

# Pulse Distributor: IV20

\_General functional description

- Basic safety instructions
- \_Technical Data
- \_Mounting
- \_Installation
- \_Commissioning

**User Manual** 

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#### **Document information**

Release date / Rev. date: Document / Rev. no.: File name: Author: 02/27/2024 TR-ECE-BA-GB-0057 v03 TR-EAK-BA-GB-0057-03.docx STB

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# **Revision index**

Revision	Date	Index
First release	17.04.1998	02
General overhaul	02/27/2024	03



# 1 General information

This User Manual is contained in the delivery package and includes the following topics:

- General functional description
- Basic safety instructions with declaration of the intended use
- Technical data
- Mounting
- Installation
- Commissioning

As the documentation is arranged in a modular structure, this Assembly Instruction is supplementary to other documentation, such as product datasheets, dimensional drawings, leaflets and interface-specific User Manuals etc.

The user manual can be included in the scope of delivery on a customer-specific basis or can be requested separately.

## 1.1 Applicability

This user manual applies exclusively to devices of the following series:

• IV20

The products are labelled with affixed nameplates and are components of a system.

The following documentation therefore also applies:

- the operator's operating instructions specific to the system
- and this User Manual

#### **1.2 EU Declaration of conformity**

The converters have been developed, designed and manufactured under observation of the applicable international and European standards and directives.

A corresponding declaration of conformity can be requested from TR Electronic GmbH.

The manufacturer of the product, TR Electronic GmbH in D-78647 Trossingen, operates a certified quality assurance system in accordance with ISO 9001.

EMC	Electromagnetic compatibility
ESD	Electro Static Discharge
EU	European Union
GND	0 V, ground of IV20 (reference potential of supply voltage)
IEC	International Electro-technical Commission
INC	Incremental
Signal-GND	Reference potential of all incremental inputs, galvanic isolated from GND
TTL input	1-level > +2.0 V DC, 0-level < +0.8 V DC, up to +/-50 V DC, 10 k $\Omega$
TTL output	1-level > +2.0 V DC, 0-level < +0.8 V DC, up to 40 mA
US	Supply voltage, +11 30 V DC
VDE	Association for Electrical, Electronic & Information Technologies

# 1.3 Abbreviations and definitions

# 1.4 General functional description

The IV20 pulse distributor is used in conjunction with an incremental encoder to extend the signal path in complex systems.

The device enables the distribution of the signals K1, /K1 and K2, /K2 as well as K0, /K0 of a single encoder to six outputs, each with different output potentials.

To cover a wide range of applications, a level conversion from 5 V differential, 11...30 V push-pull, open-collector or open-emitter at the input to 5 V TTL differential or 11...30 V push-pull at the output.

All adjustable voltage levels are output via the same contacts. As the device has a universal design, the respective connection levels must be coded in the corresponding mating connector using wire jumpers.

Pull-up or pull-down resistors are available on the input side. They are activated by a wire jumper to the corresponding auxiliary voltage on the connector. The basic configuration of the input is designed for differential 5 V signals (RS 422). If single-channel signals with levels from 11 V are to be processed, the reverse potential of the differential input must also be formed via corresponding coding in the connector.



# **2** Basic safety instructions

# 2.1 Definition of symbols and instructions

**A WARNING** means that death or serious injury can occur if the required precautions are not met.

A CAUTION means that minor injuries can occur if the required precautions are not met.

NOTICE

means that damage to property can occur if the required precautions are not met.



indicates important information or features and application tips for the product used.



signifies that respective ESD-safety measures according to DIN EN 61340-5-1 supplement 1 are to be observed.

# 2.2 Obligation of the operator before start-up

As an electronic device the converter is subject to the regulations of the EMC Directive.

It is therefore only permitted to start up the converter if it has been established that the system/machine into which the converter is to be fitted satisfies the provisions of the EU EMC Directive, the harmonized standards, European standards or the corresponding national standards.

