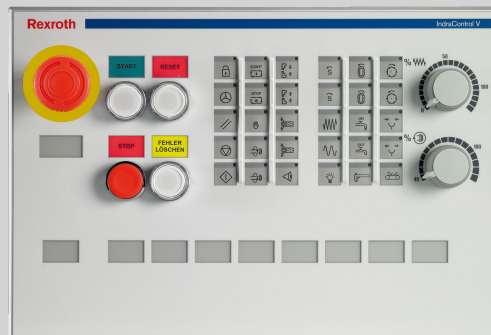
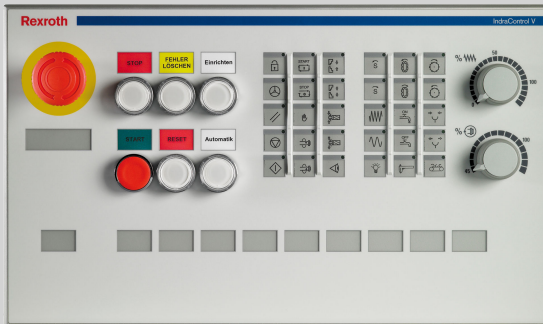


IndraControl VAM 12.1, VAM 42.1

Machine Control Panels

Operating Instructions
R911338457

Edition 03



Change Record

Edition	Release Date	Notes
Edition 01	2013-02	First edition
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Edition 03	2016-02	Supplementations, corrections

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Editorial Department

Control Components ag (KW/MePe)

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1 About this documentation

Overview on target groups and product phases

In the following illustration, the framed activities, product phases and target groups refer to the present documentation.

Example: In the product phase "Mounting", the "Mechanic/electrician" can execute the activity "Install" using this documentation.

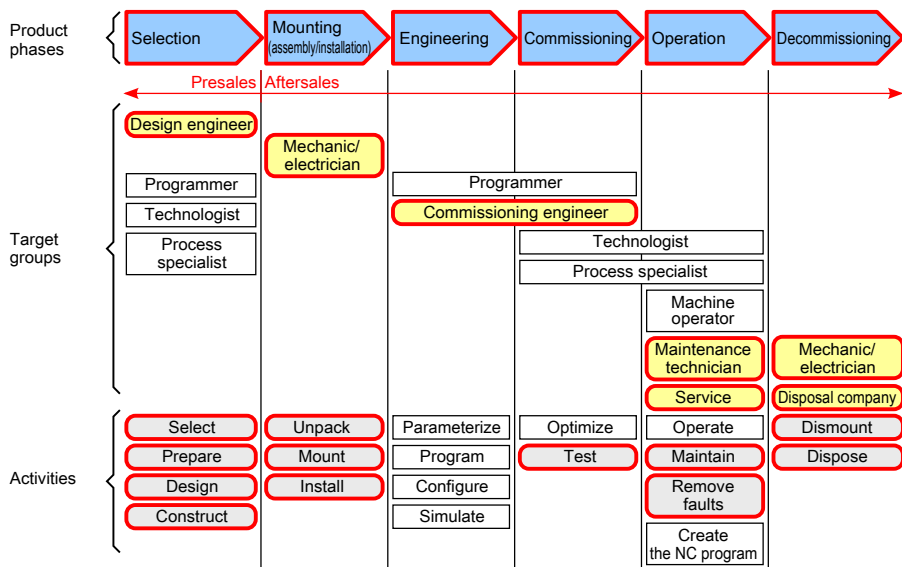


Fig. 1-1: Assigning the present documentation to the target groups, product phases and activities of the target group

Purpose

This document instructs the technical staff of the machine manufacturer on how to safely perform the mechanic and electrical installation and on how to commission the machine control panels IndraControl VAM 12.1/VAM 42.1.

Required qualification: Individual who is able to assess the tasks assigned and to identify possible safety risks owing to qualification in the subject, knowledge and experience. The individual should also be familiar with the standards and regulations.

Scope

This document is valid for all variants, whose type code starts with "VAM12.1...." or "VAM42.1....".

The type code specifications are located on the type plate of the device. Also refer to [chapter 2.1 "Product identification" on page 2](#).

Related documents

Title	Part number and document type
Rexroth IndraControl VEH 30.1 Hand-Held Terminal	R911318643 Project Planning Manual
Rexroth IndraControl VEH 30.2 Hand-Held Terminal	R911331585 Project Planning Manual
Rexroth IndraControl VCH 08.1 Hand-Held Terminal	R911320190 Project Planning Manual
Rexroth IndraControl VAP 01 Power Supply Unit	R911339613 Operating Instructions

Tab. 1-1: Related documents

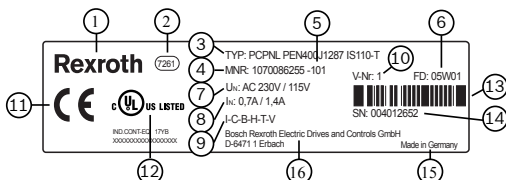
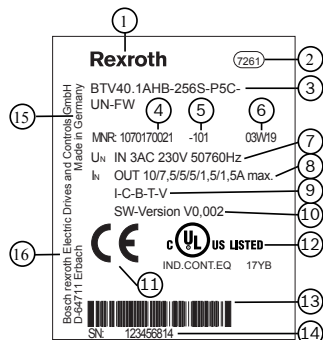
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2 Product identification and scope of delivery

2.1 Product identification

The type plate is located on the rear side or at the side of the device.



- 1 Logotype
- 2 Division or plant number
- 3 Type designation code (type code)
- 4 Parts number
- 5 State of revision
- 6 Date of manufacture (yyWww)
- 7 Nominal voltage
- 8 Nominal current

- 9 Test marking
- 10 Version number
- 11 CE mark
- 12 Underwriters Laboratories Inc. mark
- 13 Serial number as barcode
- 14 Serial number
- 15 Designation of origin
- 16 Company address

Fig. 2-1: Exemplary type plates

2.2 Scope of delivery

- Machine control panel
- Mounting kit (foil back with nuts to mount the device)

3 Use of the safety instructions

3.1 Structure of the safety instructions

The safety instructions are structured as follows:

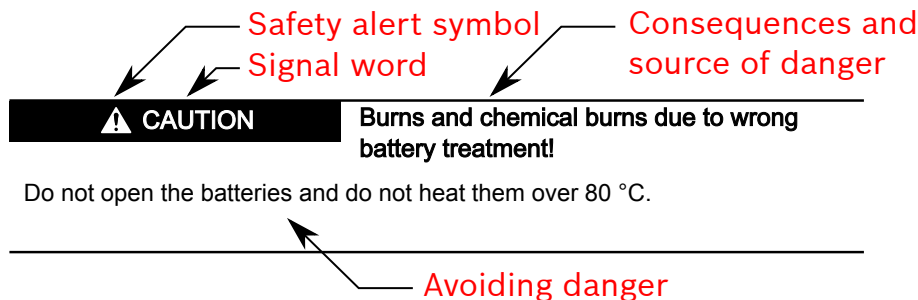


Fig. 3-1: Structure of the safety instructions

3.2 Explaining signal words and safety alert symbol

The safety instructions in this documentation contain specific signal words (danger, warning, caution, notice) and, if necessary, a safety alert symbol (according to ANSI Z535.6-2006).

The signal word is used to draw attention to the safety instruction and also provides information on the severity of the hazard.

The safety alert symbol (a triangle with an exclamation point), which precedes the signal words danger, warning and caution is used to alert the reader to personal injury hazards.

DANGER

In the event of non-compliance with this safety instruction, death or serious injury **will** occur.

WARNING

In the event of non-compliance with this safety instruction, death or serious injury **will** occur.

CAUTION

In the event of non-compliance with this safety instruction, minor or moderate injury can occur.

NOTICE

In the event of non-compliance with this safety instruction, material damage can occur.

3.3 Symbols used

Hints are represented as follows:



This is an information.

Tips are represented as follows:



This is a tip.

3.4 Signal graphic explanation on the device



Prior to the installation and commissioning of the device, refer to the device documentation.

4 Intended use

The machine control panels of the IndraControl VAM 12.1 and IndraControl VAM 42.1 by Bosch Rexroth are intended for operating control units.

NOTICE

Risk of damaging the device if not expressly stated accessories, mounting parts and other components, cables, lines and software and firmware are used

The machine control panels may only be used as intended and with the accessories, mounting parts and other components specified in this documentation. Components that are not expressly mentioned must neither be attached nor connected. The same applies to cables and lines.

Only to be operated with the component configurations and combinations expressly defined and with the software and firmware specified in the corresponding functional description.

The machine control panels IndraControl VAM 12.1 and IndraControl VAM 42.1 were developed for single-axis as well as for multiple-axes drive and control tasks.

For the application-specific use of the machine control panels IndraControl VAM 12.1 and IndraControl VAM 42.1, device types are available in different variants.

Fields of applications of the IndraControl VAM 12.1 and IndraControl VAM 42.1 machine control panels:

- Lathes
- Milling machines
- Machining centers
- Automated production

The devices of the IndraControl VAM 12.1 and IndraControl VAM 42.1 machine control panels may only be operated under the assembly conditions and installation conditions, in the specified position of use and under the specified ambient conditions (temperature, degree of protection, humidity, EMC etc.) given in this documentation.

NOTICE

Device surface damage due to unapproved lubricant and cleaner

Before use, check new lubricants or cleaners for compatibility with the material of the devices.

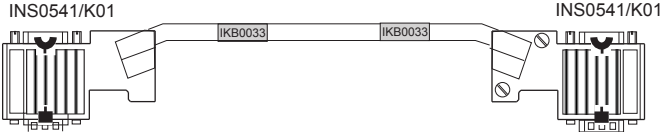
5 Spare parts, accessories and wear parts

5.1 Spare parts

Ordering code	Part number	Description
SUP-E11-VAM-OVERRIDE- 24-STUFIG-MIT-KABEL	R911171981	1 × 24-stage override switch including connecting cable
SUP-E11-VAM-OVERRIDE- 16-STUFIG-MIT-KABEL	R911171980	1 × 16-stage override switch including connecting cable
SUP-E11-VAM-EKS-A-IUXA- G01-ST01_04	R911172195	Euchner EKS type "EKS-A-IUXA-G01-ST01/04"

Tab. 5-1: Spare parts for the IndraControl VAM 12.1/VAM 42.1

5.2 Connectors and ready-made cables

Ordering code	Mating plug of the device Rexroth cable	Design of the cable end
Ready-made cable		
Profibus cable IKB0033/000,0 Part no.: R911291808		
Profibus cable IKB0034/000,0 Part no.: R911291809		

Tab. 5-2: Cable accessories

6 Ambient conditions

Ambient conditions	In operation	Transport	Storage
Max. ambient temperature	+5 °C to +45 °C	-20 °C to +60 °C	
Max. temperature gradient	Temporal temperature changes up to 3 K per minute		
Humidity	Min. relative humidity: 5 % Max. relative humidity: 85 % Min. absolute humidity: 1 g/m ³ Max. absolute humidity: 25 g/m ³ Condensation not allowed Corresponds to climatic class 3K3 acc. to EN 60721-3-3	Min. relative humidity: 5 % Max. relative humidity: 75 % Min. absolute humidity: 1 g/m ³ Max. absolute humidity: 25 g/m ³ Condensation not allowed Corresponds to climatic class 2K2 acc. to EN 60721-3-2	Min. relative humidity: 5 % Max. relative humidity: 85 % Min. absolute humidity: 1 g/m ³ Max. absolute humidity: 25 g/m ³ Condensation not allowed Corresponds to climatic class 1K2 acc. to EN 60721-3-1
Air pressure	Up to 3,000 m above sea level acc. to EN 61131-2		
Mechanical strength	Max. vibration: Frequency range: 5...200 Hz Excursion: 3.5 mm at 5...9 Hz Acceleration: 1.3 g at 9...200 Hz Acc. to EN 60068-2-6	Max. shock: 15 g 11 ms Acc. to EN 60068-2-27, No malfunction	
Contamination level	2		
Overvoltage category	2	-	

Tab. 6-1: Ambient conditions

NOTICE

Failure of the product due to contaminated air

- The ambient air must not contain acids, alkaline solutions, corrosive agents, salts, metal vapors and other electrically conductive contaminants in high concentrations
- The ambient air must be free of dust
- Housing and installation compartments must at least comply with degree of protection IP 54 according to DIN EN 60529

NOTICE

Defective product due to gases jeopardizing functions

Due to the risk of corrosion, avoid sulphurous gases (e.g. sulphur dioxide (SO₂) and hydrogen sulphide (H₂S)). The product is not resistant against these gases.



