

SIEMENS

SIPROTEC Multi-Functional Protective Relay

7SJ61, 7SJ62, 7SJ64

**Communication Module
PROFINET IO**

Bus Mapping

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NOTE

For your own safety, please observe the warnings and safety instructions contained in this document.

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Preface

Content of this Manual

This manual describes the data in the telegrams of the PROFINET IO device for the SIPROTEC devices 7SJ61, 7SJ62, and 7SJ64.

It is subdivided as follows:

- Data in the PROFINET IO mapping → Chapter 1
- Standard mapping 3-1 → Chapter 2

For general information on operation, installation, commissioning, and configuration of the SIPROTEC devices, refer to the following manuals:

Manual	Order Number
SIPROTEC 4 System manual	E50417-H1176-C151
Device manual 7SJ61	C53000-G1140-C210
Device manual 7SJ62, 7SJ64	C53000-G1140-C207

PROFINET IO Communication Profile

For information on the bus-specific parameters, data type definitions, parameterization and hardware description of the PROFINET IO communication modules for SIPROTEC devices, please refer to the following manual:

Manual	Order Number
SIPROTEC 4 Communication module, PROFINET IO - Communication profile	C53000-L1840-C360

The manuals are available on the Internet at:

<http://www.siprotec.com>

PROFINET IO Specification

The PROFINET IO specification and the structure of the PROFINET IO telegrams are defined in the following international standards:

- IEC 61158
Digital data communications for measurement and control - Fieldbus for use in industrial control systems
- IEC 61784
Digital data communications for measurement and control

Target Audience

Protection engineers, commissioning engineers, persons who are involved in setting, testing, and service of protection, automation, and control devices, as well as operation personnel in electrical plants and power plants.

Scope of Validity of this Manual

This manual is valid for the following SIPROTEC devices:

- 7SJ61, 7SJ62, and 7SJ64 (firmware version V4.90 or higher) with PROFINET IO communication module firmware version 01.00 or higher

For the device parameterization, please use the following:

- DIGSI 4 ab Version 4.86
- PROFINET IO standard mapping 3-1

Additional Support

Should further information be desired or should particular problems arise which are not covered sufficiently for the purpose of the purchaser, the matter should be referred to the local Siemens representative.

Our Customer Support Center provides around-the-clock support.

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Internet: www.siemens.com/poweracademy

Notes On Safety

This manual does not constitute a complete catalog of all safety measures required for operating the equipment (module, device) in question, because special operating conditions may require additional measures. However, it does contain notes that must be adhered to for your own personal safety and to avoid material damage to property. These notes are highlighted with a warning triangle and different keywords indicating different degrees of danger.



DANGER

Danger means that death or severe injury **will** occur if the appropriate safety measures are not taken.

- ◇ Follow all advice instructions to prevent death or severe injury.
-



WARNING

Warning means that death or severe injury **can** occur if the appropriate safety measures are not taken.

- ◇ Follow all advice instructions to prevent death or severe injury.
-



CAUTION

Caution means that minor or moderate injury can occur if the appropriate safety measures are not taken.

- ◇ Follow all advice instructions to prevent minor injury.
-

NOTICE

Notice means that damage to property can occur if the appropriate safety measures are not taken.

- ◇ Follow all advice instructions to prevent damage to property.
-



NOTE

is important information about the product, the handling of the product, or the part of the documentation in question to which special attention must be paid.

Qualified Personnel

Commissioning and operation of the equipment (module, device) described in this manual must be performed by qualified personnel only. As used in the safety notes contained in this manual, qualified personnel are those persons who are authorized to commission, release, ground and tag devices, systems, and circuits in accordance with safety standards.

Use as Prescribed

The equipment (device, module) must not be used for any other purposes than those described in the Catalog and the Technical Description. If it is used together with third-party devices and components, these must be recommended or approved by Siemens.

Correct and safe operation of the product requires adequate transportation, storage, installation, and mounting as well as appropriate use and maintenance.

During the operation of electrical equipment, it is unavoidable that certain parts of this equipment will carry hazardous voltages. Severe injury or damage to property can occur if the appropriate measures are not taken:

- Before making any connections at all, ground the equipment at the grounding terminal.
- Hazardous voltages can be present on all switching components connected to the power supply.
- Even after the supply voltage has been disconnected, hazardous voltages can still be present in the equipment (capacitor storage).
- Equipment with current transformer circuits must not be operated while open.
- The limiting values indicated in the manual or the operating instructions must not be exceeded; this also refers to testing and commissioning.