# 2.3 General risks when using the product

The product, hereinafter referred to as "device", is manufactured according to state-of-the-art technology and accepted safety rules. Nevertheless, non-intended use can pose a danger to life and limb of the user or third parties, or lead to impairment of the converter or other property!

Only use the converter in a technically faultless state, and only for its intended use, taking safety and hazard aspects into consideration, and observing these **Assembly Instructions**! Faults which could threaten safety should be eliminated without delay!

#### 2.4 Intended use

The IV20 pulse distributor is used in conjunction with an incremental encoder to extend the signal path in complex systems.

#### Intended use also includes:

- observing all instructions in these User Manual,
- observing the nameplate and any prohibition or instruction symbols on the converter,
- observing the enclosed documentation, e.g. product insert, connector configurations etc.,
- observing the operating instructions from the machine or system manufacturer,
- operating the converter within the limit values specified in the technical data.

## 2.5 Non-intended use

\Lambda WARNING

NOTICE

Danger of death, physical injury and damage to property in case of nonintended use of the converter !

- As the converter does not constitute a safety component according to the EU machinery directive, a plausibility check of the converter signal values must be performed through the subsequent control system.
- It is mandatory for the operator to integrate the converter into his own safety concept.
- > The following area of use is especially forbidden:
  - In environments where there is an explosive atmosphere.
  - for medical aims



# 2.6 Warranty and liability

The General Terms and Conditions ("Allgemeine Geschäftsbedingungen") of TR Electronic GmbH always apply. These are available to the operator with the Order Confirmation or when the contract is concluded at the latest. Warranty and liability claim in the case of personal injury or damage to property are excluded if they result from one or more of the following causes:

- Non-intended use of the converter.
- Improper assembly, installation, start-up and programming of the converter.
- Incorrectly undertaken work on the converter by unqualified personnel.
- Operation of the converter with technical defects.
- Mechanical or electrical modifications to the converter undertaken autonomously.
- Repairs carried out autonomously.
- Third party interference and Acts of God.

#### 2.7 Organizational measures

- The User Manual must always be kept accessible at the place of use of the converter.
- In addition to the User Manual, generally applicable legal and other binding accident prevention and environmental protection regulations are to be observed and must be mediated.
- The respective applicable national, local and system-specific provisions and requirements must be observed and mediated.
- The operator is obliged to inform personnel on special operating features and requirements.
- The personnel instructed to work with the converter must have read and understood the Assembly Instruction, especially the chapter "Basic safety instructions" prior to commencing work.
- The nameplate and any prohibition or instruction symbols applied on the converter must always be maintained in a legible state.
- Do not undertake any mechanical or electrical modifications on the converter, apart from those explicitly described in this User Manual.
- Repairs may only be undertaken by the manufacturer or a facility or person authorized by the manufacturer.

# 2.8 Personnel qualification; obligations

- All work on the converter must only be carried out by qualified personnel.
- Qualified personnel includes persons, who, through their training, experience and instruction, as well as their knowledge of the relevant standards, provisions, accident prevention regulations and operating conditions, have been authorized by the persons responsible for the system to carry out the required work and are able to recognize and avoid potential hazards.
- The definition of "Qualified Personnel" also includes an understanding of the standards VDE 0105-100 and IEC 364 (source: e.g. Beuth Verlag GmbH, VDE-Verlag GmbH).
- Define clear rules of responsibilities for the assembly, installation, start-up and operation. The obligation exists to provide supervision for trainee personnel!

#### 2.9 Safety-related information

A WARNING	<ul> <li>Destruction, damage or functional impairment of the device and risk of personal injury !</li> <li>&gt; Only carry out wiring work, opening and closing electrical connections when the power supply is switched off.</li> <li>&gt; Do not carry out any welding work if the device is already wired or switched on.</li> </ul>
NOTICE	<ul> <li>Ensure that the installation environment is protected from aggressive media (acids, etc.).</li> <li>Avoid shocks (e.g. hammer blows) to the device during installation.</li> <li>Opening the device is prohibited</li> </ul>



- The device contains electrostatically sensitive components and assemblies that can be destroyed by improper handling.
  - Avoid touching the device connection contacts with your fingers or use the appropriate ESD protection measures.



