The Drive & Control Company

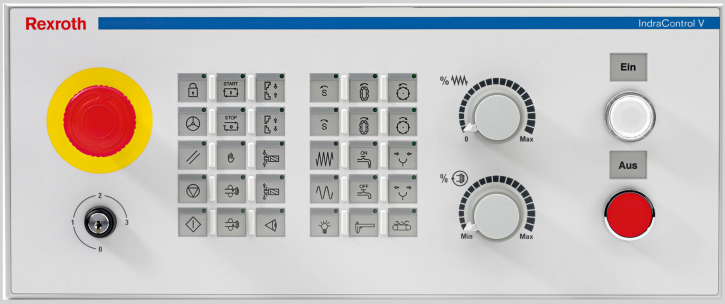
Rexroth
Bosch Group

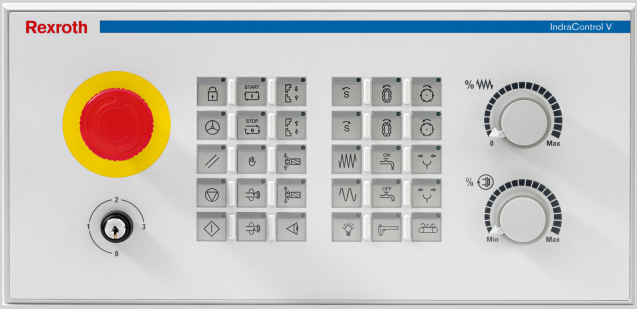
# IndraControl VAM 10.2, VAM 40.2

## Machine Control Panels

**Operating Instructions**
**R911338455**

Edition 02



## Change Record

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

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## Editorial Department

Control Components ag (KW/MePe)

# Table of Contents

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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 (assembly/installation)", the "mechanic/electrician" can execute the activity "install" using this documentation.

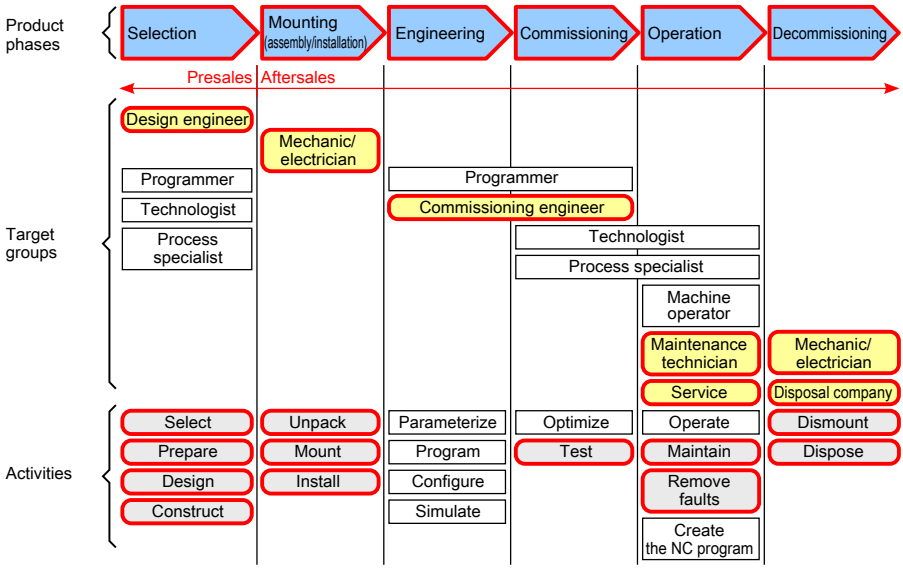



**Fig. 1-1:** Assigning the present documentation to the target groups, product phases and activities of the target group

## Purpose

This document instructs the technical staff of the machine manufacturer on how to perform the mechanical and electrical installation safely and on how to commission the Embedded Terminal.

Required qualifications: 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 "VAM10.2...." or "VAM40.2....".

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 | R911323860 |
| VAM 10.2/40.2 | Project Planning Manual |
| Machine Control Panels | Information on the following topics is included in this documentation:<br>• GSD file<br>• Profibus DP address setting<br>• Baud rate setting<br>• Address assignment of keypads, override rotary switches or external hand-held terminal<br>• Configuration specifications |
| Rexroth IndraControl | R911339613 |
| VAP 01 | Operating Instructions |
| Power Supply Unit | |

**Tab. 1-1:** Related documents

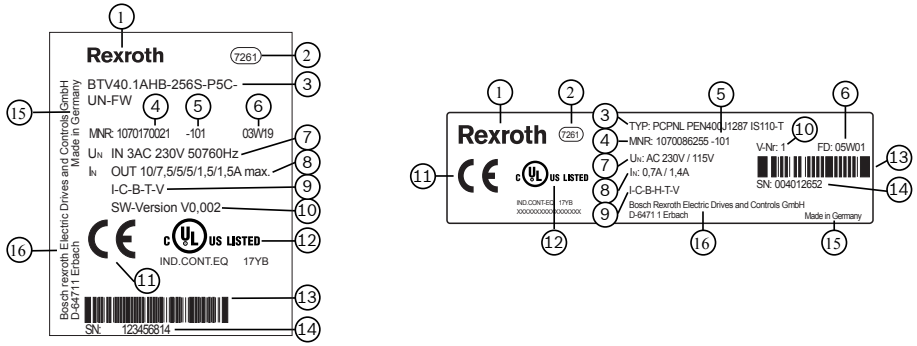
### Customer Feedback

Customer requests, comments or suggestions for improvement are of great importance to us. Please email your feedback on the documentations to Feedback.Documentation@boschrexroth.de. Directly insert comments in the electronic PDF document and send the PDF file to Bosch Rexroth.