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1 Data in the PROFINET IO Mapping

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1.1 Explanations

In Chapter 2, the maximum data scope and the pre-allocated data objects of the PROFINET IO device of the SIPROTEC devices 7SJ61, 7SJ62, and 7SJ64 are defined for the cyclic data exchange with a PROFINET IO controller. The transferred SIPROTEC objects are given in a list sorted by the data type.

The description of the standard mapping contains the pre-allocation of the mapping file at delivery or at the first assignment of a mapping in DIGSI to the SIPROTEC device.

The assignment of output relays to the switchgear and to the output channels, and the assignment of input channels to the binary inputs is defined during parameterization of the devices.

Depending on the device type and on composition and the existing protection packages, not all of the indicated output channels, binary inputs, protection indications, analog inputs (and corresponding PROFINET IO data objects) may be available in the SIPROTEC device.



NOTE

More information is available in the **SIPROTEC 4 Communication Module, PROFINET IO Communication Profile** manual, order number C53000-L1840-C360-x (see preface). In the manual you can find, among other things, the following topics:

- Data types (double-point indication, single-point indication, measured value, metered values, etc.) and the corresponding definitions
- Assigning PROFINET IO modules to SIPROTEC objects
- Reading information via acyclic data services
- Unit IDs for measured values, statistic values, and metered values
- Conversion factors for metered values
- Presetting statistic values and metered values via acyclic services
- Reading event list entries (indications with a time stamp)
- Assigning indications to a process alarm
- Parameterization in DIGSI
- Parameterization of the IO controllers

1.2 Standard Mapping

Standard mapping (standard mapping 3-1) is available for the parameterization of SIPROTEC devices 7SJ61, 7SJ62, and 7SJ64.

Standard Mapping 3-1

Standard mapping 3-1 comprises the following:

Output direction:

- 8 double commands
- 32 single commands

Input direction:

- 8 double-point indications
- 96 single-point indications
- 30 measured values
- 12 value indications
- 8 metered values

The option of transferring indications with a time stamp via an event list is possible independent of the standard mapping as a rule and it is not contained separately in the description of the standard mapping.

2 Standard Mapping 3-1

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2.1 Double Commands

In the **DIGSI Configuration Matrix**, further double commands with double-point indications as feedback can be allocated as "source system interface" to the "<user defined>" positions.

Table 2-1 Double Commands

PROFINET IO double-command number	Designation of the SIPROTEC objects	Remark	Internal object no.
1	52Breaker	52 Breaker	-
2	Disc.Swit.	Disconnect Switch	-
3	GndSwit.	Ground Switch	-
4	Q2 Op/Cl	Q2 Open/Close	-
5	Q9 Op/Cl	Q9 Open/Close	-
6	<user defined>	not pre-allocated	-
7	<user defined>	not pre-allocated	-
8	<user defined>	not pre-allocated	-

2.2 Single Commands

In the **DIGSI Configuration Matrix**, further single commands or taggings can be allocated as "source system interface" to the "<user defined>" positions.

Table 2-2 Single Commands

PROFINET IO single-command number	Designation of the SIPROTEC objects	Remark	Internal object no.
1	<user defined>	not pre-allocated	-
2	<user defined>	not pre-allocated	-
3	<user defined>	not pre-allocated	-
4	<user defined>	not pre-allocated	-
5	P-GrpA act	Activation of Setting Group A	-
6	P-GrpB act	Activation of Setting Group B	-

Table 2-2 Single Commands (Continued)