This is a product that corresponds to the limit values of the emitted interference of class A (industrial environments), but not of class B (residential area and small enterprises).

When using the product in residential areas or small enterprises, the operator has to take actions to prevent radio interferences (also refer to DIN EN 55022).

7 Technical data

7.1 Basic device

	IndraControl VAM 12.1	IndraControl VAM 42.1
Degree of protection	IP 54 (front)	
Front foil color	RAL 7035 light gray	
Dimensions (W × H × D)	350 mm × 240 mm × 58 mm	407 mm × 240 mm × 58 mm
Standard device		
Dimensions (W × H × D)	350 mm × 240 mm × 70 mm	407 mm × 240 mm × 70 mm
Customer-specific design		
Mounting cut-out (W × H)	324 mm × 215 mm	380 mm × 215 mm
Weight	Approx. 1170 g	Approx. 1380 g
Mounting depth	102 mm (with Profibus DP plug)	
Front panel material	Anodized aluminum, completely embedded, chemical resistant polyester foil	
Voltage supply	Electrically isolated	

	IndraControl VAM 12.1	IndraControl VAM 42.1
Logic supply U_L	24 V DC (19.2 V to 30 V), PELV Use for example the 24 V industrial power supply unit VAP01.1H-W23-024-010-NN with the part number R911171065 (for specifications on the operating instructions of the power supply unit, refer to " Related documents " on page 2)	
Current consumption from U_L	0.5 A max.	
Standard device		
Current consumption from U_L	With IndraControl VAC 30.2: 1.7 A max.	
Customer-specific design		
Input and output supply U_Q	24 V DC (19.2 V to 30 V), PELV Use for example the 24 V industrial power supply unit VAP01.1H-W23-024-010-NN (part number R911171065)	
Current consumption from U_Q	1.7 A max.	
Fuse for U_L and U_Q	SMD fuse 3 A	
Reverse voltage protection	Integrated	

Tab. 7-1: Technical data of the basic device

D-SUB socket, 25-pin, 9-pin

Connector strips by Weidmüller, 4-pin, 6-pin and 8-pin

Tab. 7-2: Connection method

7.2 E-STOP button



Only 24 V (protective extra-low voltage) may only be connected to the E-STOP button!

E-STOP button acc. to DIN EN 60947-5-5

Name	E-STOP button, tamper-proof with rotary release; equipped with: • 2 × standard auxiliary switches with forced opening • 1 × standard auxiliary switch N/O contact
Connection voltage	PELV/SELV
Max. current	0.5 A

B10d value mushroom button	Mechanics: B10d = 600,000 (acc. to the manufacturer) Assumption: B10d = 2 × B10 Fault exclusion at < 6050 cycles
B10d value auxiliary contact N/C contact	Electrics: B10d = 10,000,000 (acc. to the manufacturer) Assumption: B10d = 2 × B10 Fault exclusion at < 6050 cycles
B10d value auxiliary contact N/O contact	Electrics: B10d = 10,000,000 (acc. to the manufacturer) Assumption: B10d = 2 × B10 Fault exclusion at < 6050 cycles
Connection cross section	Min. without wire end sleeve (1 × 0.22 mm ²) Max. without wire end sleeve (2 × 1.5 mm ²)
Tightening torques	0.8 Nm (1.2 Nm max.)

Tab. 7-3: E-STOP button – Technical data

7.3 Machine pushbuttons



Only 24 V (protective extra-low voltage) may only be connected to the machine pushbuttons!

Name	Standard auxiliary switch, N/O contact / N/C contact	
Connection voltage	PELV/SELV	
Max. current	0.5 A	
Connection cross section	Min. without wire end sleeve (1 × 0.22 mm ²) Max. without wire end sleeve (2 × 1.5 mm ²)	
Tightening torques	0.8 Nm (1.2 Nm max.)	

Tab. 7-4: N/O and N/C contact acc. to DIN EN 60947-6-1 – Technical data

7.4 LED module

Name	LED module	
Voltage range	DC (DC voltage)	PELV/SELV
Current consumption	Direct connection 24 V AC/DC	18 mA

Tab. 7-5: LED module – Technical data

7.5 Connection module IndraControl VAC 30.2 for hand-held terminals

The connection module is required to connect the machine control panel to the hand-held terminals (IndraControl VEH 30.1, VEH 30.2, VCH 08.1).

Connections	• 1 × Ethernet connection (RJ 45, 10/100 base-T) • STOP button of the hand-held terminal • Enabling button of the hand-held terminal • Voltage supply of the 24 V hand-held terminal (see IndraControl VEH 30.1, VEH 30.2 or VCH 08.1)
Specified external protection	2 A protective fuse, slow

Tab. 7-6: Connection module for hand-held terminals

7.6 Electronic key system (EKS)

7.6.1 EKS "EK" with USB interface (type: EKS-A-IUXA-G01-ST01/04)

Voltage supply	Via USB interface
Current consumption	100 mA
Interface to PC	USB Full Speed (USB 1.1 and USB 2.0 compatible)
Transmission protocol	3964R
Data transmission rate	9.6 kBaud
Connection type of the USB interface	Socket, type B
Cable length	Max. 3 m
LED display	Green: "Stand by" (in operation) Yellow: "Electronic key is active"

Tab. 7-7: Technical data of the Electronic Key system "EK" with USB interface

Voltage supply for load U (LA, LB)	Typ. 24 V, max. 30 V
Switching current per output	Min. 1 mA, max. 50 mA
Number of actuations of the overload protection	Typ. 100
Output voltage "High" for U (LA, LB)	Min. $0.9 \times U$ and max. U [V]
Resistance in switched-on state	35 Ohm
Capacity per output	Max. 2 nF
Additional capacitive load per output	Max. 1 nF

Utilization category according to EN IEC 60947-5-2	50 mA/24 V
AC-12, AC-15, DC-12, DC-13	
Difference time of the outputs (LB first)	Typ. 200 ms
Connection type of the switching contacts	Screw terminal, 2 × 2-pin

Tab. 7-8: Parameters of the semiconductor relay outputs LA and LB



The manufacturer and operator of the higher-level overall system, e.g. of a machinery, is responsible for complying with the national and international safety and accident prevention regulations which apply to the specific use.

7.6.2 EKS "EE" with Ethernet interface (type: EKS-A-IEXA-G01-ST02/03/04)



This interface is only available for the machine control panel VAM 42.1.

Voltage supply	Typ. 24V (min. 20V, max. 28V) controlled, residual ripple < 5 %)
Current consumption	150 mA
Interface to PC	Industrial Ethernet (IEEE 802.3)
Transmission protocol	TCP/IP
Data transmission rate (full duplex)	10/100 Mbit/s
Data connection	1 × RJ45 socket
Data line	2 × 2 twisted pair copper cable, shielded, min. category 5
Cable length	100 m max.
LED display	Green: "Stand by" (in operation) Yellow: "Electronic key is active" Red: "Error"

Tab. 7-9: Technical data of the Electronic Key system "EE" with Ethernet interface

Voltage supply for load U (LA, LB)	Typ. 24 V, max. 30 V
Switching current per output	Min. 1 mA, max. 50 mA
Number of actuations of the overload protection	Typ. 100
Output voltage "High" for U (LA, LB)	Min. $0.9 \times U$ and max. U [V]
Resistance in switched-on state	35 Ohm
Capacity per output	Max. 2 nF
Additional capacitive load per output	Max. 1 nF

Utilization category according to EN IEC 60947-5-2	50 mA/24 V
AC-12, AC-15, DC-12, DC-13	
Difference time of the outputs (LB first)	Typ. 200 ms
Connection type of the switching contacts	Screw terminal, 2 × 2-pin
	0.14 min. / 1.5 mm ² max.

Tab. 7-10: Parameters of the semiconductor relay outputs LA and LB



The manufacturer and operator of the higher-level overall system, e.g. of a machinery, is responsible for complying with the national and international safety and accident prevention regulations which apply to the specific use.

7.7 X21, X22, X11 – Digital 24 V inputs and outputs

7.7.1 Characteristics of the digital inputs

Input types	Type 1 acc. to EN 61131-2
Number of inputs	16
Status display by LED	Green
Electrical isolation	Yes (to logic supply)
Reverse voltage protection	Yes
Plug grid	3.5

Tab. 7-11: Digital input characteristics

7.7.2 Characteristics of the digital outputs

Output types	Semiconductor outputs, non-saving; protected, with automatic restart, current-carrying
Number of outputs	8
Status display by LED	Green
Electrical isolation	Yes (to logic supply)
Reverse voltage protection	Only guaranteed without load connection
	Defect of the component caused by
	• Polarity reversal with simultaneous short circuit of the output lines • Polarity reversal with simultaneous connection of externally polarized suppressor diodes at the output lines • Applying an external voltage > U_Q

Output voltage	
Nominal value	24 V
Rated output current	
Nominal value:	0.2 A
UL rating:	0.2 A general purpose 5 W Tungsten
Simultaneity factor	100 %
Plug grid	3,5 (Weidmüller terminal)

Tab. 7-12: Digital output characteristics

7.8 X81 – Connection for external hand-held terminal

Handwheel supply	5 V DC $\pm$ 5 %
Current consumption, handwheel	Max. 200 mA
Max. cable length	Approx. 5 m (depending on handwheel)
Cable type	Twisted pair, separately shielded
Inputs	12 $\times$ 24 V input (for switch and pushbutton of the hand-held terminal)
Reference device	100 pulses per revolution; max. 300 min ⁻¹

Tab. 7-13: Characteristics of the handwheel interface

7.9 Connecting the hand-held terminal (IndraControl VEH 30.1, VEH 30.2, VCH 08.1)

7.9.1 X1 – 24 V DC voltage supply of the IndraControl VAC 30.2

Parameters	Value
Rated voltage U_N	24 V DC ; (+19 V to +30 V)
Residual ripple at U_N	Interfering AC voltage components - such as the ones resulting from an uncontrolled three-phase bridge circuit without smoothing and with a ripple factor (see DIN 40110/10.75, section 1.2) of 5 % - are allowed
Emitted interference and surge immunity	$U_{max} = 35$ V (for $t < 100$ ms)
Current consumption at U_N	0.7 A max.
Specified external protection	Protective fuse, 2 A, slow
Reverse voltage protection	By decoupling diode; the input fuse is activated when polarity reversal occurs

Tab. 7-14: Technical data of the 24 V DC connection IndraControl VAC 30.2

7.9.2 X3 – Ethernet interface IndraControl VAC 30.2

The hand-held terminal can be connected to an Ethernet network via the Ethernet interfaces.

RJ45, socket, 8-pin	
Type	Ethernet 10Base T/100Base X
Cable length	Max. 65 m; patch cable (category 6)
Cable type	Shielded, twisted pair
Transmission rate	10 or 100 Mbits/s; class D

Tab. 7-15: Ethernet interface



For more information on the configuration of the Ethernet interface, please refer to the documentations on the hand-held terminals (refer to "[Related documents](#)" on page 2).

8 Standards

8.1 Standards used

Standard	Meaning
EN 60204-1	Safety of machinery - Electrical equipment of machines
EN 61000-6-4	Generic standards - Emission standard (industrial environments)
EN 61000-6-2	Generic standards – Noise immunity (industrial environments)
EN 61131-2	Requirements on the 24 V inputs and outputs
EN 60947-5-5	Low-voltage switchgear and control gear - Control circuit devices and switching elements - E-STOP device with mechanical latching function
EN 60529	Degrees of protection (including housings and installation compartments)
EN 60068-2-6	Vibration test
EN 60068-2-27	Shock test
EN 60721-3-3	Classification of ambient conditions – Operation
EN 60721-3-2	Classification of ambient conditions – Transport
EN 60721-3-1	Classification of ambient conditions – Storage
DIN EN 61131-2	Programmable logic controllers Equipment and test requirements
UL 508	Industrial Control Equipment

Tab. 8-1: Standards used

8.2 CE marking

8.2.1 Declaration of conformity



The electronic products described in the present operating instructions comply with the requirements and the target of the following EU directive and with the following harmonized European standards:

EMC directive 2004/108/EC (valid until 04/19/2016)

EMC directive 2014/30/EU (valid from 04/20/2016)

The electronic products described in the present operating instructions are intended for use in industrial environments and comply with the following requirements:

Standard	Title	Edition
IEC 61000-6-4	Electromagnetic compatibility (EMC) Part 6-4: Generic standards – Emission standard for industrial environments (EN 61000-6-4: 2007 + A1:2011)	2011
IEC 61000-6-2	Electromagnetic compatibility (EMC) Part 6-2: Generic standards – Immunity for industrial environments (EN 61000-6-2:2005)	2006 + B1:2011

Tab. 8-2: Standards for electromagnetic compatibility (EMC)



Loss of CE conformity due to modifications at the device

CE marking applies only to the device upon delivery. After modifying the device, verify CE conformity.