# 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
- Assembling kit

# 3 Use of the safety instructions

## 3.1 Structure of the safety instructions

The safety instructions are structured as follows:

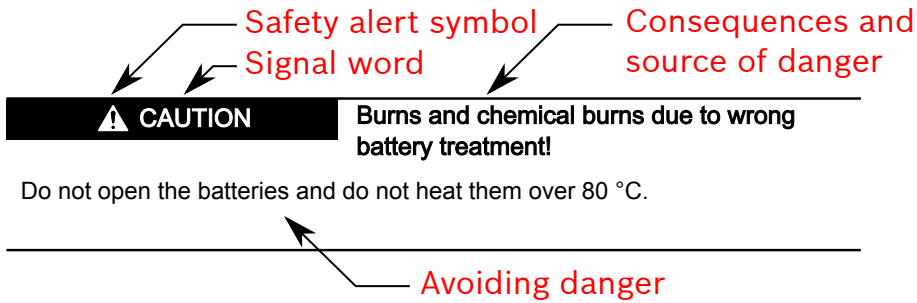



**Fig. 3-1:** Structure of the safety instructions

## 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 type IndraControl VAM 10.2 and IndraControl VAM 42.2 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 10.2 and IndraControl VAM 40.2 were developed for single-axis as well as for multiple-axes drive and control tasks.

Fields of applications of the IndraControl VAM 10.2 and IndraControl VAM 42.2 machine control panels:

- Lathes
- Milling machines
- Machining centers

The devices of the IndraControl VAM 10.2 and IndraControl VAM 40.2 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.

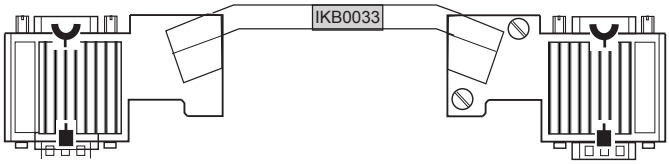
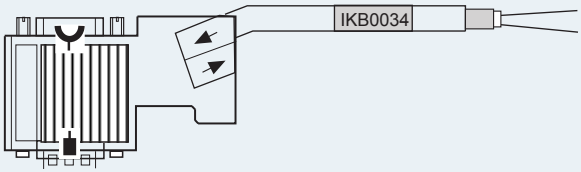
# 5 Spare parts, accessories and wear parts

## 5.1 Spare parts

| Ordering code | Part number | Description |
|---|---|---|
| SUP-E11-VAM-VA MODUL SERVICEKIT | R911171262 | Service kit for VAM-VA types,<br>1 × 16-stage override switch |
| SUP-E11-VAM-VB MODUL SERVICEKIT | R911171261 | Service kit for VAM-VB types,<br>2 × 16-stage override switch |
| SCHALTER SCHLUES. VAM 10/40.2 STAND. KB | R911171375 | Standard key switch set including switch, wiring and plug for IndraControl VAM 10.2/40.2 standard devices |
| SCHALTER SCHLUES. VAM10.2 CHIRON KB | R911171376 | Special key switch set including switch, wiring and plug for IndraControl VAM 10.2/40.2 special product |
| SUP-E11-VAM1040- SCHLUESSELSATZ | R911171987 | Spare key set for RAFI key switch |

**Tab. 5-1:** Spare parts

## 5.2 Accessories, plugs and ready-made cables

| Ordering code<br>Ready-made cable | Mating plug of the device | Rexroth cables | Design of the cable end |
|---|---|---|---|
| IKB0033/000,0<br>Part number<br>R911291808<br>Profibus cable | INS0541/K01 |  | INS0541/K01 |
| IKB0034/000,0<br>Part number:<br>R911291809 | INS0541/K01 |  | |

**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 %<br>Max. relative humidity: 85 %<br>Min. absolute humidity: 1 g/m$^3$<br>Max. absolute humidity: 25 g/m$^3$<br>Condensation not allowed<br>Corresponds to climatic class 3K3 acc. to EN 60721-3-3 | Min. relative humidity: 5 %<br>Max. relative humidity: 75 %<br>Min. absolute humidity: 1 g/m$^3$<br>Max. absolute humidity: 25 g/m$^3$<br>Condensation not allowed<br>Corresponds to climatic class 2K2 acc. to EN 60721-3-2 | Min. relative humidity: 5 %<br>Max. relative humidity: 85 %<br>Min. absolute humidity: 1 g/m$^3$<br>Max. absolute humidity: 25 g/m$^3$<br>Condensation not allowed<br>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 | | |

