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# Rexroth IndraControl VEH 30.2 Hand-Held Terminal

**R911331585** Edition 03

**Project Planning Manual** 



Title Rexroth IndraControl

**VEH 30.2** 

Hand-Held Terminal

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Purpose of Documentation In terms of the Machinery Directive 2006/42/EC, this documentation serves

as "original instructions" for the hand-held terminal IndraControl VEH 30.2.

Record of Revision

Edition	Release Date	Notes
Edition 01	10.2010	First edition
Edition 02	08.2011	Revised edition
Edition 03	02.2014	Safety instruction in chapter "Pin Assignment" added

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Development Compact HMI EH (PiGe)

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## 1 System Presentation

#### 1.1 Overview

The IndraControl VEH 30.2 Hand-Held Terminal is a portable, PC-based operator and visualization device.

The 2-circuit, 3-stage enabling device as well as the 2-circuit stop pushbutton ensure a safe operation of the IndraLogic and IndraMotion controls. The IndraControl VEH 30.2 facilitates the comfortable configuration of machines and installations located at widely distributed connection points.

All device variants feature a 213.36 (8.4") TFT display with always eight function keys at the right side and left side of the screen as well as jog keys for up to six axes for comfortable operation of the system. Additionally, service interfaces are available: a USB connector on the front panel and an Ethernet interface on the VAC 30.2 connection module. Different cable variants allow an individual adjustment to the conditions. The following table lists the most important features of the IndraControl VEH 30.2. Differences between the device variants are listed in chapter 1.2 "Device Variants" on page 5.

Display	213.36 mm TFT (8.4")
Keys	Yes
Touch screen	Yes
Enabling device	2-circuit, 3-stage
Stop button	2-circuit
Interface	Ethernet
Service interface	USB interface on the front
Connection	IndraControl VAC 30.2 with stop pushbutton jumpering
Additional options	Handwheel, 16-stage automatic override, available depending on the device variant (see tab. 1-2 "Device variants IndraControl VEH 30.2" on page 6)

Tab.1-1: Main features IndraControl VEH 30.2

The IndraControl VEH 30.2 is suitable for the following application ranges:

- Operating and visualizing Bosch Rexroth control systems.
- Configuration of machines and installations.
- Operation and diagnostics of extended handling installations.
- Remote visualization of operating panels.
- Visualization of simple operating fields and assembly lines.



The specifications about the IndraControl VEH 30 devices made in the documentation "Rexroth IndraControl VEP/VEH" DOK-SUPPL\*-VEP/VEH\*\*\*\*\*-PR01-EN-P are obsolete.

## 1.2 Device Variants

The IndraControl VEH 30.2 Hand-Held Terminals are available in different variants.

Device	Optional elements, characteristics	Safety	Parts number
VEH30.2BNN-512ET- A2D-4G0-BS-E4-FW		Stop button, Enabling device	R911172223
VEH30.2BNN-512ET- A2D-4G0-DS-E4-FW	Handwheel Override	Stop button, Enabling device	R911171948
VEH30.2BNN-512ET- A2D-4G0-DS-E2-FW	Handwheel Override Short extension cable	Stop button, Enabling device	R911172224
VEH30.2BNN-512ET- A2D-4G0-BS-E2-FW	Short extension ca- ble	Stop button, Enabling device	R911172162

Tab.1-2: Device variants IndraControl VEH 30.2

For further information on "Selection of technical safety", please refer to the sections on the new Machinery Directive in chapter 4 "Technical Data" on page 25.

## 1.3 Housing

The vibration and shock resistant housing consists of low-inflammable material (UL 94-V2). The housing is resistant to impact, water, detergents (alcohol and tensides), oil, cutting oil (drilling oil), grease, and lubricants. The robust housing was tested on free fall onto industrial floor (height 1 m) in terms of the environmental compatibility tests according to DIN EN 61131.

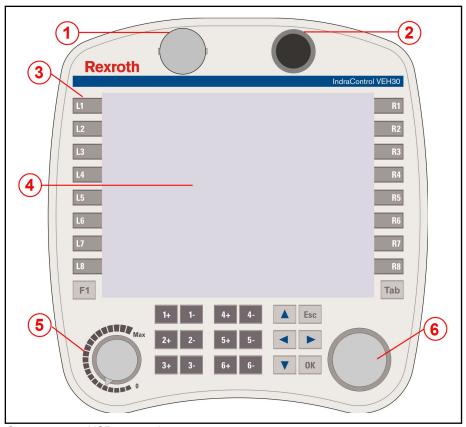
## 1.4 Membrane Keyboard

The foil keyboard consists of a chemical resistant polyester foil with embossed keys.

## 1.5 Touch screen

The front panel with touch screen allows you to operate the application software via the touch-sensitive surface of the display without keyboard and mouse.

#### 1.6 Front Panel of the IndraControl VEH 30.2



- ① USB connection
- ② Stop button
- Membrane Keyboard
- ④ Display
- ⑤ Installation point for override
- Installation point for electronic handwheelFig. 1-1: Front view of the IndraControl VEH 30.2

#### 1.7 Connection to the Control

The IndraControl VEH 30.2 hand-held terminal is connected to the control via the IndraControl VAC 30.2 connection module. At the front side a 17-pin female connector allows the comfortable connection of a IndraControl VEH 30.2. All clamps for fix wiring to the control are located on the rear side of the connection module in the control cabinet.

The VAC 30.2 connection module is suitable for hand-held terminals with stop pushbutton. The connection module is equipped with a fine thread screwed plug on the front side. The integrated "automatic stop button jumpering" allows to integrate both channels of the stop button of the hand-held terminal into the safety circuit of the running machine without accidental shutdown of the machine.

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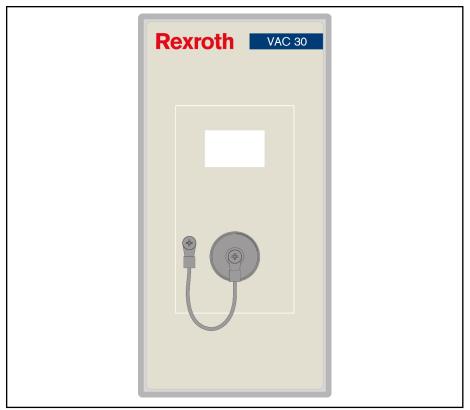


Fig.1-2: Front view: IndraControl VAC 30.2

#### **Operating System** 1.8

For license reasons IndraControl VEH 30.2 are only delivered with already installed operating system. For further information about the operating system please refer to chapter 9 "Software" on page 83.

#### Commissioning 1.9

Please mount the IndraControl VAC 30.2 connection module according to the specifications in chapter 5 "Dimensions" on page 51. After this connect the connection module to the following components:

- Voltage supply
- Stop circuit
- **Enabling circuit**
- Network

Before commissioning the IndraControl VEH 30.2 the operator has to assure that the plant, especially the safety devices, are in a proper state.



Shutdown of the plant due to the connection of a IndraControl VEH 30.2 with pressed stop pushbutton.

Before commissioning the IndraControl VEH 30.2 do observe that the stop pushbutton is not pressed.

For connecting the IndraControl VEH 30.2 put the connector without effort to the flange of the VAC 30.2 connection module. Observe the latch position of

the connection. Connecting cables with a production date before 2011 with an angled plug, are fitted in a 45° angle to the horizontal. Only if the connector snaps in properly, the correct position is reached. Now turn the knurled nut with slight pressure on the flange.

#### **NOTICE**

Loss of specified degree of protection due to incorrect connection of contacts.

While the connector is screwed on a VAC 30.2 connection module, a relay activates the stop button. In this way the IndraControl VEH 30.2 is supplied with voltage. Screw the knurled nut as far as the rubber seal is completely covered and the end position is reached to ensure the optimal connection of the contacts and to achieve the specified degree of protection.

Verify all three positions of the enabling button from both sides for correct function during commissioning of the IndraControl VEH 30.2 and regularly during routine operation.

Verify the stop pushbutton for correct function in safe state of the plant of the IndraControl VEH 30.2 in regular intervals and during commissioning.

The device may only be commissioned and connected by qualified staff.

Find further details about commissioning in the documentation of the device or installation manufacturer.

## 2 Important Instructions on Use, Target Group and Purpose of the Document

#### 2.1 General Information

Read this chapter as well as chapter 3 "Safety Instructions for Electric Drives and Controls" on page 15 before taking the product into operation – read the information carefully. For any questions, please contact your sales representative or the Bosch Rexroth Support, see chapter 12 "Service and Support" on page 101.

This document contains all specifications required by machinery directive 2006/42/EC.

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In terms of the machinery, the present project planning manual serves as assembly instructions.

## 2.2 Purpose of the Document

This documentation describes the IndraControl VEH 30.2 Hand-Held Terminals .

## 2.3 Target Group, Preconditions

This document is intended for the following persons with corresponding preconditions:

Target group	Prerequisite knowledge and ability	
Project engineer	Technical basic education (advanced technical education, engineering degree or corresponding professional experience),	
	Knowledge about:	
	the method of operation of a PLC	
	safety regulations	
	the application	
Start-up technician	Technical basic education (advanced technical education, engineering degree or corresponding professional experience),	
	Knowledge about:	
	safety regulations	
	the method of operation of the machine or system	
	fundamental functions of the application	
	system analysis and troubleshooting	
	the setting options at the operating devices	
Service technician	Technical basic education (advanced technical education, engineering degree or corresponding professional experience),	
	Knowledge about:	
	the method of operation of a PLC	
	safety regulations	
	the method of operation of the machine or system	
	diagnostic configurations	
	systematic error analysis and troubleshooting	

Tab.2-1: Target group, prerequisites

## 2.4 Appropriate Use

#### 2.4.1 Introduction

Rexroth products represent state-of-the-art developments and manufacturing. They are tested prior to delivery to ensure operational safety and reliability.

#### **A** WARNING

Physical injury and material damage might result from an inappropriate use of the products!

The products are designed for the use in an industrial environment and may therefore only be used for the appropriate use. If they are not used appropriately, situations causing personal injury as well as material damage can occur.



Bosch Rexroth disclaims as manufacturer any warranty, liability or damages occurring due to inappropriate use of the products. Furthermore, Bosch Rexroth is not paying any compensation; the user is responsible for any risks resulting from inappropriate use of the products.

Before using Bosch Rexroth products, the following requirements must be met to ensure appropriate use of the products:

- Anyone handling one of the Rexroth products in any way has to read and understand the respective safety-related guidelines as well as the instructions on appropriate use.
- Hardware products have to remain in their original state, i. e. no modification regarding the design is allowed. Software products must not be decompiled and their source codes must not be modified.
- Damaged or faulty products must not be implemented or put into operation.
- It must be ensured that the products are installed as specified in the documentation.

#### 2.4.2 Areas of Use and Application

The IndraControl VEH 30.2 Hand-Held Terminal is a PC-based operating and visualization device that can also fulfill control functionalities, depending on the application or configuration.

#### **NOTICE**

Danger of destruction of the device if not expressly stated accessories, add-on components and other components, cables, conduits, software and firmware is used.

The IndraControl VEH 30.2 Hand-Held Terminals may exclusively be used with the accessories and add-on components specified in this documentation. Components not named expressly mentioned must neither be mounted nor connected. The same applies to cables and conduits.

The products may only be operated with the expressly stated configurations and component combinations as well as with the software and firmware which given and specified in the respective functional description.

The IndraControl VEH 30.2 Hand-Held Terminal was developed for control tasks.

Typical areas of application of the IndraControl VEH 30.2 Hand-Held Terminal are:

- Handling systems and assembly systems
- Packaging and food processing machines
- Printing machines and paper converting machines
- Machine tools

The devices of the IndraControl VEH 30.2 design may only be operated under the assembly conditions and installation conditions, in the specified position of application and under the specified ambient conditions (temperature, degree of protection, humidity, EMC etc.) given in this documentation.

## 2.5 Inappropriate Use

The application of IndraControl VEH 30.2 Hand-Held Terminals that are not within the specified areas of application or under operating conditions deviating from the operating conditions and technical data specified in the documentation is considered as "inappropriate".

IndraControl VEH 30.2 Hand-Held Terminal must not be used if

- it is exposed to operating conditions that do not fulfill the ambient conditions specified. For instance, operation under water, in case of extreme variations of temperature or in extreme maximum temperatures is not allowed.
- Bosch Rexroth has not explicitly released the intended applications. It is imperative that you also note the information given in the general notes on safety!

## 3 Safety Instructions for Electric Drives and Controls

#### 3.1 Definitions of Terms

**Application Documentation** 

Application documentation comprises the entire documentation used to inform the user of the product about the use and safety-relevant features for configuring, integrating, installing, mounting, commissioning, operating, maintaining, repairing and decommissioning the product. The following terms are also used for this kind of documentation: Operating Instructions, Commissioning Manual, Instruction Manual, Project Planning Manual, Application Description, etc.

Component

A component is a combination of elements with a specified function, which are part of a piece of equipment, device or system. Components of the electric drive and control system are, for example, supply units, drive controllers, mains choke, mains filter, motors, cables, etc.

Control System

A control system comprises several interconnected control components placed on the market as a single functional unit.

Device

A device is a finished product with a defined function, intended for users and placed on the market as an individual piece of merchandise.

**Electrical Equipment** 

Electrical equipment encompasses all devices used to generate, convert, transmit, distribute or apply electrical energy, such as electric motors, transformers, switching devices, cables, lines, power-consuming devices, circuit board assemblies, plug-in units, control cabinets, etc.

**Electric Drive System** 

An electric drive system comprises all components from mains supply to motor shaft; this includes, for example, electric motor(s), motor encoder(s), supply units and drive controllers, as well as auxiliary and additional components, such as mains filter, mains choke and the corresponding lines and cables.

Installation

An installation consists of several devices or systems interconnected for a defined purpose and on a defined site which, however, are not intended to be placed on the market as a single functional unit.

Machine

A machine is the entirety of interconnected parts or units at least one of which is movable. Thus, a machine consists of the appropriate machine drive elements, as well as control and power circuits, which have been assembled for a specific application. A machine is, for example, intended for processing, treatment, movement or packaging of a material. The term "machine" also covers a combination of machines which are arranged and controlled in such a way that they function as a unified whole.

Manufacturer

The manufacturer is an individual or legal entity bearing responsibility for the design and manufacture of a product which is placed on the market in the individual's or legal entity's name. The manufacturer can use finished products, finished parts or finished elements, or contract out work to subcontractors. However, the manufacturer must always have overall control and possess the required authority to take responsibility for the product.

**Product** 

Examples of a product: Device, component, part, system, software, firmware, among other things.

**Project Planning Manual** 

A project planning manual is part of the application documentation used to support the sizing and planning of systems, machines or installations.

**Qualified Persons** 

In terms of this application documentation, qualified persons are those persons who are familiar with the installation, mounting, commissioning and operation of the components of the electric drive and control system, as well as with the hazards this implies, and who possess the qualifications their work

requires. To comply with these qualifications, it is necessary, among other things,

- 1) to be trained, instructed or authorized to switch electric circuits and devices safely on and off, to ground them and to mark them
- 2) to be trained or instructed to maintain and use adequate safety equipment
- 3) to attend a course of instruction in first aid

User A

A user is a person installing, commissioning or using a product which has been placed on the market.

#### 3.2 General Information

#### 3.2.1 Using the Safety Instructions and Passing Them on to Others

Do not attempt to install and operate the components of the electric drive and control system without first reading all documentation provided with the product. Read and understand these safety instructions and all user documentation prior to working with these components. If you do not have the user documentation for the components, contact your responsible Bosch Rexroth sales partner. Ask for these documents to be sent immediately to the person or persons responsible for the safe operation of the components.

If the component is resold, rented and/or passed on to others in any other form, these safety instructions must be delivered with the component in the official language of the user's country.

Improper use of these components, failure to follow the safety instructions in this document or tampering with the product, including disabling of safety devices, could result in property damage, injury, electric shock or even death.

## 3.2.2 Requirements for Safe Use

Read the following instructions before initial commissioning of the components of the electric drive and control system in order to eliminate the risk of injury and/or property damage. You must follow these safety instructions.

- Bosch Rexroth is not liable for damages resulting from failure to observe the safety instructions.
- Read the operating, maintenance and safety instructions in your language before commissioning. If you find that you cannot completely understand the application documentation in the available language, please ask your supplier to clarify.
- Proper and correct transport, storage, mounting and installation, as well as care in operation and maintenance, are prerequisites for optimal and safe operation of the component.
- Only qualified persons may work with components of the electric drive and control system or within its proximity.
- Only use accessories and spare parts approved by Bosch Rexroth.
- Follow the safety regulations and requirements of the country in which the components of the electric drive and control system are operated.
- Only use the components of the electric drive and control system in the manner that is defined as appropriate. See chapter "Appropriate Use".
- The ambient and operating conditions given in the available application documentation must be observed.
- Applications for functional safety are only allowed if clearly and explicitly specified in the application documentation "Integrated Safety Technolo-

gy". If this is not the case, they are excluded. Functional safety is a safety concept in which measures of risk reduction for personal safety depend on electrical, electronic or programmable control systems.

 The information given in the application documentation with regard to the use of the delivered components contains only examples of applications and suggestions.

The machine and installation manufacturers must

- make sure that the delivered components are suited for their individual application and check the information given in this application documentation with regard to the use of the components,
- make sure that their individual application complies with the applicable safety regulations and standards and carry out the required measures, modifications and complements.
- Commissioning of the delivered components is only allowed once it is sure that the machine or installation in which the components are installed complies with the national regulations, safety specifications and standards of the application.
- Operation is only allowed if the national EMC regulations for the application are met.
- The instructions for installation in accordance with EMC requirements can be found in the section on EMC in the respective application documentation.

The machine or installation manufacturer is responsible for compliance with the limit values as prescribed in the national regulations.

The technical data, connection and installation conditions of the components are specified in the respective application documentations and must be followed at all times.

National regulations which the user must take into account

- European countries: In accordance with European EN standards
- United States of America (USA):
  - National Electrical Code (NEC)
  - National Electrical Manufacturers Association (NEMA), as well as local engineering regulations
  - Regulations of the National Fire Protection Association (NFPA)
- Canada: Canadian Standards Association (CSA)
- Other countries:
  - International Organization for Standardization (ISO)
  - International Electrotechnical Commission (IEC)

## 3.2.3 Hazards by Improper Use

- High electrical voltage and high working current! Danger to life or serious injury by electric shock!
- High electrical voltage by incorrect connection! Danger to life or injury by electric shock!
- Dangerous movements! Danger to life, serious injury or property damage by unintended motor movements!
- Health hazard for persons with heart pacemakers, metal implants and hearing aids in proximity to electric drive systems!