For the declaration of conformity, go to your contact person.

8.3 UL/CSA certified



The devices are certified according to

- **UL508** (Industrial Control Equipment) and
- **C22.2 no. 142-M1987** (CSA)

UL file no. E210730

However, there can be combinations or extension stages with a limited or missing certification. Thus, verify the registration according to the UL marking on the device.



Loss of UL/CSA conformity due to modifications at the device

UL and CSA marking applies only to the device upon delivery. After modifying the device, verify UL and CSA conformity.

9 Connections

9.1 Connector panel

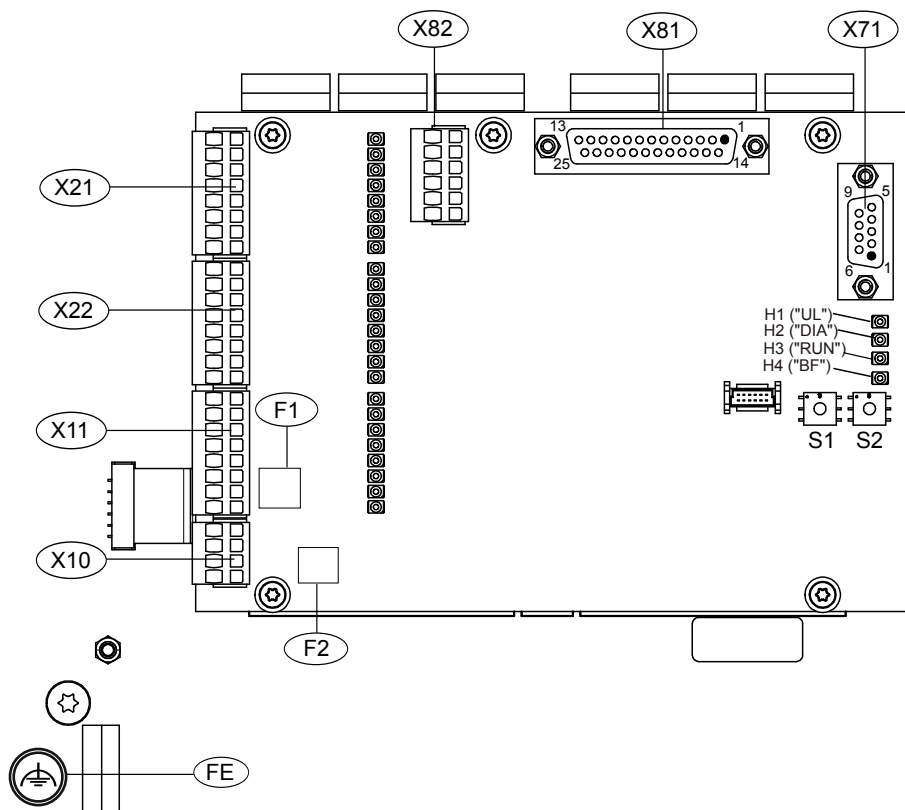


Fig. 9-1: Connector panel of the machine control panel

	Connection type	Connector type, integrated	Mating connector, external
X10	24 V DC voltage supply	Pin strip, 4-pin in the 3.5 mm grid	Socket plug, 4-pin in the 3.5 mm grid
X11	Digital 24 V outputs Q 0 - Q 7	Pin strip, 8-pin in the 3.5 mm grid	Socket plug, 8-pin in the 3.5 mm grid

	Connection type	Connector type, integrated	Mating connector, external
X21	Digital 24 V inputs I 0 - I 7	Pin strip, 8-pin in the 3.5 mm grid	Socket plug, 8-pin in the 3.5 mm grid
X22	Digital 24 V inputs I 8 - I 15	Pin strip, 8-pin in the 3.5 mm grid	Socket plug, 8-pin in the 3.5 mm grid
X81	Connection for external hand-held terminal	Socket 25-pin D-SUB	Plug 25-pin, D-SUB
X82	Connection for internal hand-wheel	Pin strip, 6-pin in the 3.5 mm grid	Socket plug, 6-pin in the 3.5 mm grid
X71	Field bus interface Profibus DP	Socket, D-SUB, 9-pin	Plug, 9-pin D-SUB
	Functional earth (FE)	M5	Ring cable lug

Tab. 9-1: Connections

Name	Description
F1	Fuse for voltage supply U_Q at X10
F2	Fuse for voltage supply U_L at X10
S1	Rotary switch for Profibus DP address setting (tens digit of the station address)
S2	Rotary switch for Profibus DP address setting (ones digit at station address)
H1-H4	Status LEDs, see chapter 12.3.1 "Status displays H1 to H4" on page 46

Tab. 9-2: Fuses, rotary switches, LEDs

9.2 X10 – 24 V DC voltage supplies

A 4-pin plug (3.5 pin spacing) with the following pin assignment is used to connect the voltage supplies:

Pin	Signal	Meaning
1	U_Q	+24 V DC input and output supply U_Q
2	0 V U_Q	0 V input supply, output supply U_Q
3	U_L	+24 V DC logic supply U_L
4	0 V U_L	0 V logic supply U_L

Tab. 9-3: Pin assignment X10

The voltage supplies at X10 are protected by the two SMD fuses F1 and F2 (refer to [chapter 10.5.4 "Notes on current and voltage supply" on page 30](#)).

9.3 X71 – Field bus interface Profibus DP

9.3.1 General information

5 V and 100 mA are provided at the X71 plug at the "VP" signal (PIN 6). Do not use any bus terminating resistors, but only a connected bus load. Thus, a hand-held terminal or an Optical Link Plug (OLP) [implementation RS485/Opto] can be connected.

Optical Profibus networks can be established in ring topology using the OLP.

Type	RS485
Electrical isolation	Yes
Baud rate	Up to 12 MBaud
2 BCD rotary switches	Station address 1-99
X71 plug	9-pin female connector strip D-SUB

Tab. 9-4: Field bus interface Profibus DP

9.3.2 Pin assignment

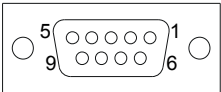


Fig. 9-2: Pin assignment of the 9-pin female connector strip D-SUB

Pin	RS485 reference	Signal	Meaning
1	-	Not assigned	
2	-	Not assigned	
3	B/B'	RxD/TxD-P	Receiving/transmitting data
4	-	CNTR_P	Repeater control signal
5	C/C'	DGND	Data reference potential (M 5 V)
6	-	VP	Supply voltage plus (P 5 V)
7	-	Not assigned	
8	A/A'	RxD/TxD-N	Receiving/transmitting data N
9	-	DGND	Data reference potential (M 5 V)

Tab. 9-5: Pin assignment of the Profibus DP interface

NOTICE

Malfunction of the Profibus DP interface due to insufficient potential equalization

Ensure that potential equalizing currents do not cross the shield conductor of the interface line. Therefore, provide a proper potential equalization between the devices to be connected before the initial commissioning.

9.4 X21, X22, X11 – Digital 24 V inputs and outputs

It is connected via three 8-pin plugs in the 3.5 grid.

Plugs	Pin	Signal	Meaning
X21	1	I0	Digital 24 V inputs I 0 – I 7
	2	I1	
	3	I2	
	4	I3	
	5	I4	
	6	I5	
	7	I6	
	8	I7	
X22	1	I8	Digital 24 V inputs I 8 - I 15
	2	I9	
	3	I10	
	4	I11	
	5	I12	
	6	I13	
	7	I14	
	8	I15	
X11	1	Q0	Digital 24 V outputs Q 0 – Q 7
	2	Q1	
	3	Q2	
	4	Q3	
	5	Q4	
	6	Q5	
	7	Q6	
	8	Q7	

Tab. 9-6: Pin assignment X21, X22, X11



DANGER

Dangerous movements due to plugging or unplugging plug connectors under load!

The plug connectors for the inputs and the outputs must not be connected or disconnected under load.

9.5 X81 - Connection for external hand-held terminal

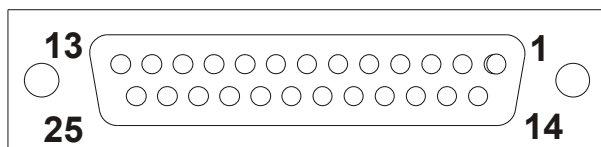


Fig. 9-3: Pin assignment 25-pin female connector strip D-SUB

Pin	Signal	Meaning
1	+24 V	24 V DC supply for hand-held terminal switch
2	IN 0	24 V input for hand-held terminal switch
3	IN 2	24 V input for hand-held terminal switch
4	IN 4	24 V input for hand-held terminal switch
5	IN 6	24 V input for hand-held terminal switch
6	IN 8	24 V input for hand-held terminal switch
7	IN10	24 V input for hand-held terminal switch
8	n.c.	Not assigned
9	n.c.	Not assigned
10	GND	0 V handwheel supply (-)
11	+5 V	5 V DC, $\pm 5\%$ handwheel supply (+)
12	/B	Handwheel, channel B, inverted
13	/A	Handwheel, channel A, inverted
14	+24 V	24 V DC supply for hand-held terminal switch
15	IN 1	24 V input for hand-held terminal switch
16	IN 3	24 V input for hand-held terminal switch
17	IN 5	24 V input for hand-held terminal switch
18	IN 7	24 V input for hand-held terminal switch
19	IN 9	24 V input for hand-held terminal switch
20	IN 11	24 V input for hand-held terminal switch
21	n.c.	Not assigned
22	GND	0 V handwheel supply (-)
23	+5 V	5 V DC $\pm 5\%$ handwheel supply (+)
24	B	Handwheel, channel B
25	A	Handwheel, channel A

Tab. 9-7: Pin assignment X81



For the address assignment of the external handheld terminal, refer to [chapter 12.10.4 "External hand-held terminal" on page 54](#).

9.6 X82 – Connection for the internal handwheel

It is connected via a 6-pin plug in the 3.5 grid.

Pin	Signal	Meaning
1	+5 V	5 V DC $\pm 5\%$ handwheel supply (+)
2	A	Handwheel, channel A
3	B	Handwheel, channel B
4	GND	0 V handwheel supply (-)
5	/A	Handwheel, channel A, inverted
6	/B	Handwheel, channel B, inverted

Tab. 9-8: Pin assignment X82

Reference de- vice	Incremental handwheel CESI 100, company EBE
	100 pulses per revolution each at the outputs A and B
	Current consumption < 60 mA



For the address assignment of the internal hand-held terminal, refer to [chapter 12.10.5 "Internal handwheel" on page 55](#).

