



DESCRIPTION

Open programmable compact safety control with integrated drive monitoring for up to 2 axes

- With extended encoder functionality
- 8 Encoder interfaces
- 14 Digital Inputs
- 2/4 pn- or pp- switching outputs
- 2 Auxiliary / pulse outputs
- Safety controller up to PL e acc. to EN ISO 13849-1 or SIL3 acc. to IEC 61508
- Optional: safe/non-safe fieldbus interface

CHARACTERISTIC OF THE MODULE

- » Extendable up to:
 - max. 42 safe digital inputs,
 - max. 12 safe digital outputs,
 - max. 20 safe digital I/O's,
 - max. 9 safe relay outputs,
 - max. 10 auxiliary outputs,
 - max. 2 safe axes
- » Logic processing up to PL e acc. to EN ISO 13849-1 or SIL 3 acc. to IEC 61508
- » Complete speed and position-related safety functions for drive monitoring of one or two axes up to PL e acc. to EN ISO 13849-1 or SIL 3 acc. to IEC 61508
- » Speed monitoring:
- » RPM-monitoring
- » Standstill monitoring
- » Sense of rotation monitoring
- » Safe incremental dimension
- » Emergency Stop monitoring
- » Position monitoring
- » Position range monitoring
- » trend range monitoring
- » Target position monitoring
- » Freely programmable modular controller for up to 800 IL instructions
- » Logic diagram oriented programming via SafePLC²
- » Pulse outputs for cross-shortening detection of digital input signals
- » External contact monitoring of connected switchgear (EMU)
- » Switchable safe semi-conductor outputs pn-, pp- switching for safety-relevant functions

SMX 12-2/2/x

SMXSERIES » Compact » Basic modules

BBH
PRODUCTS

- » Monitored relay outputs for safety relevant functions
- » Comprehensive diagnostics functions integrated
- » Parameter management for expansion modules in base device
- » Coded status display via front-side 7 segment display and status LEDs
- » Multifunction buttons (quit, start, reset) can be operated from the front side
- » Configurable via SafePLC² über USB serial adapter or ethernet based field bus
- » Extended functionality:
 - allows the connection of 2 rotary encoder per axis (SSI-Absolut, Sin/Cos,TTL, HTL proximity switch)
 - 2. encoder interface also support HTL (200 kHz), Sin/Cos High-Resolution and Resolver
- » Optional: integrated Communication interface :
 - Standard and safe field bus protocols for communication with a higher level controller (PROFIBUS, PROFINET, DeviceNet, CANopen, EtherNET/IP, EtherCAT, Modbus TCP, PROFIsafe, FSoE)
 - Safe cross communication (SMMC) for data exchange between multiple base devices
 - Field bus protocols with the same hardware can be switched with SafePLC²
 - Safe remote I/O communication for data exchange with distributed I/O systems
- » The mechanical structure of SMX12-2/2 (/x*) is depended on the respective forms of the base module

* *Optional: integrated communication interface (/DNM, /DBM)*

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SAFETY @ ITS BEST!

SAFETY RELATED CHARACTERISTIC DATA

Performance Level	PL e (EN ISO 13849-1)
PFH / architecture	12,6 FIT / Cat. 4
Safety Integrity Level	SIL 3 (IEC 61508)
Proof test interval	20 years = max. operating period

GENERAL DATA

Max. no. of expansion modules	2
Interface for expansion modules	T-bus connector, pluggable in top-hat rail
Number of safe digital inputs	14
Number of safe digital outputs	
	pp-switching ** 4
	pn-switching ** 2
Number of safe digital I/O	-
Number of relay outputs	2
Number of safe analogue inputs	-
Number of auxiliary outputs	2
Number of pulse outputs (clock outputs)	2
Type of connection	Plug-in terminals with spring or screw connection
Axis monitoring (Axes / Encoder interfaces)	2 / 8 *
Encoder technology (See table Encoder specifications)	<p>D-SUB X31, 32: SSI-Absolut, SinCos, Incremental-TTL</p> <p>D-SUB X33, 34: SSI-Absolut, SinCos, SinCos (HighRes), Incremental-TTL, Resolver</p> <p>Terminal X23: HTL proximity sensor (10kHz)</p> <p>Terminals X27, X28, X29, X30: Incremental-HTL (200kHz)</p>