- Risk of burns by hot housing surfaces!
- Risk of injury by improper handling! Injury by crushing, shearing, cutting, hitting!
- Risk of injury by improper handling of batteries!
- Risk of injury by improper handling of pressurized lines!

## 3.3 Instructions with Regard to Specific Dangers

## 3.3.1 Protection Against Contact with Electrical Parts and Housings



This section concerns components of the electric drive and control system with voltages of **more than 50 volts**.

Contact with parts conducting voltages above 50 volts can cause personal danger and electric shock. When operating components of the electric drive and control system, it is unavoidable that some parts of these components conduct dangerous voltage.

## High electrical voltage! Danger to life, risk of injury by electric shock or serious injury!

- Only qualified persons are allowed to operate, maintain and/or repair the components of the electric drive and control system.
- Follow the general installation and safety regulations when working on power installations.
- Before switching on, the equipment grounding conductor must have been permanently connected to all electric components in accordance with the connection diagram.
- Even for brief measurements or tests, operation is only allowed if the equipment grounding conductor has been permanently connected to the points of the components provided for this purpose.
- Before accessing electrical parts with voltage potentials higher than 50 V, you must disconnect electric components from the mains or from the power supply unit. Secure the electric component from reconnection
- With electric components, observe the following aspects:
  - Always wait **30 minutes** after switching off power to allow live capacitors to discharge before accessing an electric component. Measure the electrical voltage of live parts before beginning to work to make sure that the equipment is safe to touch.
- Install the covers and guards provided for this purpose before switching
- Never touch electrical connection points of the components while power is turned on.
- Do not remove or plug in connectors when the component has been powered.
- Under specific conditions, electric drive systems can be operated at mains protected by residual-current-operated circuit-breakers sensitive to universal current (RCDs/RCMs).

 Secure built-in devices from penetrating foreign objects and water, as well as from direct contact, by providing an external housing, for example a control cabinet.

## High housing voltage and high leakage current! Danger to life, risk of injury by electric shock!

- Before switching on and before commissioning, ground or connect the components of the electric drive and control system to the equipment grounding conductor at the grounding points.
- Connect the equipment grounding conductor of the components of the electric drive and control system permanently to the main power supply at all times. The leakage current is greater than 3.5 mA.
- Establish an equipment grounding connection with a minimum cross section according to the table below. With an outer conductor cross section smaller than 10 mm<sup>2</sup> (8 AWG), the alternative connection of two equipment grounding conductors is allowed, each having the same cross section as the outer conductors.

Cross section outer con- ductor	Minimum cross section equipment grounding conductor  Leakage current ≥ 3.5 mA	
	1 equipment grounding conductor	2 equipment grounding conductors
1.5 mm <sup>2</sup> (16 AWG)		2 × 1.5 mm <sup>2</sup> (16 AWG)
2.5 mm <sup>2</sup> (14 AWG)		2 × 2.5 mm <sup>2</sup> (14 AWG)
4 mm <sup>2</sup> (12 AWG)	10 mm <sup>2</sup> (8 AWG)	2 × 4 mm <sup>2</sup> (12 AWG)
6 mm <sup>2</sup> (10 AWG)		2 × 6 mm <sup>2</sup> (10 AWG)
10 mm <sup>2</sup> (8 AWG)		-
16 mm² (6 AWG)		-
25 mm <sup>2</sup> (4 AWG)	16 mm <sup>2</sup> (6 AWG)	-
35 mm <sup>2</sup> (2 AWG)		-
50 mm <sup>2</sup> (1/0 AWG)	25 mm <sup>2</sup> (4 AWG)	-
70 mm <sup>2</sup> (2/0 AWG)	35 mm <sup>2</sup> (2 AWG)	-

Tab.3-1: Minimum Cross Section of the Equipment Grounding Connection

## 3.3.2 Protective Extra-Low Voltage as Protection Against Electric Shock

Protective extra-low voltage is used to allow connecting devices with basic insulation to extra-low voltage circuits.

On components of an electric drive and control system provided by Bosch Rexroth, all connections and terminals with voltages up to 50 volts are PELV ("Protective Extra-Low Voltage") systems. It is allowed to connect devices equipped with basic insulation (such as programming devices, PCs, notebooks, display units) to these connections.

## Danger to life, risk of injury by electric shock! High electrical voltage by incorrect connection!

If extra-low voltage circuits of devices containing voltages and circuits of more than 50 volts (e.g., the mains connection) are connected to Bosch Rexroth products, the connected extra-low voltage circuits must comply with the requirements for PELV ("Protective Extra-Low Voltage").

#### 3.3.3 Protection Against Dangerous Movements

Dangerous movements can be caused by faulty control of connected motors. Some common examples are:

- Improper or wrong wiring or cable connection
- Operator errors
- Wrong input of parameters before commissioning
- Malfunction of sensors and encoders
- Defective components
- Software or firmware errors

These errors can occur immediately after equipment is switched on or even after an unspecified time of trouble-free operation.

The monitoring functions in the components of the electric drive and control system will normally be sufficient to avoid malfunction in the connected drives. Regarding personal safety, especially the danger of injury and/or property damage, this alone cannot be relied upon to ensure complete safety. Until the integrated monitoring functions become effective, it must be assumed in any case that faulty drive movements will occur. The extent of faulty drive movements depends upon the type of control and the state of operation.

## Dangerous movements! Danger to life, risk of injury, serious injury or property damage!

A **risk assessment** must be prepared for the installation or machine, with its specific conditions, in which the components of the electric drive and control system are installed.

As a result of the risk assessment, the user must provide for monitoring functions and higher-level measures on the installation side for personal safety. The safety regulations applicable to the installation or machine must be taken into consideration. Unintended machine movements or other malfunctions are possible if safety devices are disabled, bypassed or not activated.

#### To avoid accidents, injury and/or property damage:

- Keep free and clear of the machine's range of motion and moving machine parts. Prevent personnel from accidentally entering the machine's range of motion by using, for example:
  - Safety fences
  - Safety guards
  - Protective coverings
  - Light barriers
- Make sure the safety fences and protective coverings are strong enough to resist maximum possible kinetic energy.
- Mount emergency stopping switches in the immediate reach of the operator. Before commissioning, verify that the emergency stopping equip-

ment works. Do not operate the machine if the emergency stopping switch is not working.

- Prevent unintended start-up. Isolate the drive power connection by means of OFF switches/OFF buttons or use a safe starting lockout.
- Make sure that the drives are brought to safe standstill before accessing or entering the danger zone.
- Additionally secure vertical axes against falling or dropping after switching off the motor power by, for example,
  - mechanically securing the vertical axes,
  - adding an external braking/arrester/clamping mechanism or
  - ensuring sufficient counterbalancing of the vertical axes.
- The standard equipment motor holding brake or an external holding brake controlled by the drive controller is not sufficient to guarantee personal safety!
- Disconnect electrical power to the components of the electric drive and control system using the master switch and secure them from reconnection ("lock out") for:
  - Maintenance and repair work
  - Cleaning of equipment
  - Long periods of discontinued equipment use
- Prevent the operation of high-frequency, remote control and radio equipment near components of the electric drive and control system and their supply leads. If the use of these devices cannot be avoided, check the machine or installation, at initial commissioning of the electric drive and control system, for possible malfunctions when operating such high-frequency, remote control and radio equipment in its possible positions of normal use. It might possibly be necessary to perform a special electromagnetic compatibility (EMC) test.

## 3.3.4 Protection Against Magnetic and Electromagnetic Fields During Operation and Mounting

Magnetic and electromagnetic fields generated by current-carrying conductors or permanent magnets of electric motors represent a serious danger to persons with heart pacemakers, metal implants and hearing aids.

Health hazard for persons with heart pacemakers, metal implants and hearing aids in proximity to electric components!

- Persons with heart pacemakers and metal implants are not allowed to enter the following areas:
  - Areas in which components of the electric drive and control systems are mounted, commissioned and operated.
  - Areas in which parts of motors with permanent magnets are stored, repaired or mounted.
- If it is necessary for somebody with a heart pacemaker to enter such an area, a doctor must be consulted prior to doing so. The noise immunity of implanted heart pacemakers differs so greatly that no general rules can be given.
- Those with metal implants or metal pieces, as well as with hearing aids, must consult a doctor before they enter the areas described above.

#### 3.3.5 Protection Against Contact with Hot Parts

Hot surfaces of components of the electric drive and control system. Risk of burns!

- Do not touch hot surfaces of, for example, braking resistors, heat sinks, supply units and drive controllers, motors, windings and laminated cores!
- According to the operating conditions, temperatures of the surfaces can be **higher than 60 °C** (140 °F) during or after operation.
- Before touching motors after having switched them off, let them cool down for a sufficient period of time. Cooling down can require up to 140 minutes! The time required for cooling down is approximately five times the thermal time constant specified in the technical data.
- After switching chokes, supply units and drive controllers off, wait 15 minutes to allow them to cool down before touching them.
- Wear safety gloves or do not work at hot surfaces.
- For certain applications, and in accordance with the respective safety regulations, the manufacturer of the machine or installation must take measures to avoid injuries caused by burns in the final application. These measures can be, for example: Warnings at the machine or installation, guards (shieldings or barriers) or safety instructions in the application documentation.

## 3.3.6 Protection During Handling and Mounting

Risk of injury by improper handling! Injury by crushing, shearing, cutting, hit-ting!

- Observe the relevant statutory regulations of accident prevention.
- Use suitable equipment for mounting and transport.
- Avoid jamming and crushing by appropriate measures.
- Always use suitable tools. Use special tools if specified.
- Use lifting equipment and tools in the correct manner.
- Use suitable protective equipment (hard hat, safety goggles, safety shoes, safety gloves, for example).
- Do not stand under hanging loads.
- Immediately clean up any spilled liquids from the floor due to the risk of falling!

## 3.3.7 Battery Safety

Batteries consist of active chemicals in a solid housing. Therefore, improper handling can cause injury or property damage.

#### Risk of injury by improper handling!

- Do not attempt to reactivate low batteries by heating or other methods (risk of explosion and cauterization).
- Do not attempt to recharge the batteries as this may cause leakage or explosion.
- Do not throw batteries into open flames.
- Do not dismantle batteries.

- When replacing the battery/batteries, do not damage the electrical parts installed in the devices.
- Only use the battery types specified for the product.



Environmental protection and disposal! The batteries contained in the product are considered dangerous goods during land, air, and sea transport (risk of explosion) in the sense of the legal regulations. Dispose of used batteries separately from other waste. Observe the national regulations of your country.

#### 3.3.8 Protection Against Pressurized Systems

According to the information given in the Project Planning Manuals, motors and components cooled with liquids and compressed air can be partially supplied with externally fed, pressurized media, such as compressed air, hydraulics oil, cooling liquids and cooling lubricants. Improper handling of the connected supply systems, supply lines or connections can cause injuries or property damage.

#### Risk of injury by improper handling of pressurized lines!

- Do not attempt to disconnect, open or cut pressurized lines (risk of explosion).
- Observe the respective manufacturer's operating instructions.
- Before dismounting lines, relieve pressure and empty medium.
- Use suitable protective equipment (safety goggles, safety shoes, safety gloves, for example).
- Immediately clean up any spilled liquids from the floor due to the risk of falling!



Environmental protection and disposal! The agents (e.g., fluids) used to operate the product might not be environmentally friendly. Dispose of agents harmful to the environment separately from other waste. Observe the national regulations of your country.

## 3.4 Explanation of Signal Words and the Safety Alert Symbol

The Safety Instructions in the available application documentation contain specific signal words (DANGER, WARNING, CAUTION or NOTICE) and, where required, a safety alert symbol (in accordance with ANSI Z535.6-2011).

The signal word is meant to draw the reader's attention to the safety instruction and identifies the hazard severity.

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.

#### **A** DANGER

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

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#### **▲** WARNING

In case of non-compliance with this safety instruction, death or serious injury **could** occur.

## **▲** CAUTION

In case of non-compliance with this safety instruction, minor or moderate injury could occur.

#### **NOTICE**

In case of non-compliance with this safety instruction, property damage could occur.

## 4 Technical Data

## 4.1 IndraControl VEH 30.2

Processor	Intel Atom processor Z510 (1.1 GHz)
RAM	512 MB
Flash onboard	4 GB
Interfaces	1 × Ethernet connection (RJ 45, 10/100 base-T)
Service interface	USB interface on the front
Further connections	Stop button
	Enabling device
Housing material	Polyamide PA6, glass-fiber reinforced
Degree of protection	IP 65, type 1 according to NEMA (UL)
Degree of pollution	3
Voltage supply	DC 24 V
Input voltage range	DC 24 V (+19 V to +30 V)
Emitted interference and surge immunity	U <sub>max</sub> = 35 V (for t < 100 ms)
Max. input current	0.7 A for nominal voltage 24 V
Max. inrush current	3 A for nominal voltage 24 V
Prescribed external protection	Fusible cut-out, 2 A time-lag
Max. power consumption for maximum configuration	14 W

Tab.4-1: Technical data, IndraControl VEH 30.2

## 4.2 Front Panel

Display	213 mm TFT (8.4"), 1024 × 768 and 800 × 600 pixels	
	256k colors	
Operation	Touch and key operation with 40 keys	
Surface front panel	Color RAL 7035 light gray	
Degree of protection	Front panel IP 65 according to EN 60529, IEC 60529	

Tab.4-2: Technical data, front panel of the IndraControl VEH 30.2

## 4.3 Stop Pushbutton

Design	Stop button, black-gray, two-channels, isolated
Nominal voltage	DC 24 V / AC 30 V protective extra low voltage (PELV)
Nominal current	2 A = or 2.3 A~
	Current carrying capacity of the output contacts is limited by connected cable

Prescribed external protection	Fusible cut-out, 2 A time-lag
B10d value	B10d: 250.000
	Exclusion of failure at <6050 switching cycles

Tab.4-3: Technical data, stop button

#### **Enabling Device** 4.4

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Design	3-stage enabling device <sup>1)</sup> , 2-channel, electrically isolated
Nominal voltage	DC 24 V / AC 30 V protective extra low voltage (PELV)
Nominal current*	2 A = or 2.3 A~
	Current carrying capacity of the output contacts is limited by connected cable
Prescribed external protection	Fusible cut-out, 2 A time-lag
Switching cycles	>200000 for enabling range,
	>100000 for panic position
Control category	Can be used in safety-related controls up to category 4, DIN EN 954-1 (if required with additional monitoring modules).
	Can be used in safety-related controls up to category 3 according to EN ISO 13849-1
B10d value	B10d: 100.000

Technical data, enabling device

#### Connection Module IndraControl VAC 30.2 4.5

Connections	1 x Ethernet connection (RJ 45, 10/100 Base-T)	
	Stop button	
	Isolated contact "Terminal connected"	
	Enabling device	
	Voltage supply 24 V (see tab. 4-1 "Technical data, IndraControl VEH 30.2" on page 25)	
	17-pin fine-thread flange to the hand-held terminal	
Jumpering the stop pushbut- ton circuit with unplugged hand-held terminal	Automatic jumpering of relay contacts	
Prescribed external protection	Fusible cut-out, 2 A time-lag	

<sup>1)</sup> Lines must be protected against short-circuits and cross-circuits by the installation!

Material	Front panel: Aluminum, metal cover: V2A
Degree of protection	Front panel IP 65,
	Rear panel IP 30

Tab.4-5: Technical data, connection module IndraControl VAC 30.2

## 4.6 Ambient Conditions

	In operation	Storage	Transport
Max. ambient tem- perature	+5 °C to 40 °C according to EN 50178, class 3K3	-20 °C to +70 °C according to EN 50178, class 3K3	-20 °C to +70 °C according to EN 50178, class 3K3
Max. temperature gradient	Temporal temperature changes up to 3 K per minute	Temporal temperature changes up to 3 K per minute	Temporal temperature changes up to 3 K per minute
Relative humidity	Min. relative humid- ity: 10 %	Min. relative humidity: 5 %	Min. relative humid- ity: 5 %
	Max. relative humidity: 95 %	Max. relative humidity: 95 %	Max. relative hu- midity: 95 %
	Min. absolute humidity: 1 g/m <sup>3</sup>	Min. absolute humidity: 1 g/m <sup>3</sup>	Min. absolute humidity: 1 g/m <sup>3</sup>
	Max. absolute humidity: 25 g/m <sup>3</sup>	Max. absolute humidity: 25 g/m <sup>3</sup>	Max. absolute humidity: 25 g/m <sup>3</sup>
	Non-condensing acc. to climatic class 3K3 acc. to EN 60721-3-3	Non-condensing according to climat- ic class 2K2 acc. to EN 60721-3-3	Non-condensing acc. to climatic class 1K2 acc. to EN 60721-3-3
Air pressure	Up to 2,000 m above sea level acc. to EN 61131-2	Up to 3000 m above sea level acc. to EN 61131-2	Up to 3000 m above sea level acc. to EN 61131-2
Free fall	Free fall from 1 m height in the active status, hazardous impact	Free fall from a height of 1 m, haz- ardous impact	Free fall from a height of 1 m, haz- ardous impact
Mechanical strength	Max. vibration: Frequency range: 5 up to 150 Hz	Max. shock: 15 g 11 ms acc. to EN 60068-2-27	Max. shock: 15 g 11 ms acc. to EN 60068-2-27
Excursion: 3.5 mm amplitude at 5 to 9		No breakdown of the function.	No breakdown of the function.
	Acceleration: 1 g for 9 to 150 Hz acc. to EN 60068-2-6	Three shocks in each of the three axes arranged vertically to each other, always in both directions (a total of 18 shocks)	Three shocks in each of the three axes arranged vertically to each other, always in both directions (a total of 18 shocks)

Tab.4-6: Ambient conditions, IndraControl VEH 30.2

#### 4.7 Accessories

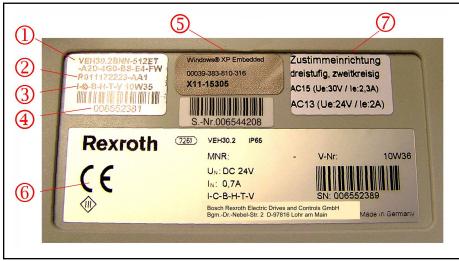
Wall holder	For stationary operation or for storage
VAS 01.1	Wall holder with cable holder
Connecting cable	Torsional, bending and impact strength with readymade 17-pin round connector
VAS 05.1	0.5 m or 8 m
RKS0011/16,0	16 m extension cable for devices with stop pushbutton

Tab.4-7: Accessories for IndraControl VEH 30.2

For ordering information for the accessories, please refer to chapter 11.2 "Accessories" on page 98.