9.7 Connecting the hand-held terminal (IndraControl VEH 30.1, VEH 30.2, VCH 08.1)

9.7.1 Pin assignment of the IndraControl VAC 30.2 connection module

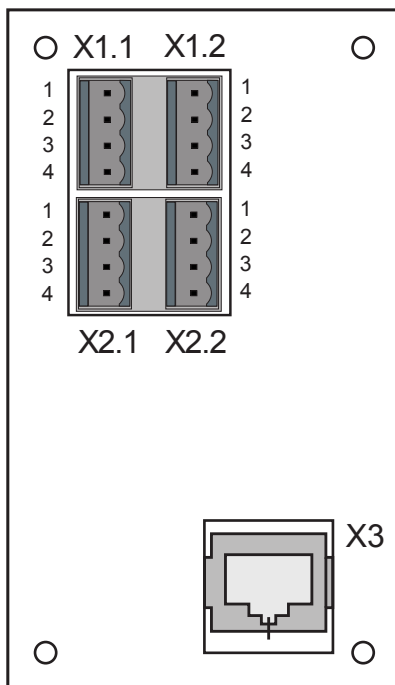


Fig. 9-4: Connection module for hand-held terminal

Pin	Signal name
X1.1 Pin1	24 V DC connection module IndraControl VAC 30.2
X1.1 Pin2	0 V
X1.1 Pin3	24 V DC hand-held terminal
X1.1 Pin4	Terminal connected IN
X1.2 Pin1	24 V DC connection module IndraControl VAC 30.2
X1.2 Pin2	0 V
X1.2 Pin3	24 V DC hand-held terminal
X1.2 Pin4	Terminal connected OUT
X2.1 Pin1	STOP buttons 1 IN
X2.1 Pin2	STOP button 1 OUT
X2.1 Pin3	STOP buttons 2 IN

Pin	Signal name
X2.1 Pin4	STOP button 2 OUT
X2.2 Pin1	Enabling button 1 IN
X2.2 Pin2	Enabling button 1 OUT
X2.2 Pin3	Enabling button 2 IN
X2.2 Pin4	Enabling button 2 OUT

Tab. 9-9: Pin assignment of the hand-held terminal connection module

9.7.2 X1 – 24 V DC voltage supply of the IndraControl VAC 30.2



The IndraControl VAC 30.2 is only available on the customized variants "D1". It is already prewired on these devices! It is supplied via the U_L voltage connection of the IndraControl VAM 12.1 or IndraControl VAM 42.1.

9.7.3 X2.1 – STOP button of the IndraControl VAC 30.2

Pin	Signal name
X2.1 Pin1	STOP buttons 1 IN
X2.1 Pin2	STOP button 1 OUT
X2.1 Pin3	STOP buttons 2 IN
X2.1 Pin4	STOP button 2 OUT

Tab. 9-10: Pin assignment of the STOP button IndraControl VAC 30.2, connection X2.1

9.7.4 X2.2 – Enabling button of the IndraControl VAC 30.2

Pin assignment X2.2

Pin	Signal name
X2.2 Pin1	Enabling button 1 IN
X2.2 Pin2	Enabling button 1 OUT
X2.2 Pin3	Enabling button 2 IN
X2.2 Pin4	Enabling button 2 OUT

Tab. 9-11: Enabling device, connection X2.2

9.7.5 X3 – Ethernet Interface IndraControl VAC 30.2

The hand-held terminal can be connected to an Ethernet network via the Ethernet interfaces. It is connected via an 8-pin RJ45 socket.

Type	Ethernet 10Base T/100Base X
Cable length	Max. 65 m; patch cable (category 6)

Cable type	Shielded, twisted pair
Transmission rate	10 or 100 Mbits/s; class D

Tab. 9-12: Ethernet interface

For more information on the configuration of the Ethernet interface, please refer to the documentations on the hand-held terminals (refer to ["Related documents" on page 2](#)).

10 Mounting, demounting and electric installation

10.1 Mounting notes

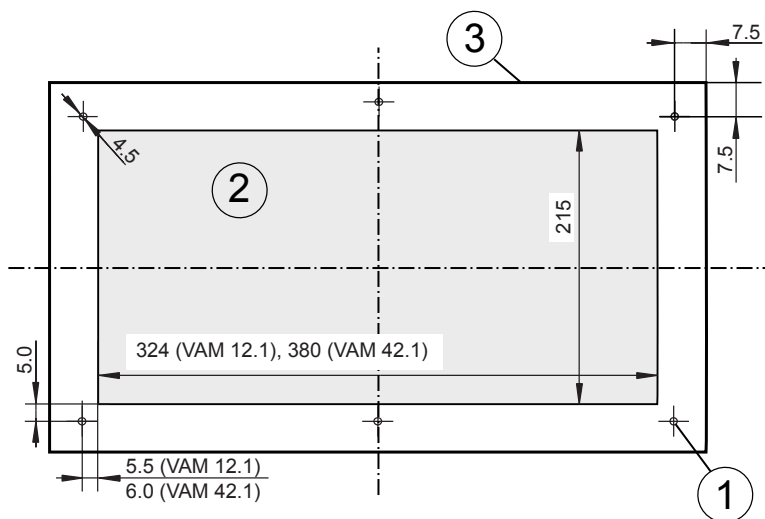
- The LED displays (H1 to H4) on the circuit board must not be hidden
- Provide a minimum space of 50 mm (on all sides of the device) for sufficient cooling and for cable routing
- Use strain reliefs for all cables
- Keep the maximum distance possible from interference sources

10.2 Mounting

Mount the machine control panel as follows:

1. Create a mounting cut-out with 6 drilled holes and a diameter of 4.5 mm acc. to [chapter 10.3 "Mounting dimensions" on page 26](#).
2. Remove the paper strip from the seal.
3. Insert the machine control panel from the front into the cut-out. The M4 mounting bolts have to be inserted into the drilled holes.
4. Fasten the machine control panel by screwing the nuts at the rear side of the mounting bolts.

10.3 Mounting dimensions



① Drilled hole for the mounting bolts with a drilling diameter of 4.5 mm

② Mounting cut-out

③ Outer edge of the housing

Fig. 10-1: Mounting dimensions of the IndraControl VAM 12.1/VAM 42.1 (in mm)

10.4 Housing dimensions

10.4.1 Front view

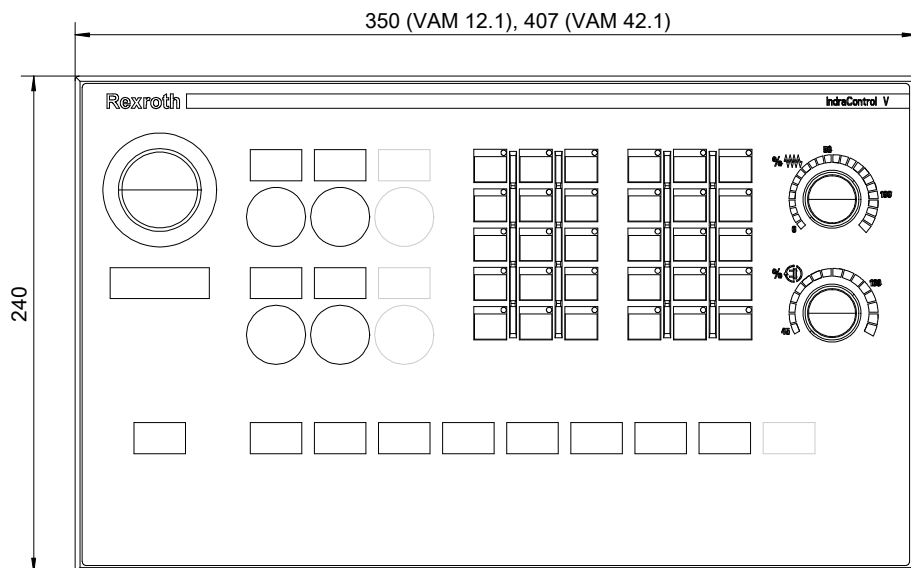


Fig. 10-2: Front view of the IndraControl VAM 12.1/VAM 42.1 (in mm)

10.4.2 Top view

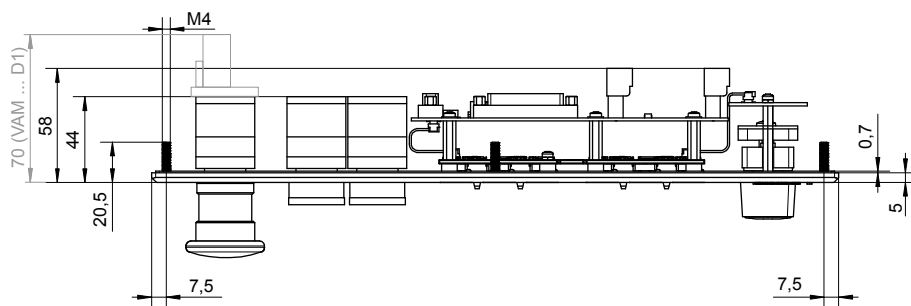


Fig. 10-3: Top view of the IndraControl VAM 12.1/VAM 42.1 (in mm)

10.5 Electric connection

10.5.1 General information

⚠ DANGER

Danger without safe separation!

- The 24 V DC input voltages must comply with the requirements of the "safe separation"!
- Plug and remove the plug connection only if there is no voltage!

10.5.2 Connecting the machine control panel to the voltage supplies

NOTICE

Both voltage supplies have to be galvanically isolated

Always use two galvanically isolated power supply units for 24 V voltage supplies.

Connection diagram

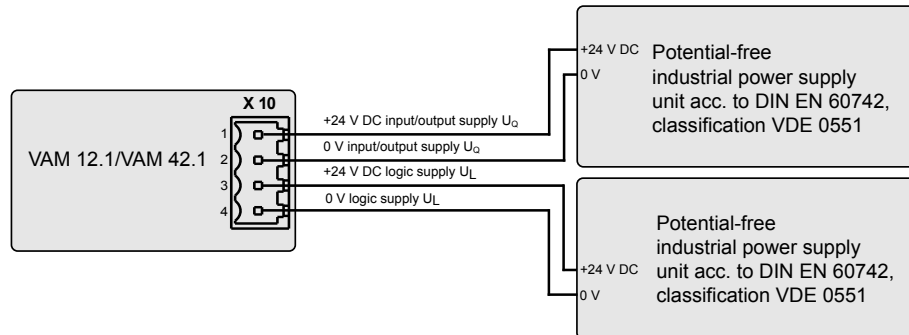


Fig. 10-4: Cabling of the machine control panel with 24 V voltage supplies

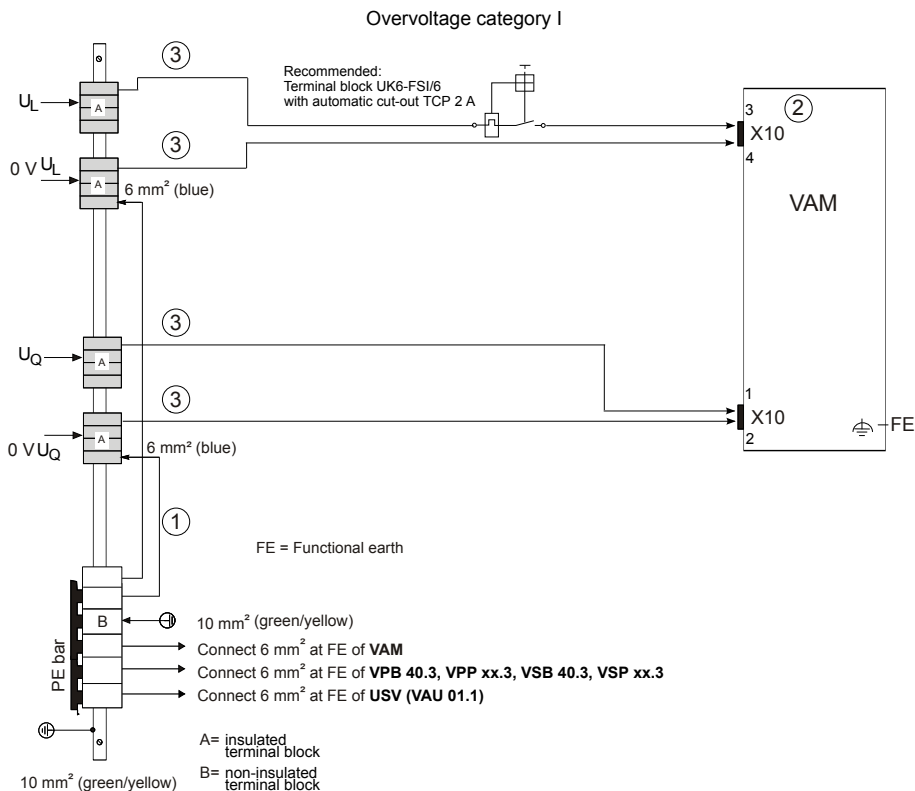
Connection

1. Connect X10 for the 24 V voltage supplies to the industrial power units.

Use 24 V industrial power supply units acc. to DIN EN 60742, classification VDE 0551, for example "VAP01.1H-W23-024-010-NN" (part number R911171065) for the voltage supplies.

