

X20DO6325

1 General information

The module is equipped with six outputs for 1 or 2-wire connections with diagnostic functions. The X20 6-pin terminal block can be used for universal 1-line wiring. Two-line wiring can be implemented using the 12-pin terminal block. The outputs on the module are designed for source connections.

- 6 digital outputs
- Source connection
- 2-wire connections
- GND for signal supply
- Integrated output protection
- 1-wire connection type with 6-pin terminal block
- Diagnostic functions (open line, short circuit and overload/overtemperature)
- OSP mode

2 Order data


Model number	Short description	Figure
	Digital outputs	
X20DO6325	X20 digital output module, 6 outputs, 24 VDC, 0.5 A, source, open line and overload detection, 2-wire connections	
	Required accessories	
	Bus modules	
X20BM11	X20 bus module, 24 VDC keyed, internal I/O supply continuous	
X20BM15	X20 bus module, with node number switch, 24 VDC keyed, internal I/O supply continuous	
	Terminal blocks	
X20TB12	X20 terminal block, 12-pin, 24 VDC keyed	

Table 1: X20DO6325 - Order data

3 Technical data

Model number	X20DO6325	
Short description		
I/O module	6 digital outputs 24 VDC for 1- or 2-wire connections with a diagnostics function	
General information		
B&R ID code	0xE284	
Status indicators	I/O function by channel, diagnostics by channel, operating status, module status	
Diagnostics		
Module run/error	Yes, using status LED and software	
Status outputs	Yes, using status LED and software	
Diagnostic outputs	Yes, using status LED and software	
Power consumption		
Bus	0.15 W	
Internal I/O	0.4 W	
Additional power dissipation caused by actuators (resistive) [W] ¹⁾	Max. 0.225 W	

Table 2: X20DO6325 - Technical data


Model number	X20DO6325
Certifications	
CE	Yes
EAC	Yes
UL	cULus E115267 Industrial control equipment
HazLoc	cCSAus 244665 Process control equipment for hazardous locations Class I, Division 2, Groups ABCD, T5
ATEX	Zone 2, II 3G Ex nA nC IIA T5 Gc IP20, Ta (see X20 user's manual) FTZÜ 09 ATEX 0083X
DNV GL	Temperature: B (0 - 55°C) Humidity: B (up to 100%) Vibration: B (4 g) EMC: B (bridge and open deck)
Digital outputs	
Variant	FET positive switching
Nominal voltage	24 VDC
Switching voltage	24 VDC -15 % / +20 %
Nominal output current	0.5 A
Total nominal current	3 A
Connection type	1- or 2-wire connections
Output circuit	Source
Output protection	Thermal cutoff if overcurrent or short circuit occurs (see value "Peak short circuit current") Internal inverse diode for switching inductive loads (see section "Switching inductive loads")
Diagnostic status	
Open circuit	Current is <1 mA (typ.): Detected if the output is OFF, delay approx. 10 ms
Short circuit to 24 VDC	Detected if the output is OFF, delay approx. 10 ms
Short circuit to GND	Detected if the output is ON, delay approx. 10 ms
Overload/Overtemperature	Detected if the output is ON, delay approx. 10 ms
Leakage current when switched off	<160 µA
$R_{DS(on)}$	150 mΩ
Peak short-circuit current	<40 A
Switching on after overload or short-circuit cutoff	Depends on the module temperature
Switching delay ²⁾	
0 → 1	<100 µs
1 → 0	<300 µs
Switching frequency	
Resistive load ²⁾	Max. 2000 Hz
Inductive load	See section "Switching inductive loads"
Braking voltage when switching off inductive loads	45 to 52 VDC
Isolation voltage between channel and bus	510 V _{eff}
Electrical properties	
Electrical isolation	Channel isolated from bus Channel not isolated from channel
Operating conditions	
Mounting orientation	
Horizontal	Yes
Vertical	Yes
Installation elevation above sea level	
0 to 2000 m	No limitations
>2000 m	Reduction of ambient temperature by 0.5°C per 100 m
Degree of protection per EN 60529	IP20
Ambient conditions	
Temperature	
Operation	
Horizontal mounting orientation	-25 to 60°C
Vertical mounting orientation	-25 to 50°C
Derating	-
Storage	-40 to 85°C
Transport	-40 to 85°C
Relative humidity	
Operation	5 to 95%, non-condensing
Storage	5 to 95%, non-condensing
Transport	5 to 95%, non-condensing
Mechanical properties	
Note	Order 1x X20TB06 or X20TB12 terminal block separately Order 1x X20BM11 bus module separately
Spacing	12.5 ^{+0.2} mm