## 4.8 Marking

Identify the device with the type plate on the rear side of the device.



- Order code, short typeParts number
- ③ Production date, example 10W35: Production year 2010, week 35
- Serial number, basic device
- ⑤ License and serial number of the operating system
- © Company logo, technical data, serial number of the basic device
- Data of the enabling button
- Fig.4-1: Type plate, IndraControl VEH 30.2

## 4.9 Weight

	4 001
IndraControl VEH 30.2	Approx. 2.6 kg

Tab.4-8: Weight, IndraControl VEH 30.2

#### 4.10 Used Standards

Enabling device and emergency stop button

The present project planning manual complies with the Machinery Directive 2006/42/EC, see also chapter 4.12 "Further Information on the Machinery Directive (MD)" on page 34. The terms used in the present project planning manual are derived from the new Machinery Directive (MD) 2006/42/EC. In

order to avoid ambiguity for users the following table lists the new and old standards.

In terms of the machinery directive (MD), this project planning manual serves as assembly instructions for the machine manufacturer.

98/37/EC (an	cient standard)	2006/42/EC (new standard)
Emergency s	top	EMERGENCY STOP
Tab.4-9: Emergency stop be		utton: Standards
EN 60204-1: standard)	1997 (ancient	EN 60204-1:2006 (new standard)
Enabling dev	ice	Enabling control device
		(is designated as "enabling pushbutton" or "enabling device" in this document)
Tab.4-10:	Enabling device: Standards	

#### **European Union Directives**

Directive	Description
98/37/EC and 2006/42/EC (valid from 29th December, 2009)	Directive on Machinery with amendment 98/79/EC and MD 2006/42/EC
2004/108/EC	EMC Directive

Tab.4-11: European Union Directives

#### Examination of the conformity regarding the Directive on Machi-

•		
Standard	Description	
EN ISO 13850:2006	Safety of machinery – EMERGENCY STOP – principles for design	
EN ISO 13849-1:2008	Safety of machinery – safety-related parts of control systems – part 1: General principles for design	
EN 60204-1:2006 (chapter 9, chapter 10)	Safety of machinery – electrical equipment of machines – part 1: General requirements	

Examination of the conformity regarding the Directive on Machinery Tab.4-12:

#### Examination of the conformity regarding the EMC Directive

, , ,		
Standard	Description	
EN 61131-2:2007 (chapter 8, chapter 9)	Programmable logic controllers – part 2: Equipment requirements and tests	
In this way the accordance to following standards is also given:		
EN 61000-6-2:2005	EMC generic standards - noise immunity for industrial environments	
EN 61000-6-4:2007	EMC generic standards - emission standard for industrial environments	

#### Examination of the conformity regarding the EMC Directive

#### Other standards

Additionally, for the design of the safety concept some parts of the following legally not bounded European standards has been used:

#### General procedures and safety principles

Standard	Description
EN ISO 12100-1:2003	Safety of machinery – basic concepts, general principles for design – part 1: Basic terminology, methodology
EN ISO 12100-2:2003	Safety of machinery – basic concepts, general principles for design – part 2: Technical principles

Tab.4-14: General procedures and safety principles

#### **Enabling device**

Standard	Description
EN ISO 13849-1:2008	Safety of machinery – safety-related parts of control systems – part 1: General principles for design
EN 60204-1:2006	Safety of machinery – electrical equipment of machines – part 1: General requirements

Tab.4-15: Enabling button

#### Stop button and emergency stop pushbutton

Standard	Description
EN ISO 13850:2006	Safety of machinery – EMERGENCY STOP – principles for design
EN 60204-1:2006 (chapter 9, chapter 10)	Safety of machinery – electrical equipment of machines – part 1: General requirements

Tab.4-16: Stop button and emergency stop pushbutton

#### **Ergonomics**

Standard	Description
EN 614-1:2006	Safety of machinery – ergonomic principles for design – part 1: Terminology and general principles
EN 894-1:1997	Safety of machinery – ergonomics requirements for the design of displays and control actuators – part 1: General principles for human interactions with displays and control actuators
EN 894-2:1997	Safety of machinery – ergonomics requirements for the design of displays and control actuators – part 2: Displays
EN 894-3:2000	Safety of machinery – ergonomics requirements for the design of displays and control actuators – part 3: Control actuators

Tab.4-17: Ergonomics

#### Stability and impermeability of the housing

Standard	Description
EN 60529:1991	Degrees of protection provided by enclosures
	Programmable logic controls  – part 2: Equipment requirements and tests

Tab.4-18: Stability and impermeability of the enclosure

#### Electrical safety and fire protection

Standard	Description
EN 61131-2:2007 (chapter 11)	Programmable logic controls  – part 2: Equipment requirements and tests
EN 50178:1997	Electronic equipment for use in power installations

Tab.4-19: Electrical safety and fire protection

#### **Environmental conditions**

Standard	Description
EN 61131-2:2007 (chapter 4)	Programmable logic controls  – part 2: Equipment requirements and tests
EN 50178	Electronic equipment for use in power installations

Tab.4-20: Environmental conditions, requirements

For the US market the following standards had been used furthermore:

#### UL examination for industrial control equipment

Standard	Description
UL 508, 17 <sup>th</sup> edition (=CSA C22.2 No.14)	Industrial Control Equipment (NRAQ, NRAQ7)

Tab.4-21: UL examination for industrial control equipment

#### 4.11 Directives

#### 4.11.1 General Information

This chapter contains further information on European Union Directives.

## 4.11.2 European Union Directives

A fundamental goal of the European Union is the creation of an Internal market within Europe and, linked to this, the reduction of trade barriers. In order to achieve this goal, the European Treaties guarantee "four freedoms".

- Free movement of goods
- Right of establishment
- Free movement of services
- Free movement of capital

Free movement of goods means that quantitative import restrictions on goods are prohibited between the member states. Goods that are hazardous to the

safety of people or the environment are excluded. Such products can be disallowed by member states in their sovereign territory.

In order that free movement of goods may also be guaranteed for these products, the national safety regulations of the member states are harmonized by means of European Union Directives.

These Directives exist for different product classes, e.g. machines, medical products or also toys. However, Directives have also been compiled for further common product safety aspects, such as protection from electricity and explosion, and electromagnetic compatibility (EMC).

The Directives are aimed at the member states, whose task is to convert them into national law. Therefore the Directives have legal character.

"CE" marking certifies that the manufacturer fulfils all obligations in relation to the product on the basis of the EU Directives. The CE mark is the "passport" within the EU and is defined on behalf of the supervisory authorities.

Additionally independent, accredited notified bodies can be commissioned to carry out an EC type-examination and draw up a certificate.

Both the Electromagnetic Directive (EMC Directive 89/336/EEC) and the Machinery Directive (MD 2006/42/EC) are applicable to the Hand-Held Terminals

#### 4.11.3 Safety of Machinery

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Overview

Additional measures must be taken wherever faults arising in the machinery may cause personal injury or significant material damage. These measures must also guarantee a safe operating condition for the whole system in the event of a fault.

Although the Hand-Held Terminal is not, in the narrower sense, a machine, it does, however, perform important tasks to guarantee the safety functions of a machinery to which it is attached.

The Hand-Held Terminal features, for example, the "Emergency Stop" safety function and an enabling device for use in special operation modes. It is, as a result, a "Safety Component" in terms of the Machinery Directive (MD).

Safety components, i.e. parts whose failure or faulty operation put the safety of people within the danger zone of the machine in danger, fall expressly within the range of application of the Machinery Directive (MD). The fundamental requirements that the Machinery Directive places on the manufacturer are as follows:

- To perform a hazard and risk analysis
- To comply with the integration of safety principles
- To compile and keep a technical construction file
- To provide solutions according to the latest state of the art
- Presumption of conformity with harmonized Standards
- To apply CE marking (on the type plate)

Basically, the same requirements apply to safety components. In their particular case, it must be proven that failure or malfunction are not possible, or that malfunction does not lead to a hazardous situation.

Risk assessment

The manufacturer of a machine is obliged to perform a risk assessment of the machine. Risk assessment comprises risk analysis and risk evaluation. The machine must be analyzed throughout its whole operating life and in all operation modes, and all hazards that may possibly arise must be documented. This has to be done without taking into account possible safeguards.

The next step is to formulate a goal for protection against each identified hazard and subsequently to define one or more protective measure(s) to achieve the protection goal.

Further details about the procedure for performing the hazard and risk analysis and lists of commonly occurring hazards can be found in the following standards:

- EN 12100-1 and EN 12100-2: "Safety of machinery basic concepts, general principles for design"
- EN 14121-1: "Safety of Machinery risk assessment"

## Principles for the integration of safety

Appendix I, chapter 1.1.2 of the Machinery Directive 2006/42/EC prescribes a clear procedure and sequence for the selection of protective measures. The procedure is as follows:

#### Eliminating or minimizing the hazards

This takes place at the design stage of the machine. These measures include, for example:

- Reduction in the use of energy (power, revolutions, voltages etc.) as far as possible
  - Avoidance of unnecessary sharp points or sharp edges
  - Avoidance of human errors by means of the ergonomic and logical design of operating devices
  - Avoidance of hazardous materials and commodities

#### Taking protective measures against hazards that cannot be eliminated

These measures include, for example:

- Guards (railings, housings, guards)
- Protective devices (light barrier for hazard elimination)
- Protective control equipment (enabling devices or enabling devices, two-hand control devices, speed monitoring,...)

#### User information about residual hazards

This last of the three options is used if residual hazards remain after the first two options have been applied. These measures include, for example:

- Warning notices
- Training and organizational measures
- The use of personal protective equipment

#### Technical construction file

The technical construction file contains all the documents that are required to prove the safety of the machinery and or the safety component. These are, for example:

- A complete drawing of the machinery or safety component including control circuit diagrams
- Hazard and risk analysis
- Calculations
- Research and test results
- A list of the basic safety requirements of the Machinery Directive applicable to the machine and a description of the solutions
- Used standards
- Operating instructions, operating manuals

The technical construction file must be retained for a minimum of 10 years after the supply of the last product, and must be presented within a period of a few days in the event of a claim for damages.

### State of the art

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"State of the art" means technical possibilities at a certain point of time that are based on certain scientific and technical knowledge. The state of the art also means something that is commercially viable, i.e. that it can be realized by the majority in the industrial sector concerned.

The "state of the art is" defined as the state of development of advanced procedures, equipment or operating methods, that makes the practical applicability of the measure appear assured overall in respect of the targeted goals (e.g. the goals of protection of work, protection of the environment, safety of third parties and operating efficiency: Namely to achieve a generally high level overall in relation to the aspects under consideration).

The state of the art can change, independent from the standards.

### Presumption of conformity with harmonized standards

The European Directives mainly contain general requirements for the safety of products; however they do not contain any details of how to carry them out. The European Standards Institutes are responsible for this. They provide implementation proposals for real safety problems or specific product classes. Standards that are assumed to meet and correctly interpret the requirements of the Directives are designated as "harmonized standards". However, most of the available standards are not harmonized.

By applying and implementing harmonized standards, a manufacturer can claim conformity for the respective product. However, the standards, in contrast to the Directives, are not legally binding. This means that the manufacturer may also take into consideration other solutions that are not described in the standards. However, these solutions must attain at least the same safety level as the relevant standards and meet the requirements of the appropriate Directives.

### Related information

Please find further information in chapter 4.12 "Further Information on the Machinery Directive (MD)" on page 34 on the following topics:

- Selection of Performance Level (PL) and safety categories according to EN ISO 13849-1
- Application of Hand-Held Terminals in special operation modes
- Notes on the "emergency stop button"
- Application of emergency stop button and stop button on the Hand-Held Terminal
- Notes on the enabling device

#### 4.12 Further Information on the Machinery Directive (MD)

### **General Information**

The Machinery Directive (MD) 2006/42/EC is valid from 29th December, 2009. This means that all machines and safety components that will be brought to market after this date have to comply with this new MD and its harmonized standards. For Bosch Rexroth hand-held terminals this means that - besides the new Machine Directive - also the standard EN ISO 13849-1:2008 will be used instead of the old standard EN 954-1. The EN ISO 13849-1 standard requires the specification of the B<sub>10d</sub> value for the safetyrelevant component "enabling device" and for the emergency stop pushbutton or gray stop pushbutton.

Which devices have to comply with the new Machinery Directive (MD)? This rule is valid for Bosch Rexroth and its customers:

Depending on the date the product has been put into circulation the new Machine Directive has to be applied or not. If the IndraControl VEH 30.2 will be

delivered in its end use after 29th December, 2009, it will be put into circulation newly - even if it has been sold by Bosch Rexroth at an earlier date.

- Devices complying with the 98/37/EC Machinery Directive that are sent to Bosch Rexroth for repair, can be repaired and delivered in compliance with the 98/37EC Machinery Directive.
- Customer sends old device for repair and will receive the same or another, equal device.
- Devices complying with the 2006/42/EC Machinery Directive that are sent to Bosch Rexroth for repair, must be repaired and delivered in compliance with the 2006/42/EC Machinery Directive.

Quantitative safety-relevant specifications for emergency stop pushbutton and for enabling device

### Emergency stop pushbutton:

Bosch Rexroth specifies a  $B_{10d}$  value, see also chapter 4 "Technical Data" on page 25. Further values (e.g. SIL, PL, Category) cannot be specified by Bosch Rexroth.

Explanation: Bosch Rexroth solely delivers the switching element, but no evaluation of the switching element. The customer has to connect the emergency stop button to his application on his own. Depending on the connection of the emergency stop to the machine, the customer can determine the SIL (Safety Integrated Level) or category with PL (Performance Level).

## Enabling device:

Bosch Rexroth specifies a  $B_{10d}$  value, see also chapter 4 "Technical Data" on page 25. Further values (e.g. SIL, PL, Category) cannot be specified by Bosch Rexroth.

Explanation: Bosch Rexroth solely delivers the switching element, but no evaluation of the switching element. The customer has to connect the enabling device to his application on his own. Depending on the connection of the enabling button to the machine, the customer receives the SIL (Safety Integrated Level) or category with PL (Performance Level).

Relationship between Performance Level (PL) and Safety Integrity Level (SIL) When evaluating safety functions according to IEC EN 62601 the PL (Performance Level) can be transformed into SIL (Ssafety lintegrity Level) according to the following equivalence table of EN ISO 13849-1.

Performance Level (PL) according to EN ISO 13849-1	Safety Integrity Level (SIL) according to IEC 61508-1
а	No corresponding value
b	1
С	1
d	2
е	3

Tab.4-22: EN ISO 13849-1, relationship between Performance Level (PL) and Safety Integrity Level (SIL)

PL (Performance Level)	Average probability of a dangerous breakdown per hour 1/h
а	≥10 <sup>-5</sup> to < 10 <sup>-4</sup>
b	3 x ≥10 <sup>-6</sup> to < 10 <sup>-5</sup>

PL (Performance Level)	Average probability of a dangerous breakdown per hour 1/h
С	≥10 <sup>-6</sup> to < 3 x 10 <sup>-6</sup>
d	≥10 <sup>-7</sup> to < 10 <sup>-6</sup>
	>10-8 +- 110-7

Tab.4-23: EN ISO 13849-1, Performance Level (PL)

#### **Abbreviations**

Abbreviation	Term	Explanation
B <sub>10d</sub>	-	Number of cycles until 10% of the components fail dangerously
		(per channel)
MTTF <sub>d</sub>	Mean Time to Dangerous Fai-	Meant time to dangerous failure
lure	(per channel)	
$DC^{2)}$	Diagnostic Coverage	Diagnostic of failures
PL	Performance Level	Ability of safety-related parts to perform a safety function under predictable conditions to meet the expected risk reduction
PFH	Probability of Failure per Hour	Probability of failure per hour
SIL	Safety Integrated Level	Safety integrated level

Tab.4-24: Abbreviations

Selection of Performance Level (PL) and Safety Categories according to EN ISO 13849-1 The Machinery Directive (MD) demands that a fault in control circuit logic, or an interference or damage thereto, must not lead to a hazardous situation. This general approach is substantiated in EN ISO 13849-1 "Safety of machinery - safety related parts of control systems", which defines Performance Levels (PL a to e) for control parts that are relevant to safety. The PL depends on the safety category, the MTTF $_{\rm d}$  value and the degree of coverage of diagnosis (DC $_{\rm avg}$ ) of the corresponding safety circuit.

As in the preceding standard EN 954-1, the safety category describes the structure of the safety function. The Performance Level (PL), which describes the conditional probability of failure and the defect discernability of the safety function, has been added.

The manufacturer of a machine has to select the PL depending on the real risk potential. The risk potential will be determined from a risk and hazard analysis. In case of hazards that can cause irreversible injury or death usually a Performance Level not less than PL "d" is required. The category of the Performance Level determines if

- the system has been built in 1-circuit technology, which means that a failure will lead to a loss of safety, although the availability of components and parts is high (category 1)
- the system has been built in 1-circuit technology, which means that a failure will lead to a loss of safety, but the failure will be detected by the system and will be displayed somehow or other (category 2)
- the system has been built in 2-circuit technology and that a fault will not lead to loss of safety (category 3)

• the system has been built in 2-circuit technology and a build up of multiple faults will not lead to loss of safety (category 4)

Starting from category 3 it is also important in this context that individual faults are detected in time to avoid a build up of faults, which may finally lead to loss of safety.

Faults that have to be detected in electric and electronic systems are e.g. cross-circuits between multiple circuits, interrupts, short-circuits or contacts that stick together. Special certified safety control devices are often used to detect faults in the individual safety circuits, which already have a certain PL. The overall PL quoted for these devices is only attained, however, if also the whole machine circuit under review lies within the scope of the respective PL.

The PL must always be considered in relation to a complete safety function and not as applied to individual components or parts.

A guide for easy calculation of the PL for a safety function consisting of several individual components can be found in standard EN ISO 13849-1 (chapter 6.3 and appendix H and I).

If safety components connected in series, the individual component with the lowest PL determines the PL of the whole safety function. For example a safety function consisting of three components, one with category 4 PL e, another one with category 3 PL d and a third component with category 2 PL c will have a PL c for the whole safety function. This means that a fault will lead to loss of safety, although components with category 4 PL e are integrated into the safety function, as one of the components being used has category 2.

If several Performance Levels (PL) are chained, the overall PL can decrease, see also standard EN 13849-1 (chapter 6.3).