* maximum 2 encoder / axis

** pn/pp are configurable via SafePLC²

ELECTRICAL DATA

Supply voltage (tolerance)		24 VDC; 2A (-15%, +20%)
Fuse	X11.1	min. 30 VDC; max. 3,15A
	X11.2	min. 30 VDC; max. 10A
Max. Power consumption (logic)		
	SMX12-2/2	4,8 W
	SMX 12-2/2/x	7,2 W
Rated data digital inputs		24 VDC; 20 mA Typ1 acc. to IEC 61131-2
Rated data digital outputs		
	pn-switching	24 VDC; 2A *
	pp-switching	24 VDC; 2A *
	auxiliary outputs	24 VDC; 250mA
	pulse outputs (clock outputs)	24 VDC; 250mA
Rated data relays		
Normally open	DC 13	24 VDC; 2A
	AC 15	230 VAC; 2A

* see „Derating Outputs“

DERATING OUTPUTS

- » Maximum current load based on temperature
- » The maximum total current is 10A

type of module	outputs	temperature 30°C / 50°C
SMX1x/2/x	Q 1 – Q 4	2A / 1,8A

ENVIRONMENTAL DATA

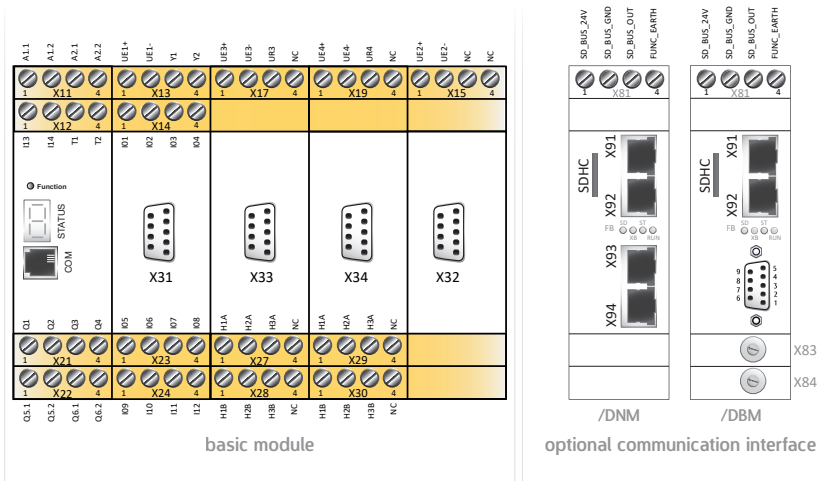
Temperature	0°C ... +50°C operation -25°C ... +70°C storage and transport
Class of protection	IP 20
Climatic category	3K3 acc. to DIN EN 60721-3
Min-, Maximum relative humidity (no condensation)	5% - 85%
EMC	DIN EN 61000-6-2, DIN EN 61000-6-4, DIN EN 61000-6-7, DIN EN 61800-3, DIN EN 61326-3, DIN EN 62061
Operating altitude	2000m

MECHANICAL DATA

Dimensions (HxDxW [mm])	SMX12-2/2	100x115x112,5
	SMX12-2/2/x *	100x115x135
Weight [g]	SMX12-2/2	520
	SMX12-2/2/x *	620
Mounting	to snap on top-hat rail	
Number of T-Bus	SMX12-2/2	5
	SMX12-2/2/x *	6
Min. terminal cross-section / AWG	0,2 mm ² / 24	
Max. terminal cross-section / AWG	2,5 mm ² / 12	

* Specification, see: „ Optional integrated communication interface“

DEVICE INTERFACES



Interface	Description of interface
X11 – X14 / X15 – X24 / X81	Voltage supply and I/O interface
COM	Diagnostic and configuration interface
X91 / X92	Decentralised SDDC ETH and SMMC interface
X93 / X94	Field bus interfaces
X23 / X27 – X30	Encoder interface
X31 – X34	Encoder interface