Table 2: X20DO6325 - Technical data

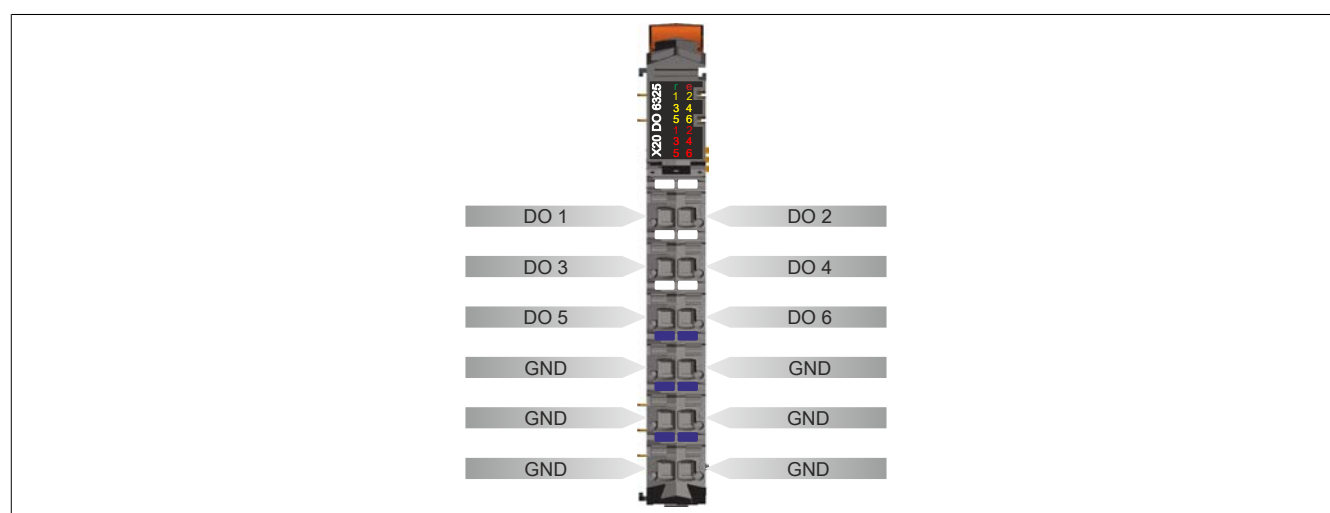
- 1) Number of outputs x $R_{DS(on)}$ x Nominal output current²⁾. For a calculation example, see section "Mechanical and electrical configuration" of the X20 system user's manual.
- 2) At loads ≤ 1 kΩ

4 LED status indicators

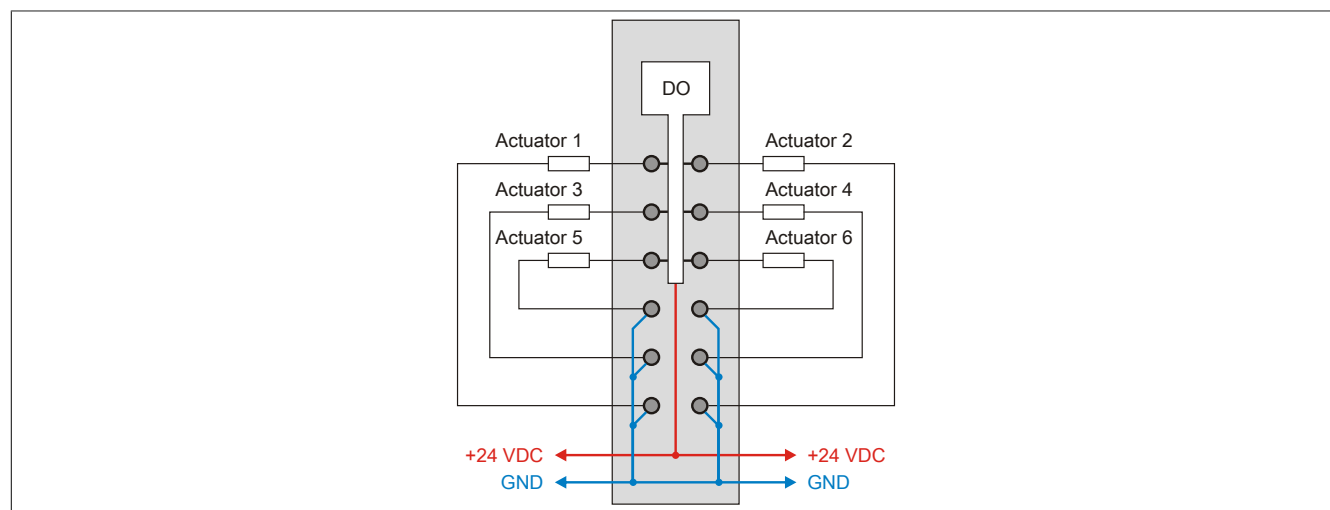
For a description of the various operating modes, see section "Additional information - Diagnostic LEDs" of the X20 system user's manual.