The proof of attainment of a safety category can take place with the aid of a FMEA (Failure Mode and Effects Analysis). In this analysis all the faults that could possibly arise are simulated, either theoretically or in practice, and it is demonstrated that the requirements of the category are fulfilled.

Application of hand-held terminals in special operation modes

For manual controlling of machines in special operation modes, where safety depends on the timely reaction of the operating staff, it is absolutely essential that the operator can overlook the operating area.

The Hand-Held Terminal has the advantage that the operator can get very close to the operating area.

At the same time, the danger of misuse increases with mobility since, in remote locations where it is not possible to observe the operating area, machine movements can also be set in motion with the Hand-Held Terminal, knowingly or unknowingly.

The user of the machine, therefore, has to find the right compromise between necessary flexibility and a reasonable limitation of the working range when selecting the corresponding cable length for the Hand-Held Terminal.

The working range of radio-operated hand-held terminals cannot be limited by means of the cable. Therefore additional technical solutions are required for these hand-held terminals.

If the machine or equipment is operated with the Hand-Held Terminal, care must be taken at this time to ensure that operation can only be controlled by the Hand-Held Terminal and cannot be operated from any other point on the equipment. The hazard zone may only be entered by the person who is operating the Hand-Held Terminal. If it should be necessary for more than one person to work in the hazard zone at the same time, each person present requires an enabling device and machinery movement may only be allowed after all the enabling buttons have been activated.

### Notes on the "emergency stop" button

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In theory, a perfectly designed machine should not require an emergency stop pushbutton, because the Machinery Directive demands that a machine must be safe throughout its lifetime and in all operation modes. In practice, however, one is aware that unforeseen situations arise, in spite of all precautions.

In order to enable a fast stopping of the machine in these cases, or to avert danger, an emergency stop button is provided on most machines. The following figure shows that, a machine is permanently in the hazard state from the viewpoint of the emergency stop button, for as long as this button is not activated.

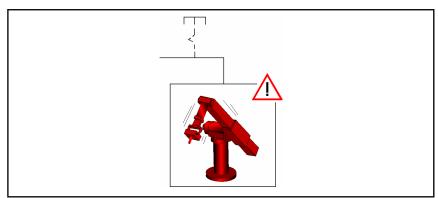


Fig.4-2: Emergency stop button in neutral position (not pressed)

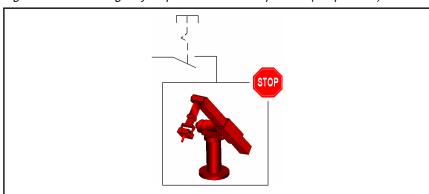


Fig.4-3: Emergency stop button pressed

Therefore the emergency stop button must not serve as the primary safety device, but is provided exclusively to cover any residual risks.

Instead of this and depending on the operation mode, other methods should be employed as the primary safety device, for example guards, light barriers and two-hand control devices or enabling devices.

When the emergency stop pushbutton is activated, the entire machine or all of the machines that are switched together in a plant must be lead to a safe state e.g. by stopping and switching off the power to the endangering drive mechanisms (stop categories 0 or 1 according to EN 60204-1).

The release of the emergency stop button must not cause any uncontrolled restart of the machine.

Irrespective of whether a hand-held terminal features an emergency stop pushbutton or not, permanently installed, universally identifiable and easily accessible emergency stop pushbuttons must be provided at selected points around the machine in every case.

Application of emergency stop button and stop button on the IndraControl VEH 30.2 The Machinery Directive does not specify any detailed requirements respecting the coloring of the operating elements for emergency stop. The requirement is as follows: "The device must have clearly identifiable, clearly visible and quickly accessible controls".

"Emergency" buttons are usually identified in red-yellow color. The specific design should have a signaling function whose effect is that any person, and especially untrained people, can quickly recognize the operating element as the device to eliminate a hazard in the case of an emergency.

One imperative requirement for equipment identified in this way is, therefore, that it must be possible to trigger a safe state at any time and in any operation mode, without further knowledge of the machine (see also EN ISO 13850). It is not acceptable for an emergency stop button to be enabled temporarily, since this can lead to faulty operation and life threatening loss of time in panic situations.

If hand-held terminals are considered in relation to these requirements it is evident that a differentiation must be made as to whether an emergency stop button on the hand-held terminal may be used or not, depending on specific criteria and applications.

Depending on the specific use case, the risk assessment of the machine (according to EN ISO 14121-1) can lead to different results, e.g. for stopping a system. The present document cannot make the decision. In the specific case, the machine manufacturer has to evaluate the case under consideration of all applying standards.

Temporarily pluggable hand-held terminals bear the risk of being available with ineffective safety device after having been disconnected from the device. In this case a gray stop button would not be detected as operating element for emergency stop. A disconnected hand-held terminal with red-yellow button could be taken for such an operating element; and the confusion could lead to a dangerous situation. In this case the professional organization demands "organizational measures" for eliminating the danger, e.g. shutting away the device.

Notes on the enabling button

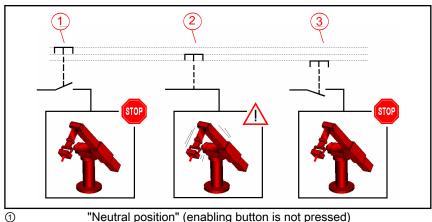
Many machines feature a normal operation mode as well as a special operation mode. The machine fulfils its primary mission in normal (automatic) operation. In this operation mode, safety is guaranteed by closed, separating protective devices and/or with functioning, not separating protective devices.

The special operation modes of a machine serve to maintain normal operation. In doing so, safety must be guaranteed in a way that is different to normal operation, because hazardous areas of the machine can now be entered and targeted machine movements have to be possible. The enabling button plays an important role.

This application requires the enabling button to eliminate the hazards that are to be controlled in a timely manner, before any personal injury occurs. For this purpose additional safety measures may be necessary, such as safely reduced speed of drive mechanisms.

In contrast to the emergency stop button (and the stop button), a machine in special operation modes with an enabling button is in a safe state as long as this enabling button is not activated (see the following figure):

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- "Neutral position" (enabling button is not pressed)
- 2 "Enabling" (enabling button is pressed)
- 3 "Panic" (enabling button is pressed heavily)

Fig.4-4: Enabling functions

The enabling function is also described in EN 60204-1:2006 and corresponds to the state of the art.

The panic position on 3-stage enabling buttons was introduced because limbs often become cramped when a person is in a state of shock and as a result is not able to release the enabling button. For this reason, firmly pushing down on the enabling button also leads to switch off.

The control must be designed in such a way that machine movement is not initiated directly when the enabling button is activated, but only as a result of the additional activation of a control button. This can be foil keys on the hand-held terminal or graphical software buttons on the touch screen.

The machine movement signal can be also triggered by an optionally available joystick.

According to EN 60204, only stop categories 0 or 1 are allowed for the enabling function, i.e. stopping the machine with the enabling button must always be combined with switching off the power supply to the drive mechanism.

In order to prevent incorrect, permanent activation of the enabling button by mechanical fixing devices, it is recommended to limit the maximum duration of an accepted enabling. This must be achieved by means of a control located downstream to the hand-held terminal.

An enabling button is not a replacement for a two-hand control device, which is specified for some machines (e.g. presses) and must therefore not be confused!

In contrast to the enabling button, the two-hand control device forces the endangered limbs of the operator into a safe position whilst the machine is in motion.

#### 4.13 Electromagnetic Compatibility (EMC)

#### 4.13.1 **General Information**

The European Union obligates its member states to harmonise their statutory provisions in respect of electromagnetic compatibility (EMC) by means of Directive 2004/108/EEC. In the following text this Directive is designated as "EMC Directive".

All electrical and electronic device that is put into circulation in Europe must, therefore, conform to the fundamental safety requirements of the EMC Directive. According to this Directive, electromagnetic compatibility is the ability of a device, plant or system to work satisfactorily in the electromagnetic environment, without itself causing electromagnetic interference that would be unacceptable to all devices, plant and systems present in this environment.

In addition to the legal requirements described above, the reliable functioning of an electrical device is also a fundamental quality characteristic of such a device. As well as basic information concerning electromagnetic compatibility, the following pages describe the implementation of the EMC requirements in respect of the IndraControl VEH 30.2 Hand-Held Terminal.

# 4.13.2 Electromagnetic Environment – Interference Sources, Interference Sinks and Coupling Paths

Electromagnetic environment – interference sources, interference sinks and coupling paths

Artificial and also natural sources of interference exist in the electromagnetic environment that can affect electrical and electronic devices.

The most well-known natural interference phenomenon is atmospheric discharge (lightning discharge).

Artificial interference sources are, on the one hand, intentional, such as mobile radio, amateur radio, TV and radio transmitters, and, on the other hand, unintentional, such as microwave ovens, arc welding, ignition systems, high voltage device, electric motors, electronic devices and also electrostatic discharge.

Atmospheric discharges (lightnings) Atmospheric discharges can take place directly or indirectly on power and communication lines. The consequence of such an impact if there is insufficient protection is the destruction of the electrical device.

Atmospheric discharges are simulated according to the international test standard IEC 61000-4-5 (EN 61000-4-5 for Europe) – "Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques. Surge immunity test".

The relevant international product standard for control systems, IEC61131-2 (EN61131-2 for Europe), divides the areas of application into zones. Higher or lower levels of interference can be expected depending on the zone in question. All Bosch Rexroth control systems and also the IndraControl VEH 30.2 are suitable for application in Zone B.

The product standard requires the testing of surge immunity according to IEC 61000-4-5.

Electrostatic discharges (ESD)

Materials can be charged by contact followed by subsequent separation. This effect only arises when at least one of the two materials is a non-conductor. As a result, discharge may take place if a charged conductor, or one that is changed by the influence of an electronic field, comes near a metallic object.

After charging, the possible voltages between the charged bodies can reach over 10 kV.

The most frequent occurrence of electrostatic discharge takes place between people and metallic objects. Since one is practically unnoticed of discharges below 3,500 V and yet electronic components are destroyed by low voltages, ESD damage to electronic components often goes unnoticed.

The international Standard IEC 61000-4-2 (EN 61000-4-2 for Europe) is used to simulate the measurement of electrostatic discharge. The international product standard IEC 61131-2 (EN 61131-2 in Europe) for programmable controls demands testing to IEC 61000-4-2 and also defines the severity level.

### Technical systems as interference sources

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Technical systems can act as interference sources. In doing so, the interference may be intentional or unintentional. Electromechanical energy is often also used for material processing.

Periodically occurring interference:

- Ignition impulses of combustion engines
- Sparking of commutator motors
- Electromagnetic fields of induction furnaces, arc welding devices, microwave ovens etc.
- Pulse currents from frequency converters and switching power supplies
- Electromagnetic fields of radio and telecommunications devices

Randomly occurring interferences are:

- Ignition impulses of fluorescent lamps
- Switching procedures on inductive electrical circuits
- Contact bounces when closing or opening switching contacts
- Voltage fluctuations on heavy load switching procedures

There is a series of test standards for the above listed interference sources, intentionally or unintentionally caused by technical systems, which simulate these interferences:

- IEC 61000-4-3 High Frequency Electromagnetic Field Immunity Test
- IEC 61000-4-4 Electrical Fast Transient / Burst Immunity Test
- IEC 61000-4-6 Test of Immunity to Conducted Disturbances, Induced by High Frequency Fields
- IEC 61000-4-8 Power Frequency Magnetic Field Immunity Test
- IEC 61000-4-11 Voltage Dips, Short Interruptions and Voltage Variations Immunity Test

All international standards listed here are also available as European standards. The Product Standard IEC 61131-2 demands testing to these Standards and also defines the severity level.

Technical systems as interference sinks In the case of functional interference, EMC problems first arise at interference sinks. The following interference sinks can be identified dependent on the degree of immunity to electromagnetic influences:

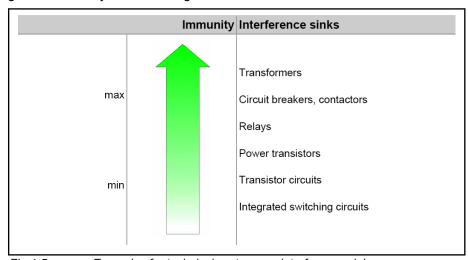


Fig.4-5: Examples for technical systems as interference sinks

Control systems without integrated switching circuits are unthinkable and would therefore not be sufficiently immune without suitable EMC measures.

### Coupling paths

The transfer of interference from an interference source to an interference sink can take place via various coupling paths. Coupling paths very often exist of two or more parallel lines running closely together. The coupling is a field coupling that takes place at low frequencies either via the electrical field (capacitive coupling) or via the magnetic field (inductive coupling). At high frequencies and with corresponding expansion of the parallel running lines one speaks about an "electromagnetic coupling" due to close linking of both field types. Direct coupling can occur when electrical circuits from the interference source and electrical circuits from the interference sink have common line components If there is a large distance between an interference source and an interference sink then one speaks of "radiation coupling".

## 4.13.3 EMC Measures

In principle, all devices should be designed in such a way as to function reliably in the planned environment and in doing so should not interfere with other systems. The IndraControl VEH 30.2 devices meet these requirements. It is not necessary to use any of the EMC measures described below if the specified additional units, cables and wiring are used. However, additional EMC measures may be necessary for various reasons. The following text is designed to help the user to correctly implement additional EMC measures, if required.

Shield system

Electromagnetic emission problems and immunity problems often occur in products at the same time. Likewise, EMC measures are mostly effective in the case of both emission problems and immunity problems.

Shielding fulfils two main tasks. On the one hand, the penetration of electromagnetic fields into sensitive electronic parts is prevented. On the other hand, the radiation of electromagnetic fields is also to be prevented. A complete EMC shield consists of a shielded housing, which protects the sensitive electronics and prevents it from transmitting interference, and cable shields that shield the sensitive interface signals and prevent the device from transmitting interference via its interfaces.

The cable shield connects two shielded houses. Therefore the cable shield must be connected directly to the shielded housings of the sensitive electronics (connection points). Particular attention should be paid to the connection between the cable shield and the shielded housings of the devices. In order that the shield effect is maintained even at higher frequencies, ensure that the cable shield connects to the largest possible surface area and thereby acts as a continuation of the device's shielded housing. Pig tail connections are not suitable.

It may be necessary to earth cable shields and shielded housings for safety reasons but this is not an effective EMC measure.

Interference suppressors, filter components

Filtering is always necessary when unshielded signal and power supply lines are brought into shielded areas. Alongside the wanted signals, these lines often also carry interference signals that must not enter into shielded areas. Filters should therefore guarantee the interference immunity of the device but should also prevent the emission of interference from the device via unshielded lines.

Unshielded lines are usually used when the wanted signals that are carried are of a very low frequency. The normally high frequency interference signals are separated from the wanted signals by means of frequency selective filtering with the aid of low-pass filtering. Low-pass filters must be sized in such a way that the lower frequency wanted signals can pass through and the higher frequency interference signals are filtered.

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Multi-stage filters are often necessary for filtering. Nearly all filter combinations contain Y-capacitors. Y-capacitors are capacitors that are connected to the filter housing for the dissipation of interference currents. In order for these filters to function correctly, the housing must be connected to a stable reference potential.

Since the interference signals must not enter into the shielded area, the potential of the shielded housing must also be the reference potential for the filter circuits.

Filter circuits or filter components must therefore be placed precisely where the lines enter the shielded area. If the filters are placed inside or outside the shield wall, this can lead to a field coupling between the filtered and unfiltered lines.

The connection to the reference potential must be as low-impedant as possible. Therefore a contacting over a large surface area is necessary between the filter housing, which is usually metallic, and the shield wall of the device. Pig tails may not be used to make such a contact.

### Line filters

Typical line filters have a metal housing that has to be connected to the protective conductor (earth wire; PE) for safety reasons. Typical line filters (see fig. 4-6 "Line filters" on page 44) consist of a current-compensated choke, of Y-capacitors, which are connected to the metal housing on one side, and of X-capacitors.

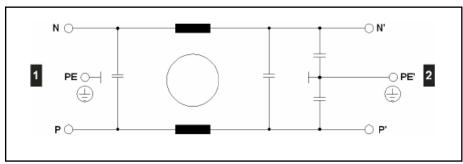


Fig.4-6: Line filters

The desired filter effect is basically governed by the correct contact between the filter housing and the shielded housing of the device. The line filters must therefore be placed directly at the inlet to the shielded housing of the device and the metal housing of the filter must be well-contacted to the shielded housing of the device. If placement at the inlet is not possible for reasons of space, partly-shielded connection lines must be used. In doing so the following procedure is to be followed:

If the filter is placed inside the shielded housing of the device, the line cable must be shielded from the inlet through to the line filter and the cable shield must be contacted on both ends. This prevents the propagation of interference on the line cable inside the device. It also prevents any electromagnetic fields that may be present inside the device from penetrating the line cable.

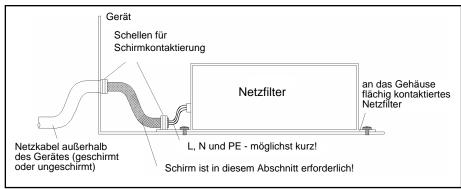


Fig.4-7: Correct connection of a compact line filter within the device

If the line filter is placed outside the shielded housing, the device connection line must be shielded from the line filter through to the shielded housing of the device and the cable shield must be contacted on both ends. This prevents interference produced by the device from being transmitted externally where it could penetrate other systems. It also prevents the penetration of interference signals back into connection wires that have already been filtered.

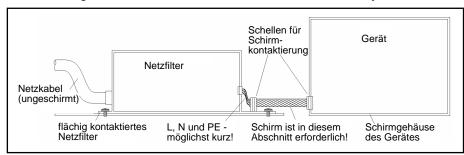


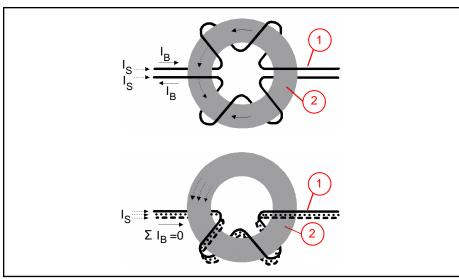
Fig.4-8: Correct connection of a compact line filter outside the device

When connecting line filters, attention should first be paid to the frequency ranges to be filtered. If frequencies in the MHz range are also to be filtered, such a line filter must feature a metal housing. Line filters with plastic housings are normally not suitable for this purpose.