| Ambient conditions | In operation | Transport | Storage |
|---|---|---|---|
| Mechanical strength | Max. vibration:<br>Frequency range:<br>5...200 Hz<br>Excursion:<br>3.5 mm at 5...9 Hz<br>Acceleration:<br>1.3 g at 9...200 Hz<br>Acc. to EN 60068-2-6 | Max. shock:<br>15 g 11 ms<br>Acc. to EN 60068-2-27<br>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 ($SO_2$) and hydrogen suphide ($H_2S$)). 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 10.2 | IndraControl VAM 40.2 |
|---|---|---|
| Degree of protection | IP 54 (front)<br>Type 1 acc. to NEMA (UL) | |
| Protection class | 1 acc. to DIN EN 50178 | |
| Front foil color | RAL 7035 light gray | |
| Dimensions (W × H × D) | 350 mm × 169 mm × 58 mm | 407 mm × 169 mm × 58 mm |
| Mounting cut-out (W × H) | 322 mm × 141 mm | 379 mm × 141 mm |
| Weight | Approx. 1170 g | Approx. 1380 g |
| Mounting depth | 102 mm (with Profibus DP plug) | |
| Front panel material | Varnished aluminum, completely embedded, chemical resistant polyester foil | |
| Voltage supply | Electrically isolated | |
| Logic supply $U_L$ | 24 V DC (19.2 V to 30 V), PELV<br>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. | |
| Input and output supply $U_Q$ | 24 V DC (19.2 V to 30 V), PELV<br>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

***NOTICE***

**Destruction of the filter choke in the input area caused by continuous operation outside the range between 19.2 V to 30 V**

Operate the device only within the permissible range between 19.2 V to 30 V.

## 7.2 Key switch

| | |
|---|---|
| Rotation angle | 3 × 90° |
| Positions | 4, 1-pin |
| Switching voltage AC/DC | 5 V min.<br>42 V max. |
| Switching current AC/DC | 5 mA min.<br>100 mA max. |
| Torque while actuating | 0.035 Nm |
| Torque against fixed stop | 1.8 Nm |
| Connections | Soldering connection, tinned |
| Fastening | Threaded ring |
| Contact equipment | 1 N/O contact per switch position |
| Contact function | Engaged |
| Contact system | Sliding contact, auto-cleaning |
| Contact materials | Au alloy |
| Service life | 50000 switching operations |

**Tab. 7-2:** Technical data of the key switch

## 7.3 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:<br>• 2 × standard auxiliary switches with forced opening<br>• 1 × standard auxiliary switch N/O contact |
| Connection voltage | PELV/SELV |
| Max. current | 0.5 A |
| B10d value mushroom button | Mechanics:<br>B10d = 600,000 (acc. to the manufacturer)<br>Assumption: B10d = 2 × B10<br>Fault exclusion at < 6050 cycles |

| | |
|---|---|
| B10d value auxiliary contact N/C contact | Electrics:<br>B10d = 10,000,000 (acc. to the manufacturer)<br>Assumption: B10d = 2 × B10<br>Fault exclusion at < 6050 cycles |
| B10d value auxiliary contact N/O contact | Electrics:<br>B10d = 10,000,000 (acc. to the manufacturer)<br>Assumption: B10d = 2 × B10<br>Fault exclusion at < 6050 cycles |
| Connection cross section | Min. without wire end sleeve (1 × 0.22 $mm^2$)<br>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

## 7.4 Machine pushbutton of the quick stop module

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

| | |
|---|---|
| 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 $mm^2$)<br>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

## 7.5 Handwheel for the IndraControl VAM 40.2

| | |
|---|---|
| Pulses per revolution | 100 each at the outputs A and B |
| Supply voltage | $U_B$ = 5 V DC ±5 % |
| Current consumption | < 60 mA |
| Output current per output | 10 mA max. |
| Outputs | TTL-compatible<br>For $U_B$ = 5 V (L model) |
| Speed | Max. 1000 $min^{-1}$ |

| | |
|---|---|
| Service life | > 20,000,000 revolutions |
| Max. output frequency | 2 KHz |

**Tab. 7-5:** Technical data of the handwheel

# 8 Standards

## 8.1 Standards used

| Standard | Meaning |
|---|---|
| EN 60 204-1 | Safety of machinery - Electrical equipment of machines |
| EN 60 61000-6-4 | Generic standards - Emission standard (industrial environments) |
| EN 60 61000-6-2 | Generic standards – Noise immunity (industrial environments) |
| EN 61558-2-6 | Transformer for 24 V power supply unit, safe separation |
| EN 60664-1 | Overvoltage category II |
| EN 61 131-2 | 24 V output requirements |
| EN 61 131-2 | 24 V current supply requirements |
| EN 60950 | Clearance and creepage distances in offices (environment) and power supply units |
| ISO 13850 | Safety of machinery, E-STOP - Principles for design |
| EN 60 529 | Degrees of protection (including housings and installation compartments) |
| EN 60 068-2-6 | Vibration test |
| EN 60068-2-27 | Shock test |
| EN 60721-3-3 | Classification of environmental conditions |
| EN 60721-3-2 | Classification of environmental conditions |
| EN 60721-3-1 | Classification of environmental conditions |
| DIN EN 61 131-2 | Programmable logic controllers<br>Equipment and test requirements |
| UL 508 | Industrial Control Equipment |

**Tab. 8-1:** Standards used

## 8.2 CE marking

### 8.2.1 Declaration of conformity

CE

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)<br>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)<br>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

