JUMO TYA 20X

Thyristor power controller

PROFINET interface description

70906107T92Z001K000

V1.00/EN/00702192/2019-10-07

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1.1 Warning symbols

DANGER!

This symbol indicates that **personal injury from electrocution** may occur if the appropriate precautionary measures are not taken.

WARNING!

This symbol in connection with the signal word indicates that **personal injury** may occur if the respective precautionary measures are not carried out.

CAUTION!

This symbol in connection with the signal word indicates that **material damage or data loss** will occur if the respective precautionary measures are not taken.

CAUTION!

This symbol indicates that **components could be destroyed** by electrostatic discharge (ESD = Electro Static Discharge) if the respective cautionary measures are not taken.

Only use the ESD packages intended for this purpose to return device inserts, assembly groups, or assembly components.

READ THE DOCUMENTATION!

This symbol, which is attached to the device, indicates that the associated **documentation for the device** must be **observed**. This is necessary to identify the nature of the potential hazard, and to take measures to prevent it.

1.2 Note signs

NOTE!

This symbol refers to **important information** about the product, its handling, or additional benefits.

REFERENCE!

This symbol refers to **additional information** in other sections, chapters, or other manuals.

FURTHER INFORMATION!

This symbol is used in tables and indicates that **further information** is provided after the table.

DISPOSAL!

At the end of its service life, the device and any batteries present do not belong in the trash! Please ensure that they are **disposed of** properly and in an **environmentally friendly** manner.

1 Safety information

2 Compatibility and system requirements

2.1 Certification

JUMO IO devices are certified by the PNO to Conformance Class C (abbreviated to CC-C) and net load class "Netload Class III".

2.2 PROFINET IO and Ethernet standard services

The PROFINET IO communication occurs in a parameterizable time pattern (RT channel). This ensures that the IO data are transferred in real-time without being affected by Ethernet standard services. The remaining time between the RT phases (NRT channel) is used for the communication between the Ethernet standard services. Broadband bottlenecks impair the performance of the standard services. The real-time capability of the PROFINET IO communication is guaranteed by the reserved RT channel.

2.3 Requirements for hardware, software, and cabling

Network installation

Any switches used to network PROFINET IO devices must support the following standards and functions:

- 100 Mbit/s (transfer rate of the switchports)
- Auto negotiation (automatic setting of the switchport transfer rate)
- Cut through (direct relaying of the data between the switchports)

  Full duplex support for the switchports

  IEEE 802.1 Q (VLAN support for at least 4 priority classes)

The network installation must be executed compliant with the requirements of a 100Base TX Ethernet network with cabling to CLASS D or higher. The "PROFINET Cabling and Interconnection Technology" guideline also provides information on correct cabling.

JUMO TYA (S)20X

To use PROFINET IO with the TYA 20X, the device must meet the following minimum requirements:

- Device software version 256.04.03 or higher

The information can be displayed and reviewed with the aid of the device menu.

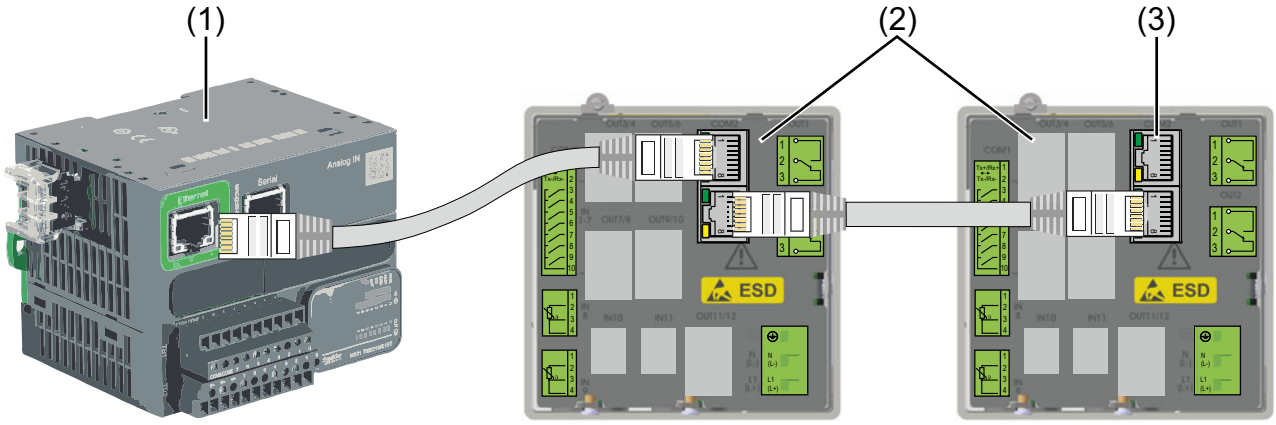
Open device software version:

Device menu >Device info

2 Compatibility and system requirements

Cabling

JUMO field devices with PROFINET IO interface have two Ethernet switchports. Additional field devices, IO controllers, an IO supervisor (programming device and/or PC for project planning) or other Ethernet components such as switches, routers etc. can be connected to each Ethernet switchport on the device.



(1) PROFINET IO controller (PLC, control station PC or similar)
(2) JUMO PROFINET IO devices
(3) free Ethernet port (e.g. for additional PROFINET IO devices)

NOTE!

The cyclical data exchange with JUMO PROFINET IO devices is based on the RT/IRT protocol (Conformance Class B/C). PROFINET RT/IRT communication cannot be routed. It is thus necessary that the PROFINET IO controller and the IO devices be in a common broadcast domain (not connected via a router).

3 Electrical connection

4.1 General information

The GSDML file of a PROFINET device contains all the information required to provide your PLC engineering system with the PROFINET IO functionality of the JUMO TYA 20X. It must be imported into the engineering system so that the JUMO TYA 20X is available here for project planning. Once the GSDML file has been imported, the relevant device and its IO functions can be integrated into the programming system of your PLC projects.

4.2 Module description

4.2.1 Introduction to the module concept

The configuration of the JUMO field device IO data to be transferred via the PROFINET IO is defined by the PROFINET modules of the device software.

The "Primary data of the master" module has a defined configuration and cannot be changed. It contains a range of cyclical IO data on the device status and the PROFINET start-up parameters of the TYA 20X. In the project structure of the IO controller, this module is always located in Slot 1 of JUMO IO devices. It cannot be relocated or removed.

All other modules also have a fixed configuration and can be selected as an optional extra in the PLC.

4.2.2 Modules

CAUTION!

All temperature values of the JUMO IO device are transferred in the unit "°C".

Misinterpretation of measured values of a JUMO IO device in the IO controller can cause errors in the system control.

▶ Note the unit for the transferred temperature values!

"Primary data of the master" module of the TYA (S)20X

The "Primary data of the master" module has a defined configuration and cannot be changed. It contains a range of cyclical IO data on the device status and the PROFINET start-up parameters of the TYA (S)20X. In the project structure of the IO controller, this module is always located in Slot 1 of JUMO IO devices. It cannot be relocated or removed.