## **Current-compensated chokes**

Device manufacturers sometimes specify the use of current-compensating chokes or the installation of ferrite loops in the power supply line. Many examples of this can be found in motor lines that are fed by frequency inverters. Such chokes (see fig. 4-9 "Current flow of a current-compensating choke" on page 46) suppress common-mode interference currents ( $I_{\rm S}$ ) and allow the operating currents ( $I_{\rm B}$ ) to pass unhindered. Observe that the operating currents in the core produce self-cancelling magnetic fields so that the operating current does not saturate the ferrite cores. Such throttles must also be placed at the inlet to the shielded housing of the device.

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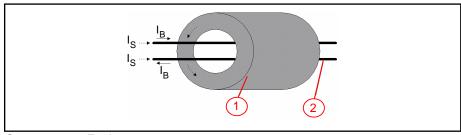
1 Supply lines 2 Ferrite loop

Interference current  $I_B$ Operating current

Fig.4-9: Current flow of a current-compensating choke

### **Ferrite**

Ferrites operating via data lines work in a similar way like current-compensating chokes. The wanted signals (see figure) can pass unhindered and the interference signals are attenuated. A fundamental difference from currentcompensating chokes is that in the case of ferrites the field of application takes place at higher frequencies. Therefore the material losses are responsible for the attenuation and the interference is not reflected, as in the case of inductance, but is converted into heat.



Ferrite 2 Data line

Interference current Operating current Current flow for ferrites Fig.4-10:

## Preventing couplings

Coupling between interference sensitive signals (e.g. analog signals) and the lines that carry the interference signals (e.g. motor lines) can be reduced by laying cables separately.

#### 4.13.4 EMC MeasuresIndraControl VEH 30.2

The IndraControl VEH 30.2 is designed for industrial applications. Considerable electromagnetic and electrostatic interference can occur in this environment. For this reason special emphasis was placed on noise immunity and data security in the design of the device. The EMC design implemented and described below considers all the above named sources of interference and the possible coupling paths.

- All shielding and filter measures (filtered power supply) in the IndraControl VEH 30.2 are carried out directly on the printed circuit board.
- The special cable design guarantees noise immunity even for greater connection lengths. I.e. the data lines (communication signals) are shielded and in this way they are separated from the control lines (power supply, enabling device, emergency stop, key switch etc.) inside the cable
- Power supply lines in the control cabinet are usually unshielded. They
  are therefore laid outside the IndraControl VEH 30.2 cable shield in order to prevent a coupling with the sensitive data lines.
- The unshielded control and power supply lines are either filtered on entry into the shielded housing of the IndraControl VEH 30.2 or separated from the electronics in such a way that any interference signals carried by these lines cannot affect the internal electronics of the IndraControl VEH 30.2.
- It is not necessary to lay the IndraControl VEH 30.2 cable separately.

Shielded connections

The cable shield of the IndraControl VEH 30.2 cable can be considered to be an extension of the IndraControl VEH 30.2 shielded housing (=printed circuit board), via the VAC connection box, to the shielded housing of the communication partner (e.g.: a PLC). From this it can be deduced that the shielded connections from the cable shield to the device shields substantially contribute to the interference immunity of the IndraControl VEH 30.2. It is not necessary to wire shielded connections to earth. The shield connection within the IndraControl VEH 30.2 is realized via the cable shield, i.e. via the 17-pin connector. Connecting the IndraControl VEH 30.2 via a connection module guarantees safe shielding protection right through to the communication partner. All connection cables available from Bosch Rexroth guarantee correct shielding connection.

The connection of the IndraControl VEH 30.2 to the shield potential of the plant must be carried out via the fine thread bolt of the VAC connection module (see fig. 4-11 "Connecting the shield potential to a VAC connection module" on page 47).

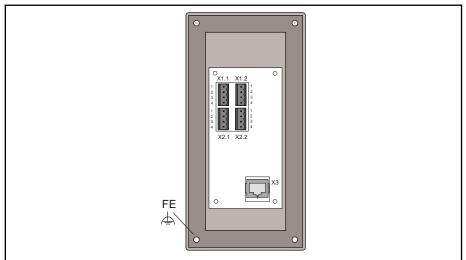


Fig.4-11: Connecting the shield potential to a VAC connection module

Shielding inside the control cabinet

In many cases a range of interference sources, e.g. servo drive modules, transformers, contactors and relays, is present in the control cabinet. Therefore it is necessary to run the cable shield from the connector housing (con-

trol cabinet) to the control (continuous connection from the hand-held terminal to the control). When using the appropriate connection module and a shielded cable for the data line from the connection module to the control, the continuous, high frequency compatible connection of the shield from the IndraControl VEH 30.2 to the control is guaranteed.

For connecting an Ethernet communication interface to a control system, a CAT6-compatible connecting cable must be used. Cables carry the Ethernet signals to a suitable connector (RJ-45) and thereby produce a continuous shielding connection and also the required characteristic impedance of the cable.

## 4.14 EC Declaration of Conformity

The EC Declaration of Conformity is filed in chapter 13 "Appendix" on page 103.

## 4.15 DGUV Test Certificate

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The part "enabling control device" was tested according to GS-ET-22 principles of testing. GS-ET-22 is harmonized with the 2006/42/EC requirements. The test certificate confirms the requirements of the GS-ET-22 for the enabling device integrated in the device. The certificate number is **ET 11030**.

## 4.16 UL and CSA certified



The devices of the IndraControl VEH 30.2 product family are certificated according to

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

UL file no. E210730

However, there can be combinations or stages of expansions with limited or missing certification. Therefore verify the certification by using the UL label on the device.



To guarantee an UL- and CSA-compliant operation, the following conditions have to be fulfilled:

Use only insulated copper wire suitable for at least 60/75 °C.

### **NOTICE**

Loss of UL and CSA compliance due to changes on the device.

The UL- and CSA- marking is only valid for the device in its delivery status. After having modified the device the UL and CSA compliance must be verified.

## 4.17 Wear Parts

LED backlight

The LED backlight is a wear part that is not subject to warranty. The LED backlight has a limited service life. The service life is exceeded if the backlight produces only 50 % of its original brightness. According to the manufacturer the service life of the display is:

Display size	Service life
213 mm (8.4")	Typically 70000 hours

Tab.4-25: Service life of the display

## 4.18 Compatibility Test

All Rexroth controls and drives are developed and tested according to the latest state-of-the-art of technology.

As it is not possible to follow the continuing development of all materials (e. g. lubricants in machine tools) which may interact with our controls and drives, it cannot be completely ruled out that any reactions with the materials used by Bosch Rexroth might occur.

For this reason, before using the respective material a compatibility test has to be carried out for new materials (e. g. lubricants and cleaning agents) and our housing or our housing materials.

## 5 Dimensions

## 5.1 General Information

All values in the illustrations are given in mm.

## 5.2 Housing Dimensions of the IndraControl VEH 30.2

## 5.2.1 Top view: VEH 30.2

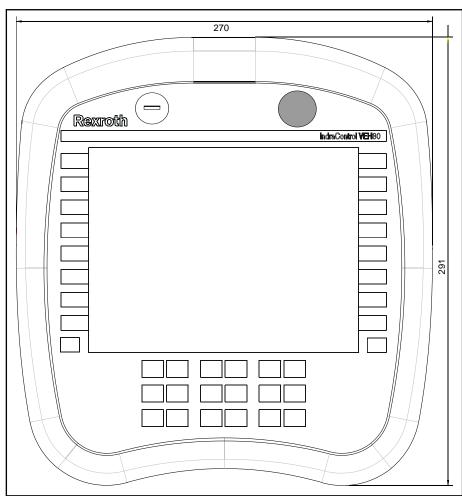


Fig.5-1: Top view: IndraControl VEH 30.2

The width of the IndraControl VEH 30.2 is 270 mm and the height is 290.54 mm.

## 5.2.2 Side view: VEH 30.2

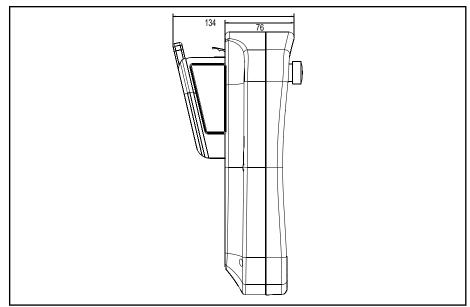


Fig.5-2: Side view: IndraControl VEH 30.2

# 5.3 Housing and Mounting Dimensions of the IndraControl VAC 30.2

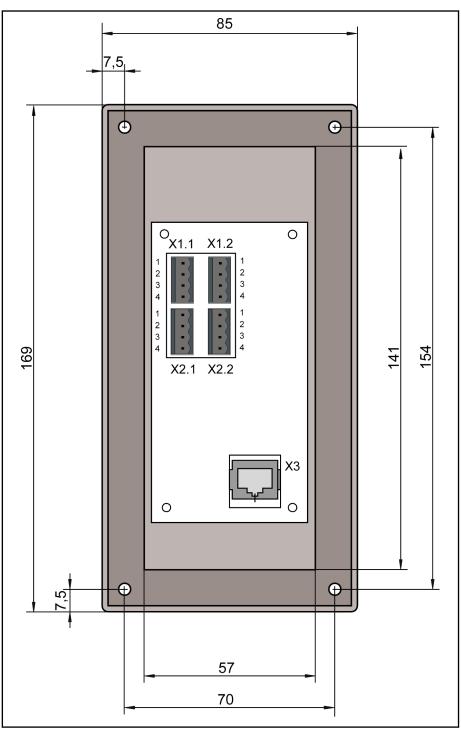


Fig.5-3: Housing and mounting dimensions: IndraControl VAC 30.2

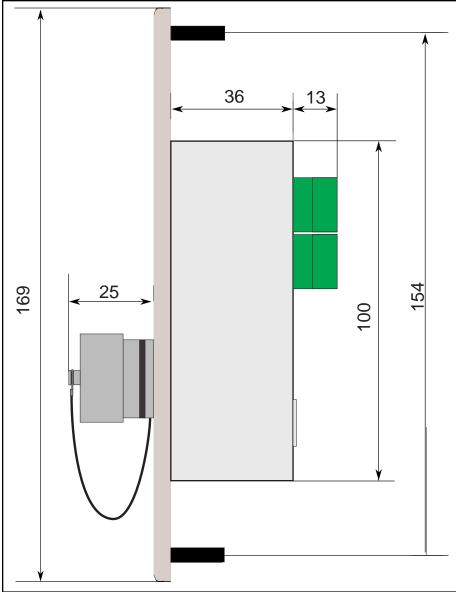


Fig.5-4: Mounting depths: IndraControl VAC 30.2

## 5.4 Dimensions of the Wall Holder for IndraControl VEH 30.2

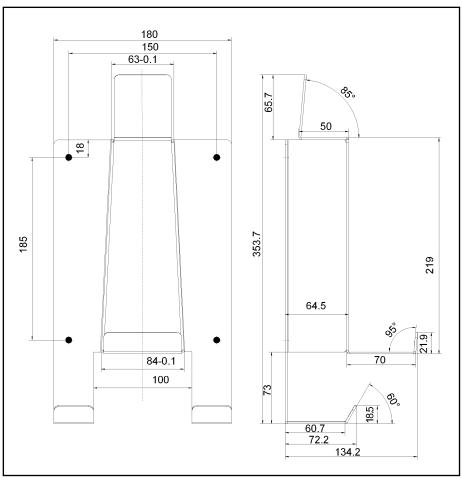


Fig.5-5: Dimensions of the wall holder for IndraControl VEH 30.2

## 6 Display and Operating Components

## 6.1 Operating Elements

## 6.1.1 General Information

The information of all necessary operating elements is transmitted to the control via real-time protocol to the control. This information is available on the control via a function block. For more detailed information, please refer to chapter 9 "Software" on page 83.

## 6.1.2 Housing of the IndraControl VEH 30.2

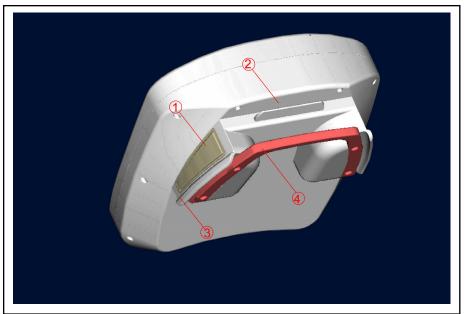
General information

The IndraControl VEH 30.2 has an enabling device with two actuators, that you can use appropriately wired and evaluated in safety circuits up to category 3 (EN ISO 13849-1).



Fig.6-1: IndraControl VEH 30.2 with handwheel and override

The concave shape of the housing (at the bottom) allows comfortable support against your body and, thus, long fatigue-free working intervals are possible. The right side has an enabling button that is integrated in the bottom part of the housing.



1 Enabling device, actuator 2 Receptacle for a touch pen 3 Cable routing connecting cable Holding and depositing handle IndraControl VEH 30.2, rear view Fig.6-2:

The enabling device as well as the two actuators are integrated in the bottom part of the housing. The housing geometry supports the carrying of the housing. Because of the housing dimensions two actuators have been integrated in the housing bottom part. The operator have to trigger only one of these actuators to activate the enabling function.

The molded enabling actuators have a routing for the connecting cable. In this way the outlet direction of the connecting cable can be changed.

The clamping in the routing serves also as antikink device and strain relief of the inlet. For this, clamp the line in an arched manner, see fig. 6-3 "Handling of the IndraControl VEH 30.2" on page 59.

### NOTICE

Damages to the cable and failure of the device or some functions due to a bending radius less than 130 mm.

The minimum bending radius must not be lower than 130 mm.

The upper area of the housing bottom part has a receptacle for a touch pen.

### **Ergonomics**

During developing the housing great importance was attached to the ergonomics.

The enabling device is intuitively operable. The status "enabled" can be fatigue-freely operated.

In case of a malfunction or if you are affrighted, you can react as follows:

- Pushing the enabling device completely into the panic position by cramping.
- 2. Loosen the grip, e.g. by dropping the Hand-Held Terminal IndraControl VEH 30.2.

Each of the both reactions interrupts the enabling circuits.

Because of its symmetric design the IndraControl VEH 30.2 can be comfortably used by right and left handers. If the working intervals are longer the holding arm can be changed.



Due to the safety requirements the enabling has to be interrupted while changing the hand.



Fig.6-3: Handling of the IndraControl VEH 30.2

The ergonomic housing shape and the molded handles support several types of use:

Hand-held

You can support the IndraControl VEH 30.2 against your body lying on the forearm, as described above.

Enable (Release)	Occurs by the fingers of the holding hand
Operation	Occurs with the free hand

Tab.6-1: Hand-held operation and enabling

Putting down on a horizontal sur-

If the operator does not have to activate the enabling, the IndraControl VEH 30.2 can be also put down on horizontal surfaces. The combined holding and depositing handle enables to put down the device easily or to work for a longer time in a sitting position. The incline of the front panel facilitates the reading of the LC display.

Hanging in holder

The IndraControl VEH 30.2 can be also mounted space-savingly at a vertical surface. For this, a wall holder is provided as accessories. Mounting the wall holder is shown in chapter 5 "Dimensions" on page 51.

## 6.1.3 Foil Keyboard

## Key Position IndraControl VEH 30.2



Fig.6-4: Key layout IndraControl VEH 30.2

Operating keys L1 to L8 and R1 to R8	The assignment of the operating keys is fixed. The evaluation is specified by the respective application software.
Jog keys 1+ to 6+ and 1- to 6-	Pressing the jog keys is transmitted directly into the control by a real-time protocol via Ethernet.
Navigation keys	The navigation keys include the cursor keys as well as the ESC key and the OK key.
Operating keys for Operation- Desktop	The "F1" and "Tab" keys are required to operate the "IndraWorks Operation" user interface.

Tab.6-2: Key assignment

## 6.1.4 Touch Screen

All variants are provided with a touch screen, that allows the operation of the application software via the touch-sensitive surface of the display.

Use the touch screen to do mouse clicks:

• "Left mouse button": Touch the touch screen shortly on the corresponding place

"Right mouse button": The function can be activated by activating the
mouse icon in the task bar on the right bottom part, see also fig. 9-6
"Windows XP Embedded desktop" on page 88. Switching-over the
mouse button applies only for the following "click" on the touch screen.

## 6.1.5 Safety Operating Elements

Safety concept

The IndraControl VEH 30.2 is provided with a 2-circuit, 3-stage enabling device, which is operated by two actuators integrated in the housing. It consists of single switching elements and can be used in safety circuits up to category 3 (EN ISO 13849-1), if the evaluation is appropriate. For this purpose the two circuits have been electrically isolated and designed in a redundant manner.

In operation modes with enabling device one of the both actuators of the IndraControl VEH 30.2 has to be consciously held in the central switch position. Releasing or firmly pushing through the actuator causes the stop of dangerous movements. When moving back from the pushed through position to the inactivated position, there is no enabling signal.

A further safety operating component of the IndraControl VEH 30.2 is a 2-circuit stop pushbutton. The switching contacts are directly guided outwards via the connecting cables and can be connected via the IndraControl VAC 30.2 connection module. The automatic stop circuit jumpering allows to loop in the hand-held terminal without interruption. The operation of the plant can be stopped in all operation modes with the stop pushbutton (stop category 0).

**Enabling function** 

The enabling device is activated by one of the both actuators. These actuators are attached at the left and right side of the device and are mechanically coupled in a manner that it is not possible to activate them simultaneously.

The enabling device of the IndraControl VEH 30.2 is designed according to "safety technology". The enabling button must be connected to the control in a manner that the requirements for electrical circuits for safety purposes according to EN 775, EN 60204, EN 13849-1, EN 1088 and VDI 2854 are fulfilled. A succeeding control has to fulfill the monitoring of the switch according to the standards and regulations valid for the respective machine and/or installation.

Because of its proper wiring with the safety contactors of the drive control, dangerous movements can only be executed in certain operation modes (e. g. installation mode or test mode), if the enabling device is hold in the central (= enabled) position. The enabling circuit on its one must not trigger dangerous movements. For this, the following commands are required:



Provide a time- or clock-dependent limitation of the enabling function.

These movements are immediately stopped if there is no activation or in completely pushed through position (panic position). Switching back from the panic position means that the device switches electrically directly to the inactivated position. A new movement is only started after entering the corresponding commands with new enabling.

## 6.1.6 Optional Operating Elements

Additional components

The following additional elements to operate controls and installations are available:

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Left side	Right side
Override	Handwheel

Tab.6-3: Additional elements of the IndraControl VEH 30.2

Override

As option the Hand-Held Terminal IndraControl VEH 30.2 can be ordered with an override switch. Divided up into 16 stages, the signals are transmitted as 4 bit gray code to the control via a real-time protocol.