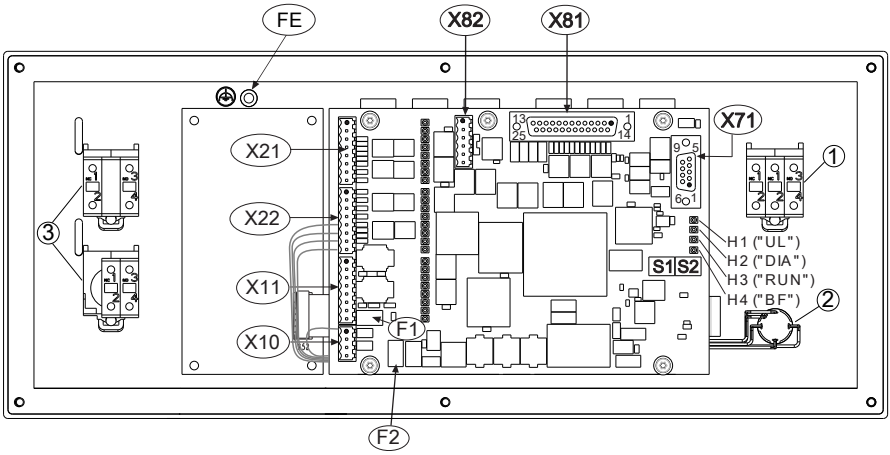
However, there can be combinations or extension stages with a limited or missing certification. Thus, verify the registration according to the UL marking on the device.

**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




① E-STOP button (refer to chapter 10.6.5 "E-STOP button and key switch" on page 26)
② Key switch (refer to chapter 10.6.5 "E-STOP button and key switch" on page 26)
③ Machine pushbutton (refer to chapter 10.6.6 "On/off pushbutton" on page 28)

**Fig. 9-1:** View on the connector panel (here: IndraControl VAM 40.2)

## 9.2 Overview

| | 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 |
| 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 |
| X71 | Field bus interface Profibus DP | Socket, D-SUB, 9-pin | Plug, 9-pin D-SUB |
| X81 | Connection for external hand-held terminal | Socket 25-pin D-SUB | Plug 25-pin, D-SUB |

| | Connection type | Connector type, integrated | Mating connector, external |
|---|---|---|---|
| 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 |
|  | Functional earth (FE) | M5 | Ring cable lug |

**Tab. 9-1:** Interfaces

| 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 30 |

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

## 9.3 X10 – 24 V DC voltage supplies

| Plug | Pin | Signal | Meaning |
|---|---|---|---|
| X10 | 1 | $U_Q$ | 24 V DC input and output supply $U_Q$ |
| | 2 | 0 V $U_Q$ | 0 V input and 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 10.6.4 "Notes on current and voltage supply" on page 26).

## 9.4 X71 field bus interface Profibus DP

### 9.4.1 General information

5 V and 100 mA are provided at the X71 plug at the "VP" signal (PIN 6). Neither bus terminating resistances nor a bus load may be present. The "VP" signal facilitates the connection of a hand-held terminal or an optical link plug (OLP) [conversion RS485/Opto].

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 acc. to EN 50170, part 2 (DP)

### 9.4.2 Pin assignment

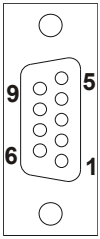



**Fig. 9-2:** Pin assignment of the Profibus DP interface

| Plug | Pin | RS485 reference | Signal | Meaning |
|---|---|---|---|---|
| X71 | 1 | - | Not assigned | |
| | 2 | - | Not assigned | |
| | 3 | B/B' | RxD/TxD-P | Receiving/sending 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.

## 9.5 X21, X22, X11 – Digital 24 V inputs and outputs

### 9.5.1 General information

The machine control panels IndraControl VAM 10.2/VAM 40.2 are provided with 16 digital 24 V inputs and 8 digital 24 V outputs. The connectors of the inputs

and outputs are located on the logic circuit board. Green LEDs indicate the I/O states.

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

The module configuration and the address assignment are described in the Project Planning Manual, see "Related documents" on page 2.

### 9.5.2 Pin assignment (3 × 8-pin plug, 3.5 grid)

| Plug | 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

**⚠ 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.

## 9.5.3 Digital input characteristics

| | |
|---|---|
| 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 mm |

**Tab. 9-7:** Digital input characteristics

## 9.5.4 Digital output characteristics

| | |
|---|---|
| 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<br>Defect of the component caused by<br>• Polarity reversal with simultaneous short circuit of the output lines<br>• Polarity reversal with simultaneous connection of externally polarized suppressor diodes at the output lines<br>• 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<br>5 W Tungsten |
| Simultaneity factor | 100 % |
| Plug grid | 3.5 mm |

**Tab. 9-8:** Digital output characteristics

## 9.6 X81 – Connection for external hand-held terminal

### 9.6.1 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 "UL" and may only be used to connect the keys of the hand-held terminal. Connection X81 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.

The module configuration and the address assignment are described in the Project Planning Manual, see "Related documents" on page 2.

