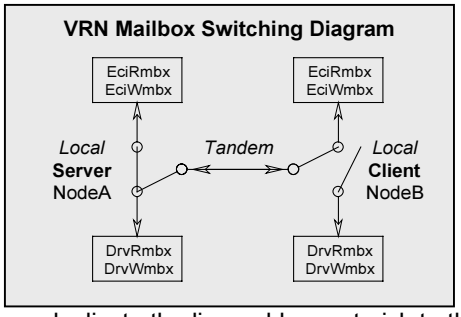
Assign the same **VRN Connect Control Table** a ***Tandem*** and a ***Local*** link to exchange Datasets through mailboxes between redundant system NodeA and NodeB as shown below. Note that ECI and Driver use separate mailboxes which are linked according to the actual Tandem Status. The Tandem Status can further be used to start/stop the local Driver if assigned to its ***TASKSTART_S[x]*** tag of the System Configuration:

VRN Connect Control - SHARED

Connect Table Name	Local Mode	*Host Name or IP Addr	*Service Name	Function and Arguments	Local Control Tag	Local Status Tag
ProlinkVRN	*DAEMON*		*`ProlinkVRN*			
Partner	*TANDEM*	*`TandemStation*	*`ProlinkVRN*			*TASKSTART_S[x]*
Partner	*CLIENT*	*`LocalStation*	*`ProlinkVRN*	*Mux=1*	*TASKSTART_S[x]*	

VRN Client Object Information - SHARED

Read from Server (Element, Item)	I/O TAGName (Wildcard)	Write to Server (Element, Item)
DrvRmbx	*EciRmbx* *EciWmbx*	*DrvWmbx*

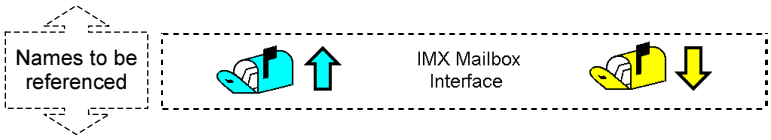


The **ECI Information Table** for Object ***SIM1_OBJ44*** shall e.g. be the same as on the previous page.

In the **ECI Control Table** assign a Rd/Wr Ds Idx e.g. ***144*** and ***244*** then, duplicate the line, add an asterisk to the table name ****SIM1_OBJ44*** and rename the Mailboxes EciRmbx+EciWmbx→***DrvRmbx***+***DrvWmbx*** in order to create a dummy entry which is referenced by the S7D Driver:

ECI Object Control - SHARED

Object Table Name	Read MailboxTag	Read Ds IdxTag	Rd Idx		Write EncArr MailboxTag	Write Ds IdxTag	Wr Idx	Wr Mode	Wr Tr	Wr Ch
SIM1_OBJ44	*EciRmbx*	*RdS1Obj44*	*144*		*EciWmbx*	*WrS1Obj44*	*244*	*H1*	*D*	*X*
VRN Mailbox Data Exchange by Local or Tandem Connect										
**SIM1_OBJ44*	*DrvRmbx*	*RdS1Obj44*	*144*		*DrvWmbx*	*WrS1Obj44*	*244*	*H1*	*D*	*X*



☜ Mailboxes and Datasets are automatically referenced by S7D

S7D ECI Object Reference Table for Communication Object ****SIM1_OBJ44*** which is transmitted in a redundant system to the Local and/or Partner station through VRN:

S7D ECI Object Reference - SHARED

ECI Object Table Name	R/W Access	First Element Symbolic Addr	Nr of Elements	Read Prio	Comment
**SIM1_OBJ44*	*Read*	*IW220*	*55*	*4*	***Read** Input **W**ord **220**, **55** words with Priority **4***
**SIM1_OBJ44*	*Write*	*DB175,W35*	*15*	*(n/a)*	***Write** **D**ata**B**lock **175**, **W**ord **35**, **15** words (Prio not applicable)*

If you do not want to control the Driver by VRN Tandem Status, replace above ***TASKSTART_S[x]*** tag by a unique tag. Note that in any case, VRN must run for data exchange between ECI and Driver.

Note data is read (updated) when triggering the ECI ➲ Read Dataset IdxTag. There are several methods to trigger this tag: Interval Timer, Math&Logic at the local system or enter ➲ Rd Mode = Suffix M (read by Maibox request) and an interval to the ECI Read Interv Ch/Cont column at the remote system. Entering e.g. Ch/Cont = 1/5 will cause ECI to continuously trigger the tag every 5 sec while it will speed-up to 1 sec whenever you change (write) an I/O tag of the ECI Information table. This may be handy as ECI automatically speeds-up communication whenever an operator changes a value within a particular table (see also ECI manual).

INFORMATION and ERROR MESSAGES

The following messages may be displayed in the RunTime Manager:

Label in S7D.TXT	**Messages reported by RunTime Manager**
START	**S7D Vx.xx starting**
RUN	**S7D Vx.xx running**
STOP	**S7D Vx.xx normal shutdown**
DEMORUN	**#001 Demo running: Shutdown by timeout**
DEMOSTOP	**#002 Demo stopped: Shutdown by timeout**
NODEMO	**#003 Demo restart prevented: Shutdown FL first**
NO_AUTHORIZATION	**#100 Option not installed or License not enabled** → Check that the Option Key is installed using UKEY –L utility. Verify the Lincense is enabled by running the KEYINST and FLKEYVAL utilities.
CTRECORD	**#101 Error reading CT record** → CT file may be corrupted
CTREC	**#102 Bad record data** → CT file may be corrupted
DEVOPEN	**#103 Error opening COM Device** → check COML-S7 configuration
NOSERVER	**#104 Server not running** → check PLC links
FOPENARG	**#105 Cannot open Programm Argument File**
PROGENVVAR	**#106 Cannot read Environment Variables**
FSETARG	**#107 Cannot set Programm Argument**
PROG_PARA_UNKNOWN	**#108 Unkown Parameter or Programm Argument in File**

The following messages and values are displayed by the element(s) entered to the S7D Connection table:

Label in S7D.TXT	**Error/Status generated by S7D and reported to Message Tag or**	**Analog Tag Value**
E0	**#200 Link normal**	**0**
E50	**#250 Link terminated**	**50**
E51	**#251 Link inactive**	**51**
E52	**#252 Link disabled**	**52**
E-1	**#301 No response from Station** → check PLC links	**-1**
E-7	**#307 Wrong Station Address** → check COML-S7 configuration	**-7**
E-14	**#314 Retry Timeout** → check SIMATIC NET or Programm Arguments	**-14**
E-15	**#315 Illegal Response received (Order ID)**	**-15**
E-16	**#316 Illegal Response received (CREF)**	**-16**
E-17	**#317 Active Abort from PLC**	**-17**
E-18	**#318 Read Error from PLC**	**-18**
E-19	**#319 Write Error to PLC**	**-19**
E-50	**#350 Data in PLC not found**	**-50**

Also indicated by ECI Warning **#021 Table %s RAPD Error ...**

PERFORMANCE CONSIDERATIONS

The S7-Protocols cyclic read method is essentially an automatic polling by the receiving station, this method is not implemented in favor of the ➲ Continous Trigger Tag in the S7D Object Reference table. When this tag is set to a value of 1 (Read Priority=1) the corresponding object will be polled as fast as possible however, still allowing for all other object data to be processed. Under this condition you may measure the number of telegrams and bytes transmitted using the statistics function as shown for the ➲ Sample Configuration A).

For TCP/IP, approx. 10 Datasets of 200 bytes (S7-300/400 at ~20 ms CPU cycle time) were measured per second with a 3COM card on a 200MHz PC through a single connection, i.e. approx. 2 kbytes/sec. These figures may be **reduced with increasing CPU cycle time or when adding connections** to a particular CP (S7-300 allows only for two connects). For a single connection, MPI may be as powerful as Ethernet. Another limiting factor is the PDU size (Protocol Data Unit) which depends on the PLC's CPU and CP type applied. The PDU size defines the maximum ➲ Number of Elements which can be transmitted by s single transaction. Note that these limitations are not due to S7D or ECI as they could handle 1000 Datasets or 200 kbytes/sec under the same condition. S7D could handle PDU sizes of up to 8'192 bytes by a single transaction.

An other point which may be considered is that the S7 CPU's allow for a data consistent block of only 8 bytes (CPU31x) or 32 bytes (CPU41x) respectively. This means, when reading e.g. recipes of more than 8 or 32 bytes, the user must take care for data consistency in the application (data synchronization).

TROUBLE SHOOTING

Note that S7D has been designed for the SOFTNET SAPI-S7 library from Siemens in order to keep PLC communication and its associated problems within the domain of the PLC experts. The IMX interface toward FactoryLink is well tested and runs in many applications. On the other hand, the interface for SOFTNET-S7 is specified by three only items: ➲ S7 Connection Name, VFD Name and Access Point.

A great deal of the setup is related to Siemens instructions which, if strictly followed, will provide you with a successful installation. If the SOFTNET-S7 library, the underlying network (Ethernet, PROFIBUS or MPI) and the S7 PLC's with its Communication Processors are properly installed and setup as described in the Siemens documentation, S7D should work without a problem. Thus, before calling for support on S7D, please carefully check the following items first:

Make sure to apply the latest Version of SOFTNET-S7 and CP Firmware Revisions from Siemens → Check SIMATIC Customer Support on Internet or consult Siemens. → After installation, it may be advisable to re-install the required WindowsNT Service Pack from Microsoft.
It may be cumbersome to determine a Rack/Slot number for the Remote TSAP at COML-S7 setup → This must be the Rack/Slot of the PLC's CPU (not CP), you may try with different numbers 01..05 or consult Siemens
Verify your PLC Communication Processor is configured properly for SIMATIC NET → Check to have the NCM S7 option installed for the STEP 7 configuration
If S7D cannot communicate with a PLC → Carefully check the entries for „S7 Connection Name", „VFD Name" and „Access Point" as they may include special characters as colon etc. (e.g. CP_L2_1:) → MCI/PROFIBUS: Check the station addresses live, using the PC/PG tools „Diagnostic" menu → TCP/IP: Check the CP's address live using the „ping [IP address]" command from a DOS Window → ISO: Carefully verify all Ethernet addresses and TSAPs as there is no runtime check tool → The total number of connects are limited depending on the PLC type and/or SOFTNET-S7 library
Note that TCP/IP connection/reconnection takes time → According to Siemens, TCP/IP may be slow to connect, this also applies when switching a CP Off and On
Note that PLC memory access may be slow since it is synchronized with the CPU cycle → If the cycle time is e.g. 100 ms, a max of 10 Read+Write jobs/sec are possible for a particular connection → Use ECI's Action/Reaction method for commands sent-to and read-back from the PLC → Use multiple connections to split „fast" and „slow" jobs
Increasing the number of connections to a PLC drops data troughput for an actual connect → This depends on the PLC Communication Processor, use the ➲ Read Priority of S7D to tune your system
Check Debug and Log Information in file {flapp}\shared\log\S7D.log (see sample file overleaf) ➔ Adjust a Verbose Level 1...63 as desired for the approprate ➲ Program Argument. **Caution!** a Verbose Level greater than 15 may overflow your harddisk quickly. → Note, the braces at the end of a line „**...->(err: %d, %s)**" displays the exact error nr+text from the SAPI-S7 library.
If a link is frequently down and being reconnected → Check the network load, it may be high due to other partners e.g. due to file transfer etc. → In S7D.log compare the avarage Response Checks with ➲ Program Argument „TimeoutFactor" → If Response Check counts > TimeoutFactor, tune TimeoutFactor or possibly SleepTime → Else tune ➲ Program Argument S7_MINI_DB_ABORT_TIMEOUT
If a Dataset from/to a PLC is not or partially transmitted only → Make sure all data accessed in a PLC has been created, for Timer/Counter prevent address gaps → In the S7D.log file check the PDU size negotiated, the lower value found for S7D or PLC will be applied. Allow for an 18 byte Read - and a 28 byte Write data header, for example: S7-300 PDU size = 240 bytes → Read Dataset may be 212 bytes max, Write Dataset may be 202 bytes max. S7-400 PDU size = 480 bytes → Read Dataset may be 462 bytes max, Write Dataset may be 452 bytes max. Any Datasets longer than the PDU size minus the data header will be truncated accordingly.
Block Read Data is not synchronized → The S7 CPU's allow for a data consistent block of only 8 bytes (CPU31x) or 32 bytes (CPU41x) respectively. → Use the ➲ ECI Read Complete Trigger to synchronize. Use Dataset chaining by triggering the following Dataset with the Complete Trigger of the previous Dataset for data blocks larger than the PDU size.
Before consulting Siemens, setup a trace file to gather more information → Setup a trace file (default „s7trace.txt") by PC/PG tool „Diagnostic". Functions are described in ➲ Siemens SAPI-S7 documentation „SOFTNET-S7" „S7 Programming Interface" „S7_MINI_DB..." and check appropriate ➲ Program Arguments. Note, modified Trace Functions are only accepted after restartig S7D.
Some SOFTNET-S7 Parameters may be adjusted in the Registry using REGEDIT → Do not adjust these Parameters unless clearly advised by Siemens.