Figure	LED	Color	Status	Description
	r	Green	Off	No power to module
			Single flash	RESET mode
			Blinking	PREOPERATIONAL mode
			On	RUN mode
			Flickering (approx. 10 Hz)	Module is in OSP mode
	e	Red	Off	No power to module or everything OK
			Single flash	Warning/Error on an I/O channel. Level monitoring for digital outputs has been triggered.
			Double flash	I/O supply is outside valid range.
	e + r	Red on / Green single flash		Invalid firmware
	Channel 1 - 6	Orange		Output status of the corresponding digital output
	Diagnostics 1 - 6	Red		Monitoring of the corresponding digital output was tripped (short circuit, open line or overload)

5 Pinout



6 Connection example



Caution!

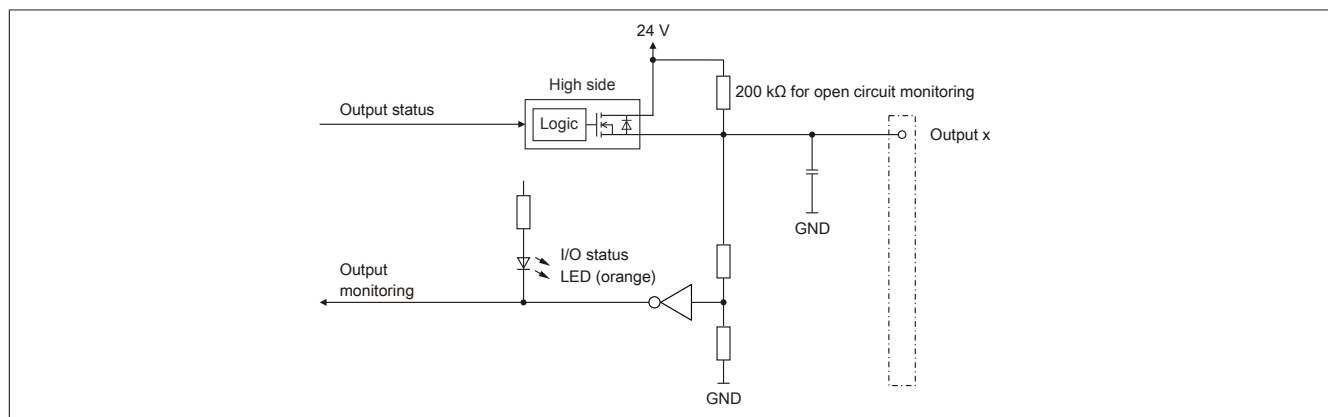
If the module is operated outside of specifications, the output current can increase above the maximum permissible nominal current. This applies to individual channels and also to the summation current for the module.

Therefore sufficient cable cross sections or external safety measures must be used.

7 OSP hardware requirements

In order to use OSP mode sensibly, it should be ensured that the power supply of the output module and CPU are independent of each other when the application is set up.