### 9.6.2 Pin assignment (25-pin female connector strip, D-SUB

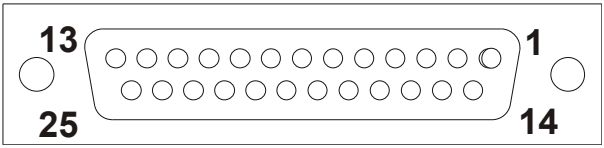



**Fig. 9-3:** Pin assignment X81

| Plug | Pin | Signal | Meaning |
|---|---|---|---|
| X81 | 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 ±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 ±5% handwheel supply (+) |
| | 24 | B | Handwheel, channel B |
| | 25 | A | Handwheel, channel A |

**Tab. 9-9:** Pin assignment X81

| | |
|---|---|
| Handwheel supply | 5 V DC ± 5 % |
| Current consumption, handwheel | 200 mA max. |
| Maximum cable length | Approx. 5 m (depending on handwheel) |
| Cable type | Twisted pair, separately shielded |
| Inputs | 12 × 24 V input<br>(For switch or pushbutton of the hand-held terminal) |
| Reference device | HBA 102434, company Euchner<br>100 pulses per revolution; max. 300 $min^{-1}$ |

**Tab. 9-10:** Characteristics of the handwheel interface at X81

## 9.7 X82 – Connection for the internal handwheel

### 9.7.1 General information

Connection "X82" 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.

The module configuration and the address assignment are described in the Project Planning Manual, see "Related documents" on page 2.

### 9.7.2 Pin assignment (6-pin in 3.5 mm grid)

| Plug | Pin | Signal | Meaning |
|---|---|---|---|
| X82 | 1 | +5 V | 5 V DC ±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. 9-11:** Pin assignment X82

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

**Tab. 9-12:** Reference device

# 10 Mounting, demounting and electric installation

## 10.1 General information

All values are given in mm.

## 10.2 Mounting notes

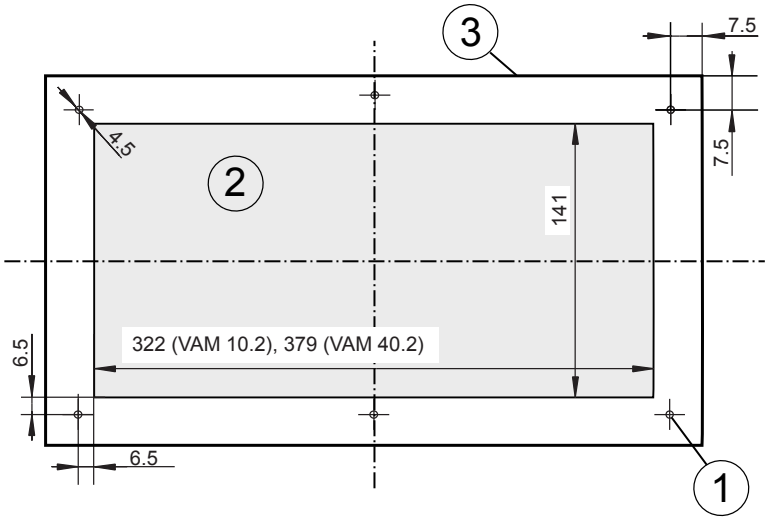
- The LED displays (H1 to H4) on the circuit board must not be hidden
- Provide a minimum space of 50 mm (on all sides of the device) for sufficient cooling and cable routing
- Use strain reliefs for all cables
- Keep the maximum distance possible from interference sources

## 10.3 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 10.4 "Mounting dimensions" on page 22.
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.

## 10.4 Mounting dimensions




① Drilled hole for the mounting bolts, drilling diameter of 4.5 mm
② Mounting cut-out (gray area)
③ Outer edge of the housing