VOLTAGE SUPPLY AND I/O INTERFACE

X 11		
Pin	1 - A1.1	Voltage supply device +24 VDC
	2 - A1.2	Voltage supply device +24 VDC outputs
	3 - A2.1	Voltage supply device 0 VDC
	4 - A2.2	Voltage supply device 0 VDC
X 12		
Pin	1 - I13	Safe digital inputs
	2 - I14	
	3 - T1	Clock outputs
	4 - T2	

X 13		
Pin	1 – UE1+	Voltage supply Encoder +24V DC X31
	2 – UE1-	Voltage supply Encoder 0V DC X31
	3 - Y1	Auxiliary outputs
	4 - Y2	
X 14		
Pin	1 - I01	Safe digital inputs
	2 - I02	
	3 - I03	
	4 - I04	

X 15		
Pin	1 - UE2+	Voltage supply Encoder +24V DC X32
	2 - UE2-	Voltage supply Encoder 0V DC X32
	3 - NC	No function
	4 - NC	No function
X 17		
Pin	1 - UE3+	Voltage supply Encoder +24V DC X33
	2 - UE3-	Voltage supply Encoder 0V DC X33
	3 - UR3	Reference voltage encoder X33
	4 - NC	No function
X 19		
Pin	1 - UE4+	Voltage supply Encoder +24V DC X34
	2 - UE4-	Voltage supply Encoder 0V DC X34
	3 - UR4	Reference voltage Encoder X34
	4 - NC	No function
X 21		
Pin	1 - Q1	Output of the pn-switching Q1_PP / pp-switching Q1
	2 - Q2	Output of the pn-switching Q2_PN / pp-switching Q2
	3 - Q3	Output of the pn-switching Q3_PP / pp-switching Q3
	4 - Q4	Output of the pn-switching Q4_PN / pp-switching Q4

X 22		
Pin	1 - Q5.1	Safe relay output
	2 - Q5.2	
	3 - Q6.1	Safe relay output
	4 - Q6.2	
X 23		
Pin	1 - I05	Safe digital inputs
	2 - I06	
	3 - I07	
	4 - I08	
X 24		
Pin	1 - I09	Safe digital inputs
	2 - I10	
	3 - I11	
	4 - I12	
X 81 *		
Pin	1 - SD_BUS_24V	Power supply SD-BUS +24 VDC
	2 - SD_BUS_GND	Power supply SD-BUS 0 VDC
	3 - SD_BUS_OUT	SD-BUS Output
	4 - FUNC_EARTH	Functional Earth

* Only available for field bus variants

DIAGNOSTIC AND CONFIGURATION INTERFACE

Pin assignment

RJ 10, 4-pin		
Pin	Description	COM front side
1	GND	
2	RS485-	
3	RS485+	
4	VCCH	

» With existing Ethernet-based fieldbus interface, it can be used as a diagnostic and configuration interface.

DECENTRALISED SDDC ETH AND SMMC INTERFACE

Pin assignment female connector

Communication interface (RJ45-Buchse)				Front side
Pin	Name	Description	Colour	X91 / X92
1	TX+	Transmit Data +	white-orange	
2	TX-	Transmit Data -	orange	
3	RX+	Receive Data +	white-green	
4	nc	not used	blue	
5	nc	not used	white-blue	
6	RX-	Receive Data -	green	
7	nc	not used	white-brown	
8	nc	not used	brown	

Safe Master – Master Communication (SMMC)

SMMC communication enable a secure data exchange of 2 bytes between multiple SDDC masters. Communication takes place without a master for coordinating the data. This means that data exchange between available subscribers is always possible. This principle means that an incomplete or separates network can work in part areas without chnaging the configuration.

Each port can be configured in the SafePLC².