8 Output circuit diagram



9 Open line detection

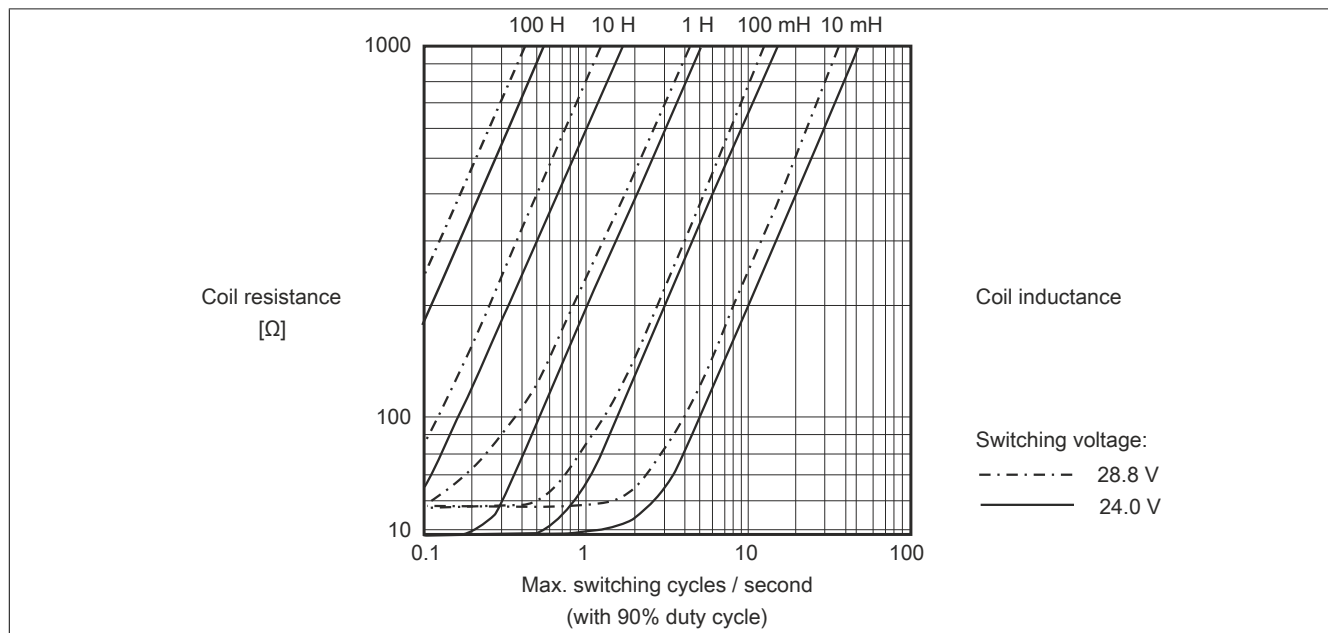
Each output is equipped with an internal 200 kOhm resistor to 24 V for open line detection.

If the charging resistance at the terminal is greater than 25 to 100 kOhm (tolerance range) an open line is therefore detected at 24 V. When switched on, this corresponds to a current of 0.2 to 1 mA with all tolerances taken into consideration.

Supply voltage	Min. load	Max. load	Corresponds to load current when ON
24 V	100 kOhm	25 kOhm	0.2 to 1 mA

10 Switching inductive loads

Environmental temperature: 60°C, all outputs with the same load



Information:

If the maximum number of operating cycles per second is exceeded, an external inverse diode must be used.

Operating conditions outside of the area in the diagram are not permitted!

11 Register description

11.1 General data points

In addition to the registers described in the register description, the module has additional general data points. These are not module-specific but contain general information such as serial number and hardware variant.

General data points are described in section "Additional information - General data points" of the X20 system user's manual.

11.2 Function model 0 - Standard

Register	Name	Data type	Read		Write	
			Cyclic	Non-cyclic	Cyclic	Non-cyclic
Configuration						
4	CfgBwStatus	USINT				•
Communication						
2	DigitalOutput	USINT			•	
	DigitalOutput01	Bit 0				
				
	DigitalOutput06	Bit 5				
28	StatusInput01	USINT	•			
	DigitalStatusGnd01	Bit 0				
				
	DigitalStatusGnd06	Bit 5				
29	StatusInput02	USINT	•			
	DigitalStatusVcc01	Bit 0				
				
	DigitalStatusVcc06	Bit 5				
30	StatusInput03	USINT	•			
	DigitalStatusBw01	Bit 0				
				