**Fig. 10-1:** Mounting dimensions of the IndraControl VAM 10.2/VAM 40.2

## 10.5 Housing dimensions

### 10.5.1 Front view

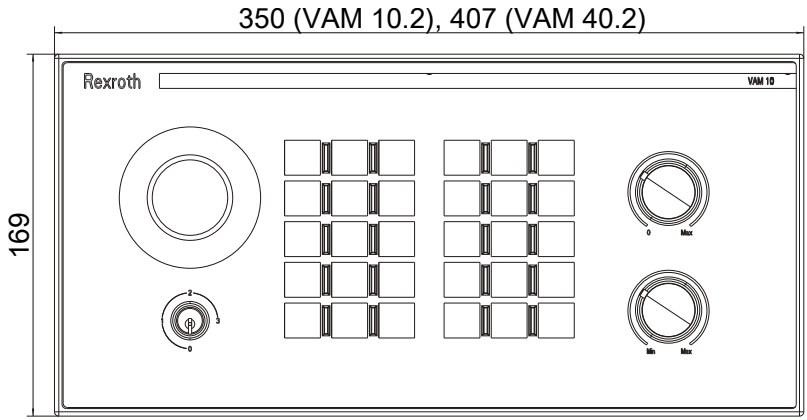



**Fig. 10-2:** Front view of the IndraControl VAM 10.2/VAM 40.2

### 10.5.2 Top view

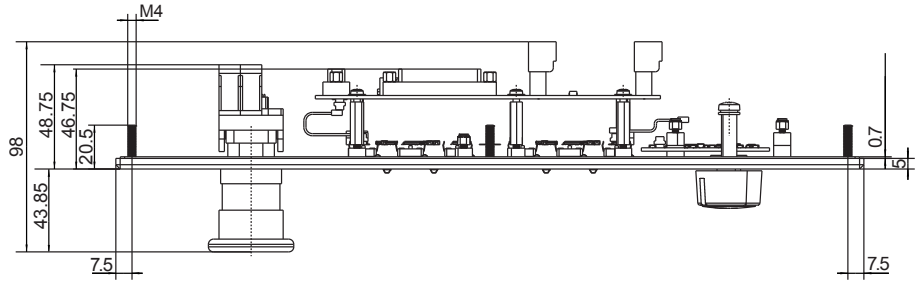



**Fig. 10-3:** Top view of the IndraControl VAM 10.2/VAM 40.2

## 10.6 Electric connection

### 10.6.1 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!

## 10.6.2 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

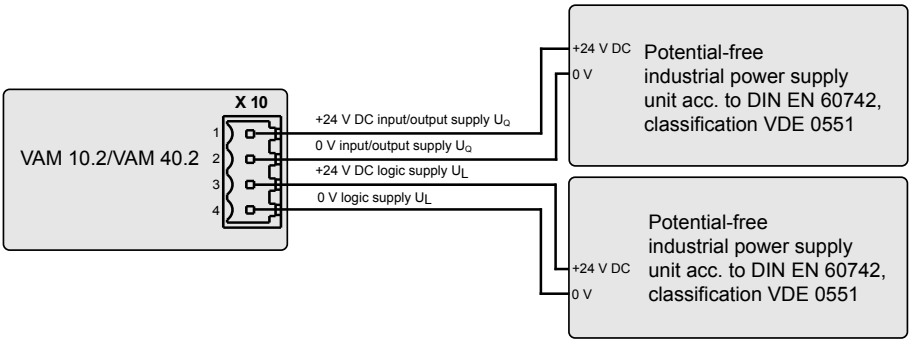



**Fig. 10-4:** Cabling of the machine control panel with 24 V voltage supplies

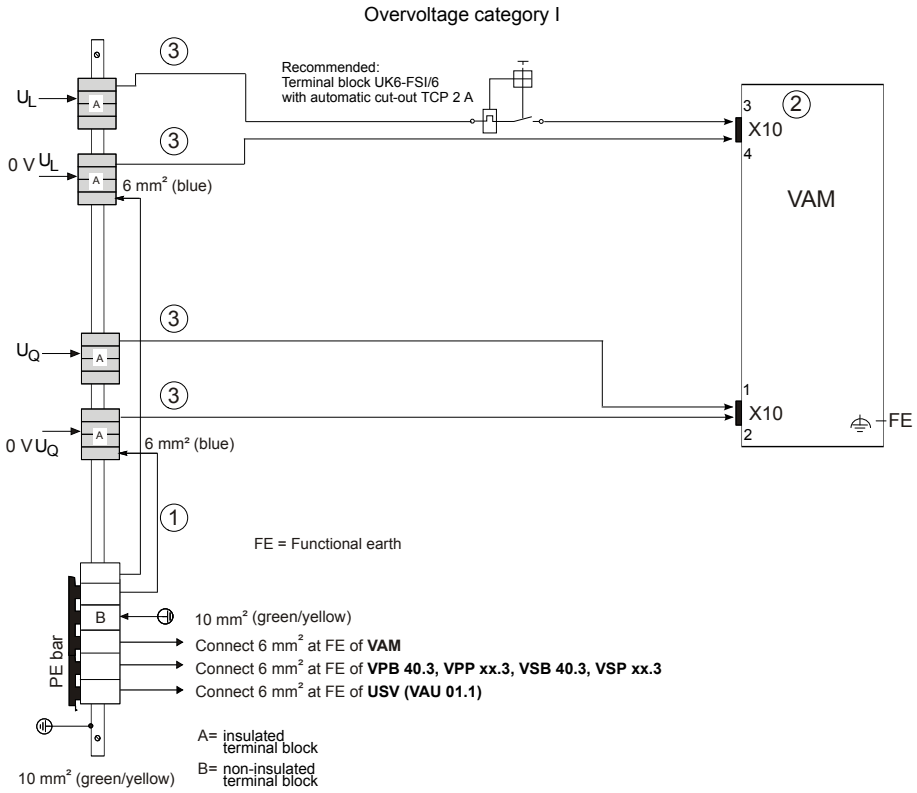
### Connection

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 on 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 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

## 10.6.3 Functional earth connection

Ensure a sufficient conductor cross section during functional earth wiring.

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

To ensure a proper operation of the EMC suppressor circuits of the IndraControl VAM 10.2/VAM 40.2 according to the guidelines, the functional earth has to be connected!

### 10.6.4 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 (plug 11) against 0 V<br>• Simultaneous exceedance of I = 200 mA at several outputs (X11)<br>• 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<br>• Hardware defect |

**NOTICE**

**The fuses are soldered on the board**

SMD fuses may only be replaced by trained staff.

### 10.6.5 E-STOP button and key switch

This cut-out is 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 of the machine control panel complies with the requirements of the EN ISO 13850. It has to be designed as a STOP button of the categories 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.

The connections of both N/C contacts ("NC") are labeled with "1" and "2" in the following illustration.