For specifications of the operating instructions of the power supply unit, refer to ["Related documents" on page 2](#).

Machine control panel cabling



- ① Easy to remove and visible
- ② Polarity reversal of the X10 plug can destroy the operator terminal if there is no additional external protection (fire hazard). The reason is a simultaneous grounding of the 0 V of the device and of the 0 V (PELV) (1)

- ③ Cable length between +24 V power supply unit and VAM is 6 m max. at a minimum cross-section of 0.75 mm². Cable length between +24 V power supply unit and VAM is 10 m max. at a minimum cross-section of 1.5 mm². An additional power supply unit is required if the length exceeds 10 m

Fig. 10-5: Machine control panel cabling

10.5.3 Functional earth connection

Ensure a sufficient conductor cross section during functional earth wiring.

For the functional earth wiring, use a cable with a cross section of at least 6 mm².



To ensure a proper operation of the EMC suppressor circuits of the IndraControl VAM 12.1/VAM 42.1 according to the guidelines, the functional earth has to be connected!

10.5.4 Notes on current and voltage supply

NOTICE

Insufficient contact and loss of UL certification if inadequate wire is used.

Use only copper wire (24 to 18 AWG) for wiring the connection terminals.

Fuses

The voltage supplies at X10 are internally protected by the SMD fuses F1 and F2 with 3 A each.

Supply	Fuse	Fuse blows
U_Q	F1	- Simultaneous short circuit of several outputs (X11 plug) against 0 V - Simultaneous exceedance of $I = 200 \text{ mA}$ at several outputs (X11) - Hardware defect
U_L	F2	- Short circuit of the +24 V supply of the hand-held terminal (X81 plug, pin 1 or pin 14) against 0 V - Hardware defect

NOTICE

The fuses are soldered on the board

SMD fuses may only be replaced by trained staff.

10.5.5 Digital 24 V inputs and outputs

NOTICE

Insufficient contact and loss of UL certification if inadequate wire is used.

Use only copper wire (24 to 14 AWG) for wiring the connection terminals.



WARNING

Dangerous movements due to plugging or unplugging plug connectors under load!

The plug connectors for the inputs and the outputs must not be connected or disconnected under load.

10.5.6 Field bus interface Profibus DP

NOTICE

Malfunction of the Profibus DP interface due to insufficient potential equalization

Ensure that potential equalizing currents do not cross the shield conductor of the interface line. Therefore, provide a proper potential equalization between the devices to be connected before the initial commissioning.

10.5.7 Connection for external hand-held terminal

General information

Next to the inputs for the handwheel of the hand-held terminal (A, /A, B, /B), 12 inputs (IN0 – IN11) are available for the keys of the hand-held terminal. The keys are supplied via the "+24 V" provided at the X81 plug.

The "+24 V" supply is internally generated by the supply "UL". The "+24 V" supply may only be used to connect the keys of the hand-held terminal. The X81 connection for the hand-held terminal is located on the logic circuit board.

The states of the inputs and the counter value of the handwheel are transmitted to the master control via Profibus DP.



For the address assignment, refer to [chapter 12.10.4 "External hand-held terminal" on page 54](#).

10.5.8 Connecting the hand-held terminal (IndraControl VEH 30.1/30.2, VCH 08.1)

Pin assignment of the IndraControl VAC 30.2 connection module

The IndraControl VAC 30.2 connection module including automatic STOP button jumpering is supplied with voltage via X1.1 pin1 or X1.2 pin1. The connected hand-held terminal is supplied with voltage via X1.1 pin3 or X1.2 pin3. To switch on and off the hand-held terminal when it is plugged on, the wire link between X1.2 pin1 and X1.2 pin3 has to be removed and the switching voltage for the hand-held terminal has to be applied to X1.1 pin3 or X1.2 pin3.

For the connector pin assignment, see [chapter 9.7.1 "Pin assignment of the IndraControl VAC 30.2 connection module" on page 23](#).



WARNING

Risk of injury caused by voltage loss and a non-functioning STOP button!

For safety reasons, the voltage supply for the connection module (X1.1 pin1, X1.2 pin1) has to be monitored. If the voltage fails, the STOP button at the device is inoperative.

24 V DC voltage supply of the IndraControl VAC 30.2

All internally required voltages are generated with electrical isolation via a DC/DC converter. The connection X1 is designed as pin strip S, grid of 3.50 mm, to ensure that cables up to a maximum conductor cross-section of 1.5 mm² can be connected.



The IndraControl VAC 30.2 is only available on the customized variants. It is already prewired on these devices! It is supplied via the U_L voltage connection of the IndraControl VAM 12.1 or IndraControl VAM 42.1.

NOTICE

Possible damages due to missing protection at the 24 V lead

The external voltage supply has to have a rated voltage of 24 V and must not exceed an output voltage of 30 V. The 24 V supply line to the connection module has to be protected with a slow 2 A safety fuse.

⚠ WARNING

Danger without safe separation!

- The 24 V DC input voltage must comply with the requirements of the "safe separation"!
- Plug and remove the plug connection only if there is no voltage!

Interfering AC voltage components - such as the ones resulting from an uncontrolled three-phase bridge circuit without smoothing and with a ripple factor of 5 % (see DIN 40110/10.75, section 1.2) - are allowed.

That results in the greatest absolute value of 30.2 V as upper voltage limit. The lowest absolute value of 18.5 V is the lower voltage limit.

STOP button of the IndraControl 30.2

⚠ WARNING

Risk of injury due to malfunction of the STOP button or E-STOP button

The circuit of the STOP or E-STOP button may be operated with up to 30 V and has to be protected with a slow 2 A safety fuse.

For the connector pin assignment, see [chapter 9.7.3 "X2.1 – STOP button of the IndraControl VAC 30.2" on page 24](#).

Enabling button of the IndraControl VAC 30.2

WARNING

Risk of injury due to malfunction of the enabling control

The circuit of the enabling device may be operated with up to 30 V and has to be protected with a slow 2 A safety fuse.

The following special requirements apply to the connection between the hand-held terminal (IndraControl VEH 30.1, VEH 30.2 or VCH 08.1) and the safety-related evaluation for the enabling button. It is required that short circuits and cross-faults on the safety-related signal paths are safely detected by evaluation devices.

The simultaneity monitoring has to be executed by the monitoring device. Otherwise, an unidentified error accumulation can occur and a loss of safety can result.

EN 60204-1:1997 also specifies that the enabling button has to be connected to a stop of category 0 or 1, i.e. the energy has to be switched off.



For more information on the cabling of the enabling button as well as examples on how to reach safety category 3 with the hand-held terminals IndraControl VEH 30.1, VEH 30.2 or VCH 08.1 and safety-related parts, refer to the documentation on the respective hand-held terminal (see ["Related documents" on page 2](#)).

For the connector pin assignment, see [chapter 9.7.4 "X2.2 – Enabling button of the IndraControl VAC 30.2" on page 24](#).

Personality function

In the majority of cases, the system features a continuous Ethernet network. However, M-keys, STOP buttons or enabling buttons are fixedly assigned to one control. The STOP button and the enabling button are permanently wired to the connection module IndraControl VAC 30.2 (= the VAM connection module). The network data of the IndraControl VEH 30.1, 30.2 or VCH 08.1 as well as the IP address of the control are saved in the IndraControl VAC 30.2 connection module via the memory function.

Thus, different system section can be visualized using an IndraControl VEH 30.1, VEH 30.2 or VCH 08.1 via multiple IndraControl VAC 30.2 connection modules. Upon each replugging, the IndraControl VEH 30.1, VEH 30.2 or the VCH 08.1 obtain for example a new target IP address or UDP address.

The IndraControl VEH 30.1, VEH 30.2 or VCH 08.1 applies the network settings retrieved from the IndraControl VAC 30.2 connection module upon each restart. These settings can be adjusted in the "Rexroth settings" of the IndraControl VEH 30.1, VEH 30.2 or VCH 08.1 hand-held terminals. These changes are saved in the IndraControl VAC 30.2.



For more information on the "Personality" function, refer to the documentation of the respective hand-held terminal (see ["Related documents" on page 2](#)).

10.5.9 E-STOP button

The connections of both NC contacts ("NC") are labeled with "1" and "2" in the following illustration. An additional N/O contact "NO" with the connection names "3" and "4" is available. This N/O contact can for example be used as signal contact for the state evaluation of the E-STOP button via a PLC.



Only 24 V (protective extra-low voltage) may only be connected to the E-STOP button!

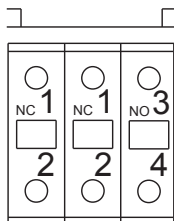


Fig. 10-6: N/C contacts (NC) and N/O contacts (NO) of the E-STOP button



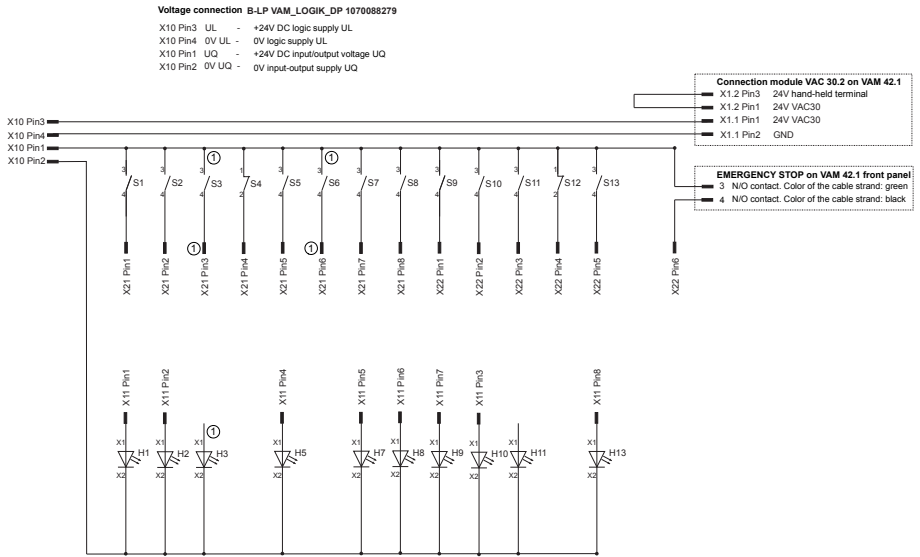
WARNING

Non-functioning E-STOP devices can have fatal consequences!

Ensure that the release of the E-STOP button does not cause any uncontrolled machine restart!

Test the E-STOP function cyclically by actuating the E-STOP button.

10.5.10 Wiring the machine pushbuttons and the E-STOP button for the customized device variant "D1"



① Only for IndraControl VAM 42.1 devices

Fig. 10-7: Wiring of the machine pushbuttons and of the E-STOP button, device variant "D1"



Only 24 V (protective extra-low voltage) may only be connected to the machine buttons and to the E-STOP button!

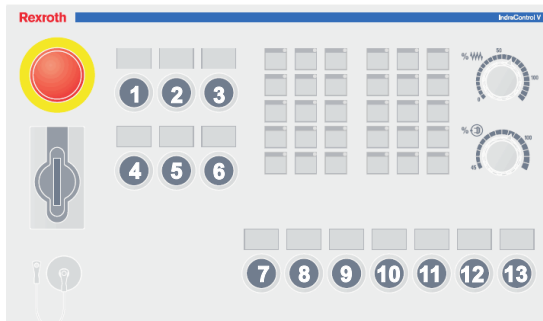


Fig. 10-8: Position and numbering of the machine pushbuttons and LEDs (H1-H13), variant "D1"

10.5.11 Connection for external hand-held terminal

Next to the inputs for the handwheel of the hand-held terminal (A, /A, B, /B), 12 inputs (IN0 – IN11) are available for the keys of the hand-held terminal. The keys are supplied via the "+24 V" provided at the X81 plug.

The "+24 V" supply is internally generated by the supply "UL". The "+24 V" supply may only be used to connect the keys of the hand-held terminal. The X81 connection for the hand-held terminal is located on the logic circuit board.

The states of the inputs and the counter value of the handwheel are transmitted to the master control via Profibus DP.



For the address assignment, refer to [chapter 12.10.4 "External hand-held terminal" on page 54](#).

For the connector pin assignment, see [chapter 9.5 "X81 - Connection for external hand-held terminal" on page 21](#).