SAMPLE DEBUG FILE S7D.LOG

Header and Verbose Information

```
Debugfile:D:\mmisampl\shared\log\S7D.log with Debugstate has opened:63 at: 2000-06-30 14:07:22
Startup Messages of the driver ..............................  (1) ON
Startup Errors of the driver ................................  (2) ON
Data read transfer Errors of the driver .....................  (4) ON
Data write transfer Errors of the driver ....................  (8) ON
Logging of the read Datarequests ............................ (16) ON
Logging of the write Datarequests ........................... (32) ON
```

For setup, see ➲ Program Arguments.
To prevent harddisk overflow, DO NOT leave **Verbose Level** greater than 15

Initialize S7 Connection

```
Message:  2000-06-30 14:07:22.010-> START OPEN DEVICE: CP_NAME:S7_CP3, VFD_NAME:VFD1, CONNECT_NAME:PLC_15
Message:  2000-06-30 14:07:22.023-> CONNECT_NAME:PLC_15-> S7_GET_DEVICE has been found !!!
Message:  2000-06-30 14:07:22.036-> CONNECT_NAME:PLC_15-> S7_GET_VFD has been found !!!
Message:  2000-06-30 14:07:22.047-> CONNECT_NAME:PLC_15-> S7_INITIATE_REQ ok !!!
Message:  2000-06-30 14:07:22.052-> CHECK OPEN DEVICE: CP_NAME:S7_CP3, VFD_NAME:VFD1, CONNECT_NAME:PLC_15
Message:  2000-06-30 14:07:22.062-> CONNECT_NAME:PLC_15-> S7_RECEIVE-> ok (ret=0) !!!
                                   ... further Response Checks...
Message:  2000-06-30 14:07:34.093-> CHECK OPEN DEVICE: CP_NAME:S7_CP3, VFD_NAME:VFD1, CONNECT_NAME:PLC_15
Message:  2000-06-30 14:07:34.108-> CONNECT_NAME:PLC_15-> S7_RECEIVE ok (ret=257) !!!
Message:  2000-06-30 14:07:34.116-> FINISH OPEN DEVICE: CP_NAME:S7_CP3, VFD_NAME:VFD1, CONNECT_NAME:PLC_15 (ACTIVE PDU-SIZE:240)
```

Begin Data Transmission

```
Message:  2000-06-30 14:07:34.124-> READ: orderid:1, PLC-Address:DB110,B0
Message:  2000-06-30 14:07:34.137-> READ: Symbolic Variable Address:DB110,B0,180 !!!
Message:  2000-06-30 14:07:34.142-> receive:0, orderid:1, active_orders:1
Message:  2000-06-30 14:07:34.151-> receive:0, orderid:1, active_orders:1
                                   ... further Response Checks...)
Message:  2000-06-30 14:07:34.332-> receive:769, orderid:1, active_orders:1
Message:  2000-06-30 14:07:34.349-> S7_GET_READ_CNF -> OK (25,12,64,0,4,5,0,0,0,0,0,26,0,0,0,0,0,0,0,0)
```

PDU Size in Bytes negotiated with PLC

Start Next Job

```
Message:  2000-06-30 14:07:34.362-> READ: orderid:2, PLC-Address:DB08,B0
Message:  2000-06-30 14:07:34.376-> READ: Symbolic Variable Address:DB8,B0,60 !!!
Message:  2000-06-30 14:07:34.388-> receive:0, orderid:2, active_orders:1
Message:  2000-06-30 14:07:34.394-> receive:0, orderid:2, active_orders:1
                                   ... further Response Checks...
Message:  2000-06-30 14:07:34.502-> receive:769, orderid:2, active_orders:1
Message:  2000-06-30 14:07:34.516-> S7_GET_READ_CNF -> OK (-46,11,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0)
```

First 20 Bytes of Dataset

Start Next Job .... etc. etc. etc.

```
Message:  2000-06-30 20:17:33.044-> READ: orderid:14425, PLC-Address:DB110,B0
Message:  2000-06-30 20:17:33.057-> READ: Symbolic Variable Address:DB110,B0,180 !!!
Message:  2000-06-30 20:17:33.066-> receive:0, orderid:14425, active_orders:1
Message:  2000-06-30 20:17:33.074-> receive:0, orderid:14425, active_orders:1
                                   ... further Response Checks...
Message:  2000-06-30 20:17:33.172-> receive:769, orderid:14425, active_orders:1
Message:  2000-06-30 20:17:33.181-> S7_GET_READ_CNF -> OK (25,12,64,0,4,5,0,0,0,0,0,2,0,0,0,0,0,0,0,0)
```