The following tables list the data in the "Primary data of the master" module of the TYA (S)20X.
The GSDML file can be downloaded from: qr-sw-709061-gsdml-de.jumo.info

Primary data of the master

IO item	Type	Bit item	Bit address	Explanation
Submodule 1: Input data				
Load voltage	REAL			
Load current	REAL			
Power	REAL			
Load resistance	REAL			
Binary signals 1a	USINT	Bit 0: Inhibit input	0	
		Bit 1: digital input 1	1	
		Bit 2: digital input 2	2	
		Bit 3: External inhibit input	3	
		Bit 4: External digital input 1	4	
		Bit 5: External digital input 2	5	
		Bit 6: Digital output	6	
		Bit 7: Inhibit	7	
Binary signals 1b	USINT	Bit 0: Inhibit of slave/slave 1	0	
		Bit 1: Soft start still running	1	
		Bit 2: Current limiting is active	2	
		Bit 3: The external switchover to phase-angle control is active	3	
		Bit 4: The external current limit value is being used	4	
		Bit 5: The display circuit board has been connected	5	
		Bit 6: The power controller is currently being reconfigured	6	
		Bit 7: The power controller is operating in test and calibration mode	7	
Binary signals 2a	USINT	Bit 0: The power controller is operating in manual mode	0	
		Bit 1: The keypad has been locked	1	
		Bit 2: The display has been switched off	2	
		Bit 3: The power controller has been connected to the mains voltage	3	
		Bit 4: The slave/slave 1 has been connected to the mains voltage	4	
		Bit 5: The rotary field detection has been successfully completed	5	
		Bit 6: Resistance limitation is active	6	
		Bit 7: The external switchover of the setpoint specification is active	7	
Binary signals 2b	USINT	Bit 0: Slave 2 has been connected to the mains voltage	0	
		Bit 1: Inhibit of slave 2	1	
		Bit 2: Reserved	2	
		Bit 3: Reserved	3	
		Bit 4: Reserved	4	
		Bit 5: Reserved	5	
		Bit 6: Reserved	6	
		Bit 7: Reserved	7	

Primary data of the master

IO item	Type	Bit item	Bit address	Explanation
Interference signals 1a	USINT	Bit 0: Min. alarm	0	
		Bit 1: Max. alarm	1	
		Bit 2: Load error	2	
		Bit 3: The Teach-In for load monitoring is missing	3	
		Bit 4: Fuse failure	4	
		Bit 5: Thyristor failure	5	
		Bit 6: Thyristor short circuit	6	
		Bit 7: Limited power due to excess temperature	7	
Interference signals 1b	USINT	Bit 0: Excess temperature	0	
		Bit 1: Mains voltage too low	1	
		Bit 2: Mains voltage too high	2	
		Bit 3: Temporary drop in mains voltage	3	
		Bit 4: Wire break at current input	4	
		Bit 5: Wire break at voltage input	5	
		Bit 6: Bus error	6	
		Bit 7: Reserved	7	

Primary data of the master

IO item	Type	Bit item	Bit address	Explanation
Submodule 1: Output data				
Input setpoint value	REAL			
Binary signals 1a	USINT	Bit 0: External inhibit input	0	
		Bit 1: External digital input 1	1	
		Bit 2: External digital input 2	2	
		Bit 3: Digital output	3	
		Bit 4: Reserved	4	
		Bit 5: Reserved	5	
		Bit 6: Reserved	6	
		Bit 7: Reserved	7	
Binary signals 1b	USINT	Bit 0: Reserved	0	
		Bit 1: Reserved	1	
		Bit 2: Reserved	2	
		Bit 3: Reserved	3	
		Bit 4: Reserved	4	
		Bit 5: Reserved	5	
		Bit 6: Reserved	6	
		Bit 7: Reserved	7	

Start-up parameters for primary data of the master

Parameter	Type	Values	Explanation
Byte sequence for cyclical data	Bit	0 (Big Endian) 1 (Little Endian)	Selection of byte sequence for transferred cyclical data The byte sequence to be set is specified by the IO controller.
Byte sequence for noncyclical data	Bit	0 (Big Endian) 1 (Little Endian)	Selection of byte sequence for transferred noncyclical data The byte sequence to be set is specified by the IO controller.
IOPS handling	Bit	0 (OFF) 1 (ON)	Handling of the IOPS status via the IO device **0 (OFF):** The IOPS status of the respective IO device slot communicates to the IO controller the validity status of the input values following successful system boot. If the IOPS status is valid, all values of the slot are valid. If at least 1 invalid input value occurs in the slot concerned, the IOPS status is likewise set to invalid. **1 (ON):** The IOPS status of the relevant IO device slot is valid following successful system boot and no longer depends on the validity of the input data. The validity check of the input values must be implemented in the IO controller if necessary. In case of invalid float values (REAL type), JUMO field devices map an error code in the transferred input values, i.e. the error number rather than the input value is contained. ⇨ chapter 7.1 "Error messages for invalid values", Page 41

"Secondary data of the master" module of the TYA (S)20X

The "Secondary data of the master" module has a defined configuration and cannot be changed. In the project structure of the IO controller, this module is always located in Slot 2 (optional extra) of JUMO IO devices. It cannot be relocated.

The following tables list the data in the "Secondary data of the master" module of the TYA (S)20X.

Secondary data of the master

IO item	Type	Bit item	Bit address	Explanation
Submodule 1: Input data				
Actual value (in %)	REAL			
Effective setpoint value (in %)	REAL			
Output level (in %)	REAL			
Alpha (in °)	REAL			
Mains voltage (in V)	REAL			

Secondary data of the master

IO item	Type	Bit item	Bit address	Explanation
Mains frequency (in Hz)	REAL			
Device temperature (in °C)	REAL			
Current input (in mA)	REAL			
Voltage input (in V)	REAL			

Primary data of the master

IO item	Type	Bit item	Bit address	Explanation
Submodule 1: Output data				
Alpha value (in °)	REAL			

"Data of the first slave" module of the TYA (S)20X

The "Data of the first slave" module has a defined configuration and cannot be changed. In the project structure of the IO controller, this module is always located in Slot 3 (optional extra) of JUMO IO devices. It cannot be relocated.

The following tables list the data in the "Data of the first slave" module of the TYA (S)20X.