10.5.12 Connection for internal handwheel

The X82 connection for the internal handwheel is located on the logic circuit board.

The counter value of the handwheel is transmitted to the master control via Profibus DP.



For the address assignment, refer to [chapter 12.10.5 "Internal handwheel" on page 55](#).

For the connector pin assignment, see [chapter 9.6 "X82 – Connection for the internal handwheel" on page 22](#).

10.5.13 Override VD

The module is connected to the logic circuit board via the internal shift register bus. The switch positions of both rotary switches are transmitted to the master control via Profibus DP.



For details refer to [chapter 12.6 "Override rotary switch" on page 50](#).

10.5.14 Electronic Key System (EKS)

EKS "EK" with USB interface (type: EKS-A-IUXA-G01-ST01/04)

The system connection is established via the integrated USB interface, which is a virtual COM port in Windows®-based systems. The voltage is also supplied via the USB connection.

For information on the pin assignment, refer to the following table:

USB interface	USB, type B
Screw terminal outputs LA1/LA2 and LB1/LB2	Channel LA Pin1, Pin2 Channel LB Pin1, Pin2 The channels LA and LB are marked on the housing

Tab. 10-1: Pin assignment of the Electronic Key System

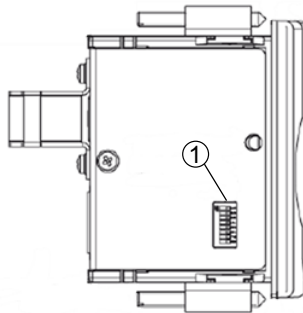


The screw terminal outputs LA1/LA2 and LB1/LB2 can be connected via the coded 2 × 2-pin connector part with screw terminals. Conductor cross-section of 0.14 mm² to 1.5 mm², tightening torque of 0.22 Nm.

Different parameters can be set via the DIP switches S1 to S8. A write protection can be activated via the S1 DIP switch. This impedes writing data on the write-read key. The settings are only used when applying the voltage supply.

DIP switch	Functions	Manufacturer settings (default)
S1	ON = Write protection for write-read key	OFF
S2 - S7		OFF
S8	OFF = write-read-key ON = Only-read key	OFF

Tab. 10-2: DIP switch settings Electronic Key System (EKS)



① Position of the DIP switches

Fig. 10-9: EKS "EK" with USB interface – Position of the DIP switches S1 to S8

EKS "EE" with Ethernet interface (type: EKS-A-IEXA-G01-ST02/03/04)



This interface is only available for the machine control panel IndraControl VAM 42.1.

The system connection is established via the Ethernet interface. The voltage is supplied via a 3-pin screw terminal.

For information on the pin assignment, refer to the following table:

Ethernet interface	RJ45
Screw terminal outputs LA1/LA2 and LB1/LB2	Channel LA Pin1, Pin2 Channel LB Pin1, Pin2 The channels LA and LB are marked on the housing
Voltage supply of the screw terminals	"UB" supply voltage + 24 V DC, pin1 "OV" supply voltage 0 V DC, pin 2 "Functional earth" connected electroconductively with housing, pin 3

Tab. 10-3: Pin assignment of the Electronic Key System



The screw terminal outputs LA1/LA2 and LB1/LB2 can be connected via the coded 2 × 2-pin connector part with screw terminals. The voltage is supplied via a coded connector part, 3-pin with screw terminals. Conductor cross-section of 0.14 mm² to 1.5 mm², tightening torque of 0.22 Nm.

Different parameters can be set via the DIP switches S1 to S3. A write protection can be activated via the S1 DIP switch. This impedes writing data on the write-read key. The settings are only used when applying the voltage supply.

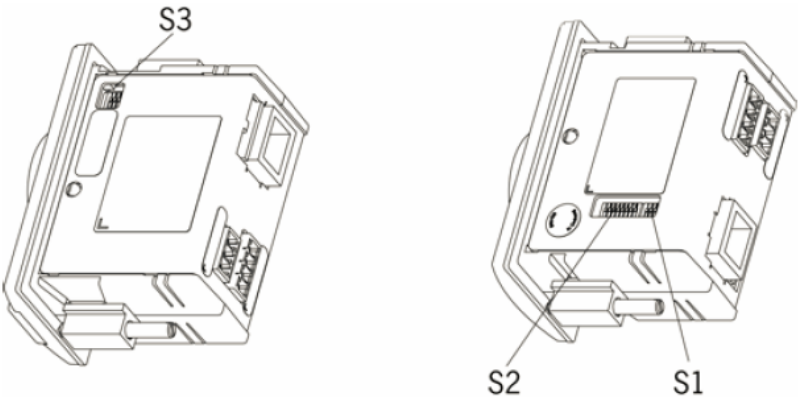


Fig. 10-10: EKS "EE" with Ethernet interface – Position of the DIP switches S1 to S3

DIP switch	Functions	Manufacturer settings (default)
S1 (4-stage)	S1.1 ... S1.4; write and read settings S1.1 ON = Write protection for write-read key S1.2 - S1.4 without function	All OFF
S2 (8-stage)	S2.1 ... S2.8; setting of a specified DNS name (only required for special applications at third-party controls). Not relevant for the operation at Bosch Rexroth controls	
S3 (4-stage)	S3.1 ... S3.4; settings for network connection and service For details, refer to the following table	

Tab. 10-4: DIP switch settings Electronic Key System (EKS)

Function	S3.1	S3.2	S3.3	S3.3
Specified IP address	Any	Any	OFF	OFF
Default IP address 192.168.1.1	Any	Any	ON	OFF
Obtain IP address from DHCP server	Any	Any	OFF	ON
Obtain IP address from a SINUMERIK control	Any	Any	ON	ON
Internal function, keep switch on OFF	Any	OFF	Any	Any
Allow configuration via web browser	OFF	Any	Any	Any

Tab. 10-5: DIP switch settings S3 EKS "EE"

10.5.15 Connection module IndraControl VAC 30.2 (integrated)

General information

On the rear side, all interfaces are provided to permanently wire the connection module to the control. A 17-pin socket with screwed plug is located on the front panel. The IndraControl VEH 30.1, VEH 30.2, or VCH 08.1 hand-held terminals in STOP button variant can be connected comfortably to the socket.

Enabling button of hand-held terminals

The hand-held terminals IndraControl VEH 30.1, VEH 30.2 or VCH 08.1 are provided with a 2-circuit, 3-stage enabling button operated by two actuators integrated in the rear of the housing. For more information, refer to the documentation of the respective hand-held terminal (see ["Related documents" on page 2](#)).

STOP button of hand-held terminals

The connection module for the hand-held terminals IndraControl VEH 30.1, VEH 30.2 or VCH 08.1 is equipped with an automatic STOP circuit jumpering. Due to this jumpering, the operator can connect or disconnect the hand-held

terminals IndraControl VCH 08.1, VEH 30.1 or VEH 30.2 via the connection module without causing an unintended system stop.

NOTICE

Shutdown of the system by connecting a hand-held terminal with pressed STOP button

Before commissioning the IndraControl VEH 30.1, VEH 30.2 or VCH 08.1, ensure that the STOP button is **NOT** pressed.



For more information on the safety concept and on connecting the stop and enabling circuits of the IndraControl VEH 30.1, VEH 30.2 or VCH 08.1, refer to the documentation on the respective hand-held terminal (see ["Related documents" on page 2](#)).

11 Commissioning

11.1 Profibus DP settings

11.1.1 Address settings

The station addresses 1-99 are set via the two BCD rotary switches S1 and S2 (refer to the following figure). S1 represents the tens digit and S2 the ones digit of the station address.

The address has to be set when there is no voltage.

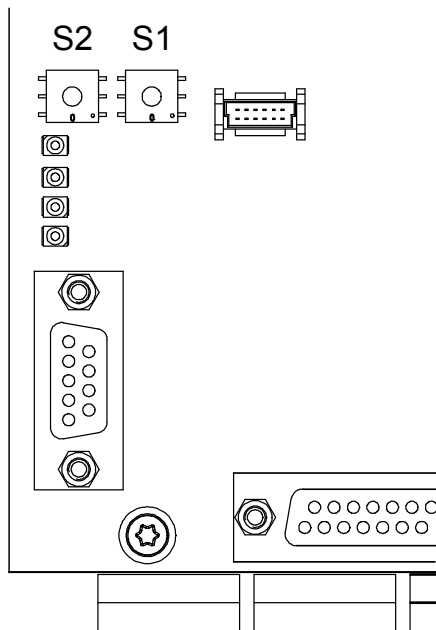


Fig. 11-1: BCD rotary switches S1 and S2

11.1.2 Baud rate setting

The machine control panels IndraControl VAM 12.1/VAM 42.1 automatically detect the baud rate set at the Profibus DP. Supported are baud rates ranging from 9.6 kBaud to 12 MBaud:

- 9.6 kBaud
- 19.2 kBaud
- 45.45 kBaud
- 93.75 kBaud
- 187.5 kBaud
- 500 kBaud
- 1.5 MBaud
- 3 MBaud
- 6 MBaud
- 12 MBaud

11.2 Engineering tool "IndraWorks"

The Bosch Rexroth engineering tool "IndraWorks" can be used for commissioning. In this engineering tool, the devices IndraControl VAM 12.1 and IndraControl VAM 42.1 are already in the device library "Periphery".

11.3 GSD file

A Profibus device description file (GSD file) is required when commissioning with another engineering tool.

Bosch Rexroth provides two GSD files :

- GSD_VAM12_42_WITH_OVERRIDE_RX070123.ZIP
- GSD_VAM_12_42DE_EN_WITHOUT_OVERRIDE.ZIP

11.4 Configuration specifications

11.4.1 General information



The following tables show how to configure the modules in the Profibus configurator with regard to the type code.

11.4.2 VAM12.1-PB-NF-NN-TB-VD-NN-1608-NN / VAM12.1-PB-NF-AB-TB-VD-EK-1608-D1

Module number	Module	Data format	Inputs (in bytes)	Outputs (in bytes)
0	16DI, 8DO	BYTE	2	1
1	Manual Control Unit	WORD	4	0
2	Handwheel	WORD	2	0
3	Keypad TA	BYTE	2	2
4	Keypad TA	BYTE	2	2
5	Override VD	BYTE	2	0

Tab. 11-1: VAM12.1-PB-NF-NN-TB-VD-NN-1608-NN / VAM12.1-PB-NF-AB-TB-VD-EK-1608-D1

11.4.3 VAM12.1-PB-NF-AB-TB-NN-EK-1608-D1

Module number	Module	Data format	Inputs (in bytes)	Outputs (in bytes)
0	16DI, 8DO	BYTE	2	1
1	Manual Control Unit	WORD	4	0
2	Handwheel	WORD	2	0

Module number	Module	Data format	Inputs (in bytes)	Outputs (in bytes)
3	Keypad TA	BYTE	2	2
4	Keypad TA	BYTE	2	2

Tab. 11-2: VAM12.1-PB-NF-AB-TB-NN-EK-1608-D1

11.4.4 VAM42.1-PB-NF-NN-TB-VD-NN-1608-NN / VAM42.1-PB-NF-AB-TB-VD-EK-1608-D1

Module number	Module	Data format	Inputs (in bytes)	Outputs (in bytes)
0	16DI, 8DO	BYTE	2	1
1	Manual Control Unit	WORD	4	0
2	Handwheel	WORD	2	0
3	Keypad TA	BYTE	2	2
4	Keypad TA	BYTE	2	2
5	Override VD	BYTE	2	0

Tab. 11-3: VAM42.1-PB-NF-NN-TB-VD-NN-1608-NN / VAM42.1-PB-NF-AB-TB-VD-EK-1608-D1

11.4.5 VAM42.1-PB-NF-AB-TB-NN-EK-1608-D1 / VAM42.1-PB-NF-AB-TB-NN-EE-1608-D1

Module number	Module	Data format	Inputs (in bytes)	Outputs (in bytes)
0	16DI, 8DO	BYTE	2	1
1	Manual Control Unit	WORD	4	0
2	Handwheel	WORD	2	0
3	Keypad TA	BYTE	2	2
4	Keypad TA	BYTE	2	2

Tab. 11-4: VAM42.1-PB-NF-AB-TB-NN-EK-1608-D1 / VAM42.1-PB-NF-AB-TB-NN-EE-1608-D1

12 Device description

12.1 General information

Machine control panels supplement operator and visualization terminals. They are used for the operation mode selection and the manual machine operation.