PROFINET IO single-command number	Designation of the SIPROTEC objects	Remark	Internal object no.
7	P-GrpC act	Activation of Setting Group C	-
8	P-GrpD act	Activation of Setting Group D	-
9	<user defined>	not pre-allocated	-
10	<user defined>	not pre-allocated	-
11	<user defined>	not pre-allocated	-
12	<user defined>	not pre-allocated	-
13	<user defined>	not pre-allocated	-
14	<user defined>	not pre-allocated	-
15	<user defined>	not pre-allocated	-
16	<user defined>	not pre-allocated	-
17	<user defined>	not pre-allocated	-
18	<user defined>	not pre-allocated	-
19	<user defined>	not pre-allocated	-
20	<user defined>	not pre-allocated	-
21	<user defined>	not pre-allocated	-
22	<user defined>	not pre-allocated	-
23	<user defined>	not pre-allocated	-
24	<user defined>	not pre-allocated	-
25	<user defined>	not pre-allocated	-
26	<user defined>	not pre-allocated	-
27	<user defined>	not pre-allocated	-

Table 2-2 Single Commands (Continued)

PROFINET IO single-command number	Designation of the SIPROTEC objects	Remark	Internal object no.
28	<user defined>	not pre-allocated	-
29	<user defined>	not pre-allocated	-
30	<user defined>	not pre-allocated	-
31	<user defined>	not pre-allocated	-
32	<user defined>	not pre-allocated	-

Setting Group Switching

Switching ON a setting group simultaneously switches OFF the currently active setting group.

Transmission of the **OFF** value is insignificant for the switching of the setting group and is rejected by the SIPROTEC device.

Switching the setting group via PROFINET IO is only possible if the parameter **Change to Another Setting Group** (parameter address = 0302) has the value **via Protocol**.

2.3 Double-Point Indications

In the **DIGSI Configuration Matrix**, further double-point indications (for example, feedbacks of double commands) can be allocated as "destination-system interface" to the "<user defined>" positions.

Table 2-3 Double-Point Indications

PROFINET IO double-point indication number	Designation of the SIPROTEC objects	Remark	Internal object no.
1	52Breaker	Checkback indication 52 Breaker	-
2	Disc.Swit.	Checkback indication Disconnect Switch	-
3	GndSwit.	Checkback indication Ground Switch	-
4	Q2 Op/Cl	Checkback indication Q2	-
5	Q9 Op/Cl	Checkback indication Q9	-
6	<user defined>	not pre-allocated	-

Table 2-3 Double-Point Indications (Continued)

PROFINET IO double-point indication number	Designation of the SIPROTEC objects	Remark	Internal object no.
7	<user defined>	not pre-allocated	-
8	<user defined>	not pre-allocated	-

2.4 Single-Point Indications

In the **DIGSI Configuration Matrix**, further protection indications, single-point indications, or taggings can be allocated as "destination system interface" to the "<user defined>" positions.

Table 2-4 Single-Point Indications

PROFINET IO single-point indication number	Designation of the SIPROTEC objects	Remark	Internal object no.
1	<user defined>	not pre-allocated	-
2	<user defined>	not pre-allocated	-
3	<user defined>	not pre-allocated	-
4	<user defined>	not pre-allocated	-
5	<user defined>	not pre-allocated	-
6	<user defined>	not pre-allocated	-
7	<user defined>	not pre-allocated	-
8	Device OK	1 = Update of the data image in the SIPROTEC device completed after initial start or restart	51
9	ProtActive	1 = At least one protection function is active	52
10	Settings Calc.	1 = Setting calculation is running	70
11	Error Sum Alarm	1 = Error with a summary alarm	140
12	Alarm Sum Event	1 = Alarm Summary Event	160
13	Relay PICKUP	1 = Relay PICKUP	501

Table 2-4 Single-Point Indications (Continued)

PROFINET IO single-point indication number	Designation of the SIPROTEC objects	Remark	Internal object no.
14	Relay TRIP	1 = Relay GENERAL TRIP command	511
15	50(N)/51(N) PU	1 = 50(N)/51(N) O/C PICKUP	1761
16	50(N)/51(N)TRIP	1 = 50(N)/51(N) TRIP	1791
17	<user defined>	not pre-allocated	-
18	<user defined>	not pre-allocated	-
19	<user defined>	not pre-allocated	-
20	<user defined>	not pre-allocated	-
21	<user defined>	not pre-allocated	-
22	<user defined>	not pre-allocated	-
23	<user defined>	not pre-allocated	-
24	<user defined>	not pre-allocated	-
25	<user defined>	not pre-allocated	-
26	<user defined>	not pre-allocated	-
27	<user defined>	not pre-allocated	-
28	<user defined>	not pre-allocated	-
29	P-GrpA act	1 = Setting Group A is active	-
30	P-GrpB act	1 = Setting Group B is active	-
31	P-GrpC act	1 = Setting Group C is active	-
32	P-GrpD act	1 = Setting Group D is active	-
33	<user defined>	not pre-allocated	-
34	<user defined>	not pre-allocated	-