Data of the first slave

IO item	Type	Bit item	Bit address	Explanation
Submodule 1: Input data				
Three-phase power	REAL			
Load voltage for slave 1	REAL			
Load current for slave 1	REAL			
Power for slave 1	REAL			
Load resistance for slave 1	REAL			
Mains voltage for slave 1	REAL			
Device temperature for slave 1	REAL			
Interference signals 2a	USINT	Bit 0: Min. alarm for slave 1	0	
		Bit 1: Max. alarm for slave 1	1	
		Bit 2: Load error for slave 1	2	
		Bit 3: Fuse failure for slave 1	3	
		Bit 4: Thyristor failure for slave 1	4	
		Bit 5: Thyristor short circuit for slave 1	5	
		Bit 6: Limited power due to excess temperature in slave 1	6	
		Bit 7: Excess temperature for slave 1	7	

Data of the first slave

IO item	Type	Bit item	Bit address	Explanation
Interference signals 2b	USINT	Bit 0: Mains voltage at slave 1 too low	0	
		Bit 1: Mains voltage at slave 1 too high	1	
		Bit 2: Temporary drop in mains voltage at slave 1	2	
		Bit 3: Reserved	3	
		Bit 4: Reserved	4	
		Bit 5: Energy meter incorrectly configured	5	
		Bit 6: Reserved	6	
		Bit 7: Reserved	7	
Interference signals 3a	USINT	Bit 0: Master–slave synchronization has failed	0	
		Bit 1: Error during master–slave communication	1	
		Bit 2: Error in data cable between master and slave	2	
		Bit 3: The rotary field detection has failed	3	
		Bit 4: Rotary field error	4	
		Bit 5: Wiring error	5	
		Bit 6: The/one of the slave power controller(s) is incompatible	6	
		Bit 7: Adjustment not possible	7	
Interference signals 3b	USINT	Bit 0: Reserved		
		Bit 1: Reserved		
		Bit 2: Reserved		
		Bit 3: Reserved		
		Bit 4: Reserved		
		Bit 5: Reserved		
		Bit 6: Reserved		
		Bit 7: Reserved		

"Data of the second slave" module of the TYA (S)20X

The "Data of the second slave" module has a defined configuration and cannot be changed. In the project structure of the IO controller, this module is always located in Slot 4 (optional extra) of JUMO IO devices. It cannot be relocated.

The following tables list the data in the "Data of the second slave" module of the TYA (S)20X.

Data of the second slave

IO item	Type	Bit item	Bit address	Explanation
Submodule 1: Input data				
Load voltage for slave 2	REAL			
Load current for slave 2	REAL			
Power for slave 2	REAL			
Load resistance for slave 2	REAL			
Mains voltage for slave 2	REAL			
Device temperature for slave 2	REAL			

Data of the second slave

IO item	Type	Bit item	Bit address	Explanation
Interference signals 4a	USINT	Bit 0: Min. alarm for slave 2	0	
		Bit 1: Max. alarm for slave 2	1	
		Bit 2: Load error for slave 2	2	
		Bit 3: Fuse failure for slave 2	3	
		Bit 4: Thyristor failure for slave 2	4	
		Bit 5: Thyristor short circuit for slave 2	5	
		Bit 6: Limited power due to excess temperature in slave 2	6	
		Bit 7: Excess temperature for slave 2	7	
Interference signals 4b	USINT	Bit 0: Mains voltage at slave 2 too low	0	
		Bit 1: Mains voltage at slave 2 too high	1	
		Bit 2: Temporary drop in mains voltage at slave 2	2	
		Bit 3: Reserved	3	
		Bit 4: Reserved	4	
		Bit 5: Reserved	5	
		Bit 6: Reserved	6	
		Bit 7: Reserved	7	

4 The GSDML file

CAUTION!

All temperature values of the JUMO IO device are transferred in the unit "°C".

Misinterpretation of measured values of a JUMO IO device in the IO controller can cause errors in the system control.

▶ Note the unit for the transferred temperature values!

5.1 Programming the noncyclical data exchange in the IO controller

In addition to the cyclical data exchange between IO controller and IO device in the RT channel, PROFINET IO also offers the option of event-controlled noncyclical data exchange. The noncyclical communication is controlled by the IO controller (similar to the master-slave principle) via write/read requests and has to be implemented by the user. Noncyclical data are provisioned by PROFINET IO users as "Record Data". The transfer occurs in the NRT channel.

For the programming of write/read requests, the engineering systems of the various manufacturers contain libraries with relevant function blocks such as "RDREC" (Read Record) and "WRREC" (Write Record).

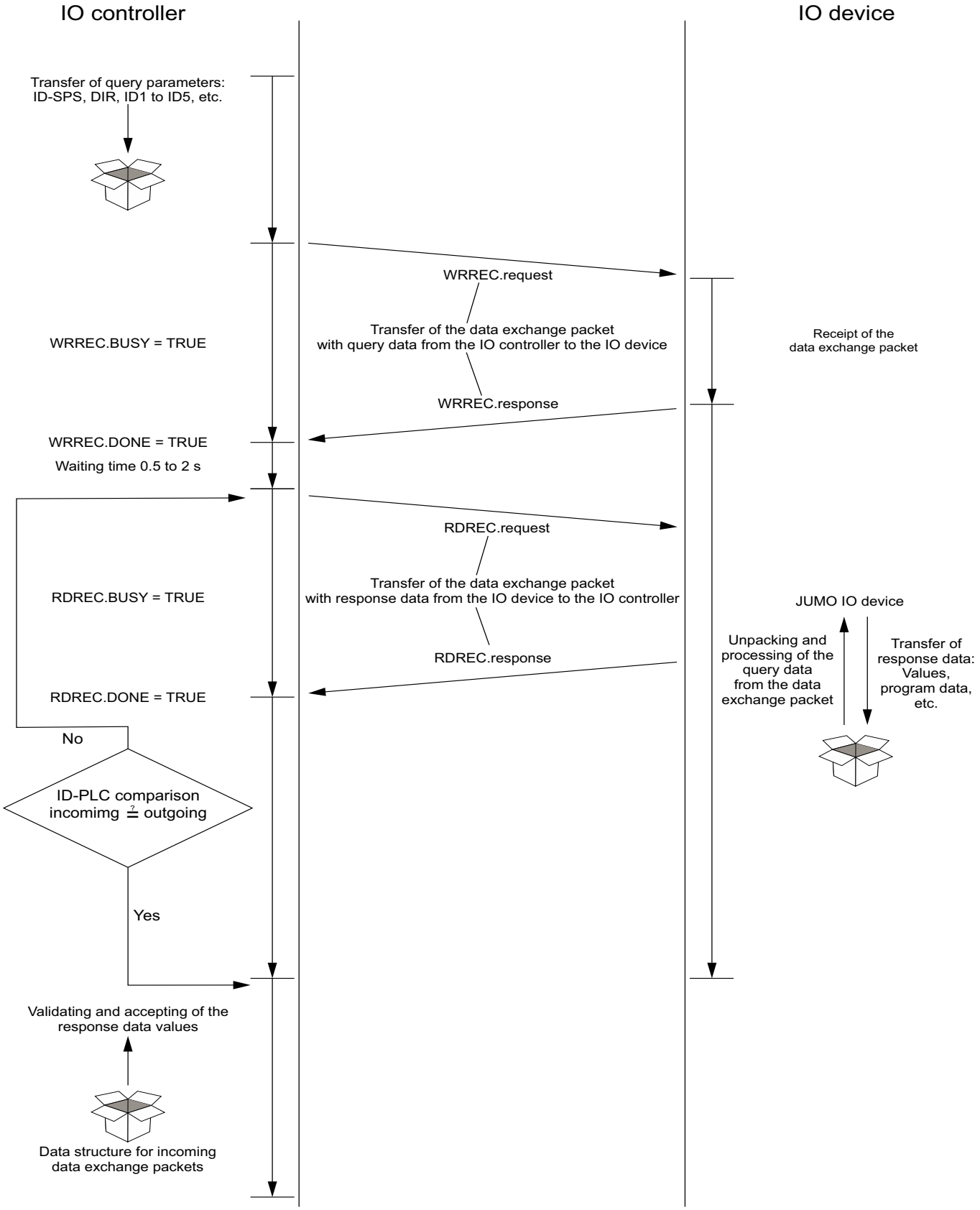
With JUMO PROFINET IO devices, the write/read requests do not access the "Record Data" directly. Instead, they transfer data exchange packets between IO controller and IO device, which are further processed in the background by the field devices. For an IO controller to be able to exchange noncyclical data with a JUMO IO device, appropriate data structures (data blocks/data type objects) have to be created in the IO controller for the data exchange packet concerned. These data structures provide the memory for the outgoing and incoming data exchange packets. Data exchange packets are identified by an index, which has to be transferred to the write/read function blocks in the form of parameters. JUMO TYA (S)20X IO devices have 2 indices for 2 different types of data exchange packets, which are transferred via the write/read commands. The table below lists the available indices of the TYA (S)20X.