Example of Timeout

```
Message:  2000-06-30 20:17:33.197-> READ: orderid:14426, PLC-Address:DB08,B0
Message:  2000-06-30 20:17:33.209-> READ: Symbolic Variable Address:DB8,B0,60 !!!
Message:  2000-06-30 20:17:33.214-> receive:0, orderid:14426, active_orders:1
Message:  2000-06-30 20:17:33.227-> receive:0, orderid:14426, active_orders:1
                                   ... too many Response Checks cause a timeout...
Message:  2000-06-30 20:17:34.353-> receive:0, orderid:14426, active_orders:1
Error:    2000-06-30 20:17:34.368-> READ: S7_RECEIVE (TIMEOUT): 0, there was no error
```

Timeout: compare Response Checks counts with ➲ Program Argument „**TimeoutFactor**“

Data Returns Too Late → this is considered an error by displaying the mailbox contents:

```
Error:    2000-06-30 20:17:34.371-> MBX.mm_msg.m_len:128, MBX.mm_mbx:65535:65535, MBX.mm_type:0x3, MBX.mm_user1:0x0, MBX.mm_user2:7602176
Error:    2000-06-30 20:17:34.380-> ECIHEAD.version:0x1, ECIHEAD.handling:0x0, ECIHEAD.format:0x1, ECIHEAD.boundary:0x1
Error:    2000-06-30 20:17:34.392-> ECIHEAD.elements:60, ECIHEAD.elementaddr:0, ECIHEAD.cde:0xc00
```

Reconnect

```
Message:  2000-06-30 20:17:38.006-> START OPEN DEVICE: CP_NAME:S7_CP3, VFD_NAME:VFD1, CONNECT_NAME:PLC_15
Message:  2000-06-30 20:17:38.014-> CONNECT_NAME:PLC_15-> S7_GET_DEVICE has been found !!!
Message:  2000-06-30 20:17:38.020-> CONNECT_NAME:PLC_15-> S7_GET_VFD has been found !!!
Message:  2000-06-30 20:17:38.031-> CONNECT_NAME:PLC_15-> S7_INITIATE_REQ ok
Message:  2000-06-30 20:17:38.045-> CHECK OPEN DEVICE: CP_NAME:S7_CP3, VFD_NAME:VFD1, CONNECT_NAME:PLC_15
Message:  2000-06-30 20:17:38.052-> CONNECT_NAME:PLC_15-> S7_RECEIVE ok (ret=0) !!!
                                   ... further Response Checks...
Message:  2000-06-30 20:17:50.011-> CHECK OPEN DEVICE: CP_NAME:S7_CP3, VFD_NAME:VFD1, CONNECT_NAME:PLC_15
Message:  2000-06-30 20:17:50.027-> CONNECT_NAME:PLC_15-> S7_RECEIVE ok (ret=257) !!!
Message:  2000-06-30 20:17:50.035-> FINISH OPEN DEVICE: CP_NAME:S7_CP3, VFD_NAME:VFD1, CONNECT_NAME:PLC_15 (ACTIVE PDU-SIZE:240)
```

Restart Normal Processing

```
Message:  2000-06-30 20:17:50.042-> READ: orderid:14427, PLC-Address:DB09,B0
Message:  2000-06-30 20:17:50.055-> READ: Symbolic Variable Address:DB9,B0,210 !!!
Message:  2000-06-30 20:17:50.066-> receive:0, orderid:14427, active_orders:1
Message:  2000-06-30 20:17:50.072-> receive:0, orderid:14427, active_orders:1
                                   ... further Response Checks...
Message:  2000-06-30 20:17:50.182-> receive:769, orderid:14427, active_orders:1
Message:  2000-06-30 20:17:50.194-> S7_GET_READ_CNF -> OK (1,15,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0)
```

Start Next Job .... etc. etc. etc.

Note, a possible error is displayed with the exact SAPI-S7 error number+text in braces at the end of a line by „**...→(err: %d, %s)**“

INSTALLATION and AUTHORIZATION

Insert the FactoryLink CD (Value Added Products) to drive x: or open a possible upgrade .zip file.

- Now browse the media to select **x:\vap\s7d\setup.exe** or **setup.exe** in the .zip file and press Enter then, follow the instructions. Completion will be indicated by a message.

After the installation above, add the task to the RunTime Manager screen as described for FactoryLink under ➲ Adding New Tasks Fundamentals manual:

- In the Configuration Explorer/Manager *select the System Configuration in the SHARED folder/domain.*
- *Add the* required *information to the end* of the System Configuration Information panel using Copy and Paste and assign the new task's element names the *next available array dimension*. In the Flags column enter ***FR***, set the Task Name column to ***S7D***, enter a description as e.g. ***PROLINK-S7D*** and the Executable File column to ***BIN/S7D*** then, select Enter to save the information.

☞ **PROLINK-S7D requires PROLINK-ECI to run**. Therefore, you should have PROLINK-ECI installed as described in its manual.

Authorization

The license is enabled by the standard FactoryLink authorization number which is optained from USDATA or via your supplier. For registration refer to ➲ the FactoryLink Installation Guide. Check the Option bit contents by typing UKEY –L in the Run dialog. Use KEYINST to (re)enter configuration information then, run KEYVAL and follow the instructions for registration.

SOFTNET-S7 Driver Library Installation

For SIMATIC NET installation/setup refer to ➲ **Siemens CD Manuals for SIMATIC NET NCM S7** PROFIBUS or Industrial Ethernet chapter 1 (Communication) and chapter 2 (Installation/Commissioning).
Important! for the S7-Protocol no PLC programming (Send/Receive) is required.

The SOFTNET-S7 Driver Library is installed and set-up according to the instructions supplied by Siemens. Insert the SIMATIC NET CD in the CD-ROM drive and – unless automatically started - click on Start→Run in the Windows Taskbar to display the Run dialog and enter or click on e.g. ***x:\setup.exe***, where **x** denotes the CD-ROM drive. Note, it is recommended to check the readme.txt file and product informations on the CD prior starting with any installation. Now press the Software Installation button, select the setup language and follow the instructions displayed. You may discard „Run automatic authorization" and later authorize the software. Now choose the components to be installed by clicking the desired check box(es). A SOFTNET-S7 module is required, other software depends on the network type and interface card to be installed.