Table 2-4 Single-Point Indications (Continued)

PROFINET IO single-point indication number	Designation of the SIPROTEC objects	Remark	Internal object no.
35	<user defined>	not pre-allocated	-
36	<user defined>	not pre-allocated	-
37	<user defined>	not pre-allocated	-
38	<user defined>	not pre-allocated	-
39	<user defined>	not pre-allocated	-
40	<user defined>	not pre-allocated	-
41	<user defined>	not pre-allocated	-
42	<user defined>	not pre-allocated	-
43	<user defined>	not pre-allocated	-
44	<user defined>	not pre-allocated	-
45	<user defined>	not pre-allocated	-
46	<user defined>	not pre-allocated	-
47	<user defined>	not pre-allocated	-
48	<user defined>	not pre-allocated	-
49	<user defined>	not pre-allocated	-
50	<user defined>	not pre-allocated	-
51	<user defined>	not pre-allocated	-
52	<user defined>	not pre-allocated	-
53	<user defined>	not pre-allocated	-
54	<user defined>	not pre-allocated	-
55	<user defined>	not pre-allocated	-

Table 2-4 Single-Point Indications (Continued)

PROFINET IO single-point indication number	Designation of the SIPROTEC objects	Remark	Internal object no.
56	<user defined>	not pre-allocated	-
57	<user defined>	not pre-allocated	-
58	<user defined>	not pre-allocated	-
59	<user defined>	not pre-allocated	-
60	<user defined>	not pre-allocated	-
61	<user defined>	not pre-allocated	-
62	<user defined>	not pre-allocated	-
63	<user defined>	not pre-allocated	-
64	<user defined>	not pre-allocated	-
65	<user defined>	not pre-allocated	-
66	<user defined>	not pre-allocated	-
67	<user defined>	not pre-allocated	-
68	<user defined>	not pre-allocated	-
69	<user defined>	not pre-allocated	-
70	<user defined>	not pre-allocated	-
71	<user defined>	not pre-allocated	-
72	<user defined>	not pre-allocated	-
73	<user defined>	not pre-allocated	-
74	<user defined>	not pre-allocated	-
75	<user defined>	not pre-allocated	-
76	<user defined>	not pre-allocated	-

Table 2-4 Single-Point Indications (Continued)

PROFINET IO single-point indication number	Designation of the SIPROTEC objects	Remark	Internal object no.
77	<user defined>	not pre-allocated	-
78	<user defined>	not pre-allocated	-
79	<user defined>	not pre-allocated	-
80	<user defined>	not pre-allocated	-
81	<user defined>	not pre-allocated	-
82	<user defined>	not pre-allocated	-
83	<user defined>	not pre-allocated	-
84	<user defined>	not pre-allocated	-
85	<user defined>	not pre-allocated	-
86	<user defined>	not pre-allocated	-
87	<user defined>	not pre-allocated	-
88	<user defined>	not pre-allocated	-
89	<user defined>	not pre-allocated	-
90	<user defined>	not pre-allocated	-
91	<user defined>	not pre-allocated	-
92	<user defined>	not pre-allocated	-
93	<user defined>	not pre-allocated	-
94	<user defined>	not pre-allocated	-
95	<user defined>	not pre-allocated	-
96	<user defined>	not pre-allocated	-

2.5 Measured Values

In the **DIGSI Configuration Matrix**, further measured values can be allocated as "destination system interface" to the "<user defined>" positions.