FIELDBUS INTERFACES

Pin assignment female connector

Ethernet-based fieldbus interface /xNx (RJ45)				Front side
Pin	Name	Description	Colour	X93 / X94
1	TX+	Transmit Data +	white-orange	
2	TX-	Transmit Data -	orange	
3	RX+	Receive Data +	white-green	
4	nc	not used	blue	
5	nc	not used	white-blue	
6	RX-	Receive Data -	green	
7	nc	not used	white-brown	
8	nc	not used	brown	

CAN-based fieldbus interface /DBM, /xBM (D-Sub)				Front side
Pin	CANopen	PROFIBUS	DeviceNet	
1	—	—	V-	
2	CAN_L	—	CAN_H	
3	isoGND	RXD/TXD-P (B)	DRAIN	
4	—	CNTR-P	CAN_L	
5	—	GND	V+	
6	—	VP (+5V)	—	
7	CAN_H	—	—	
8	—	RXD/TXD-N (A)	—	
9	—	CNTR-N	—	

OPTIONAL INTEGRATED COMMUNICATION INTERFACE

- » Subsequent expansion capability of standard to safe field bus via additional Mini SD card on the back of the module is possible (/xNx und /xBx)
- » Different specifications can be combined

General data	
Decentralised communication interface	
/D	2x RJ 45 *
Fieldbus interface	
/xN	2x RJ 45 **
/xB	1x Sub-D ***
MemoryCard (safety program)	
/xxM	1x Mini SD (front side)
Memory Card (license for safe field bus)	
/xNx	1x Mini SD (rear side)
/xBx	
SD bus	plug-in terminals
Status LEDs	4
Fieldbus address rotary switch	
/xBx	2

* optional for SDDC or SMMC

** available field buses PROFINET, EtherCAT, Modbus TCP and Ethernet TCP/IP

*** available field buses PROFIBUS, CANopen und DeviceNet

Combination options

	/D	/DNM	/xNM	/xxM	/DBM	/xBM
Field bus protocols						
PROFIBUS		X	X			
DeviceNet		X	X			
CANopen		X	X			
PROFINET					X	X
Ethernet IP					X	X
EtherCAT					X	X
Modbus TCP					X	X
PROFIsafe *	X	X	X	X	X	X
FSoE *				X	X	X

* Specification required in your order

» The CAN-based and Ethernet-based fieldbus interfaces can be switched via the SafePLC² between the fieldbus protocols

ENCODER INTERFACES

Pin assignment X31 / X32 , X33 / X34

Pin	X31 / X32 Inc / Sin/Cos / SSI	X33 / X34 Inc / Sin/Cos / SSI	X33 / X34 Resolver	Front side SMX
1	n.c.	n.c.	Ref_Out +	
2	GND_ENC	GND_ENC	GND_ENC	
3	n.c.	n.c. / n.c. / Clk +	Ref_In +	
4	B- / COS - / Clk -	B- / COS - / n.c.	COS -	
5	A+ / SIN + / Data +	A+ / SIN + / Data +	SIN +	
6	A- / SIN - / Data -	A- / SIN - / Data -	SIN -	
7	n.c.	n.c. / n.c. / Clk -	Ref -	
8	B+ / COS + / Clk +	B+ / COS + / n.c.	COS +	
9	U_ENC	U_ENC	U_ENC	

Pin assignment X23 , X27 / X29 , X28 / X30

Pin	Z1 – Z1 / Z2 – Z2	Terminals
1	A (\bar{A}) / A (\bar{A})	
2	-- / B (\bar{B})	
3	A (\bar{A}) / A (\bar{A})	
4	-- / B (\bar{B})	

Pin	A+/A-	A+ Signal	Terminals
1 – H1A	A+	24V	
2 – H2A	A-	A	
3 – H3A	A+	GND	
4 – NC	—	—	

Pin	B+/B-	B+ Signal	Terminals
1 – H1B	B+	24V	
2 – H2B	B-	B	
3 – H3B	B+	GND	
4 – NC	—	—	