The machine control panels contain operating elements, e. g. keys with LED displays, rotary switches for feed and spindle override, E-STOP button, cut-outs for 22.5 mm operating and display elements as well as a connection for a hand-held terminal.

The machine control panels IndraControl VAM 12.1/VAM 42.1 were especially designed to be used with the devices of the IndraControl VPB, IndraControl VPP, IndraControl Vxx product family and are adapted to the design of these devices. The IndraControl VAM 12.1 width corresponds to the IndraControl VSP 16 width. The IndraControl VPP 16 and IndraControl VAM 42.1 widths correspond to the width of the IndraControl VSP 40 and IndraControl VPP 40.

IndraControl VAM 12.1/VAM 42.1 devices are machine control panels for CNC machines with Profibus connection.

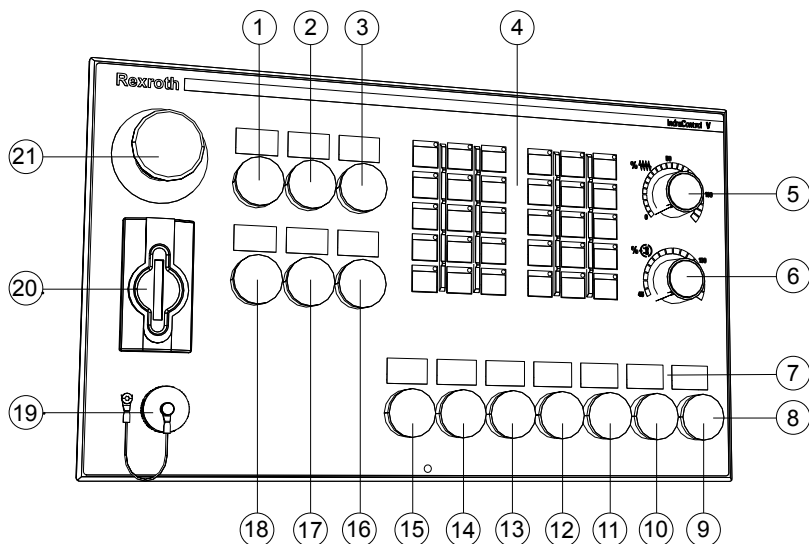


Fig. 12-1: Exemplary machine control panel

Equipping contacts/button color and type

1	N/O contact	White, illuminated
2	N/O contact	White, illuminated Green, illuminated (only for VAM ... D1)
3	N/O contact	White, illuminated (only for VAM42.1...)
4	Keypads with keys that can be freely labeled and programmed	
5	Override rotary switch for feed (only for VAM ... VD...)	
6	Override rotary switch for spindle (only for VAM... VD...)	
7	Depending on the variant between six and ten labeling fields	
8	Cut-outs 9 to 15 for operating and display elements Cut-outs 9 to 15 for VAM...D1 already equipped	
9	N/O contact	White, illuminated (only for VAM ... D1)
10	N/C contact	Red, not illuminated (only for VAM ... D1)

11	N/O contact	White, illuminated (only for VAM42.1 ... D1)
12	N/O contact	White, illuminated (only for VAM ... D1)
13	N/O contact	White, illuminated (only for VAM ... D1)
14	N/O contact	White, illuminated (only for VAM ... D1)
15	N/O contact	White, illuminated (only for VAM ... D1)
16	N/O contact	White, illuminated (only for VAM42.1...) Yellow, not illuminated (only for VAM42.1 ... D1)
17	N/O contact	White, illuminated Blue, illuminated (only for VAM ... D1)
18	N/C contact	Red, not illuminated Black, not illuminated (only for VAM ... D1)
19	IndraControl VAC 30.2 connection module (only for VAM ... AB)	
20	Electronic Key System (EKS) (only for VAM ... EK or VAM ... EE...)	
21	E-STOP button	

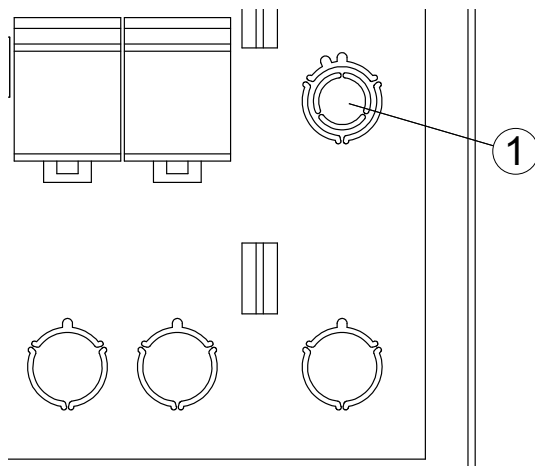
The following components are located on the rear side of the IndraControl VAM 12.1/VAM 42.1:

- 25-pin plug to connect a hand-held terminal
- 6-pin plug to connect a handwheel
- 16 digital 24 V inputs
- 8 digital 24 V outputs
- Voltage supply connections
- Field bus interface Profibus DP
- LEDs for status displays
- Functional earth connection

12.2 Equipping with 22.5 mm operating and display elements

The machine control panels can be equipped with 22.5 mm operating and display elements. For this purpose, the front panel is provided with pre-milled cut-outs. The switching elements can be application-specifically wired by the customer. The number of cut-outs varies between the individual hardware configurations.

The VAM12.1-PB-NF-NN-TB-VD-NN-1608-NN and VAM42.1-PB-NF-NN-TB-VD-NN-1608-NN device variants are provided with a cut-out, where either a 16 mm or a 22.5 mm hole can be broken out.



① Cut-out

Fig. 12-2: Position of the cut-out for a 16 mm or 22.5 mm operating or display element



Only 24 V (protective extra-low voltage) may be connected to the operating elements!

12.3 Operating and error display

12.3.1 Status displays H1 to H4

For the position of the status LEDs H1 to H4, refer to the following figure.

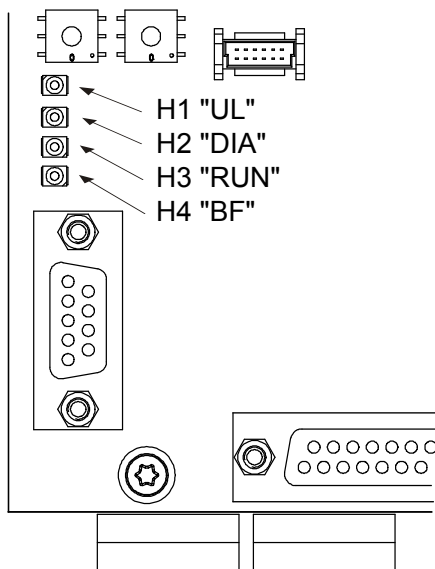


Fig. 12-3: Status displays H1-H4

Position	LED	Display	Meaning
H1	"UL"		24 V supply (X10 plug)
		Green	24 V supply present
		Green~	The bus connection is kept in the initialization phase by one or several modules
		Green~~	System stop (see chapter 12.3.2 "Status display "System stop" H1 UL and H2 DIA" on page 48)
		Off	No 24 V supply present
H2	"DIA"		Diagnostic display
		Red	One or several modules report diagnostics
		Red~	System stop (see chapter 12.3.2 "Status display "System stop" H1 UL and H2 DIA" on page 48)
		Red~~	System stop (see chapter 12.3.2 "Status display "System stop" H1 UL and H2 DIA" on page 48)
		Off	No diagnostics or system stop
H3	"RUN"		Operating display
		Green	Cyclic I/O data exchange (normal operation)
		Green~	Configuration error (command/actual assignment different)

Position	LED	Display	Meaning
		Off	The bus connection is not triggered by the DP master. Causes: • Incorrect Profibus DP station address • The Profibus DP station address is assigned several times at the bus • The trigger watchdog time is expired • Error in master parameter set (GSD file); e.g. incorrect PNO ID number, incorrect buffer sizes (Prm, Cfg, ...) • Incorrect parameterization in User_Prm_Data[1]

H4	"BF"		Bus error
		Red	The bus connection is searching for the baud rate
		Red~	Parameterization error (invalid parameterization data)
		Off	The bus connection detected and applied the baud rate

Legend:

~ Slow flashing of the display (0.8 s on and 0.2 s off)

~~ Fast flashing of the display (0.125 s on and 0.125 s off)

Tab. 12-1: Status displays

12.3.2 Status display "System stop" "H1 UL" and "H2 DIA"

The two LEDs "H1 UL" and "H2 DIA" display the "system stop" state. Upon system stop, the outputs are set to the safe state (0) and the bus traffic to the DP master is interrupted. Restart the component group (Network on) to exit the system stop.

H1 ("UL")	H2 ("DIA")	Meaning	Action
Off, green or green~	Off or red	No system stop	-
Green	Red~	Unknown I/O module	Load new firmware version (service case)
Green~~	Off	Misconfiguration	Check I/O configuration
Off, green	Red~~	Firmware exception	Service case
Green~~	Red~~	Hardware exception	Service case

~ Slow flashing of the display (0.8 s on and 0.2 s off)

~~ Fast flashing of the display (0.125 s on and 0.125 s off)

Tab. 12-2: Display of the "System stop" state

System stop "Unknown I/O module"

The system stop "Unknown I/O module" means that the machine operator panel detected a module that is not supported by the firmware version of the bus connection.

- To operate the I/O module, update the firmware
- If an error occurs with the current firmware version, the module has a hardware error

System stop "Misconfiguration"

The following I/O configurations cause a system stop due to misconfiguration:

- No I/O modules equipped
- More than 16 I/O modules equipped
- More than 64 bytes inputs equipped
- More than 64 bytes outputs equipped
- The total parameterization data of all modules is greater than 64 bytes
- The total diagnostic data of all modules is greater than 64 bytes

Exception, "Hardware" (HW)

When booting the bus connection ("Network on"), the hardware components are tested. During the cyclic operation, the I/O configuration and the transmission quality to the I/O modules are monitored. If errors occur, the component is set to the system stop "HW exception".

12.4 E-STOP button

IndraControl VAM 12.1/VAM 42.1 are equipped with an unwired standard E-STOP button. The two N/C contacts of the switching elements can be wired in the E-STOP circuits of the machine.

The red-yellow E-STOP button at the IndraControl VAM 12.1/VAM 42.1 complies with the requirements of the EN ISO 13850. It has to be designed as a STOP button of category 0 or 1 (see EN 60204-1 chapter 9.2.5.4.2) based on the risk assessment for the machine. The connection of the positive break contacts to an appropriate monitoring system must meet the category (acc. to EN ISO 13849-1) defined based on the risk assessment (acc. to EN ISO 14121-1) of the machine.



Only 24 V (protective extra-low voltage) may only be connected to the E-STOP button!

For information on the connections, refer to [chapter 10.5.9 "E-STOP button" on page 34](#).

12.5 Keypads

Two keypads, each with 15 keys, are available. The keys are short-stroke keys that can be configured and labeled freely. The keys are covered by a foil arranged in a matrix containing five columns and three rows. Each key is illuminated by a green point LED.

There are plastic separators between the keys preventing the user from accidental key activation.



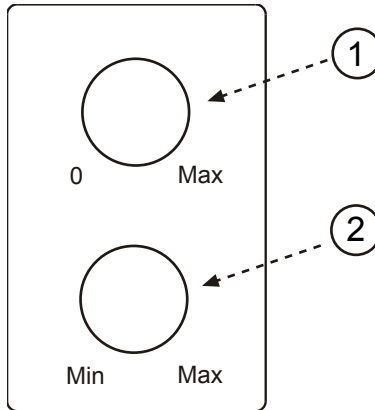
For the address assignment of the keypads, refer to [chapter 12.10.1 "Keypads" on page 51](#).

12.6 Override rotary switch

In the standard variant, this cut-out is equipped with two override rotary switches.

Feed override	24 switch positions from "0" to "Max"
Spindle override	16 switch positions from "Min" to "Max"

Tab. 12-3: Override rotary switch



- ① Feed override
- ② Spindle override

Fig. 12-4: Override rotary switch – Schematic



For the address assignment of the override rotary switches, refer to [chapter 12.10.2 "Override rotary switch" on page 52](#).