Index	Data exchange packet	Explanation
201	Single-ID	For the write and read transfer of single noncyclical data points with a length of up to 4 bytes (in the case of the TYA 20X) within a data exchange sequence Length of the data exchange packet: 65 bytes
202	Multi-ID	For the write and read transfer of multiple noncyclical data points within a data exchange sequence; the single data points are allowed to be up to 4 bytes long (in the case of the TYA 20X). Length of the data exchange packet: 65 bytes (in the case of the TYA 20X)

Within a data exchange sequence, the IO controller transfers a data exchange packet to the IO device. The IO device processes the data exchange packet and re-provisions it for pick-up by the IO controller (response with data or status messages). In order to control processing by the IO device (e.g. defining the data direction and selection of noncyclical data), the data exchange packet must be parameterized accordingly.

With JUMO IO devices, the noncyclical services are always assigned to Slot 1. In JUMO IO devices, Slot 1 is always pre-configured. Consequently, the noncyclical services are not dependent upon the module configuration or project planning in the IO controller, and are available as soon as the system has successfully booted.

Sequence of a WRREC-RDREC cycle for transferring data exchange packets



5.1.1 Single-ID and Multi-ID

To implement the exchange of single (Single-ID) or multiple (Multi-ID) noncyclical data points, you must take the following actions:

- Declare 1 data structure each for both the outgoing and the incoming direction. Select the "Single-ID" format to transfer 1 data point within a data exchange sequence. Select the "Multi-ID" format to transfer up to 4 data points within a data exchange sequence.
- Program a sequence control for the data exchange sequence.

The procedure is described below.

Declaration of a data structure in the "Single-ID" format

In the IO controller, you need to declare 1 data structure each (user-defined "STRUCT variable") for incoming and outgoing data exchange packets as the target and source memory for data exchange packets. Data exchange packets in the "Single-ID" format have a fixed length of 65 bytes and must be created with the following structure:

Structure variable for data exchange packets in the "Single-ID" format

Data type	Name	Explanation
BYTE	ID-PLC	Sequential numbering for assigning the data exchange packets from queries and responses The "ID-PLC" value can be used by the IO controller for sequentially numbering the outgoing data exchange packets. JUMO IO devices enter the same number in the ID-PLC in the data exchange packet of the ensuing response, so that response and query can be assigned at the IO controller, or so that an error in the sequence of query and response can be intercepted by suitable control structures in the IO controller.
BYTE	**Outgoing:** DIR **Incoming:** ERROR	**With the data structure for outgoing data exchange packets:** „DIR“ ist die Data direction for transferring noncyclical data. The data direction must be specified by the PLC programmer in the data exchange packet of the query from the IO controller, and then controls the processing of data in the JUMO IO device. Coding: Value = 1: Write (from IO controller to IO device) Value = 2: Read (from IO device to IO controller) **With the data structure for incoming data exchange packets:** The JUMO IO device enters the value "1", for example, into "ERROR" if an invalid ID was indicated in the query data (outgoing data exchange packet). In the IO controller, "ERROR" can be evaluated via a corresponding control structure. Applicable to all JUMO devices: ⇨ chapter 7.2 "Error message for noncyclical services", Page 41)
WORD	ID1	5-element ID of the data point from the noncyclical data table (see chapter 5.2 "Data tables of noncyclical data", Page 27)
WORD	ID2	
WORD	ID3	
WORD	ID4	
WORD	ID5	
ARRAY[53 bytes] (e.g. REAL, INT, BYTE)	VALUE	Data point to be queried or overwritten of the noncyclical data with a length of 53 bytes; however, only a maximum of 4 bytes are currently used. Value to be read/written of the data point; this variable can be declared as any data type with a length of 4 bytes.

Declaration of a data structure in the "Multi-ID" format

In the IO controller, you need to declare 1 data structure each (user-defined "STRUCT variable") for incoming and outgoing data exchange packets as the target and source memory for incoming/outgoing data exchange packets. Data exchange packets in the "Multi-ID" format have a fixed length of 65 bytes and must be created with the following structure:

Structure variable for data exchange packets in the "Multi-ID" format

Data type	Name	Explanation
BYTE	ID-PLC	Sequential numbering for assigning the data exchange packets from queries and responses The "ID-PLC" value must be used by the IO controller for sequentially numbering the outgoing data exchange packets. JUMO IO devices enter the same number in the ID-PLC in the data exchange packet of the ensuing response, so that response and query can be assigned at the IO controller, or so that an error in the sequence of query and response can be intercepted by suitable control structures in the IO controller.

Structure variable for data exchange packets in the "Multi-ID" format

<table>
<tr><th>Data type</th><th>Name</th><th colspan="2">Explanation</th></tr>
<tr><td>BYTE</td><td>DIR_1[a]</td><td rowspan="8">Query/response data for data point 1</td><td rowspan="17">Data for transferring up to 4 data points of noncyclical data; the following variables are declared for each data point:
DIR: Data direction for transferring the respective data point;
The data direction of each data point must be specified by the PLC programmer in the data exchange packet of the query from the IO controller. The "DIR" variables control the processing of the single data points in the JUMO IO device accordingly.
Coding:
Value = 1: Write (from IO controller to IO device)
Value = 2: Read (from IO device to IO controller)