	DigitalStatusBw06	Bit 5				
31	StatusInput04	USINT	•			
	DigitalStatusSum01	Bit 0				
				
	DigitalStatusSum06	Bit 5				
	PowerSupply01	Bit 7				

11.3 Function model 1 - OSP

Register	Name	Data type	Read		Write	
			Cyclic	Non-cyclic	Cyclic	Non-cyclic
Configuration						
4	CfgBwStatus	USINT				•
32	CfgOSPMode	USINT				•
Communication						
2	Switching state of digital outputs 1 to 6	USINT			•	
	DigitalOutput01	Bit 0				
				
	DigitalOutput06	Bit 5				
28	Short circuit to GND and overtemperature	USINT	•			
	DigitalStatusGnd01	Bit 0				
				
	DigitalStatusGnd06	Bit 5				
29	Short circuit to voltage	USINT	•			
	DigitalStatusVcc01	Bit 0				
				
	DigitalStatusVcc06	Bit 5				
30	Open circuit	USINT	•			
	DigitalStatusBw01	Bit 0				
				
	DigitalStatusBw06	Bit 5				
31	Cumulative status	USINT	•			
	DigitalStatusSum01	Bit 0				
				
	DigitalStatusSum06	Bit 5				
	PowerSupply01	Bit 7				
34	Enabling OPS output in the module	USINT			•	
	OSPValid	Bit 0				
36	CfgOSPValue	USINT			•	

11.4 Function model 254 - Bus controller

Register	Offset ¹⁾	Name	Data type	Read		Write	
				Cyclic	Non-cyclic	Cyclic	Non-cyclic
Configuration							
4	-	CfgBwStatus	USINT				•
Communication							
2	0	Switching state of digital outputs 1 to 6	USINT			•	
		DigitalOutput01	Bit 0				
					
		DigitalOutput06	Bit 5				
28	-	Short circuit to GND and overtemperature	USINT		•		
		DigitalStatusGnd01	Bit 0				
					
		DigitalStatusGnd06	Bit 5				
29	-	Short circuit to voltage	USINT		•		
		DigitalStatusVcc01	Bit 0				
					
		DigitalStatusVcc06	Bit 5				
30	-	Open circuit	USINT		•		
		DigitalStatusBw01	Bit 0				
					
		DigitalStatusBw06	Bit 5				
31	-	Cumulative status	USINT		•		
		DigitalStatusSum01	Bit 0				
					
		DigitalStatusSum06	Bit 5				
		PowerSupply01	Bit 7				

1) The offset specifies the position of the register within the CAN object.

11.4.1 Using the module on the bus controller

Function model 254 "Bus controller" is used by default only by non-configurable bus controllers. All other bus controllers can use additional registers and functions depending on the fieldbus used.

For detailed information, see section "Additional information - Using I/O modules on the bus controller" of the X20 user's manual (version 3.50 or later).

11.4.2 CAN I/O bus controller

The module occupies 1 digital logical slot on CAN I/O.

11.5 Digital outputs

The output status is transferred to the output channels with a fixed offset (<60 µs) in relation to the network cycle (SyncOut).

11.5.1 Switching state of digital outputs 1 to 6

Name:

DigitalOutput

DigitalOutput01 to DigitalOutput06

The switching state of digital outputs 1 to 6 are stored in this register.

Only function model 0 - Standard:

Setting "Packed outputs" in the Automation Studio I/O configuration determines whether all bits of this register should be applied individually as data points in the Automation Studio I/O assignment ("DigitalOutput01" to "DigitalOutput0x") or whether this register should be displayed as a single USINT data point ("DigitalOutput").

Data type	Values	Information
USINT	0 to 63	Packed outputs = On
	See bit structure.	Packed outputs = Off or Function model <> 0 - Standard

Bit structure:

Bit	Name	Value	Information
0	DigitalOutput01	0	Digital output 01 reset
		1	Digital output 01 set
...
5	DigitalOutput06	0	Digital output 06 reset
		1	Digital output 06 set

11.6 Digital output status

The status of the outputs is checked every 4 ms. To suppress disturbances on the feedback inputs, two readings are compared.