Handwheel

Optionally, the IndraControl VEH 30.2 can be ordered with a handwheel. Position and direction of rotation are broken down into 16 bit data and are transmitted to the control via a real-time protocol. The application applies the display of the set value. The set values are reset via an operating element of the pertinent application.

## 7 Pin Assignments of the IndraControl VEH 30.2

# 7.1 Connection of the IndraControl VEH 30.2 via the IndraControl VAC 30.2

## 7.1.1 General Information

The IndraControl VEH 30.2 is connected via the IndraControl VAC 30.2 connection module.

## 7.1.2 Stop pushbutton

Stop pushbutton

The IndraControl VAC 30.2 connection module is equipped with an automatic stop circuit jumpering. In this way the IndraControl VEH 30.2 hand-held terminal can be connected or disconnected via the IndraControl VAC 30.2 connection module without causing an unintended stopping of the installation.

### **NOTICE**

Shutdown of the plant due to connecting a IndraControl VEH 30.2 with pressed stop pushbutton.

Before commissioning the IndraControl VEH 30.2 do observe that the stop pushbutton is **not** pressed.

## Functionality of the stop circuit jumpering

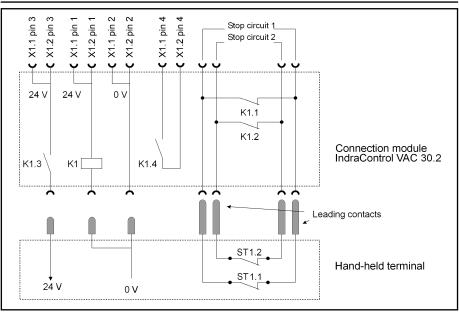


Fig.7-1: Stop circuit jumpering

If the IndraControl VEH 30.2 hand-held terminal is not plugged in, the contacts K1.1 and K1.2 of relay K1 in the IndraControl VAC 30.2 connection module keep the stop circuits 1 and 2 of the control closed. The stop circuits are active; the control is ready to operate.

If you start to screw the 17-pin connector of the IndraControl VEH 30.2 on the IndraControl VAC 30.2 connection module, firstly the NC contacts ST1.1 and ST1.2 are switched in the stop circuits via leading contacts. The IndraControl VEH 30.2 is still without voltage supply and the stop pushbutton has no effect.

If the 17-pin connector is completely screwed on the connection module, relay K1 switches and supplies the IndraControl VEH 30.2 with voltage via N/O

contact K1.3. Simultaneously, by opening contacts K1.1 and K1.2 the stop circuit jumpering is deactivated. The stop circuits are active; the control is ready to operate; the IndraControl VEH 30.2 is in operation and the stop pushbutton is integrated in the stop circuit.

The time course of the connection procedure is illustrated in fig. 7-2 "Time course when connecting the IndraControl VEH 30.2 stop circuit" on page 64

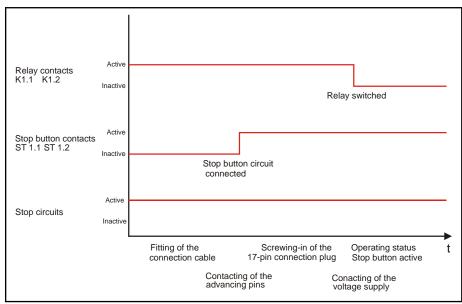


Fig.7-2: Time course when connecting the IndraControl VEH 30.2 stop circuit

## 7.1.3 Pin Assignment IndraControl VAC 30.2

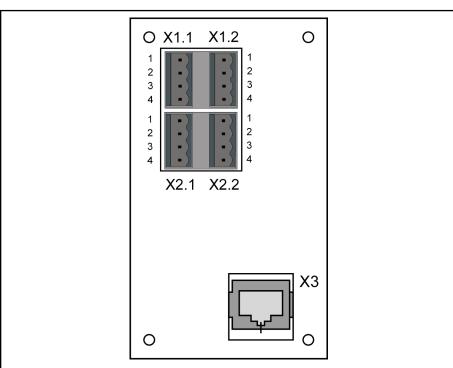


Fig.7-3: Pin assignment of the IndraControl VEH 30.2 connection module

Pin	Signal name
X1.1 pin1	DC 24 V connection module
X1.1 pin2	0 V
X1.1 pin3	DC 24 V terminal
X1.2 pin1	DC 24 V connection module
X1.2 pin2	0 V
X1.2 pin3	DC 24 V terminal
X1.1 pin4	Terminal connected IN
X1.2 pin4	Terminal connected OUT
X2.1 pin1	Stop pushbutton 1 IN
X2.1 pin2	Stop pushbutton 1 OUT
X2.1 pin3	Stop pushbutton 2 IN
X2.1 pin4	Stop pushbutton 2 OUT
X2.2 pin1	Enabling device 1 IN
X2.2 pin2	Enabling device 1 OUT
X2.2 pin3	Enabling device 2 IN
X2.2 pin4	Enabling device 2 OUT

Tab.7-1: Pin assignment of the IndraControl VAC 30.1 connection module

## **NOTICE**

Destruction of screw terminals, insufficient contact and loss of UL certificiation if inadquate wire is used and/or wrong tightening torque.

Use only copper wire for wiring the connection terminals. Tighten the screws of the screw terminals with a torque of 2.25 lb in (0.22 Nm).

## **▲** DANGER

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

For safety reasons, the voltage supply for the connection module (X1.1 pin1, X1.2 pin1) must be monitored. If the voltage fails, the stop pushbutton at the device is inoperative.

The IndraControl VAC 30.2 connection module including automatic stop pushbutton 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 make the hand-held terminal engageable or disengageable when it is plugged-on, the wire jumper between X1.2 pin1 and X1.2 pin3 is to be removed and the switching voltage for the hand-held terminal is to be applied to X1.1 pin3 or X1.2 pin3.

In contrast to the IndraControl VAC 30.2, the previous variant IndraControl VAC 30.1 was neither equipped with a separated voltage supply nor with a signal contact. The pins 4 and 3 of the terminal blocks X1.1 and X1.2 are not available on the IndraControl VAC 30.1. All existing pins of the VAC 30.1 connection module are compatible with the IndraControl VAC 30.2 pins.

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#### **▲** WARNING Danger to life due to electric shock!

- Supply the device only with voltage sources that feature protective extra-low voltage (e.g. SELV or PELV according to EN 61131-2).
- Connect only voltages and circuits to connectors, terminals and interfaces up to 50 V nominal voltage that ensure safe isolation to dangerous voltages (e.g. by sufficient isolation and electric strength).

#### NOTICE Fire hazard due to defective components!

The DC 24 V power supply of the IndraControl VEH 30.2 must be fused appropriately in the final application! The max. allowed fuse is 2 A.

#### WARNING Personal injury due to wrong project planning!

- The hand-held terminal must be projected correctly by the machine manufacturer according to the risk assessment. The following safety aspects must be taken into consideration:
  - Correct cable length for working area limitation
  - Stop pushbutton necessary and permissible
  - Adequate category and performance level for the relevant application
- The danger zone must be seen by the operator positioned in the operating zone.
- The device may be operated only in proper condition in adherence to the project planning manual.
- The operator must have the required qualifications and know the specifications given in the appropriate use according to the project planning manual.

#### 7.1.4 X1: DC 24 V Voltage Supply

All internally required voltages are generated with electrical isolation via a DC/DC converter. The connection is designed as male connector strip (SL), 3.81 mm pin spacing, 2 × 4-pin, so that cables up to a maximum conductor cross-section of 1.5 mm<sup>2</sup> can be connected.

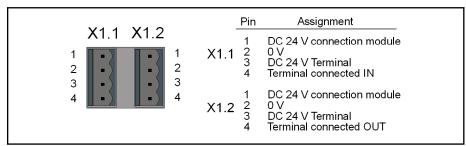


Fig.7-4: Pin assignment, DC 24 voltage supply X1

Parameters	Value
Rated voltage U <sub>N</sub>	DC 24 V ; (+19 V to +30 V)
Residual ripple at U <sub>N</sub>	See fig. 7-6 "Limit values of the DC 24 V voltage" on page 68

Parameters	Value
Emitted interference and surge immunity	U <sub>max</sub> = 35 V (for t < 100 ms)
Current consumption for U <sub>N</sub>	0.7 A max.
Prescribed external protection	Fusible cut-out, 2 A time-lag
Reverse voltage protection	Occurs via decoupling diode; the input fuse is activated when polarity reversal occurs.

Tab.7-2: DC 24 V connection, technical data

## **NOTICE**Possible damages due to missing protection of the 24 V lead.

The external voltage supply must have a rated voltage of 24 V and must not exceed an output voltage of 30 V. The 24 V line to the connection module is to be protected by a 2 A time-lag fusible cut-out.

## **⚠ DANGER** Danger without protective separation!

- The DC 24 V input voltage must comply with the requirements of the "Protective separation"!
- Plug and unplug the connector only if there is no voltage!

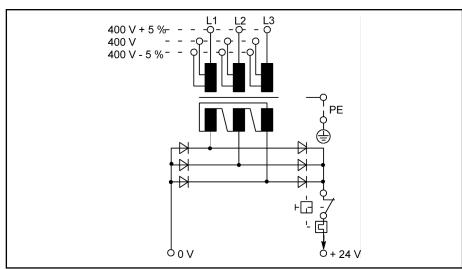


Fig.7-5: Safety transformer according to EN 60742

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.

The voltage limits are:

- Upper voltage limit: 30.2 V (highest absolute value)
- Lower voltage limit: 18.5 V (lowest absolute value)

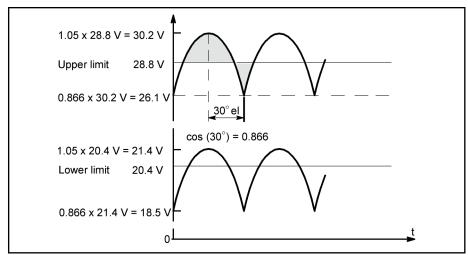


Fig.7-6: Limit values of the DC 24 V voltage

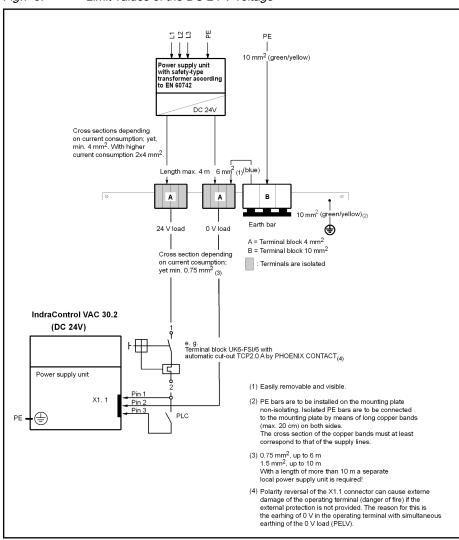


Fig.7-7: Wiring the DC 24 V power connection to the hand-held terminal

## 7.1.5 X2.1: Stop Pushbutton

## Pin Assignment

Pin	Signal name
X2.1 pin1	Stop pushbutton 1 IN
X2.1 pin2	Stop pushbutton 1 OUT
X2.1 pin3	Stop pushbutton 2 IN
X2.1 pin4	Stop pushbutton 2 OUT

Tab.7-3: Pin assignment of the stop button X2.1

**A** DANGER

Risk of injury due to malfunction of the stop button or emergency stop button.

The circuit of the stop button or emergency stop button might be operated with a maximum of 30 V and must be protected with a 2-A-fusible cut-out.

## 7.1.6 X2.2: Enabling Button

## **Pin Assignment**

Pin	Signal name
X2.2 pin1	Enabling device 1 IN
X2.2 pin2	Enabling device 1 OUT
X2.2 pin3	Enabling device 2 IN
X2.2 pin4	Enabling device 2 OUT

Tab.7-4: Pin assignment of the enabling button X2.2

**A** DANGER

Risk of injury due to malfunction of the enabling button.

The circuit of the enabling device might be operated with a maximum of 30 V and has to be protected with a 2-A-fusible cut-out.

## Circuit Diagram of the Enabling Device

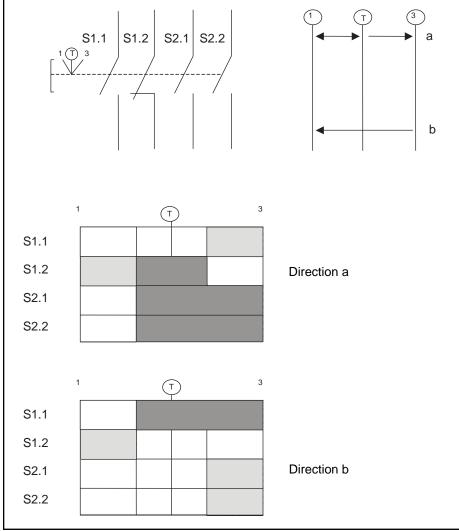


Fig.7-8: Circuit diagram of the enabling button

### Contact Travel Diagram of the Enabling Device

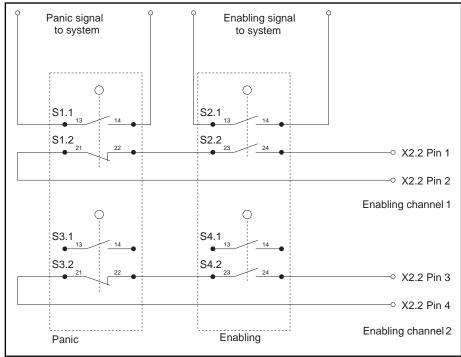


Fig.7-9: Contact travel diagram of the enabling button

### Wiring of the Enabling Device

The following special requirements apply for the connection between the IndraControl VEH 30.2 and the safety-related evaluation for the enabling device. It is required that short-circuits and/or cross-circuits on the safety-related signal paths are safely detected by evaluation devices.

The following pages contain examples how to realize different control categories by means of the IndraControl VEH 30.2. If the requirements of the corresponding control categories are observed, further wiring options can be realized and other parts can be used.

Category 1 (EN 954-1) The 2-circuit enabling device in the IndraControl VEH 30.2 can be used for category 1.

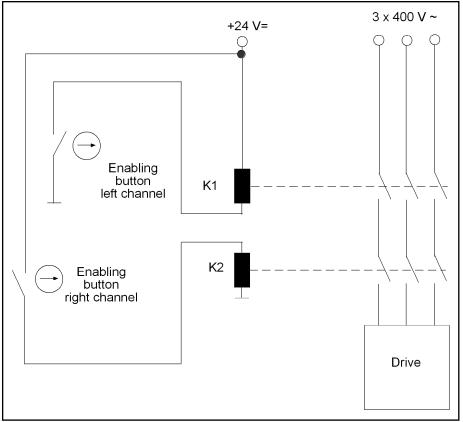


Fig.7-10: Wiring example: Category 1, contact logic idle state

In the example mentioned above the circuits are realized in proved and tested manner. Both have to be in the "Enabling" status to activate the power contactors.

The weak point of category 1 is its missing self-monitoring. If a circuit is faulty and remains in the enabled status, the circuit continues to work. A further error might cause a dangerous situation. Therefore you have to test the independent function of each individual circuit regularly (e. g. during each commissioning).

### Category 2 (EN 954-1)

If the 2-circuit enabling device is wired in the IndraControl VEH 30.2 according to category 1 and is completed by an automatic (not necessarily safety-relevant) test, category 2 can be achieved.

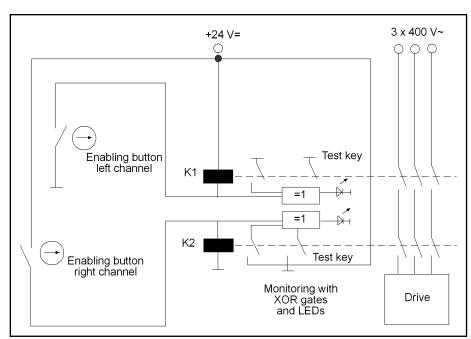


Fig. 7-11: Wiring example: Category 2, contact logic idle state

With category 1 the circuits are designed in proved and tested technique. The "Exclusive-Or" logic monitors the safety function automatically. Only if the activation of Kx matches the switching status, the output level of the gates is "low". If there are deviations, the error (high-level) is indicated by red indicator lamps.

With category 2 the monitoring is not designed in safe technique. Therefore safety function and diagnostics have to be tested regularly (e. g. during each commissioning).

### Category 3/4 (EN 954-1)

If the IndraControl VEH 30.2 shall be used in control category 3 or 4, the IndraControl VEH 30.2 has to be wired with an appropriate monitoring module also recognizing short-circuits and cross-circuits in the line. For this, the safety relay combinations SCR4-W22-3.5-D (part no. 607.5111.009; Bernstein AG) are recommended.

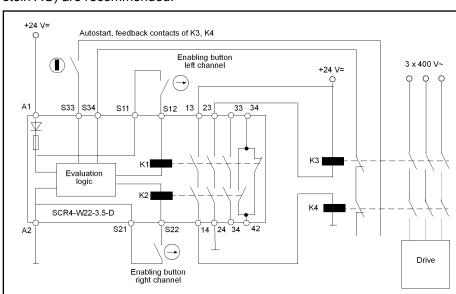


Fig.7-12: Wiring example: Category 3, contact logic idle state

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A channel of the enabling button is connected to the terminals S11 and S12. the other channel to the terminals S21 and S22. Both circuits are monitored to avoid cross-circuits.

The SCR1) compares both channels during operation. Only if the contacts of both channels are closed, also the N/O contacts of the SCR (13/14, 23/24, 33/34 ) are closed. If one of the two input contacts should be short-circuited because of an error, the outputs are nevertheless switched off when opening the input contacts. As the undamaged input channel still introduces the switch off. When activating the enabling device the next time, the outputs remain open because the SCR has recognized the different input signals as

The output circuits 13/14 and 23/24 are switched in the SCR via forced-guided safety relays (in the example 33/34 and 41/42 can remain free). They serve to trigger the two redundant power contactors K3 and K4.

Path S33, S34 serves for the start enabling of the SCR (here: automatic start) and is used for rereading the auxiliary contacts of the power contactors. If a switched on contactor is blocked, the next cycle in the SCR cannot be started anvmore.

The suggested installation scheme only serves as example. Do observe the documentation of the used components.

#### Performance Level according to EN ISO 13489-1

### Connection example of the enabling button: Overview



At the IndraControl VEH 30.2 devices, the enabling devices always feature 2 circuits.

To meet the safety category 3 PL d in accordance with EN ISO 13849-1, the enabling button must be realized with 2 circuits and these circuits have to be monitored on short circuits.