ERROR:
The JUMO IO device enters the value "1", for example, into "ERROR" if an invalid ID was indicated in the query data (outgoing data exchange packet). In the IO controller, "ERROR" can be evaluated via a corresponding control structure.
Applicable to all JUMO devices:
⇨ chapter 7 "Error messages", Page 41
ID1 to ID5: 5-element ID of the respective data point from the noncyclical data table
⇨ chapter 5.2 "Data tables of noncyclical data", Page 27
VALUE: Value to be read/written of the respective data point; this variable must always be declared as a basic data type with a length of 32 bits. If the query aims at an IO device data type with 16 or 8 bits, only the corresponding lower-value bytes are relevant. The higher-value bytes are to be considered pure fill bits.</td></tr>
<tr><td>BYTE</td><td>ERROR_1</td></tr>
<tr><td>WORD</td><td>ID1_1</td></tr>
<tr><td>WORD</td><td>ID2_1</td></tr>
<tr><td>WORD</td><td>ID3_1</td></tr>
<tr><td>WORD</td><td>ID4_1</td></tr>
<tr><td>WORD</td><td>ID5_1</td></tr>
<tr><td>Any basic data type with a length of 32 bits</td><td>VALUE_1</td></tr>
<tr><td>.
.
.</td><td>.
.
.</td><td>Query/response data for data points 2 and 3 with identical structure</td></tr>
<tr><td>BYTE</td><td>DIR_32</td><td rowspan="8">Query/response data for data point 4</td></tr>
<tr><td>BYTE</td><td>ERROR_32</td></tr>
<tr><td>WORD</td><td>ID1_32</td></tr>
<tr><td>WORD</td><td>ID2_32</td></tr>
<tr><td>WORD</td><td>ID3_32</td></tr>
<tr><td>WORD</td><td>ID4_32</td></tr>
<tr><td>WORD</td><td>ID5_32</td></tr>
<tr><td>Any basic data type with a length of 32 bits</td><td>VALUE_32</td></tr>
</table>

[a] In the "Multi-ID" format, all variables are declared and also transferred for 4 data points.

CAUTION!

The data exchange packets have a predefined format.

If the data structures are not filled with fill bytes to the correct length, errors can occur during the data exchange.

▶ Be sure to respect the data structure defined above (data types, sequence of the variables and total length, including fill bytes) when declaring the data structures for data exchange packets.

Data exchange sequence for data exchange packets in the "Single-ID" and "Multi-ID" formats

With JUMO IO devices, the noncyclical data are not directly accessed via the "WRREC" and "RDREC" PROFINET IO function blocks. Instead, data exchange packets that are processed by the IO device are transferred. The IO controller has to write a data exchange packet with query data to the JUMO IO device (WRREC). JUMO IO devices accept the data from the data exchange packet and then prepare this packet with response data for the IO controller. The IO controller must pick up this data exchange packet with response data again (RDREC). The data exchange packets in the "Single-ID" format can be used to transfer single data points within a data exchange sequence. The "Multi-ID" format can be used to transfer up to 4 data points within a data exchange sequence. This requires a suitable sequence control to be implemented in the IO controller. The sequence control of a data exchange sequence in the "Single-ID" and "Multi-ID" formats can be designed as follows:

Sequence control of a data exchange sequence for single-ID data exchange packets

1. **Parameterize data structure for outgoing data exchange packets with query data:** To be able to correctly control the processing of the query in the JUMO IO device, the "ID-PLC" count variable is incremented. It can be used to check the affiliation of query and response data. In the "DIR" variable, the transfer direction (write/read) for the single data points must be defined (see description of the data structures for the "Single-ID" and "Multi-ID" formats above). The 5-element IDs of the respective data points to be written to/read in the JUMO IO device are entered into fields ID1 to ID5 (see chapter 5.2 "Data tables of noncyclical data", Page 27). For write data exchange sequences (IO controller sends data points to IO device), the values to be transferred must be entered into the "VALUE" variables. For queries in "Multi-ID" format, the number of data points to be transferred must be entered into the "NUMBER" variable. The first of the indicated number of corresponding data points are read/written. The subsequent data points are not processed by the JUMO IO device.
2. **Transfer the data exchange packet to the IO device:** The data exchange packet must now be transferred to the IO device. This is done by calling up the write function (WRREC) in the IO controller. The parameters that have to be transferred at call-up appear in the table at the end of this section.
3. **Wait for the successfully completed transfer of the outgoing data exchange packet:** The JUMO IO device acknowledges the "Write Request" of the IO controller following successful transfer (Write Response). "WRREC.DONE", "WRREC.BUSY", "WRREC.ERROR" and "WRREC.STATUS" can be evaluated to be able to query the status of the transfer. The JUMO IO device reports back WRREC.DONE = TRUE to the IO controller to signal successful receipt of the data exchange packet. The JUMO IO device starts to process the transferred query data. At this point, the IO controller should respect a waiting period of 0.5 to 2 seconds before continuing with the next steps in the data exchange sequence.
4. **Pick-up of the data exchange packet with response data from the IO device:** The IO controller must pick-up data exchange packets from the device in cycles and check their validity as response data by means of "ID-PLC" (polling). If the values of outgoing and incoming "ID-PLC" match, valid response data have been read from the JUMO IO device. The IO controller can then end the polling process and accept the response data from the data structure of the incoming data exchange packets.
   a) **Polling:** The IO controller has to pick-up, via cyclical read accesses (RDREC), data exchange packets from the JUMO IO device, place them in the data structure for incoming data exchange packets and compare the "ID-PLC" variables in the data structures for outgoing and incoming data exchange packets with one another (polling). Unless the outgoing and incoming values of "ID-PLC" are identical, processing in the JUMO IO device is still ongoing and the IO controller must continue with the polling process. If the values of outgoing and incoming "ID-PLC" match, the IO controller has received valid response data from the JUMO IO device and polling can be ended.

      In order to query the status of the individual RDREC transfers within the poll cycles, "RDREC.VALID", "RDREC.BUSY", "RDREC.ERROR" and "RDREC.STATUS" can be evaluated. When RDREC.VALID = TRUE, the data exchange packet has been successfully received and transferred to the data structure for incoming data exchange packets. Following the successful transfer of a data exchange packet, outgoing and incoming "ID-PLC" must be compared and

a decision made as to whether a further poll cycle is required ("ID-PLC" different) or valid response data were received ("ID-PLC" identical). The parameters that need to be transferred at cyclical call-ups of RDREC appear in the table at the end of this section.

b) **Acceptance of response data:** As soon as a data exchange packet is received from the JUMO IO device and the values for "ID-PLC" in the data structures for outgoing and incoming data exchange packets are identical, the data structure for incoming data exchange packets contains the valid response data from the JUMO IO device. The data have to be copied from here to the target before they are overwritten by another read request.

Parameterizing function blocks WRREC/RDREC

Input parameters for WRREC/ RDREC	**Transfer values**	
	Single-ID	**Multi-ID**
LEN (Length of the data to be written for WRREC in bytes)	65	65
MLEN (Maximum length of the data to be read for RDREC in bytes)		
ID (Hardware detection of slots/subslots to be addressed on the IO device)	Hardware detection of Slot 1 on JUMO IO devices (DeviceStatusBlock)	
INDEX (Index of the target range for data exchange packets of JUMO IO devices)	201	202
RECORD (Pointer on data points to be read/ written; with JUMO IO devices, data structures for incoming and outgoing data exchange packets are transferred.)	for WRREC: Pointer on the data structure for **outgoing** data exchange packets for RDREC: Pointer on the data structure for **incoming** data exchange packets	

5.2 Data tables of noncyclical data

CAUTION!