Important! carefully read all Siemens instructions and cleary notify all SIMATIC NET names, addresses and directories to be referenced as they may be used at configuration and conflicts may cause troubles.
To configure PLC communication processors you need the NCM S7 option for the STEP 7 programming tool.
Make sure to have the latest Version of SIMATIC NET SOFTNET-S7 and Service Pack(s) from Siemens and verify the Firmware Revision of your S7-300/400 PLC(s) and Communication Processor(s).

PROGRAM ARGUMENTS

The only Program Argument accepted in the System Configuration Table (see ➲ Adding New Tasks) is the verbose argument **–V63** explained below. You can however reference a file, in order to specify multiple arguments as listed below. In this case enter a filename without a leading dash and specify pathnames and/or environment variables in braces {...} as e.g. {flink}\opt\S7D_para.run. Note that **argument names are case insensitive**. A sample Program Argument file is on the installation media and may look as follows:

```
# S7D_para.run Program Argument File
# *********************************
# This is a sample program argument file. If you want S7D to read the arguments from this file, just insert the
# file's name together with its path to the program argument column of the System Configuration Table.
# This is helpful for tuning S7D since you need not to shutdown FactoryLink but you may stop S7D, manipulate
# the program argument file and restart S7D. Valid program arguments are shown below. Please note the following:
#          Caution! Program arguments – if wrongly adjusted - may cause unpredictable results
# Lines beginning with a number sign (#), an asterisk (*) or a space ( ) are considered comments and thus not
# being processed. The examples below may be enabled by removing the characters indicating a comment line.
#
# Program Arguments for Debugging:
# Verbose Level 1..63 for debugging and logging information to file = {flapp}\shared\log\S7D.log
# The level is identified as the sum of binary values each of enabling a log action in order to display ...
#        1 = Startup Messages of the driver                2 = Startup Errors of the driver
#        4 = Data Read transfer Errors of the driver       8 = Data Write transfer Errors of the driver
#       16 = Logging of the Read Data Requests            32 = Logging of the Write Data Requests
# Enter value 63 (=1+2+4+8+16+32) to enable all actions, DEFAULT=15 enabling actions 1+2+4+8:
# -V15
# (Note, the only program argument accepted directly in the System Configuration table is -V63)
#
# Program Arguments for Tuning:
# Adjust process speed / CPU load by suspending program every scan, DEFAULT=10 [ms]:
# -SleepTime10
# Factor for number of response checks before a timeout (TimeoutFactor*SleepTime) error is set, DEFAULT=1000:
# -TimeoutFactor1000
#
# Parameters for S7 Connections:
# (See ➲ Siemens SAPI-S7 documentation „SOFTNET-S7“ „S7 Programming Interface“ „S7_MINI_DB...“)
# Number of simultaneous jobs allowed to receive by active partner, DEFAULT=3, subject to negotiate with PLC:
# -S7_MINI_DB_INIT_REQ_AMQ_CALLING3
# Number of simultaneous jobs allowed to send by active partner, DEFAULT=3, subject to negotiate with PLC:
# -S7_MINI_DB_INIT_REQ_AMQ_CALLED3
# Protocol Data Unit size of active partner (max 8192), DEFAULT=960 [bytes], subject to negotiate with PLC:
# -S7_MINI_DB_INIT_REQ_PDU_SIZE960
# Number of simultaneous jobs allowed to receive by passive partner, DEFAULT=3, subject to negotiate with PLC:
# -S7_MINI_DB_INIT_RSP_AMQ_CALLING3
# Number of simultaneous jobs allowed to send by passive partner, DEFAULT=3, subject to negotiate with PLC:
# -S7_MINI_DB_INIT_RSP_AMQ_CALLED3
# Protocol Data Unit size of passive partner (max 8192), DEFAULT=960 [bytes], subject to negotiate with PLC:
# -S7_MINI_DB_INIT_RSP_PDU_SIZE960
# Max number of transmission attempts / retries before aborting an active connection, DEFAULT=5 [counts]
# -S7_MINI_DB_PERSISTANCE_COUNT5
# Time allowed for retries or to establish an active connection, DEFAULT=300 [51 ms] (i.e. 300*51 = 15‘300 ms)
# -S7_MINI_DB_ABORT_TIMEOUT300
#
# WindowsNT Task Priority Arguments
# You may specify the S7D Task Priority Class and Thread Priority as described in the sample file S7D_para.run.
# Warning! these arguments may cause undesired results and should only be adjusted by WindowsNT experts !!
#
```

SYSTEM REQUIREMENTS

- ❑ **FactoryLink® Ver6.6x or Ver7.0x for WindowsNT/95/98**
- ❑ **PROLINK®ECI Enhanced Communication Interface** for above FactoryLink System
- ❑ **PROLINK®S7D Siemens SIMATIC S7-Protocol Driver** for above FactoryLink System
- ❑ **Siemens SOFTNET-S7 Library for PROFIBUS and Multipoint Interface MPI using S7-Protocol**
  (includes SIMATIC NET configuration tools, for actual order information see Siemens catalogue)
  Option a) **SOFTNET-S7/WindowsNT for PROFIBUS** with CPU controlled stack **6GK1704-5CW00-3AA0**
  Option b) **S7-5412/WindowsNT** for CP5412A2 for „on-board“ protocol stack **6GK1702-5CB00-3AA0**
- ❑ **Siemens PC Interface Adaptor Boards for PROFIBUS and Multi Point Interface MPI**
  (uses CP342-5, CP343-5 or CP443-5 at PLC, for actual order information see Siemens catalogue)
  For option a) **CP5511** or newer (PCMCIA) for LapTop CPU controlled stack **6GK1551-1AA00**
  For option a) **CP5611** or newer (PCI) for CPU controlled stack **6GK1561-1AA00**
  For option b) **CP5412A2** or newer (ISA) „on-board“ protocol stack (recommended for MPI) **6GK1541-2BA00**
  (Note that CP5411 (ISA) may be incompatible with some PC's memory allocation)
- ❑ **Siemens SOFTNET-S7 Library for Industrial Ethernet using S7-Protocol**
  (includes SIMATIC NET configuration tools, for actual order information see Siemens catalogue)
  Option c) **SOFTNET-S7/WindowsNT for Industrial Ethernet** CPU ctrld stack, 8 connects **6GK1704-1CW00-3AA0**
  Option d) **SOFTNET-S7/WindowsNT for Industrial Ethernet** CPU ctrld stack, 64 connects **6GK1704-1CX00-3AA0**
  Option e) **S7-1413/WindowsNT** for „on-board“ protocol stack (upgrade for CP1413) **6GK1701-1CB00-3AA0**
  Option f) **S7-NET1413/WindowsNT** includes the CP1413 (ISA) adaptor board (hardware) **6GK1141-3CB00**
- ❑ **Siemens PC Interface Adaptor Boards for Industrial Ethernet**
  (uses CP343-1, CP343-1 TCP, CP443-1 or CP443-1 TCP at PLC, for order information see Siemens catalogue)
  For option c or d) **CP1411** or newer (ISA) for CPU controlled stack **6GK1141-1AA00**
  For option c or d) **CP1511** or newer (PCMCIA) for LapTop CPU controlled stack **6GK1151-1AA00**
  For option c or d) **3COM** for CPU controlled stack (card from any supplier)
  For option e or f) CP1413 available or included in S7-NET1413/WindowsNT package (card only not available)