Table 2-5 Measured Values

PROFINET IO measured-values number	Designation of the SIPROTEC objects	Remark	Internal object no.
1	Ia =	Ia	601
2	Ib =	Ib	602
3	Ic =	Ic	603
4	In =	In	604
5	Va-b =	Va-b	624
6	Vb-c =	Vb-c	625
7	Vc-a =	Vc-a	626
8	VN =	VN	627
9	P =	P (active power)	641
10	Q =	Q (reactive power)	642
11	S =	S (apparent power)	645
12	Freq =	Frequency	644
13	PF =	Power Factor	901
14	<user defined>	not pre-allocated	-
15	<user defined>	not pre-allocated	-
16	<user defined>	not pre-allocated	-
17	<user defined>	not pre-allocated	-
18	<user defined>	not pre-allocated	-
19	<user defined>	not pre-allocated	-

Table 2-5 Measured Values (Continued)

PROFINET IO measured-values number	Designation of the SIPROTEC objects	Remark	Internal object no.
20	<user defined>	not pre-allocated	-
21	<user defined>	not pre-allocated	-
22	<user defined>	not pre-allocated	-
23	<user defined>	not pre-allocated	-
24	<user defined>	not pre-allocated	-
25	<user defined>	not pre-allocated	-
26	<user defined>	not pre-allocated	-
27	<user defined>	not pre-allocated	-
28	<user defined>	not pre-allocated	-
29	<user defined>	not pre-allocated	-
30	<user defined>	not pre-allocated	-

2.6 Statistic Values

In the **DIGSI Configuration Matrix**, further statistic values can be allocated as "destination system interface" to the "<user defined>" positions.

Table 2-6 Statistic Values

PROFINET IO statistic-values number	Designation of the SIPROTEC objects	Remark	Internal object no.
1	Ia =	Primary fault current Ia	-
2	Ib =	Primary fault current Ib	-
3	Ic =	Primary fault current Ic	-
4	Sum Ia =	Accumulation of interrupted current Ph A	1021
5	Sum Ib =	Accumulation of interrupted current Ph B	1022

Table 2-6 Statistic Values (Continued)

PROFINET IO statistic-values number	Designation of the SIPROTEC objects	Remark	Internal object no.
6	Sum Ic =	Accumulation of interrupted current Ph C	1023
7	Op.Hours =	Counter of operating hours	1020
8	<user defined>	not pre-allocated	-
9	<user defined>	not pre-allocated	-
10	<user defined>	not pre-allocated	-
11	<user defined>	not pre-allocated	-
12	<user defined>	not pre-allocated	-

2.7 Metered Values

In the **DIGSI Configuration Matrix**, further metered values can be allocated as "destination system interface" to the "<user defined>" positions.

Table 2-7 Metered Values

PROFINET IO metered-values number	Designation of the SIPROTEC objects	Remark	Internal object no.
1	WpForward	Wp Forward (metered measurand derived from measured values)	924
2	WqForward	Wq Forward (metered measurand derived from measured values)	925
3	WpReverse	Wp Reverse (metered measurand derived from measured values)	928
4	WqReverse	Wq Reverse (metered measurand derived from measured values)	929
5	Wp(puls)	Pulsed Energy Wp (active) via binary input	888
6	Wq(puls)	Pulsed Energy Wq (reactive) via binary input	889

Table 2-7 Metered Values (Continued)

PROFINET IO metered-values number	Designation of the SIPROTEC objects	Remark	Internal object no.
7	#of TRIPs =	Number of TRIPs	-
8	<user defined>	not pre-allocated	-

The scaling factor of the metered values can be determined with the following relationship or can be read via acyclic data services using PROFINET IO (see manual **SIPROTEC 4 Communication Modules, PROFINET IO Communication Profile**).

Scaling

The scaling of the metered values derived from measured values refers to the following:

$$60,000 \text{ pulses/h at } V = V_{\text{rated}} \text{ and } I = I_{\text{rated}}$$

V_{rated} = rated operating voltage of the primary installation (parameter address = 1101)

I_{rated} = rated operating current of the primary installation (parameter address = 1102)

Example

Parameterization in the parameter set is:

$$I_{\text{rated}} = 100 \text{ A and } V_{\text{rated}} = 12 \text{ kV}$$

Therefore, 60,000 pulses correspond to:

$$1 \text{ h} * 100 \text{ A} * 12 \text{ kV} * \sqrt{3} = 2078.46 \text{ kWh}$$



NOTE

- The type of restoring (cyclic, with or without deletion) and the restoring interval must be set for the metered values using the DIGSI parameterization software.
- The scaling of the metered values at a binary input (pulse counter) depends on the externally connected pulse generator.