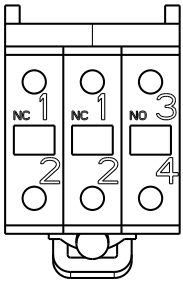



**Fig. 10-6:** N/C contacts of the E-STOP button

**⚠ WARNING** **Danger due to operational unreliability of E-STOP buttons!**

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

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

Additionally, this module slot is equipped with a four-stage key switch (priority switch ) with authorization system. Use the three keys to assign different authorizations to the machine operators.

☞ The switch positions of the machine control panel key switches are not forced-guided. The key switch cannot be used to switch safety-relevant functions (such as operation modes).

### Key designs

| Key ID | Authorization |
|---|---|
| Key labelled with 1 | Authorization for switch positions 0 and 1 |
| Key labelled with 2 | Authorization for switch positions 0, 1 and 2 |
| Key labelled with 3 | Authorization for switch positions 0, 1, 2 and 3 |

**Tab. 10-1:** Key design with authorizations

### Removing keys

The key of the IndraControl VAM 10.2/VAM 40.2 standard variants can be removed in any switch position.

For a customized variant of the IndraControl VAM 10.2 (R911170771, VAM10.2-PB-NB-TA-TA-VA-1608-NN), the key can only be removed in the left switch position (position 0).

### Contact assignment

| Position | Contacts closed |
|---|---|
| 0 | P - 0 |
| 1 | P - 1 |
| 2 | P - 2 |
| 3 | P - 3 |

**Tab. 10-2:** Contact assignment of the key switch

### Wiring scheme

Upon delivery, the switch positions of the key switch are wired to the digital inputs of the Profibus main board of the machine control panel (see fig. 10-7 "Wiring scheme of the key switch" on page 28). The switch positions can be evaluated via the PLC.

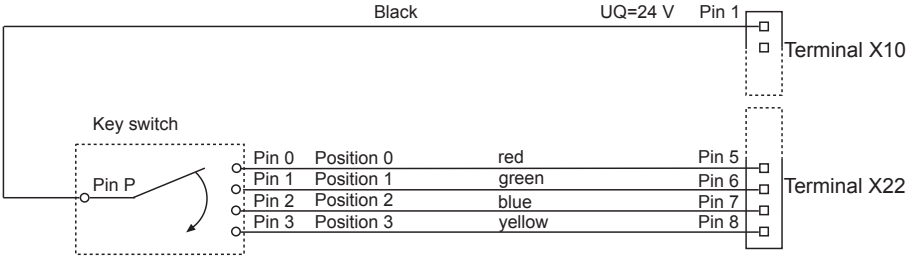



**Fig. 10-7:** Wiring scheme of the key switch

The configuration of the digital inputs and the address assignment of the switch positions are described in the Project Planning Manual, see "Related documents" on page 2.

## 10.6.6 On/off pushbutton

The machine buttons can be wired application-specifically.

The illuminated white machine button features an N/C contact (contact names 1 and 2), an N/O contact (contact names 3 and 4) and a 24 V LED (contact names X1 and X2).

The unilluminated red machine button is provided with one N/C contact (contact names 1 and 2) and one N/O contact (contact names 3 and 4).

# 11 Commissioning

The product can be used directly. To efficiently use the machine control panels, they have to be configured. Bosch Rexroth provides two GSD files (RX010123.GSD and RX020123.GSD). For more information, please refer to the project planning manual, see "Related documents" on page 2.

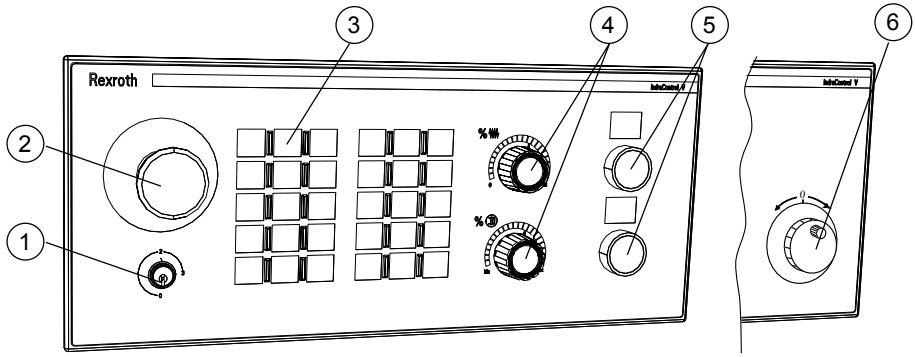
# 12 Device description

## 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. Thus, the machine control panels contain operating elements, e. g., keys with LED displays, rotary switches for feed and spindle override, E-STOP buttons, key switches with authorization system and machine buttons.

The machine control panels IndraControl VAM 10.2 and IndraControl VAM 40.2 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 10.2 width corresponds to the IndraControl VPP 16 panel PC width. The IndraControl VAM 40.2 width corresponds to the IndraControl VPP 40 panel PC width.

IndraControl 10.2/VAM 40.2 devices are machine control panels for CNC machines with Profibus connection.