Make sure to have the latest Version of SIMATIC NET SOFTNET-S7 and Service Pack(s) from Siemens → check SIMATIC Customer Support on Internet http://www4.ad.siemens.de/csinfo/livelink

UPGRADE INFORMATION

☞ Check the latest version on http://www.prolink.ch and download the desired product(s) and manual(s). The following is a brief summary of enhancements and bugs resolved:

Ver7.0x New compiled version for FactoryLink 7.0x using Siemens SAPI-S7 Library of November 1999. „PROLINK-“ in panel titles removed.

Ver6.6x New compiled version for FactoryLink 6.6x. Bug resolved with regard to invalid Write access. New configuration check with regard to Read and Write access. Online Configuration implemented by method BUMP. New CD installation media for PC's supporting USDATA authorization with FLKEYVAL and UKEY –L. Additional Program Arguments and Program Argument File. Bug with priority control at high load resolved. Bug with Word DWord syntax resolved. First Element Addr syntax extended for relative addressing (appending „>0“). Error numbers #3xx now indicated by ECI „#021 Table %s RAPD Error xx=0xhhh“. Includes previous Ver6.5x: (Authorization code from PROLINK to be entered to file %flink%\opt\prolink.key). English text in log file. Independent link supervision and shutdown. Error in data generation (ctgen) at startup resolved. Now allows for maximum Dataset size of up to 8 kbytes (buffer size). Write complete function added. Bit Write access for Datasets with a byte boundary. Tests performed with MPI CP5611 (PCI) for CPU controlled stack and CP5412A2 (ISA) „on-board“ protocol stack as well as with TCP/IP using standard 3COM Ethernet Adaptor. Results for S7-300/400 with a 200 MHz CPU → see Perfomance Considerations. Periphery Input/Output access not yet implemented.

FIRST TIME INSTALLATION CHECKLIST

Below is a checklist for setting-up and testing the S7D communication at first installation. Please note that a great deal of the setup is related to Siemens instructions which, if strictly followed, should provide you with a successful installation. Before calling for support on S7D, make sure you have proceeded as follows:

❶ ***Check to have the latest Version of SOFTNET-S7 and CP Firmware Revisions*** from Siemens. If the SOFTNET-S7 library, the underlying network and the SIMATIC-S7 PLC's with its Communication Processors are properly installed and setup as described by Siemens, S7D should run without a problem. Note, ***it may be advisable to re-install the required WindowsNT Service Pack*** from Microsoft after installation.

❷ ***Check whether you can access the SIMATIC-S7 PLC's from your PC*** using the standard ***ping [IP address]*** command from a DOS Window (for TCP/IP only) and the ***PG/PC tools*** supplied by Siemens. The SOFTNET-S7 CD from Siemens includes the COML-S7 and PG/PC tools, used to configure SIMATIC NET for the S7-Protocol. Please note that ***Remote Addresses must be unique***. Also note that pairs of ***Access Point and VFD must be unique*** and that the ***Remote TSAP must identify the Rack/Slot of the CPU*** (not the Slot of the CP) - you may try different numbers or consult Siemens. If you cannot "ping" a CP300/400 TCP or if the PG/PC tool does not recognize the SIMATIC-S7 PLC and its Communication Processor you must ask Siemens before trying to proceed with any further step!

❸ ***Make sure to properly setup a memory portion in the PLC*** that can later be accessed by the S7D. Define e.g. ***DB231,B0...B299*** (Word 0..298 or DoubleWord 0..296) for later use according to ➲ Appendix B. Test to access these data bytes using the PG/PC tool. If you do not succeed you must ask Siemens before proceeding with any further step!

❹ ***Now only install S7D*** as described for ➲ INSTALLATION and AUTHORIZATION. In the System Configuration Program Argument column enter a file name e.g. ***{flink}\opt\S7D_para.run*** as described for ➲ S7D Program Arguments (this will make it easier to modify Program Arguments later). Then specify ***Verbose Level -V63*** in {flink}\opt\S7D_para.run (this will later create a log file {flapp}\shared\log\S7D.log). Note, Verbose Levels greater than 15 may create a large file when running a longer period. The log file will also be used to determine the ➲ PDU size, see also ➲ Sample Debug file S7D.log. Important, ***you must also have ECI installed*** for the next steps!

❺ ***Specify one single connect*** as described for the ➲ Siemens SIMATIC-S7 Connections table. A connect is specified by three items: ***S7 Connection Name, VFD Name and Access Point***, use e.g. the names as shown for the COML-S7 and PG/PC tools. These names can freely be specified by the user and since they may include special characters as colons etc. (e.g. CP_L2_1:), ***carefully check the entries to be identical in both, S7D configuration and COML-S7, PG/PC tool.*** For more details on these items, strictly refer to Siemens instructions and point ❷ above. Optionally enter an Error Status Tag and an Error Status Message Tag for display in your application.