The hardware diagnostics recognize the following states:

- Short circuit to ground GND (when output is ON)
- Short circuit to 24 VDC (when output is OFF)
- Open line (when output is OFF)
- Overtemperature / overload

The error is logged in the corresponding status registers and in the cumulative status register.

An open line error is also indicated by the corresponding LED. The LED indicator can be disabled so that an open (unused) channel does not constantly indicate an error.

11.6.1 Enabling the status LED

Name:

CfgBwStatus

For each output there is a corresponding enable bit. In this register, the bit can be set to define whether or not the status LED should be used to indicate an open line error. This allows the LED to be disabled for unused channels. In the bus controller function model the default value is 0xBF.

Data type	Values	Bus controller default setting
USINT	See the bit structure.	191

Bit structure:

Bit	Name	Value	Information
0	Channel 01	0	Open line indicator 01 disabled
		1	Open circuit indicator 01 enabled (bus controller default setting)
...		...	
5	Channel 06	0	Open line indicator 06 disabled
		1	Open circuit indicator 06 enabled (bus controller default setting)
6	Reserved	0	
7	PowerSupply01	0	No error status indicators
		1	Monitor supply voltage (bus controller default setting)

11.6.2 Short circuit to GND and overtemperature

Name:

StatusInput01

DigitalStatusGnd01 to DigitalStatusGnd06

In this register, a short circuit or overtemperature error is indicated by the corresponding channel bit being set. It is not possible to differentiate between short circuit to GND and overload/overtemperature.

Only function model 0 - Standard:

The "Packed outputs" setting in the Automation Studio I/O configuration is used to determine whether all of the bits from this register should be set up individually as data points in the Automation Studio I/O mapping ("DigitalStatusGnd01" to "DigitalStatusGnd06") or whether this register should be displayed as an individual USINT data point ("StatusInput01").

Data type	Values	Information
USINT	0 to 63	Packed outputs = On
	See bit structure.	Packed outputs = Off or Function model <> 0 - Standard

Bit structure:

Bit	Name	Value	Information
0	DigitalStatusGnd01	0	No error
		1	Channel 1: Short circuit or overload
...		...	
5	DigitalStatusGnd06	0	No error
		1	Channel 6: Short circuit or overload
6 - 7	Reserved	0	

11.6.3 Short circuit to voltage

Name:

StatusInput02

DigitalStatusVcc01 to DigitalStatusVcc06

In this register, a short circuit is indicated by the corresponding channel bit being set.

Only function model 0 - Standard:

The "Packed outputs" setting in the Automation Studio I/O configuration is used to determine whether all of the bits from this register should be set up individually as data points in the Automation Studio I/O mapping ("DigitalStatusVcc01" to "DigitalStatusVcc06") or whether this register should be displayed as an individual USINT data point ("StatusInput02").

Data type	Values	Information
USINT	0 to 63	Packed outputs = On
	See bit structure.	Packed outputs = Off or Function model <> 0 - Standard

Bit structure:

Bit	Name	Value	Information
0	DigitalStatusVcc01	0	No error
		1	Channel 1: Short circuit to voltage
...		...	
5	DigitalStatusVcc06	0	No error
		1	Channel 6: Short circuit to voltage
6 - 7	Reserved	0	

11.6.4 Open circuit

Name:

StatusInput03

DigitalStatusBw01 to DigitalStatusBw06

In this register, an open circuit is indicated by the corresponding channel bit being set.

Only function model 0 - Standard:

The "Packed outputs" setting in the Automation Studio I/O configuration is used to determine whether all of the bits from this register should be set up individually as data points in the Automation Studio I/O mapping ("DigitalStatusBw01" to "DigitalStatusBw06") or whether this register should be displayed as an individual USINT data point ("StatusInput03").

Data type	Values	Information
USINT	0 to 63	Packed outputs = On
	See bit structure.	Packed outputs = Off or Function model <> 0 - Standard

Bit structure:

Bit	Name	Value	Information
0	DigitalStatusBw01	0	No error
		1	Channel 1: Open circuit
...		...	
5	DigitalStatusBw06	0	No error
		1	Channel 6: Open circuit
6 - 7	Reserved	0	

11.6.5 Cumulative status

Name:

StatusInput04

DigitalStatusSum01 to DigitalStatusSum06

PowerSupply01

Every error found in the other status registers is also shown in this register. This provides an easy way to check whether any errors have occurred.