All temperature values of the JUMO IO device are transferred in the unit "°C".

Misinterpretation of measured values of a JUMO IO device in the IO controller can cause errors in the system control.

▶ Note the unit for the transferred temperature values!

5.2.1 Device data

JUMO ID	Name	Data type	Value range	Default setting
2.1.0.0.0	Language assistant	USINT	0: No 1: Yes	1
2.1.0.1.0	Language	USINT	0: German 1: English 2: French 3: 4th language	0
2.1.0.2.0	Temperature unit	USINT	0: °C 1: °F	0
2.1.0.3.0	Switch off display	UINT	0 to 1440 min	0
2.1.0.4.0	Code manual mode	UINT	0 to 9999	0
2.1.0.5.0	Code operation level	UINT	0 to 9999	0
2.1.0.6.0	Code configuration level	UINT	0 to 9999	0

5.2.2 Power controller

JUMO ID	Name	Data type	Value range	Default setting
2.2.0.0.0	Mains switching variant	USINT	0: Single-phase m 1: Free-run.eco.cir 2: Eco.Circ. Master 3: Eco.Circ. Slave 4: 3-phase master 5: 3-phase slave 1 6: 3-phase slave 2	Depends on device type
2.2.0.1.0	Three-phase load wiring	USINT	0: Y without N-wire 1: Y with N-wire 2: Delta connection 3: Open delta conn.	0
2.2.0.2.0	Thyristor control	USINT	0: Contin.(contr.) 1: Logic (switch)	0
2.2.0.3.0	Operating mode	USINT	0: Burst firing 1: Phase angle 2: Half-wave contr.	0
2.2.0.4.0	Cycle time	USINT	0: fixed (500 ms) 1: as fast as poss.	0

JUMO ID	Name	Data type	Value range	Default setting
2.2.0.5.0	Min switch on duration	USINT	0: none 1: 3 sine movements	0
2.2.0.6.0	Alpha start	USINT	0: No 1: Yes	0
2.2.0.7.0	Angle alpha start	UINT	0 to 90 degrees	75
2.2.0.8.0	Soft start	USINT	0: No 1: Yes	0
2.2.0.9.0	Soft start type	USINT	0: With phase angle 1: W. burst firing	0
2.2.0.10.0	Soft start duration	UINT	1 to 65535	1
2.2.0.11.0	Current limiting	USINT	0: No 1: Yes	0
2.2.0.12.0	Current limit value	REAL	0 to 275	Depends on device type
2.2.0.13.0	Resistance limiting	USINT	0: No 1: Yes	0
2.2.0.14.0	Resistance limit value	REAL	0 to 999.99	999.99
2.2.0.15.0	Load type	USINT	0: Resistive load 1: Transformer load	0
2.2.0.16.0	Dual energy management	USINT	0: off 1: Device1 2: Device2	0
2.2.0.17.0	Subordinated control	USINT	0: none 1: U^2 2: U 3: I^2 4: I 5: P	1

5.2.3 Analog input

JUMO ID	Name	Data type	Value range	Default setting
2.3.0.0.0	Current measuring range	USINT	0: switched off (don’t use) 1: 0 to 20 mA 2: 4 to 20 mA 3: 0 to 10 V (don’t use) 4: 2 to 10 V (don’t use) 5: 0 to 5 V (don’t use) 6: 1 to 5 V (don’t use) 7: Customer spec.	1
2.3.0.1.0	Current range start	REAL	0 to 20 mA	0
2.3.0.2.0	Current range end	REAL	0 to 20 mA	20

JUMO ID	Name	Data type	Value range	Default setting
2.3.0.3.0	Voltage measuring range	USINT	0: switched off (don't use) 1: 0 to 20 mA (don't use) 2: 4 to 20 mA (don't use) 3: 0 to 10 V 4: 2 to 10 V 5: 0 to 5 V 6: 1 to 5 V 7: Customer spec.	3
2.3.0.4.0	Voltage range start	REAL	0 to 10 V	0
2.3.0.5.0	Voltage range end	REAL	0 to 10 V	10

5.2.4 Setpoint value configuration

JUMO ID	Name	Datentyp	Wertebereich	Werk-sein-stellung
2.4.0.0.0	Setpoint input	USINT	0: No default value (don't use) 1: Last value (don't use) 2: Current input 3: Voltage input 4: Value adjustable (don't use) 5: Via interface 6: Binary input 1 7: Binary input 2	2
2.4.0.1.0	Alpha input	USINT	0: No default value 1: Last value (don't use) 2: Current input 3: Voltage input 4: Value adjustable 5: Via interface 6: Binary input 1 (don't use) 7: Binary input 2 (don't use)	0
2.4.0.2.0	Alpha default value	UINT	0...180 Degrees	0
2.4.0.3.0	Input during error	USINT	0: No default value (don't use) 1: Load value 2: Current input 3: Voltage input 4: Value adjustable 5: Via interface (don't use) 6: Binary input 1 (don't use) 7: Binary input 2 (don't use)	4
2.4.0.4.0	Input value during error	REAL	0...115 %[a]	0
2.4.0.5.0	Maximum SCR output value	REAL	0...115 %[b]	100
2.4.0.6.0	Basic load	REAL	0...100 %[c]	0

[a] Anders als bei der Konfiguration im Setup-Programm oder über Tastatur direkt am Steller kann man hier den Wert nicht in Volt, Ampere oder Watt eingeben (in Abhängigkeit von der eingestellten Unterlagerten Regelung), sondern man muss ihn in Prozent umrechnen. 100% entspricht der Nennwert des Stellers.

[b] Anders als bei der Konfiguration im Setup-Programm oder über Tastatur direkt am Steller kann man hier den Wert nicht in Volt, Ampere oder Watt eingeben (in Abhängigkeit von der eingestellten Unterlagerten Regelung), sondern man muss ihn in Prozent umrechnen. 100% entspricht der Nennwert des Stellers.

[c] Anders als bei der Konfiguration im Setup-Programm oder über Tastatur direkt am Steller kann man hier den Wert nicht in Volt, Ampere oder Watt eingeben (in Abhängigkeit von der eingestellten Unterlagerten Regelung), sondern man muss ihn in Prozent umrechnen. 100% entspricht der Nennwert des Stellers.

Beispiel: Bei einem Steller mit 230 V Nennspannung wird der Sollwert über den Stromeingang 4...20 mA vorgegeben und es wird U^2 geregelt. Bei einem Eingangssignal von 20 mA soll der Steller aber nur eine Lastspannung von 200 V ausgeben. Der Quadratwert von 200 V (40000 V^2) entspricht 75,6 % vom Quadratwert der Nennspannung 230 V (52900 V^2). Also wird 75,6 % als Max. Stellgröße konfiguriert.