The safety category 3 PL d means, that 1 failure must not lead to the loss of the safety function, and whenever possible, the single failure is detected. The connection example in "Category 3/4 (EN 954-1)" on page 73 shows how the safety category 3 PL d can be fulfilled by the enabling device up to the output terminal K4 within the connection module. Observe that the entire concept of the machine must be laid out according to the above mentioned principles.

### **WARNING**

Risk due to non-detection of a malfunction of the enabling device due to an invalid parameter selection for the monitoring of simultaneity.

Always enable the monitoring of simultaneity for both channels of the enabling device at the VEH30.2 in the safety monitoring device. Select a valid time parameters that should not be larger than 0.5 seconds. Take the Performance Level of the safety function (according to DIN EN ISO 13849-1) and the risk assessment (DIN EN ISO 12100) of the system into consideration when selecting the parameters for the monitoring of simultaneity.

The monitoring of the simultaneity by the monitoring device is necessary. Otherwise maybe a failure culmination would not be recognized and this would cause the safety loss:

Rexroth IndraControl VEH 30.2 Hand-Held Terminal

Pin Assignments of the IndraControl VEH 30.2

Example:

If one channel of the enabling button switches to the enabled state as a result of a failure and after some time the second channel also switches to the enabled state as a result of a failure, then no de-energisation by the enabling device would be possible.

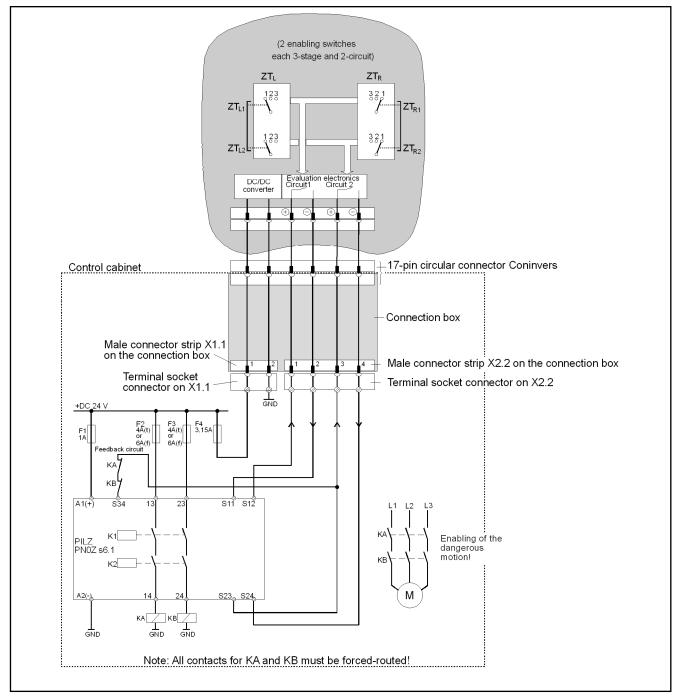
Further the EN 60204-1 specifies that the enabling device has to be connected to a stop of category 0 or 1, i.e. the energy has to be switched off.

For calculating the PL for the "enabling" safety function the PL and B10d values of all involved components have to be included. For details on the determination of the PL for the whole safety function, please refer to EN ISO 13849-1 (chapter 6.3, and and appendix H and I).

Connection example with PILZ PN0Z s6.1 monitoring device

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### Pin Assignments of the IndraControl VEH 30.2



Circuit proposal: Suggested wiring of enabling buttons to fulfill safety category 3 PL d for the enabling device with PILZ monitoring device. Also follow the instructions described in the PILZ operating manual for the PNOZ s6.1. device. For calculating the whole safety function "enabling" the monitoring device and all subsequent components have to be taken into consideration.

Fig.7-13: Connection example with PILZ PNOZ s6.1 monitoring device

### Functional procedure

- Only if both channels are activated "simultaneously" (by pressing one of the enabling devices), both output relays K1 and K2 will energize and the output contacts 13-14 and 23-24 will close.
- The output relays K1 and K2 will not energize if:
  - only one enabling channel was closed (in case of a defect).
  - the tolerance value for the simultaneity period is exceeded.
  - the feedback control loop S34 is open.
- If one enabling channel is deactivated after being simultaneously activated (by releasing the enabling button or in case of a defect), the output relays K1 and K2 will return to their initial position again. The forced-guided output contacts 13-14 and 23-24 will open. The output relays will energize again only after both enabling channels have been deactivated and closed activated once again.

In this way the enabling buttons avoid that one single error makes the safety function inoperative. A single error will be recognized at the next cycle at the latest, detecting that re-enabling is no longer possible. The monitoring device switches to the "ERROR" state if an short-circuit or cross-circuit occurs. The device has to be switched off ("OFF") and after the error elimination the device has to be switched on again ("ON").

### 7.1.7 X3: Ethernet Interface

Via the Ethernet interface, the hand-held terminal IndraControl VEH 30.2 can be connected to an Ethernet network.

RJ45, female connector, 8-pin	
Туре	Ethernet 10Base T / 100Base X
Cable length	100 m max.
Cable type	Shielded, twisted pair
Transmission rate	10 or 100 MBit/s

Tab.7-5: Ethernet interface: X3:

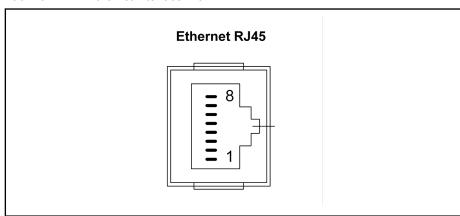


Fig.7-14: Pin assignment: Ethernet interface X3

For further information on the configuration of the Ethernet interfaces, please refer to chapter 9 "Software" on page 83.

## 7.2 Personality Function

In most cases the plant has a continuous Ethernet network. However, the assignment of M-keys, stop button or enabling button is assigned to one control.

The stop pushbutton and the enabling device are hard-wired to the VAC 30.2 connection module. The network data of the IndraControl VEH 30.2 as well as the IP address of the control are saved in the VAC 30.2 connection module via the memory function.

In this way different sections of a plant can be visualized by means of one IndraControl VEH 30.2 via several IndraControl VAC 30.2 connection modules. With each change of the plug-in location the IndraControl VEH 30.2 gets e. g. a new target IP address or a UDP address.



The following functionality is in preparation:

As far as IndraWorks is concerned, the intelligent connection module IndraControl VAC 30.2 is intended to serve as wild card for a firmly projected operating device. The application is filed in the IndraControl VEH 30.2, on a network server or on the control, see IndraWorks VCH configuration dialogs.

The IndraControl VEH 30.2 applies the network settings that are read out from the VAC 30.2 connection module after every restart. These settings can be adjusted in the Rexroth Settings, see chapter 9 "Software" on page 83. These settings are saved in the IndraControl VAC 30.2 connection module.

If the data is successfully retrieved during switching on the IndraControl VAC 30.2, this configuration always takes priority. If no configuration data is found in the IndraControl VAC 30.2, the IndraControl VEH 30.2 device starts with the internally saved settings.

## 7.3 Foreseeable Misuse of the Enabling Device

Impermissible fixing of the enabling button in the enabling position by using auxiliary means is considered as foreseeable misuse. Such foreseeable misuse can be prevented.

The following measures causing the stop of the machine in the manual mode are recommended:

- Inquiry of the enabling device when turning on the machine or plant and inquiry of the enabling device when changing the operation mode from automatic to manual (the enabling device must not be in the enabling position).
- The enabling device must be released within a defined period and pushed into the enabling position again. The length of the period must be defined according to the requirements of the activity.

### **A** WARNING

Non-functioning enabling devices can have lethal consequences!

Pin Assignments of the IndraControl VEH 30.2

- The enabling enabling device is only suitable as safety function if the
  person activating the enabling button recognizes the dangerous situation in time so that he or she can immediately take the necessary measures to avoid such situations.
- As additional measure reduced speed of the movement can be necessary. The allowed speed must be determined by means of a risk assessment.
- The enabling device must not be used as only component for initiating dangerous states. For initiating dangerous states a second, intentional start command is necessary (button on the hand-held terminal).
- Only the person who operates the enabling device is allowed to work in the dangerous area.
- For further information regarding the enabling device, do observe also chapter 4.4 "Enabling Device" on page 26 and chapter 7.1.6 "X2.2: Enabling Button" on page 69.

Maintenance and Installation

## 8 Maintenance and Installation

### 8.1 General Information

The IndraControl VEH 30.2 Hand-Held Terminals are maintenance-free. However, some components are subject to wear and are to be replaced.

#### Maintenance

Include the following measures in the maintenance schedule:

The screen is to be cleaned at least once a week using an antistatic fabric or a cleansing agent containing alcohol.

### **WARNING**

Dissolution of the foil surface as well as the display 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!
- At least once a year, all plug and terminal connections of the components are to be checked regarding proper tightness and possible damage.

Check that cables are not broken or crushed. Damaged parts must be replaced immediately.

## 8.2 LCD Display

A fading backlight causes a progressive deterioration of the readability of the LCD display, so that a backlight exchange is required. For further information please contact the Bosch Rexroth Service, see chapter 12 "Service and Support" on page 101.

## 8.3 Maintenance of the IndraControl VEH 30.2

The IndraControl VEH 30.2 is designed for the use in the industrial environment. No special appearance care is required for the IndraControl VEH 30.2.

We recommend to keep the device away from humidity, oils and emulsions. If from the ergonomic point of view a particular degree of fouling is achieved the IndraControl VEH 30.2 has to be cleaned with a smooth, dry and fuzz-free cloth to restore e. g. the full grip.

# 8.4 Measures in Case of Malfunctions at the IndraControl VEH 30.2

The IndraControl VEH 30.2 does not contain any components to be maintained by the operator. The housing must not be opened for maintenance purposes.

The following table contains different types of malfunctions, possible causes and remedies, see tab. 8-1 "Error table" on page 82.

Malfunctions that are not mentioned in the table require a check of the device at the manufacturer. Information about the manufacturer is placed on the type plate on the rear panel of the device, see also fig. 4-1 "Type plate, IndraControl VEH 30.2" on page 28.

### Maintenance and Installation

Type of mal- function	Operating device	Enabling device, left side	Enabling button, right side	Possible cause	Measure
Enabling is not possible	ОК	No reaction	No reaction	Button me- chanically damaged. Cable dam- aged.	Use a new device. Use a new cable or a new device.
Enabling only possible on the left side.	ОК	OK	Defective	XOR operation, the pushbutton gets stuck.	Relieve the left button, retry.
				Internal me- chanics dam- aged.	Otherwise, use a new device.
Enabling only possible on the right side	ОК	Defective	OK	XOR operation, the pushbutton gets stuck.	Relieve the right button, retry.
				Internal me- chanics dam- aged.	Otherwise, use a new device.
Connector can- not be plugged	-	-	-	Wrong connector orientation.	Turn correctly.
in		Wrong cable coupling.	Use an ade- quate cable.		
				Plug-pins dam- aged.	Replace de- vice/cable.

Tab.8-1: Error table

### 9 Software

### 9.1 General Information

The IndraControl VEH 30.2 can be ordered with the "Windows XP Embedded" Embedded operating system. The operating system is contained in the firmware (FWA); the firmware has to be ordered in addition to the IndraControl VEH 30.2. The "Windows XP Embedded" firmware serves as basis for the "IndraWorks Operation Desktop" visualization software that can be ordered. Using the operating system, systems can be additionally visualized via Remote Desktop.

The following tables list the available licenses.

Order code	Description
FWA-VEH*02-XPE-01VRS-D0-A*	IndraControl VEH 30.2: Windows XP Embedded.

Tab.9-1: Firmware type for IndraControl VEH 30.2

Order code	Description
SWL-IWORKS-MTX-xxVRS-D0-OPD	Indra Works Operation Desktop

Tab.9-2: Firmware type for IndraControl VEH 30.2



Do all required settings of the IndraControl VEH 30.2, especially the network settings, using the "Rexroth Settings" configuration dialog. Settings that are made directly in the Windows control panel are overwritten by the Rexroth Settings or can cause system errors!

## 9.2 First Commissioning

For the IndraControl VEH 30.2 default values are set and the touch screen is precalibrated ex works. If the IndraControl VEH 30.2 is screwed on the the VAC connection module, the operating system starts with the configurations for network and application stored in the connection module. If a system update has been executed, the application to calibrate the touch screen is automatically started during the first commissioning, see chapter 9.3 "Touch Screen Calibration" on page 83. Then the tool to set the network and application data is automatically set, see chapter 9.4 "Rexroth Settings" on page 84.

### 9.3 Touch Screen Calibration

If the position of the mouse pointer differs from the point that is touched on the display, the touch screen can be recalibrated.

**NOTICE** 

Risk of destroying the touch screen or the front panel by using inappropriate items.

Operate the touch screen only with your finger or with a special touch pen (parts number 1070923266).

"Touchcal" calibration tool

Start the calibration program "Touchcal" via the start menu **Start Program** Files > Accessories > TouchCal.

**Bosch Rexroth AG** 

Software

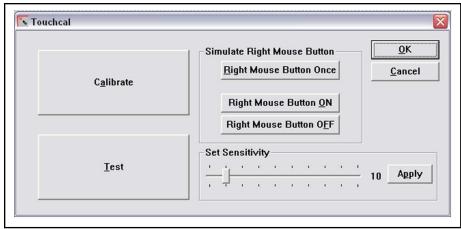


Fig.9-1: Application "Touchcal" for calibrating the touch screen



In case of an operating system update the program automatically starts.

Touch exactly the five calibration points one after each other with a touch pen (red crosses). After actuating the last calibration point, the OK button is displayed to confirm the settings. Comparable to a pen in a graphics program the proper calibration of the touch screen can be tested by free-hand drawings. Use the **OK** button to confirm successful calibration.

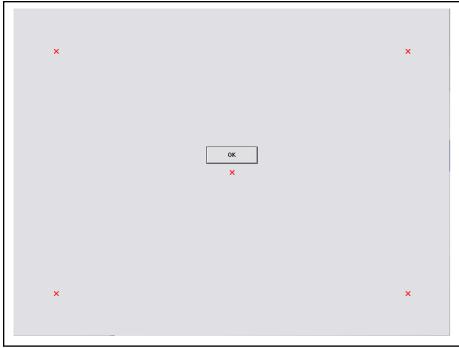


Fig.9-2: "TouchCal" calibration tool

#### **Rexroth Settings** 9.4

#### 9.4.1 **General Information**

Use the "Rexroth Settings" tool to set the basic network and application settings of the hand-held terminal. Start the tool via the Rexroth Settings desktop icon or via the start menu Start ► Program Files ► Accessories ► Rexroth **Settings**. In case of an operating system update the tool automatically starts.

All information contained in the "Rexroth Settings" of the IndraControl VEH 30.2 are read from the IndraControl VAC 30.2 connection module, see chapter 7 "Pin Assignments of the IndraControl VEH 30.2" on page 63.



When commissioning the IndraControl VAC 30.2 connection module for the first time, all values are set to default. Standard settings are DHCP, no UDP transmission, no control, no automatic application start.

## 9.4.2 Ethernet Adapter

In the "Ethernet Adapter" tab the Ethernet adapter of the IndraControl VEH 30.2 is configured.

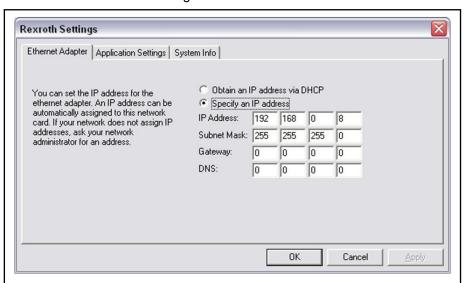


Fig.9-3: Rexroth Settings: Ethernet Adapter

Obtain an IP address via DHCP Specify an IP address

Automatic assignment of the network parameters via DHCP.

Manual configuration of the network parameters.

- IP address: Manual input of the device's IP address.
- Subnet Mask: Manual input of the Subnet Mask.
- Gateway: Manual input of the Gateway.
- DNS: Manual input of the Domain Name Server.

## 9.4.3 Application Settings

In the "Application Settings" tab the settings for autostart and visualization connection to the control are configured.

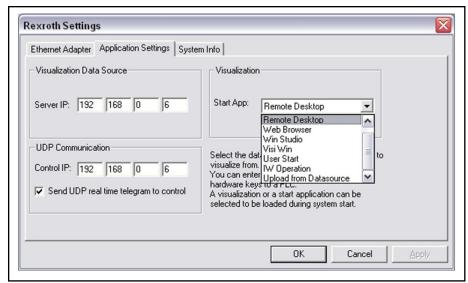


Fig.9-4: Rexroth Settings: Application Settings

### Visualization Data Source **UDP Communication**

**Bosch Rexroth AG** 

- Server IP: IP address of the control connected via Ethernet.
- Control IP: IP address of the control to which the UDP telegrams are to be sent.
- Send UDP real time telegram to control: Selection, if the data is to be sent to the control (control IP) via UDP telegram.

The following data is sent to the control (control IP) via UDP telegram:

- Key codes for IndraControl VEH 30.2
- Data of the additional elements for IndraControl VEH 30.2. Additional elements are e.g. handwheel, override, key switch.

### Visualization

- None: Visualization software is not automatically started.
- Remote Desktop: Autostart of the Remote Desktop Client. A PC with Remote Desktop Server in the network is operated by remote control via the IndraControl VEH 30.2.
- Web Browser: Start of a web visualization.
- WinStudio: Autostart of the "StorageCard\Rexroth\Winstudio\startup.cmd" file. This file can be modified to adapt the start behavior. If WinStudio has been selected, the OPC server is registered and the corresponding information is entered in the "OPCServer.ini".
- VisiWin: Autostart of the "StorageCard\Rexroth\VisiWin\startup.cmd" file. This file can be modified to adapt the start behavior.
- User Start: Autostart of the "StorageCard\Rexroth\User\startup.cmd" file. If this option has been selected, the PLC is not automatically started – in contrast to all other selection possibilities. The user can define the complete start process in this file.
- IW Operation: If this option has been selected, the IndraWorks Operation Desktop starts.
- Upload from Data Source:Loads the "startup.cmd" file via a FTP server from the control (Visualization Data Source) to "StorageCard\Rexroth \startup.cmd". Please observe that a FTP server has to be activated on the control to do this.

## 9.4.4 System Info

**General Information** 

The "System Info" tab contains information about firmware and IndraControl hardware.