If the I/O supply fails, Bit 7 is set and all status bits in the other status registers are reset to 0.

Only function model 0 - Standard:

The "packed outputs" setting in the Automation Studio I/O configuration is used to determine whether all of this registers' bits should be set up individually as data points ("DigitalStatusSum01 through DigitalStatusSum06", "PowerSupply01") in the Automation Studio I/O mapping or whether this register should be displayed as an individual USINT data point ("StatusInput04").

Data type	Value	Information
USINT	0 to 255	Packed outputs = On
	See the bit structure.	Packed outputs = Off or function model ≠ 0 - Standard.

Bit structure:

Bit	Name	Value	Information
0	DigitalStatusSum01	0	No error
		1	Channel 1: Error occurred
...
5	DigitalStatusSum06	0	No error
		1	Channel 6: Error occurred
6	Reserved	0	
7	PowerSupply01	0	No error
		1	Pending supply voltage error

11.7 Function model "OSP"

In function model "OSP" (Operator Set Predefined), the user defines an analog value or digital pattern. This OSP value is output as soon as the communication between the module and master is aborted.

Functionality

The user has the choice between 2 OSP modes:

- Retain last valid value
- Replace with static value

In the first case, the module retains the last value recognized as a valid output status.

When selecting mode "Replace with static value", a plausible output value must be entered in the associated value register. When an OSP event occurs, this value is output instead of the value currently requested by the task.

11.7.1 Enabling OPS output in the module

Name:

OSPValid

This data point makes it possible to start the output of the module and request the use of OSP during operation.

Data type	Values
USINT	See the bit structure.

Bit structure:

Bit	Description	Value	Information
0	OSPValid	0	Request OSP operation (after initial startup or module in stand-by)
		1	Request normal operation
1 - 7	Reserved	0	

Bit OSPValid exists once on the module and is managed by the user task. It must be set to start the enabled channels. As long as bit OSPValid remains set in the module, the module behaves the same as in function model "Standard".

If an OSP event occurs, e.g. communication between the module and master CPU aborted, then bit OSPValid is reset on the module. The module enters the OSP state and output occurs according to the configuration in register "OSPMoDe" on page 11.

The following generally applies:

Even after regeneration of the communication channel, the OSP replacement value is still pending. The OSP state is only exited again when a set OSPValid bit is transferred.

When the master CPU is restarted, bit OSPValid bit is reinitialized in the master CPU. It must be set once more by the application and transferred via the bus.

In the event of brief communication errors between the module and master CPU(e.g. due to EMC), the cyclic registers fail to refresh for several bus cycles. Within the module, bit OSPValid is reset; the set bit is retained in the CPU, however. During the next successful transfer, the module-internal OSPValid bit is set again and the module automatically returns to normal operation.

If the task in the master CPU needs the information about which output mode the module is currently in, bit ModulOK can be evaluated.

Warning!

If bit OSPValid bit is reset to "0" by the module, the output status no longer depends on the responsible task in the master CPU. Nevertheless, output is made depending on the configuration of the OSP replacement value.

11.7.2 Setting OSP mode

Name:
CfgOSPMode

This register controls the behavior of a channel when using OSP.

Data type	Values	Explanation
USINT	0	Replace with static value
	1	Retain last valid value

11.7.3 Defining an OSP-digital output value

Name:
CfgOSPValue

This register contains the digital output value that is output in "Replace with static value" mode during OSP operation.

Data type	Values
USINT	See the bit structure.

Bit structure:

Bit	Description	Value	Information
0		0 or 1	OSP output value for channel DigitalOutput00
...		...	
x		0 or 1	OSP output value for channel DigitalOutput0x

Warning!

"OSPValue" is only applied by the module if bit "OSPValid" has been set in the module.

11.8 Minimum cycle time

The minimum cycle time specifies the time up to which the bus cycle can be reduced without communication errors occurring. It is important to note that very fast cycles reduce the idle time available for handling monitoring, diagnostics and acyclic commands.

Minimum cycle time
150 µs

11.9 Minimum I/O update time

The minimum I/O update time defines how far the bus cycle can be reduced while still allowing an I/O update to take place in each cycle.

Minimum I/O update time
Equal to the minimum cycle time