5.2.5 Monitoring

JUMO ID	Name	Data type	Value range	Default setting
2.5.0.0.0	Limit value monitoring	USINT	0: Switched off 1: Load voltage 2: Load voltage^2 (don't use) 3: Load current 4: Load current^2 (don't use) 5: Power [W] 6: Power [kW] 7: Load resistance 8: Mains voltage 9: Device temperat. 10: Setpoint (don't use) 11: From interface (don't use)	0
2.5.0.1.0	Min alarm limit value	REAL	0 to 9999	0
2.5.0.2.0	Max alarm limit value	REAL	0 to 9999	9999
2.5.0.3.0	Hysteresis limit value	REAL	0 to 9999	1
2.5.0.4.0	Load monitoring	USINT	0: No load monit 1: Under-current 2: Over-current	0
2.5.0.5.0	Limit value load monitoring	REAL	0 to 100	10
2.5.0.6.0	Teach-In	USINT	0: manual 1: autom. once 2: autom. cyclical	0
2.5.0.7.0	Load type	USINT	0: Standard 1: IR radiator	0
2.5.0.8.0	Control loop monitoring	USINT	0: No 1: Yes	0
2.5.0.9.0	Mains voltage drop monitoring	USINT	0: No 1: Yes	0

5.2.6 Digital input

JUMO ID	Name	Data type	Value range	Default setting
2.6.0.0.0	Ext. change-over to phase angle op.	USINT	0: Switched off 1: Binary input 1 2: Binary input 2 3: Ext. bin.input 1 4: Ext. bin.input 2	0
2.6.0.1.0	Ext. change-over setpoint input	USINT	0: Switched off 1: Binary input 1 2: Binary input 2 3: Ext. bin.input 1 4: Ext. bin.input 2	0
2.6.0.2.0	Setpoint input at change-over	USINT	0: No default value (don’t use) 1: Last value (don’t use) 2: Current input 3: Voltage input 4: Value adjustable 5: Via interface (don’t use) 6: Binary input 1 (don’t use) 7: Binary input 2 (don’t use)	3
2.6.0.3.0	Setpoint value at change-over	REAL	0 to 115 %	0
2.6.0.4.0	Ext. current limiting	USINT	0: Switched off 1: Binary input 1 2: Binary input 2 3: Ext. bin.input 1 4: Ext. bin.input 2	0
2.6.0.5.0	Ext. current limit value	REAL	0 to 275	Depends on device type
2.6.0.6.0	Ext. change-over load monitoring	USINT	0: Switched off 1: Binary input 1 2: Binary input 2 3: Ext. bin.input 1 4: Ext. bin.input 2	0
2.6.0.7.0	Limit value load monitoring	REAL	0 to 100 %	10
2.6.0.8.0	Keyboard lock	USINT	0: Switched off 1: Binary input 1 2: Binary input 2 3: Ext. bin.input 1 4: Ext. bin.input 2	0
2.6.0.9.0	Ext. deactivation of display lighting	USINT	0: Switched off 1: Binary input 1 2: Binary input 2 3: Ext. bin.input 1 4: Ext. bin.input 2	0
2.6.0.10.0	Control direction inhibit input	USINT	0: open-Load OFF 1: open-Load ON	1
2.6.0.11.0	Control direction digital input 1	USINT	0: open active 1: open inactive	0

JUMO ID	Name	Data type	Value range	Default setting
2.6.0.12.0	Control direction digital input 2	USINT	0: open active 1: open inactive	0

5.2.7 Digital output

JUMO ID	Name	Data type	Value range	Default setting
2.7.0.0.0	Output mode	USINT	0: Fault alrm. outp 1: Energy meter 2: Interf.sign.outp	0
2.7.0.1.0	Control direction digital output	USINT	0: Normally open 1: Normally closed	1
2.7.0.2.0	Pulses per kWh	UINT	1 to 1000	1000
2.7.0.3.0	Pulse length	UINT	30 to 2000 ms	30
2.7.0.4.0	Min. pulse pause	UINT	30 to 2000 ms	30

5.2.8 Analog output

JUMO ID	Name	Data type	Value range	Default setting
2.8.0.0.0	Signal type	USINT	0: switched off 1: 0 to 20 mA 2: 4 to 20 mA 3: 0 to 10 V 4: 2 to 10 V 5: 0 to 5 V 6: 1 to 5 V 7: Customer spec. (don’t use)	0
2.8.0.1.0	Value to be output	USINT	0: Switched off (don’t use) 1: Load voltage 2: Load voltage^2 3: Load current 4: Load current^2 5: Power [W] 6: Power [kW] 7: Load resistance 8: Mains voltage 9: Device temperat. 10: Setpoint 11: From interface	2
2.8.0.2.0	Signal range start value	REAL	0.0 to 9999.9	0
2.8.0.3.0	Signal range end value	REAL	0.0 to 9999.9	9999.9

5.2.9 Customized parameters

JUMO ID	Name	Data type	Value range	
2.11.0.0.0	Customized parameter 1	UINT	0 to 65535	
2.11.0.1.0	Customized parameter 2	UINT	0 to 65535	
2.11.0.2.0	Customized parameter 3	UINT	0 to 65535	
.	.	UINT	0 to 65535	
.	.	UINT	0 to 65535	
.	.	UINT	0 to 65535	
2.11.0.89.0	Customized parameter 90	UINT	0 to 65535	

5 Noncyclical data exchange

6.1 Project integration of JUMO IO devices

For JUMO field devices to be integrated into the project structure of the IO controller as IO device, the GSDML file of the respective device must be imported into the engineering system of your IO controller. The GSDML file describes all PROFINET-IO features of IO devices and delivers to the engineering system all the information required for the project planning phase. Once the GSDML file has been imported into the engineering system, the corresponding field device is available as an IO device in the engineering system (e.g. "Hardware catalog" for SIMATIC®[1] or "Device repository" for CODESYS®[2]), and can be incorporated into the hardware structure of your projects. With JUMO IO devices, modules can then be added as slots. In the engineering system, modules are treated as modular devices for expanding IO devices. They are selected from the engineering system catalog and assigned to the slots in the JUMO IO device. The procedure for integrating devices into project structures is described in the documentation for the engineering system of your IO controller.

Procedure

1. Import the GSDML file for your JUMO IO device into the engineering system of your IO controller. Make sure the device software version matches the version data in the GSDML file.

NOTE!

The GSDML file for the current device version is located on the DVD from the scope of delivery of your JUMO field device. Alternatively, you can download the GSDML file from the JUMO website.

2. Integrate the desired JUMO field device into the project structure of your IO controller. Make sure the device software version matches the version data of the JUMO field device integrated into the project structure.

NOTE!

The JUMO IO device appears in the project structure with the "DeviceStatusBlock" module in Slot 1. The "DeviceStatusBlock" module is immovably placed in Slot 1.

NOTE!

The exact procedure for integrating PROFINET IO devices can be found in the description of your engineering system.