① Key switch
② E-STOP button
③ Keypads
④ Module with two override rotary switches
⑤ Module with two machine pushbuttons
⑥ Module with handwheel

**Fig. 12-1:** Exemplary machine control panel

## 12.2 Modules

### 12.2.1 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.

The module is connected to the logic circuit board via the internal shift register bus. The states of the pushbuttons are transmitted to the master control via Profibus DP. The LEDs are triggered via Profibus DP by the master control.

### 12.2.2 Override rotary switch

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

**Tab. 12-1:** Override rotary switch

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.

### 12.2.3 On/off pushbutton

An on/off pushbutton is only available on the IndraControl VAM 40.2 machine control panel.

The on/off pushbutton is provided with a illuminated white machine pushbutton and an unilluminated red machine pushbutton. Both buttons can be labeled application-specifically with a labeling strip.

### 12.2.4 Handwheel module

A handwheel module is only available on the IndraControl VAM 40.2 machine control panel.

The IndraControl VAM 40.2 can be ordered as customized variant with a handwheel module (R911170968 VAM40.2-PB-NA-TA-TA-VB-HA-1608-NN).

Upon delivery, the handwheel signals are wired directly to the "X82" connection (internal handwheel) of the Profibus main board. The states of the handwheel are transmitted to the master control via Profibus DP.

## 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 fig. 9-1 "View on the connector panel (here: IndraControl VAM 40.2)" on page 14.

| H | LED | Display | Meaning |
|---|---|---|---|
| H1 | "UL" | | **24 V supply (X10 plug)** |
| | | Green | 24 V supply present |
| | | Green~ | The bus connection is held in the initialization phase by one or several modules |

| H | LED | Display | Meaning |
|---|---|---|---|
| | | Green~~ | System stop (see chapter 12.3.2 "Status display “System stop”H1 UL and H2 DIA" on page 31) |
| | | Off | No 24 V supply present |
| | | | |
| H2 | "DIA" | | **Diagnostic display** |
| | | Red | One or multiple modules report diagnostics |
| | | Red~ | System stop (see chapter 12.3.2 "Status display “System stop”H1 UL and H2 DIA" on page 31) |
| | | Red~~ | System stop (see chapter 12.3.2 "Status display “System stop”H1 UL and H2 DIA" on page 31) |
| | | 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) |
| | | Off | The bus connection is not activated by the DP master<br>Causes:<br>• Incorrect Profibus DP station address<br>• The Profibus DP station address was assigned several times at the bus<br>• The trigger watchdog time is expired<br>• Error in master parameter set (GSD file); e.g. incorrect PNO ID number, incorrect buffer sizes (Prm, Cfg, ...)<br>• 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. 12-2:** 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. To quit the system stop, restart a component (“Network on”).

| 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. 12-3:** Display of the "System stop" state

### System stop "Unknown II/O module"

The system stop "Unknown I/O module" means that the machine control 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

### Exceptional error, "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".

# 13 Error causes and troubleshooting

For the error display on the board, refer to chapter 12.3 "Operating and error display" on page 30.

| Errors | 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 $U_Q$ 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

- Clean the screen at least once a week using an antistatic fabric or a cleansing agent containing alcohol.

***NOTICE***

**Dissolution of the foil surface as well as the seal by solvents or by high pressure cleaning devices!**

- Do not use any solvents (e. g. diluents)!
- Do not use compressed air, steam jet and 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

| Column | 1-3 | 4-5 | 6 | 7 | 8 | 9-10 | 11 | 12-22 | 23 | 24-27 | 28 | 29-30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Product features | Product | Series | | Design | | Communication bus | | Configuration ① | | Master board | | Other models |
| Type code | VAM | 10 | . | 2 | . | PB | - | MA | - | 1608 | - | NN |
| | | | | | | | | NA | | | | |
| | | | | | | | | NB | | | | |
| | | | | | | | | TA | | | | |
| | | | | | | | | VA | | | | |
| | | | | | | | | VB | | | | |

**PB** Profibus DP
**MA** On/off pushbutton
**NA** E-STOP module and key switch
**NB** E-STOP module and key switch – can only be disconnected in position "0"
**TA** Keyboard, can be labelled
**VA** Feed override
**VB** Feed override and spindle override
① Example configuration: NA-TA-TA-VB
**1608** 16 inputs, 8 outputs

**Tab. 15-1:** Type code of the IndraControl VAM 10.2

| Column | 1-3 | 4-5 | 6 | 7 | 8 | 9-10 | 11 | 12-25 | 26 | 27-30 | 31 | 32-33 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Product features | Product | Series | | Design | | Communication bus | | Configuration ① | | Master board | | Other models |
| Type code | VAM | 40 | . | 2 | . | PB | - | BA | - | 1608 | - | NN |
| | | | | | | | | HA | | | | |
| | | | | | | | | MA | | | | |
| | | | | | | | | NA | | | | |
| | | | | | | | | TA | | | | |
| | | | | | | | | VB | | | | |

**PB** Profibus DP
**MA** On/off pushbutton
**NA** E-STOP module and key switch
**TA** Keyboard, can be labelled
**VB** Feed override and spindle override
**BA** Dummy panel
**HA** Handwheel
① Example configuration: NA-TA-TA-VB-MA
**1608** 16 inputs, 8 outputs

**Tab. 15-2:** Type code of the IndraControl VAM 40.2

# 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

The Drive & Control Company

Rexroth
Bosch Group

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