❻ ***Specify the PLC data that shall be read/written and decoded/encoded***. Note, you cannot access PLC data unless declared as described under ❸, read also chapter ➲ S7D ECI Object Reference. Now consider to setup the example shown in ➲ Appendix B: this sample uses some of the data (DB231,B120..B207) declared under ❸ above. As a first step, just specify a single line (dark grey, all other entries are set default) in each of the tables as shown below:

ECI Object Information - SHARED

Alternate ReadTag	Elem Addr	Rd CDE	Object I/O Tag	Wr CDE	Elem Addr	Alternate WriteTag	R/W Range Function
	120	*S0*	*First_Word_of_1st_Block*	*-*	*-1*		

ECI Object Control - SHARED

Object Table Name	Read MailboxTag	Read Ds IdxTag	Rd Idx	...	Write EncArr MailboxTag	Write Ds IdxTag	Wr Idx	Wr Mode	Wr Tr	Wr Ch
SIM1_OBJ3	*ReadMbx*	*RdS1Obj3*	*-1*				*-1*	*H*	*N*	*X*

← *see* ❻

S7D ECI Object Reference - SHARED

ECI Object Table Name	R/W Access	First Element Symbolic Addr	Nr of Elements	Read Prio	Comment
SIM1_OBJ3	*Read*	*DB231,B120*	*30*	*4*	***Read** DataBlock **231**, **Byte 120**, **30** bytes with Priority **4***

← *see* ❻

S7D Siemens SIMATIC-S7 Connection - SHARED

S7 Connection Name	VFD Name	Access Point CP Name	Link Enable Tag	Error Status Tag	Error Status Message Tag
TCPConnect3	*VFD1_TCP*	*S7_CP3*		*Conn3_Status*	*Conn3_ErrMsg*

← *see* ❺

You have now specified a connect ***[TCPConnect3][VFD1_TCP][S7_CP3]*** with a Read Dataset ***RdS1Obj3*** representing ***DataBlock 231, Bytes 120..149*** of which ***Elem 120+121*** are decoded to Analog I/O Tag ***First_Word_of_1st_Block***, read by ***Priority 4*** (only relevant for multiple Datasets).

Now test whether you can read ***Elem 120+121*** (bytes) to I/O Tag ***First_Word_of_1st_Block*** by changing the value of bytes ***DB231,B120*** and/or ***B121*** in the PLC. Note that ***data is read (updated) only when triggering*** the ➲ ECI Read Dataset IdxTag ***RdS1Obj3***. If you cannot read the information, verify steps ❶...❹ or proceed with step ❼ below.

If above test was successful, you may test to read and write data from/to the PLC by adding the following (dark grey):

ECI Object Information - SHARED

Alternate ReadTag	Elem Addr	Rd CDE	Object I/O Tag	Wr CDE	Elem Addr	Alternate WriteTag	R/W Range Function
	120	*S0*	*First_Word_of_1st_Block*	*-*	*-1*		
	150	*S0*	*First_Word_of_2nd_Block*	*S0*	*150*		

ECI Object Control - SHARED

Object Table Name	Read MailboxTag	Read Ds IdxTag	...	Interv Ch/Cont	Upd Delay	Write EncArr MailboxTag	Write Ds IdxTag	Wr Idx	Wr Mode	Wr Tr	Wr Ch
SIM1_OBJ3	*ReadMbx*	*RdS1Obj3*		*1/5*	*3*	*WriteMbx*	*WrS1Obj3*	*-1*	*H1*	*B*	*X*

S7D ECI Object Reference - SHARED

ECI Object Table Name	R/W Access	First Element Symbolic Addr	Nr of Elements	Read Prio	Comment
SIM1_OBJ3	*Read*	*DB231,B120*	*30*	*4*	***Read** DataBlock **231**, Byte **120**, **30** bytes with Priority **4***
SIM1_OBJ3	*Rd/Wr*	*DB231,B150*	*12*	*1*	***Read/Write** DataBlock **231**, Byte **150**, **12** bytes with Priority **1***

S7D Siemens SIMATIC-S7 Connection - SHARED

S7 Connection Name	VFD Name	Access Point CP Name	Link Enable Tag	Error Status Tag	Error Status Message Tag
TCPConnect3	*VFD1_TCP*	*S7_CP3*		*Conn3_Status*	*Conn3_ErrMsg*

This will extend the already defined Dataset ***RdS1Obj3*** by ***DataBlock 231, Bytes 150..161*** which can be read at ***Priority 1*** and written (***Rd/Wr***), the write priority is always 1. Now test whether you can write the Analog I/O Tag ***First_Word_of_2nd_Block*** to ***Elem 150+151*** (bytes) in the PLC. Note that data will be written at change (***Wr at Ch=X***) of the I/O Tag which would however return to the old (previous) value after the ***Update Delay of 3 sec*** if data was not read back from the PLC. This is automatically done by ECI due to the ***Read Interv Ch/Cont of 1/5 sec*** specified. If you remove this value, you must trigger ***RdS1Obj3*** within the Update Delay in order to keep the value written to the I/O Tag.

There are several methods to trigger the Read Dataset IdxTag: Interval Timer, Math&Logic or enter a Read Interval as shown. The values ***1/5*** will cause to trigger the tag continuously every ***5 sec*** while it will speed-up to ***1 sec*** if you change (write) an I/O Tag of the corresponding table. This not only unburdens communication but it is also handy as ECI automaticallly speeds-up communication whenever an operator changes a value. An advantage of this bi-directional method is that you can change a value at either side, FactoryLink and/or PLC and, it cares for data consistency: if a value is not received, not accepted or not sent back by the PLC it will return to the previously set value. This is important as the PLC is normally the data server while FactoryLink may be stopped and will automatically synchronize its database with the PLC at startup. Further more, you can also display the transition state by simply specifying an I/O Status Tag in the corresponding field of ECI. Off course you can setup so called „Write-only“ tags. Based on above knowledge, it is however recommended the „Read/Write“ method for all commands, setpoints etc.