ENCODER SPECIFICATION

Incremental - TTL	
Physical Layer	RS-422 compatible
Measuring signal A/B	Track with 90 degree phase difference
Type of connection	D-SUB 9-pole
Max. frequency of input cycles (X31, X32 / X33, X34)	200 kHz / 250 kHz
Sin/Cos	
Physical Layer	RS-422 compatible
Measuring signal A/B	Track with 90 degree phase difference
Type of connection	D-SUB 9-pole
Standard Mode	
Max. frequency of input cycles (X31, X32 / X33, X34)	200 kHz / 250 kHz
High Resolution Mode	
Max. frequency of input cycles (X33, X34)	15 kHz
SSI-Absolut	
Data interface	Serial Synchronous Interface (SSI) with variable data length of 12 – 28 Bit
Data format	Binary, Gray code
Physical Layer	RS-422 compatible
Type of connection	D-SUB 9-pole
Mode	Master or Listener
SSI-Master operation	
Clock rate	150 kHz
SSI-Listener operation	
Clock rate (X31 / X33)	100 kHz ... 200 kHz / 100 kHz ... 250 kHz
Min. clock pause time	150 µsec
Max. clock pause time	1 msec
Resolver	
Measuring signal	Sin/Cos – track with 90° phase difference
Signal frequency	max. 600 Hz (900Hz Deep pass)
Input voltage	max. 8 Vss (an 16 kΩ)
Resolution	9 Bit / pole
Supported pole number	2 - 16
Type of connection (X33 / X34)	D-SUB 9-pole
Mode	Master or Listener
Resolver-Master operation	
Reference frequency	8 kHz
Resolver-Listener operation	
Reference frequency	4 kHz – 16 kHz

Reference amplitude	8 Vss – 28 Vss
Reference signal form	Sinusoidal, triangle
Transformation ratio	2:1; 3:1; 4:1
Phase fault	max. 8°

Incremental - HTL

Signal level	24V / 0V
Physical Layer	PUSH / PULL
Max. counting pulse frequency	200 kHz
Type of connection (X27, X28, X29, X30)	Plug-in terminals with spring or screw connection

HTL proximity sensor

Signal level	24V / 0V
Max. counting pulse frequency (circuit logic de-bounced)	10 kHz
Pulse width	50 µsec
Type of connection (X23)	Plug-in terminals with spring or screw connection

HTL proximity switch - extended monitoring

Signal level	24V / 0V
Max. counting frequency (circuit logic de-bounced)	4 kHz
Physical Layer	PUSH / PULL
Measuring signal A/B	Track with 90 degree phase difference
Type of connection (X23)	Plug-in terminals with spring or screw connection

ORDER INFORMATIONS

BASIC MODULES

item	description	item no.
SMX12-2/2	Basic module with integrated drive monitoring for up to 2 axes + extended encoder functionality	2027
SMX12-2/2/D	Basic module + decentralised communication	1779
SMX12-2/2/DNM	Basic module + decentralised communication + Ethernet-based field bus interface + Memory Card	1574
SMX12-2/2/xNM	Basic module + Ethernet-based field bus interface + Memory Card	1765
SMX12-2/2/xxM	Basic module + Memory Card	2031
SMX12-2/2/DBM	Basic module + decentralised communication + CAN-based field bus interface + Memory Card	1766
SMX12-2/2/xBM	Basic module + CAN-based field bus interface + Memory Card	1767

ACCESSORIES

item	description	item no.
SMX91	Programming cable SMX	1010
SXxxx-x	Terminal connector, screw terminals (set), encoded for cabling SMX12-2/2	on request
SX0232-3	Terminal connector, spring terminals (set), encoded for cabling SMX12-2/2	1629
SX0000-9	T-Bus connector voltage-carrying (grey)	1015
SXxxx-x	Y-cable for encoder splitting	on request
FSoE License	Field bus license for FSoE	2366
PROFIsafe License	Field bus license for PROFIsafe	2319

EXTENSIONS

item	description	item no.
SMX31/2	I/O expansion module	1705
SMX31R/2	I/O expansion module with relay option	2046
SMX31R-4/2	I/O expansion module with relay option	2047

SOFTWARE

item	description	item no.
SafePLC ² 1st	Programming software, 1te License incl. Hardlock	1244
SafePLC ² 2nd	Programming software, 2te License incl. Hardlock	1646
SafePLC ² 3rd	Programming software, 3te License incl. Hardlock	1647