12.7 X21, X22, X11 – Digital 24 V inputs and outputs

The machine control panels provide 16 digital 24 V inputs and 8 digital 24 V outputs. The plugs of the inputs and outputs are located on the logic circuit board. The states of the I/Os are indicated by LEDs.

The states of the inputs are reported to the master control via Profibus DP. The outputs are specified by the master control via Profibus DP.



For the address assignment of the inputs and outputs, refer to [chapter 12.10.3 "Digital 24 V inputs and outputs" on page 54](#).

For characteristic data of the inputs and outputs, refer to [chapter 7.7 "X21, X22, X11 – Digital 24 V inputs and outputs" on page 13](#).

12.8 Electronic Key System (EKS)

Device variants with the abbreviation "EK" in the type code, integrate an Electronic Key System adapter with USB interface in the "FSA" variant.

Device variants with the abbreviation "EE" in the type code (only available for IndraControl VAM 42.1) are provided with an (Electronic Key System) electronic key adapter with Ethernet interface integrated in the "FSA" variant.



Fig. 12-5: Euchner EKS key adapter

12.9 Connection module IndraControl VAC 30.2

Device variants with the abbreviation "AB" in the type code are provided with an integrated VAC 30.2 connection module to connect an IndraControl VEH 30.1, VEH 30.2 or VCH 08.1 hand-held terminal in STOP button variant.

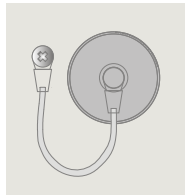


Fig. 12-6: Connection module IndraControl VAC 30.2

12.10 Address allocations

12.10.1 Keypads

Each Sx.y key (input) is assigned to one green LED Hx.y (output). The keypads are connected to the logic circuit board via the internal shift register bus. The inputs (buttons) and outputs (LEDs) of the keypad are mapped in the "Keypad TA" module on the field bus. For each of the keypads 1 and 2, one module "Keypad TA" has to be configured in the Profibus configurator.

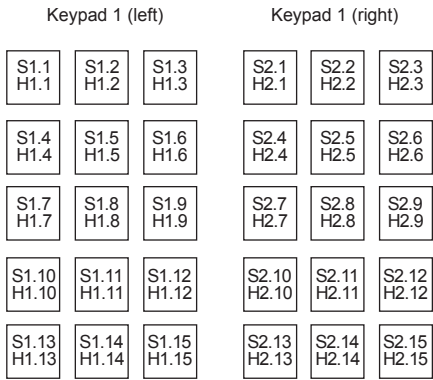


Fig. 12-7: Keypads

Profibus DP module for keypad 1 (GSD file)

Keypad TA	Format	MSB								LSB
LED outputs	BYTE	H1.8	H1.7	H1.6	H1.5	H1.4	H1.3	H1.2	H1.1	
	BYTE	-	H1.15	H1.14	H1.13	H1.12	H1.11	H1.10	H1.9	
Key inputs	BYTE	S1.8	S1.7	S1.6	S1.5	S1.4	S1.3	S1.2	S1.1	
	BYTE	0	S1.15	S1.14	S1.13	S1.12	S1.11	S1.10	S1.9	

Tab. 12-4: I/O assignment of the module "keypad 1"

Profibus DP module for keypad 2 (GSD file)

Keypad TA	Format	MSB								LSB
LED outputs	BYTE	H2.8	H2.7	H2.6	H2.5	H2.4	H2.3	H2.2	H2.1	
	BYTE	-	H2.15	H2.14	H2.13	H2.12	H2.11	H2.10	H2.9	
Key inputs	BYTE	S2.8	S2.7	S2.6	S2.5	S2.4	S2.3	S2.2	S2.1	
	BYTE	0	S2.15	S2.14	S2.13	S2.12	S2.11	S2.10	S2.9	

Tab. 12-5: I/O assignment of the module "keypad 2"

12.10.2 Override rotary switch

The positions of the rotary switches (inputs) of the override module are mapped in the "Override VD" module at the field bus.

Gray code table for 24-stage feed override

Switch setting	E	D	C	B	A
0 (min.)	0	0	0	0	0
1	0	0	0	0	1

Switch setting	E	D	C	B	A
2	0	0	0	1	1
3	0	0	0	1	0
4	0	0	1	1	0
5	0	0	1	1	1
6	0	0	1	0	1
7	0	0	1	0	0
8	0	1	1	0	0
9	0	1	1	0	1
10	0	1	1	1	1
11	0	1	1	1	0
12	0	1	0	1	0
13	0	1	0	1	1
14	0	1	0	0	1
15	0	1	0	0	0
16	1	1	0	0	0
17	1	1	0	0	1
18	1	1	0	1	1
19	1	1	0	1	0
20	1	1	1	1	0
21	1	1	1	1	1
22	1	1	1	0	1
23 (max.)	1	1	1	0	0

Tab. 12-6: Gray code table for 24-stage feed override

Gray code table for 16-stage spindle override

Position	D	C	B	A
0 (min)	0	0	0	0
1	0	0	0	1
2	0	0	1	1
3	0	0	1	0
4	0	1	1	0
5	0	1	1	1
6	0	1	0	1
7	0	1	0	0
8	1	1	0	0
9	1	1	0	1

Position	D	C	B	A
10	1	1	1	1
11	1	1	1	0
12	1	0	1	0
13	1	0	1	1
14	1	0	0	1
15 (max.)	1	0	0	0

Tab. 12-7: Table: 4-bit gray code

Profibus DP module for override rotary switch (GSD file)

Override VD	Format	MSB								LSB
Feed override	BYTE	0	0	0	0	D	C	B	A	
Spindle override	BYTE	0	0	0	E	D	C	B	A	

Tab. 12-8: Input assignment, module "Override VD"

12.10.3 Digital 24 V inputs and outputs

The digital I/Os are mapped at the field bus in the module "16DI, 8DO".

Profibus DP module for inputs and outputs (GSD file)

16DI, 8DO	Format	MSB								LSB
Digital outputs 0-7	BYTE	Q7	Q6	Q5	Q4	Q3	Q2	Q1	Q0	
Digital inputs 0-7	BYTE	I7	I6	I5	I4	I3	I2	I1	I0	
Digital inputs 8-15	BYTE	I15	I14	I13	I12	I11	I10	I9	I8	

Tab. 12-9: I/O assignment of the module "16DI, 8DO"

12.10.4 External hand-held terminal

The inputs of the hand-held terminal (pushbutton and 16-bit counter of the handwheel) are mapped in the "Manual Control Unit" module at the field bus.

Profibus DP module for external hand-held terminal (GSD file)

Manual Control Unit	Format	MSB																LSB
Handwheel	WORD	16-bit counter value																
Button inputs	WORD	0	0	0	0	IN11	IN10	IN9	IN8	IN7	IN6	IN5	IN4	IN3	IN2	IN1	IN0	

Tab. 12-10: Input assignment for the module "Manual Control Unit"

12.10.5 Internal handwheel

The 16-bit counter of the handwheel is mapped at the field bus in the "Handwheel" module.

Profibus DP module for internal handwheel (GSD file)

Handwheel	Format	MSB	LSB
Handwheel, internal	WORD	16-bit counter value, handwheel	

Tab. 12-11: Input assignment for the "Handwheel" module

13 Error causes and troubleshooting

For the error display on the board, refer to [chapter 12.3 "Operating and error display" on page 46](#).

Error	Troubleshooting
No communication with Profibus DP master	Set projected Profibus DP address at Profibus DP slave (machine control panel)
No function of inputs and outputs	+24 V DC input and output supply U_0 not connected to X10

Tab. 13-1: Error causes and troubleshooting



Repairs at the device by the customer are not permitted. Exceptions are maintenance works listed in the chapter "Maintenance".

For further information in the event of repair, please contact the Bosch Rexroth Service.

14 Maintenance

14.1 General information



Only the maintenance works at the device listed in this chapter are permitted.

For further information in the event of repair, please contact the Bosch Rexroth Service.

NOTICE

Loss of IP degree of protection due to incorrect maintenance

Ensure that the IP degree of protection remains during maintenance!

NOTICE

Damages to the device due to electrostatic discharges!

Comply with all ESD protective measures while working with modules and components! Avoid electrostatic discharges!

NOTICE

Destruction of screw terminals, insufficient contact and loss of UL certification if no copper wire is used and/or wrong tightening torque

Use only copper wires to wire connection terminals. Tighten the screws of the screw terminal blocks with a torque of 2.25 lb in (0.22 Nm).

14.2 Tightening torques and stripping length

Torques

Thread	Tightening torque
M2,5	0.4 Nm
M3	0.7 Nm
M4	1.4 Nm
M5	2.8 Nm

Tab. 14-1: Torques for the screws M2,5 ... M5

Stripping length

The stripping length for female connector strips is 10 mm.

14.3 Cleaning notes

NOTICE

The foil surface is dissolved by solvents!

- Do not use any solvents (e. g. diluents)!
- Do not use high pressure cleaning devices!

14.4 Regular maintenance tasks

- Check all plug and terminal connections of the components for proper tightness and possible damage at least once a year
- Check that no cables are broken or pinched
- Replace damaged parts immediately

15 Ordering information

15.1 Accessories and spare parts

For ordering information on accessories and spare parts, refer to [chapter 5 "Spare parts, accessories and wear parts"](#) on page 6.

15.2 Type code

Short text column	1	2	3	4	5	6	7	8	9	1	0	1	2	3	4	5	6	7	8	9	2	0	1	2	3	4	5	6	7	8	9	3	0	1	2	3	4	5
Example:	V	A	M	4	2	.	1	-	P	B	-	N	F	-	A	B	-	T	B	-	V	D	-	N	N	-	1	6	0	8	-	N	N					
Product																																						
VAM..... = VAM																																						
Line																																						
12..... = 12																																						
42..... = 42																																						
Design																																						
1..... = 1																																						
Communication bus																																						
Profibus-DP..... = PB																																						
Configuration¹⁾																																						
E.g. NF-AB-TB-VD-NN																																						
Master board																																						
16 inputs and 8 outputs..... = 1608																																						
Other design																																						
None..... = NN																																						
Design D1..... = D1																																						

Note:

- 1) Configuration
 - AB = Connecting module VAC30.2
 - EK = Card reader (EKS)
 - EE = Card reader (EKS with Ethernet interface) (only VAM 42.1)
 - NF = E-STOP module
 - NN = Not equipped
 - TB = Keypad with pushbuttons to be labeled by slide-in strips
 - VD = 24-stage manual feed override and 16-stage spindle override

Fig. 15-1: Type code of the IndraControl VAM 12.1/VAM 42.1

16 Disposal

16.1 General Information

Dispose of the products according to the respective national standard.

16.2 Take-Back

Our products can be returned to our premises free of charge for disposal. However, the products must be free of impurities like oil, grease or other impurities.

Furthermore, the products returned for disposal must not contain any undue foreign material or foreign components.

Send the products "free domicile" to the following address:

Bosch Rexroth AG
Electric Drives and Controls
Bürgermeister-Dr.-Nebel-Straße 2
97816 Lohr am Main, Germany

16.3 Packaging

The packaging materials consist of cardboard, plastic material, wood or expanded polystyrene (EPS). The packaging materials can be recycled without any problem.

For ecological reasons, please refrain from returning the empty packages to us.

17 Service and support

Our worldwide service network provides an optimized and efficient support. Our experts offer you advice and assistance should you have any queries. You can contact us **24/7**.

Service Germany

Our technology-oriented Competence Center in Lohr, Germany, is responsible for all your service-related queries for electric drive and controls.

Contact the **Service Hotline** and **Service Helpdesk** under:

Phone:	+49 9352 40 5060
Fax:	+49 9352 18 4941
E-mail:	service.svc@boschrexroth.de
Internet:	http://www.boschrexroth.com/

Additional information on service, repair (e.g. delivery addresses) and training can be found on our internet sites.

Service worldwide

Outside Germany, please contact your local service office first. For hotline numbers, refer to the sales office addresses on the internet.

Preparing information

To be able to help you more quickly and efficiently, please have the following information ready:

- Detailed description of malfunction and circumstances
- Type plate specifications of the affected products, in particular type codes and serial numbers
- Your contact data (phone and fax number as well as your e-mail address)

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Notes

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