3. Assign a device name.

NOTE!

Engineering systems offer a function for **identifying** field devices. If JUMO field devices are addressed via the **"Identification function"** of the engineering system, this is signaled by the flashing of the front display.

4. Insert the configured modules into the project structure of the IO controller in the desired slot position below the 1st slot on the JUMO IO device.
5. Set the communication parameters of the JUMO field device in the project structure of the IO controller.

   ⇨ chapter 6.2 "Configuring the JUMO IO device", Page 36
6. Set the start-up parameters in the project structure of the IO controller correctly. Pay attention in particular to the settings for the byte sequence for cyclical and noncyclical data. The byte sequence to be set is specified by the IO controller. Please refer to the documentation for your IO controller.

[1] SIMATIC is a registered trademark of Siemens AG in 80333 Munich, Germany.
[2] CODESYS is a registered trademark of 3S-Smart Software Solutions GmbH in 87439 Kempten, Germany.

7. The IO data of the JUMO IO device are now available for the programming of the IO controller. To localize the IO data configured in the JUMO field device, refer to the printed module configuration list. During programming, the assignment of the device data to the IO items of the modules can be taken from this list.

6.2 Configuring the JUMO IO device

6.2.1 Start-up parameters

When the system boots, the start-up parameters are transferred from the IO controller to the JUMO field device during the course of the IO device parameterization procedure. Prior to start-up, you must configure the settings for the start-up parameters with the engineering system in the project planning of your IO controller. The start-up parameters for each JUMO field device are located in the "Primary data of the master" module (Slot 1).

The list of start-up parameters to be configured can be found in the module description.

⇨ chapter 4.2.2 "Modules", Page 11

6.2.2 Communication parameters

Station name

To improve the overview in the IO controller project structure, each device should be assigned a self-explanatory and preferably unique station name. This permits a better overview for programming and project planning. The station name is entered in the engineering system of your IO controller at the PNIO identification data of the JUMO IO device.

Modules

The modules have a fixed configuration. Slot 1 is always pre-assigned. Slots 2 to 4 can always be added as optional extras.

Cyclical transfer timing

Send clock and reduction ratio determine the frequency at which an IO device transfers cyclical data in a PROFINET IO network. The transfer cycle time of the JUMO IO device is calculated by dividing the send clock by the reduction ratio. With JUMO field devices, these parameters apply globally for all slots. The setting is configured in the engineering system of your IO controller at the PNIO parameters of the JUMO IO device.

NOTE!

In order to set meaningful transfer cycles, it is advisable to observe the processing cycle time of the respective JUMO field device.

JUMO TYA 20X: 40 to 50 ms

Watchdog

If the watchdog function is activated, the cyclical communication is monitored in cycles. The watchdog cycle time can be set as a multiple of the transfer cycle time (maximum 1.92 s). If a "consumer" detects a communication failure, it dismantles the "Application Relation" and hence also the "Communication Relation" to the provider.

NOTE!

The watchdog cycle time can be set up to a maximum of 1.92 s. This is defined by the PROFINET IO standard for RT communication.

Starting up the PROFINET interface of a JUMO IO device

Proceed as follows to start up the PROFINET interface of a JUMO IO device:

1. After a valid IP configuration has been saved in the JUMO IO device, the PROFINET IO interface connects to the JUMO IO device and is initialized. To test, check the following indicators: The **front status LED on the PROFINET optional board must glow green** and the **MAC addresses of the PROFINET optional board** must now have valid content (not 00-00-00-00-00-00).

   Check the MAC addresses:*Device menu > Device info > PROFINET > Info*

   ⇨ chapter 6.2.3 "Device information", Page 37

2. If you have not yet inserted a network connector into the switchports of the PROFINET interface, establish the connections to your network now.

   Check the PROFINET status:*Device menu > Device info > PROFINET > Status*

   ⇨ chapter 6.2.3 "Device information", Page 37

3. Make sure that the correct communication settings have been defined in the project planning for your IO controller. Check for correct assignment of the IP configuration and unique station name for the JUMO IO device.

   The subnet configuration for PROFINET communication must be saved in the IO controller. Then, as the system is booted, the IP configuration (IP address, subnet mask and default gateway) is transferred from the PROFINET IO controller to the IO device according to the IO controller configuration. The procedure for project planning can be found in the documentation of the engineering system you are using for the project planning of your system.

4. After the system has booted successfully with DCP assignment of the IP configuration to the JUMO IO device by the IO controller, the device is ready to communicate with the IO controller. Immediately thereafter, communication with the IO controller starts and the PROFINET status changes to "PLC Connection Up".

6.2.3 Device information

The device info for the JUMO IO device displays, for control and error diagnostics, information about network configuration, hardware and software component versions, as well as counters for evaluating data traffic. For more details about the displayed data, see the operating manual for your JUMO IO device.

Call-up: Device menu > Device info > PROFINET IO

Status: Data for connecting the JUMO IO device to the IO controller The last PROFINET diagnosis event is displayed as the current connection status: • **Init Error** Unable to initialize the PROFINET interface. Restart the device. • **Initialized** The PROFINET interface was initialized and is ready to establish the connection. • **AR established** There is an active connection to a PROFINET controller. • **AR not in op** Connection to a PROFINET controller was terminated.	

Info: Network data of the IO device The network configuration data of the PROFINET interface such as the MAC addresses of the 3 interfaces of the PROFINET optional board are displayed here (cf. chapter 6.2.2 "Communication parameters", Page 36). The individual MAC addresses: • **MAC address** MAC address of the internal interface (SMK socket) of the PROFINET optional board for connection to the internal Ethernet interface of the JUMO IO device (COM2 slot); this MAC address represents the JUMO IO device in your project planning for device detection and topology recognition • **MAC port 1/2** MAC addresses of the two switchports (RJ 45) of the PROFINET optional board	
Version: Version numbers of hardware and software components	

The status of the Ethernet interface is relevant for the PROFINET interface. For checking and for diagnostic purposes, the IP configuration of the PROFINET interface can be viewed in Device info.

Call-up: Device menu > Device info > PROFINET IO > ...

IP configuration data of the internal PROFINET interface of the JUMO IO device	

6 Project planning

7.1 Error messages for invalid values

For measured values in floating-point format (cyclical transfer), the error number appears directly in the value, i.e. it contains the error number instead of the measured value.

Error code for floating-point values	Error
3.0×10^{37}	Not a valid input value

7.2 Error message for noncyclical services

In the ERROR item, possible errors are reported back to the PLC for both service 201 and service 202. The following error IDs have been defined for JUMO:

Error ID	Description
0	No error
1	Incorrect index
3	Incorrect ID
14	Currently unable to write to the config. parameters
15	Incorrect DIRECTION (only 1 (PLC_WRITE) and 2 (PLC_READ) are permitted)

⇨ chapter 5 "Noncyclical data exchange", Page 19

7 Error messages

8.1 PROFINET certificate

The certificate is available as a download:

qr-709061-de.jumo.info

8 PROFINET

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