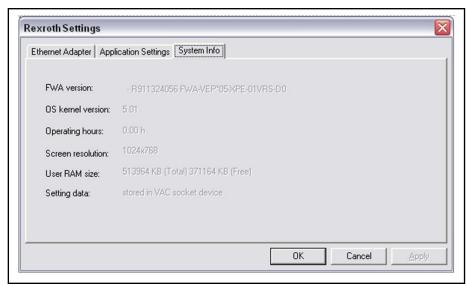


Fig.9-5: Rexroth Settings: System Info

**FWA version** Version display of the Windows XP Embedded image.

OS kernel version Version display of the operating system kernel

**Operating hours** Display of the IndraControl devices runtime.

Screen resolution Display of the display resolution.

User RAM size: Display of the RAM memory available for the user.

**Setting data** Display of the memory location of the device settings.

- stored internally: For IndraControl VEP devices.
- stored in VAC socket device: For IndraControl VEH 30.2 devices connected via the IndraControl VAC 30.2 connection module.

## 9.5 Windows XP Embedded

### 9.5.1 General Information

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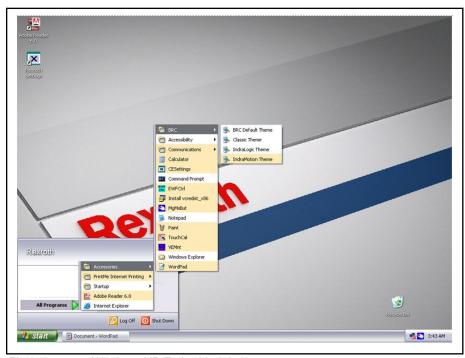


Fig.9-6: Windows XP Embedded desktop

Several programs and tools are provided in the Windows XP Embedded operating system image.

### 9.5.2 Operation

Touch screen operation

Operate the IndraControl VEH 30.2 via the touch screen. Operate the touch screen with your finger or, more comfortable, with a touch pen.

The "right mouse button" function can be activated by actuating the mouse icon in the right bottom part of the task bar, see fig. 9-6 "Windows XP Embedded desktop" on page 88. Switching-over the mouse button applies only for the following "click" on the touch screen.

### **NOTICE**

Risk of destroying the touch screen or the front panel by using inappropriate items.

Operate the touch screen only with your finger or with a special touch pen (parts number 1070923266).

Text input via virtual keyboard

To enter texts, a virtual keyboard is available. The virtual keyboard can be operated via the touch screen. To manually open the keyboard, select the "On-Screen Keyboard" via **Start** ► **Accessories** ► **Accessibility**. The size and design of the virtual keyboard can be modified or the virtual keyboard can be closed via the menu bar of the program.

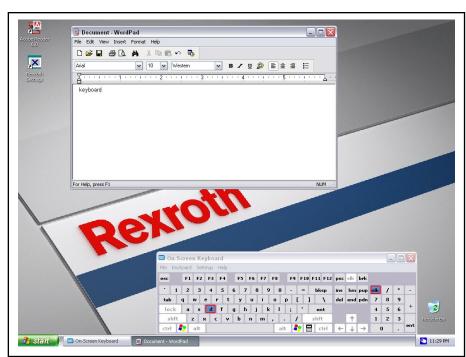


Fig.9-7: Text input via virtual keyboard

### 9.5.3 Further Programs

#### **General Information**

The following programs can be called either directly via desktop icons or via the start menu.

Adobe Reader

 Adobe Reader Program to display PDF files (Portable Document Files in \*.PDF format).

**Further Microsoft programs** 

- Command Prompt MS-DOS command prompt.
- Internet Explorer Program to display web sites.
- Microsoft WordPad Program to display and generate text files.
- Remote Desktop Connection Remote Desktop Client. Permits to operate computers by remote control with the remote desktop server in the network.
- Windows Explorer Program to display the file structure and to create and delete files.

Further desktop icons

- My Computer Displays data structure and files on the IndraControl VEH 30.2.
- Recycle Bin Recycle bin.
- My Documents Opens the folder "My Documents".

### 9.5.4 FTP Server

The FTP server is disabled as default and is configured automatically when the IndraWorks Operation desktop is used. If a FTP server should be required, this server can be configured via the Windows Internet Information Service. The service can be accessed via Start ► Control Panel ► Administrative Tools ► Internet Information.

图

To avoid conflicts with the FTP settings of the IndraWorks Operation select another port (but not port 21).

#### Web Server 9.5.5

The web server is disabled.

#### 9.5.6 Telnet Server

The telnet server is deactivated.

#### **Evaluation of the Operating Element Commands** 9.6

#### **General Information** 9.6.1

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In addition to the operation per touch screen, the device can be operated also via the keys on the front panel.

The navigation key block features the default functionality of the cursor, enter, and escape key. Further keys are arranged besides and below the display. They are used for special special tasks:

#### Keys for special tasks

	Position	Key labeling	Function
M-keys	Side of the display	L1 to L8, R1 to R8	Triggering ope- rating actions
Jog keys	Under the display	1+ to 6-	Moving axes step by step

Tab.9-3: Keys for special tasks

Depending on the design - in addition to the keys - further operating elements e. g. override and handwheel can be provided on the front panel.

#### 9.6.2 **Evaluating the Operating Status in the Control**

The operating status of the following elements is transmitted directly into the control by a real-time protocol via Ethernet communication:

- M-keys
- Jog keys
- **Enabling device**
- Additional operating elements

In the control the status of the operating elements can be evaluated by means of a function block. The bit assignment within the function block to the operating elements is specified and the assignment cannot be modified.



The information of safety components like stop or emergency stop pushbutton and enabling device in the function block must not be integrated in the safety concept of the plant. This non-deterministic information does not belong to the DGUV test certificate according to DIN ISO 13849-1; this information serves only e.g. for state display in the visualization interface.

The keys of the navigation key block are not transmitted into the control.

UDP bit	PLC-FB	VEH 30.2	VCH	Remark
0	Data[0].7	L1		M-key
1	Data[0]0.6	L2		M-key
2	Data[0]0.5	L3		M-key
3	Data[0]0.4	L4		M-key

UDP bit	PLC-FB	VEH 30.2	VCH	Remark
4	Data[0]0.3	L5		M-key
5	Data[0]0.2	L6		M-key
6	Data[0]0.1	L7		M-key
7	Data[0]0.0	L8		M-key
8	Data[1].7	R1	//	M-key
9	Data[1]0.6	R2	Hand	M-key
10	Data[1]0.5	R3	->	M-key
11	Data[1]0.4	R4		M-key
12	Data[1]0.3	R5		M-key
13	Data[1]0.2	R6		M-key
14	Data[1]0.1	R7		M-key
15	Data[1]0.0	R8		M-key
16	Data[2].7	1+		Jog key
17	Data[2]0.6	1-		Jog key
18	Data[2]0.5	2+		Jog key
19	Data[2]0.4	2-		Jog key
20	Data[2]0.3	3+		Jog key
21	Data[2]0.2	3-		Jog key
22	Data[2]0.1	4+		Jog key
23	Data[2]0.0	4-		Jog key
24	Data[3].7	5+		Jog key
25	Data[3]0.6	5-		Jog key
26	Data[3]0.5	6+		Jog key
27	Data[3]0.4	6-		Jog key
28	Data[3]0.3	1	0	Device identification.1
29	Data[3]0.2	0	1	Device identification.0
30	Data[3]0.1	Enable	Enable	Enabling button
31	Data[3]0.0	Panic	Panic	Enabling button
32	Data[4].7			
33	Data[4]0.6			
34	Data[4]0.5			
35	Data[4]0.4			
36	Data[4]0.3			
37	Data[4]0.2			
38	Data[4]0.1			

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UDP bit	PLC-FB	VEH 30.2	VCH	Remark
39	Data[4]0.0	Pressed		Stop/emergency stop push- button
40	Data[5].7			
41	Data[5]0.6			
42	Data[5]0.5			
43	Data[5]0.4			
44	Data[5]0.3	OvR.3	OvR.3	Override
45	Data[5]0.2	OvR.2	OvR.2	Override
46	Data[5]0.1	OvR.1	OvR.1	Override
47	Data[5]0.0	OvR.0	OvR.0	Override
48	Data[6].7	HW.15	HW.15	Handwheel
49	Data[6]0.6	HW.14	HW.14	Handwheel
50	Data[6]0.5	HW.13	HW.13	Handwheel
51	Data[6]0.4	HW.12	HW.12	Handwheel
52	Data[6]0.3	HW.11	HW.11	Handwheel
53	Data[6]0.2	HW.10	HW.10	Handwheel
54	Data[6]0.1	HW.9	HW.9	Handwheel
55	Data[6]0.0	HW.8	HW.8	Handwheel
56	Data[7].7	HW.7	HW.7	Handwheel
57	Data[7]0.6	HW.6	HW.6	Handwheel
58	Data[7]0.5	HW.5	HW.5	Handwheel
59	Data[7]0.4	HW.4	HW.4	Handwheel
60	Data[7]0.3	HW.3	HW.3	Handwheel
61	Data[7]0.2	HW.2	HW.2	Handwheel
62	Data[7]0.1	HW.1	HW.1	Handwheel
63	Data[7]0.0	HW.0	HW.0	Handwheel

Tab.9-4: Bit assignment in the function block

## 9.6.3 Evaluation of the Keys in the Operating System

If one of the M-key foil keys is activated, additionally to the signaling of the keystroke in the control function block a keystroke in the operating system is triggered.

## 9.7 System Update

### 9.7.1 General Information

Use the default function for image creation of Microsoft Windows PE to carry out a "system update".

Bosch Rexroth provides the valid operating system image in the "Windows Imaging" file format (WIM). The images can be imported to the target system by using the "ImageX" tool.

The scriptability of the "ImageX" tool allows to automize such processes. Bosch Rexroth provides such update scripts on a boot medium (USB flash drive) that can be ordered. This boot medium can be ordered via the Service (see also chapter 12 "Service and Support" on page 101). This boot medium provides a documentation that describes the update process step-by-step.

## 9.7.2 Preparation

### **NOTICE**

Data loss due to missing data backup!

Back up all data filed on the device.

Connect a keyboard and the boot medium to the front panel of the IndraControl VEH 30.2 via the USB service interface using a USB hub.

Restart the IndraControl VEH 30.2 while pressing the F11 key. The boot menu is displayed. The boot medium (USB flash drive) has to be selected via the boot menu.

A console-based Windows PE operating system and a ready-made script start, which lead the user step-by-step through the update process.

Check the operating version after the update.

**Environmental Protection and Disposal** 

#### **Environmental Protection and Disposal** 10

#### **Environmental Protection** 10.1

**Production Processes** 

The products are made with energy- and resource-optimized production processes which allow re-using and recycling the resulting waste. We regularly try to replace pollutant-loaded raw materials and supplies by more environment-friendly alternatives.

No Release of Hazardous Sub-

stances

Our products do not contain any hazardous substances which may be released in the case of appropriate use. Normally, our products will not have any negativ influences on the environment.

Significant Components

Basically, our products contain the following components:

Electronic devices	Motors
• steel	<ul> <li>steel</li> </ul>
<ul> <li>aluminum</li> </ul>	<ul> <li>aluminum</li> </ul>
• copper	<ul><li>copper</li></ul>
<ul> <li>synthetic materials</li> </ul>	• brass

electronic components and modules

· magnetic materials · electronic components and modules

#### **Disposal** 10.2

Return of Products

Our products can be returned to our premises free of charge for disposal. It is a precondition, however, that the products are free of oil, grease or other dirt.

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 Buergermeister-Dr.-Nebel-Strasse 2 97816 Lohr am Main, Germany

**Packaging** 

The packaging materials consist of cardboard, wood and polystyrene. These materials can be recycled anywhere without any problem.

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

**Batteries and Accumulators** 

Batteries and accumulators can be labeled with this symbol.

The symbol indicating "separate collection" for all batteries and accumulators is the crossed-out wheeled bin.

The end user within the EU is legally obligated to return used batteries. Outside the validity of the EU Directive 2006/66/EC keep the stipulated directives.

Used batteries can contain hazardous substances, which can harm the environment or the people's health when they are improper stored or disposed of.

After use, the batteries or accumulators contained in Rexroth products have to be properly disposed of according to the country-specific collection.

Recycling

Most of the products can be recycled due to their high content of metal. In order to recycle the metal in the best possible way, the products must be disassembled into individual modules.

### **Environmental Protection and Disposal**

Metals contained in electric and electronic modules can also be recycled by means of special separation processes.

Products made of plastics can contain flame retardants. These plastic parts are labeled according to EN ISO 1043. They have to be recycled separately or disposed of according to the valid legal requirements.

**Ordering Information** 

## 11 Ordering Information

## 11.1 Type Designation Code

### 11.1.1 General Information

The IndraControl VEH 30.2 Hand-Held Terminal and the VAC 30.2 connection module are available according to the following type designation codes.

### 11.1.2 Type Designation Code for IndraControl VEH 30.2

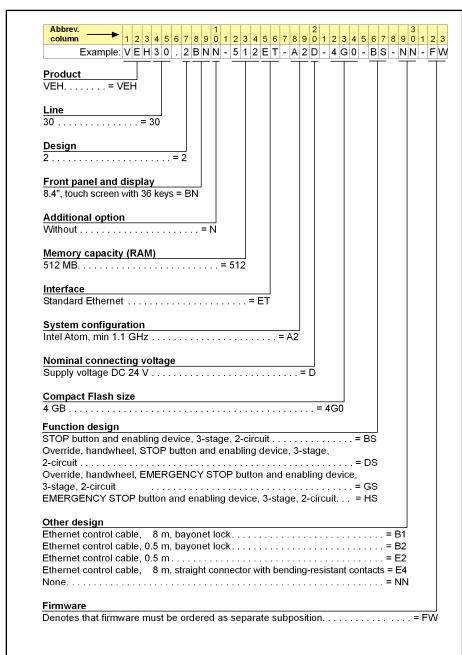


Fig. 11-1: Type designation code for IndraControl VEH 30.2

Ordering Information

### 11.1.3 IndraControl VAC 30.2

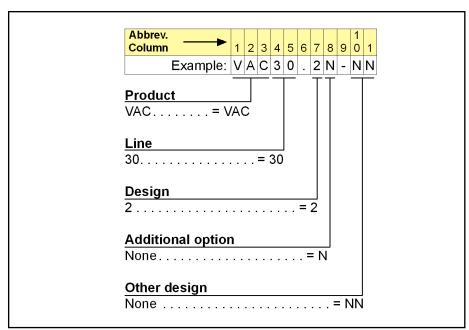


Fig.11-2: Type designation code for IndraControl VAC 30.2

### 11.2 Accessories

### 11.2.1 Extension Cable

Order code	Parts number	Description		
RKS0011/016,0	R911171696	Extension IndraControl	cable VEH	for 30.2
		Hand-Held Te	erminal,	16 m

Tab.11-1: Parts number of the extension cable for IndraControl VEH 30.2

### 11.2.2 Wall Holder

Order code	Parts number	Description	
VAS01.1-001-NNN-NN	R911170076	Wall holder for IndraControl VEH 30 Hand-Held Terminal	or .2

Tab.11-2: Parts number of wall holder for IndraControl VEH 30.2

### 11.2.3 Boot Medium

The order data for the boot medium (USB flash drive) for the IndraControl VEH 30.2 IndraControl VEH 30.2 is still in preparation. Contact your local contact person or the Bosch Rexroth Service for ordering the boot medium, see chapter 12 "Service and Support" on page 101.

**Ordering Information** 

## 11.3 Spare Parts

## 11.3.1 Touch Pen

Order code	Parts number	Description	
Touch pen	1070923266	Touch pen f IndraControl VEH 30.2	or

Tab.11-3: Parts number of the touch pen for IndraControl VEH 30.2

## 11.3.2 Connecting Cables

Order code	Parts number	Description
VAS05.1-004-008-CP	R911171951	Connecting cable for IndraControl VEH 30.2, 17-pin, stop button, 8 m
VAS05.1-004-0M5-CP	R911171952	Connecting cable for IndraControl VEH 30.2, 17-pin, stop button, 0.5 m
RKS0011/16,0	R911171696	Extension cable, 16 m, for VAS05.1-004-0M5-CP, stop button

Tab.11-4: Parts number for connecting cables for IndraControl VEH 30.2

Service and Support

## 12 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 Helpdesk & Hotline 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 resulting in the malfunction
- Type plate name of the affected products, in particular type codes and serial numbers
- Your contact data (phone and fax number as well as your email address)

**Appendix** 

## 13 Appendix

## 13.1 Declaration of Conformity

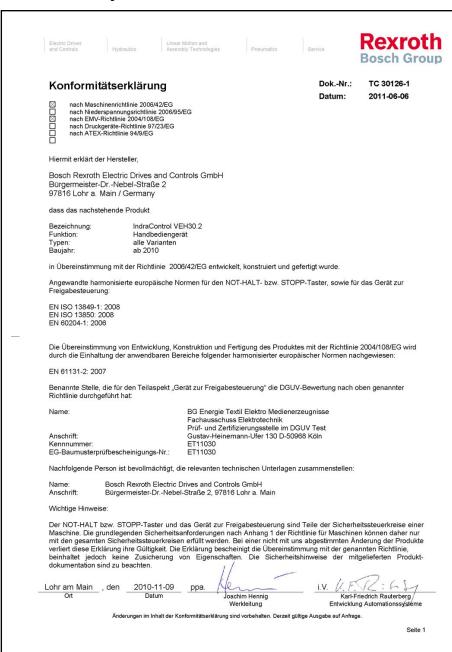


Fig. 13-1: Declaration of conformity

### **Appendix**

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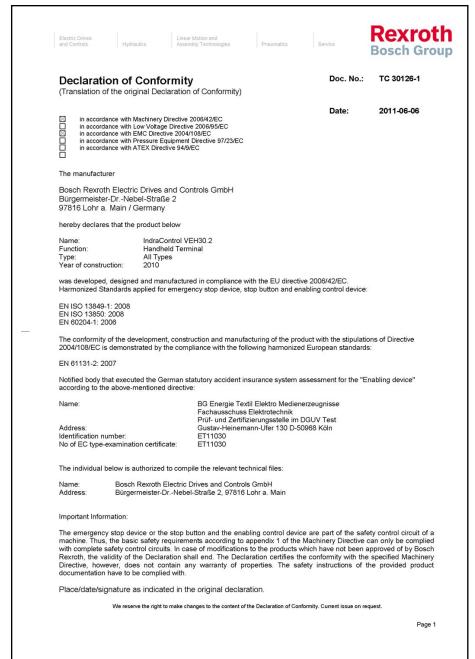


Fig. 13-2: Translation of the original Declaration of Conformity

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## **Notes**



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