You may now enter the remainder information as shown and described in ➲ Appendix B. It shows that you can assemble an ECI Object consisting of different memory areas in the PLC with individual Read/Write access. This may e.g. be used to display an entire DataBlock in a single ECI Information table while data must be transmitted in portions due to the limited ➲ PDU size. Note, the Write Dataset IdxTag ***WrS1Obj3*** may be used as a Block Write trigger to transmit all I/O Tag information to the PLC.

❼ You can at any time check file ***{flapp}\shared\log\S7D.log***, especially check the ***PDU size*** negotiated: you may not specify Datasets larger than the PDU size of which you must subtract 18 bytes for Read or 28 bytes for Write Datasets. Note, Verbose Level ***-V63*** which you setup under ❹ should be removed after testing. For debugging you may further set Program Arguments for ECI: use ***-dRmbx*** and/or ***-dWmbx*** to check the dataflow in the Read and/or Write Mailbox respectively (see ECI ➲ Program Arguments). The ECI Log file is ***{flapp}\shared\log\ECI.log*** and will represent transmitted data in hexadecimal similar as described for the ECI ➲ Encoded Array or Mailbox Tag column.

Please also read chapter ➲ TROUBLE SHOOTING and before you consult Siemens on their library, setup an ***S7-trace file*** using the PC/PG tool "Diagnostic". In any case of troubles it is advisable to send us the S7D.log file (with -V63) together with the s7trace.txt file. Also you may send us your exact configuration of S7D and ECI.

GLOSSARY

PROLINK-ECI Enhanced Communication Interface supports the ***IMX Intertask Mail eXchange*** interface for data transmission from/to ***RAPD Drivers*** or through LAN. ***Object I/O*** data is extracted, decoded and/or scaled of data received from a driver. An Object I/O represents a Sub-Element (e.g. a bit) an Element (e.g. a byte) or a number of Elements (e.g. a float) of data in the external device. On the other hand, write jobs are created, buffered and sent by ECI to the driver.

IMX Intertask Mail eXchange protocol defines a standardized interface for the transmission of so called ***Datasets*** through ***Mailboxes***. In particular, it simply specifies the identification and structure of messages transmitted from a sender to a receiver and vice versa by structured mailbox contents.

Rapid Application Protocol Drivers RAPD (also referred to as IMX Driver) use the IMX Intertask Mail eXchange protocol for Read/Write data exchange with external devices. The ECI converter supports ***Block Read, Block Write, Exception*** and ***Encoded Write*** procedures for any standardized IMX interface.

Mailboxes are always owend by the receiving task, thus the owner of the Read Mailbox is the ECI Task, the owner of the Write Mailbox is the IMX Driver Task. Read/Write Mailboxes are used as a data buffer. Therefore, unprocessed jobs may remain in the Mailbox until they can be handled by the receiving task. An IMX message contains all necessary information as addresses, type, size or number of **Elements** of a so called user specified **Dataset**. The transmitted data in the Mailbox is "neutralized" and thus, independent on any external device and its structure or addressing system.

Datasets represent a number of data Elements forming a coherent block of data with contiguous addresses in the external device. All Elements within a Dataset have the same size called Boundary. Each Element has a specific address thus, it may be accessed individually or blockwise. The ECI task can handle individual Read and Write Datasets for a single Object I/O table. On the other hand, the Read and Write Datasets may also be identical for a particular table. Datasets are specified by the user in the IMX Driver Dataset Definition Table. A Dataset is identified by its Index which may be specified as a Tag (IdxTag) or a Constant (Idx). The IMX Driver sends an entire Dataset as an Element Data Block through the Read Mailbox while the ECI task sends data through the Write Mailbox by either an entire or only a part of a Dataset as e.g. a single Element or even a Sub-Element.

Elements of a Dataset are defined as one discrete bit or a 1, 2 or 4 byte binary value having a dedicated element address in the external device as e.g. a Siemens FLAG/BYTE, DATAWORD, an Allen-Bradley WORD, a Modicon COIL or REGISTER etc. Thus, an Object I/O always represents a Sub-Element (e.g. a bit) an Element (e.g. a byte) or a number of Elements (e.g. a float) of a Dataset in the external device. All Elements within a particular Dataset have the same size called Dataset Boundary.

SIMATIC NET is the general term for the former SINEC product family of Siemens. SIMATIC NET reflects the network structure by three levels: For cell and area control, the **Industrial Ethernet** using robust hardware (formerly called SINEC H1), for the plant, the **PROFIBUS**, the european Process Field Bus (formerly called SINEC L2) and for the devices, the **AS-Interface**, an Actor/Sensor bus (former SINEC-S1). All SIMATIC-S7 300/400 series PLC's support the **Multi Point Interface MPI** as a low cost port for PC's using a PROFIBUS adaptor **CP5412A2** (ISA) with „on-board" protocol stack (recommended) or, the **CP5511** (PCMCIA) or **CP5611** (PCI) respectively. The PROFIBUS further requires a **CP342-5**, **CP343-5** or **CP443-5** communication processor on the PLC side. The Industrial Ethernet requires an ordinary **3COM** card on the PC side or the **CP1411** (ISA) or **CP1511** (PCMCIA) or, the **CP1413** (ISA) with „on-board" protocol stack. At the PLC, the Industrial Ethernet requires a communication processor **CP343-1** (ISO) or **CP343-1 TCP** or, a **CP443-1** (ISO) or **CP443-1 TCP** respectively. Important! to configure PLC communication processors you need the **Network Communication Management NCM S7** option for the STEP 7 programming tool.

SOFTNET-S7 is the term for software libraries for SIMATIC-S7 communication. The CD includes the Configuration Management Local **COML-S7** and **PG/PC** tools, used to configure SIMATIC NET for the **S7-Protocol** which suits for both, Multi Point Interface MPI and networks: MPI and PROFIBUS require the **S7-5412/WindowsNT** for „on-board" protocol stack or the **SOFTNET-S7/WindowsNT for PROFIBUS** for CPU controlled stack. Industrial Ethernet requires the **S7-1413/WindowsNT** for „on-board" protocol stack or the **S7-NET1413/WindowsNT** which includes the CP1413 (ISA board) or, the **SOFTNET-S7/WindowsNT for Industrial Ethernet** for CPU controlled stack using a standard 3COM Ethernet card.