Glossary

C

CFC	Continuous Function Chart
Client	Device in the communication network that sends data requests or commands to the server devices and receives responses from these devices

D

DAP	Device Access Point : usually in slot 0 of the IO device; interface data and port data can be read.
DC	Double command ; data type
DB	Data block (in S7 programming)
DCP	Discovery and Configuration Protocol
DHCP	Dynamic Host Configuration Protocol enables the network configuration to be assigned to the devices by a DHCP server.
DIGSI	Parameterization software for SIPROTEC 4 devices
DP	Double-point indication; data type
DST	Daylight Saving Time

E

EEPROM	Electrically Erasable Programmable Read-Only Memory ; integrated circuit in the EN100 for permanently storing the network parameters, station name and I&M data
EN100	100-Mbit Ethernet module for SIPROTEC 4 devices
Ethernet	Cable-based data network technology for local data networks

G

Gateway	Enables networks based on different protocols to communicate with each other
GOOSE	Generic Object Oriented Substation Event
GSDML	Generic Station Description as XML file

H

HTML	HyperText Markup Language
HTTP	HyperText Transfer Protocol

I		
IEC	International E lectrotechnical C ommission: standardization body; communication standard for substations and protection devices	
IED	Intelligent E lectronic D evice	
I&M	Device I dentification and M aintenance functions	
Indication CLEARED	The status of the indication changes from ON to OFF, that is the indication is deleted.	
Indication RAISING	The status of the indication changes from OFF to ON, that is the indication is currently present.	
Input direction/ Input data	Data-transmission direction from the IO device to the IO controller with the direction of data transmission always being observed from the location of the IO controller. This transmission direction is also referred to as the monitoring direction.	
IO controller	Controlling device in a PROFINET IO network	
IO device	Controlled device in a PROFINET IO network	
IO module	Module in the IO device which executes a part of or all input and output functionalities (indications, measured values, commands, etc.) of the device, including the associated parameter settings via the PROFINET IO parameterization software. An IO module can be either real hardware (hardware module for the data acquisition in a modular IO device, for example ET200S from Siemens I IA) or a virtual module. The module can be parameterized for different applications in a SIPROTEC device.	
IOCS	Input/Output C onsumer S tatus	
IOPS	Input/Output P rovider S tatus	
IP	Internet P rotocol	
IP address	Addresses in computer networks based on the Internet protocol	
L		
LLDP	Lower L ayer D iscovery P rotocol	
LSB	Least S ignificant B it	
M		
MIB	M anagement I nformation B ase: Information that can be queried or modified via the SNMP network management protocol	
MLFB	Order number	
MMS	M anufacturing M essage S pecification	
MRP	M edia R edundancy P rotocol	
MSB	M ost S ignificant B it	
N		
NaN	N ot a N umber means "invalid": result of an invalid computing operation	
NRT	N on- R eal T ime; PROFINET IO NRT processing when using UDP	
NTP	N etwork T ime P rotocol: standard for synchronizing clocks in computer systems using packet-based communication networks (see RFC5905)	

O	OB	Organization block (in S7 programming)
	OID	Object Identifier (of the data point in an SNMP MIB)
	Output direction/ Output data	Data-transmission direction from the IO controller to the IO device with the direction of data transmission always being observed from the location of the IO controller. This transmission direction is also referred to as the control direction.
P	PLC	Programmable Logic Controller
	PRP	Parallel Redundancy Protocol
R	RJ45	Ethernet plug connector
	RSTP	Rapid Spanning Tree Protocol
	RT	Real Time (PROFINET IO RT uses Ethernet EtherType 0x8892)
	RTA	Real Time Alarm (PROFINET IO alarm processing)
S	SC	Single command ; data type
	Server	Sends data upon the client's request
	SFB	System function block (in S7 programming)
	SFC	System function (in S7 programming)
	SNMP	Simple Network Management Protocol : monitors and controls network elements from a central station.
	SNTP	Simple Network Time Protocol : simplified version of the NTP
	SP	Single-point indication ; data type
Step 7	Software for programming programmable logic controllers (PLC) of the SIMATIC-S7 family of Siemens AG	
T	TCP	Transmission Control Protocol
U	UTC	Universal Time Coordinated : universal time standard referred to the time at the prime meridian
	UDP	User Datagram Protocol
V	VI	Value Indication ; DIGSI data type for statistic values

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