#### Disposal

If the appliance has to be disposed of at the end of its service life, the applicable national regulations must be observed.



# **3 Transportation / Storage**

#### Notes on transportation

#### Do not drop the device or expose it to strong strokes!

#### Only use the original packaging!

The wrong packaging material can cause damage to the device during transportation.

#### Storage

Storage temperature: -20 to +50 °C Store in a dry place

# **4** Technical Data

# 4.1 Characteristics

Unit supply	Power pack for 11 to 30 V
Aux. voltage output (optional)	5 V for galvanically uncoupled 5 V encoders, max. 200 mA
Reverse polarity protection	yes
Transient voltage protection	ESD
Excess current release	VDE 0113
Filter groups	IEC 1000-4-x
Power consumption (unloaded)	approx. 100 mA
min./max. input current per trace	1,5 mA / 20 mA (diode current photocoupler)
Output level	5 V differential, 1130 V, 30 mA each
max. input impulse frequency	150 kHz
Pull-up/pull-down resistor	1 kΩ
Weight	approx. 500 g

# 4.2 Dimension drawing



#### Plug version:

Mating connector 10-pin Article no.: 62-005-017 (scope of delivery) \* (Type Minicombicon)

Plug housing 10-pin (Type Minicombicon) Article no.: 64-035-003 (not included in scope of delivery)

\* When ordering separately, the coding lugs must be removed according to the intended slot.



# **5** Mounting

The device is designed for rail mounting in the control cabinet. No additional mounting accessories are required to snap the device housing onto the mounting rail.



The device housing is placed on the mounting rail from below using the tension springs and pressed upwards (Figure 1). Press the device housing against the mounting rail until the housing snaps into place on the mounting rail (Figure 2).



# 6 Installation / Preparation for commissioning

# 6.1 General Rules

- The shielding effect of cables must also be guaranteed after installation (bending radii/tensile strength!) and after plug changes. If in doubt, use a more flexible cable with a higher load capacity.
- To connect the device, only use connectors that ensure good contact between the cable shield and the connector housing. The cable shield must be connected to the connector housing over a large area.
- When wiring the drive/motor, it is recommended to use a 5-core cable with a PE conductor separate from the N conductor (so-called TN network). This largely prevents potential equalization currents and the coupling of interference.
- Equipotential bonding measures must be provided for the entire processing chain of the system. In particular, equalizing currents due to potential differences across the shield to the device must be avoided.
- A shielded and stranded data cable must be used in order to achieve a high immunity of the system to electromagnetic interference. If possible, the shield should be connected to protective earth **on both sides** with good conductivity via large-surface shield clamps. The shield should only be earthed **at one end** in the switch cabinet if the machine earth is subject to high levels of interference in relation to the switch cabinet earth.
- Separate routing of power and signal cables. The national safety and installation guidelines for data and power cables must be observed during installation.
- No spur lines
- Separate or isolate the device from possible interference transmitters.
- Observe the manufacturer's instructions when installing inverters, shield the power cables between the frequency inverter and motor.
- Adequate dimensioning of the power supply.
- To ensure safe and trouble-free operation, the relevant standards and directives must be observed. In particular, the EMC Directive as well as the shielding and earthing directives in their current versions must be observed.
- It is recommended that a visual inspection with a report is carried out after the installation work has been completed.
- It is recommended to carry out a visual inspection with a report after completion of the installation work.

# 6.2 Galvanic Isolation

With long supply lines for the incremental input data, a potential shift is to be expected for the incremental signal transmitter and IV20, even with the same power supply unit. It may then not be possible to evaluate the incremental data reliably. For this reason, the power supply of the IV20 is internally galvanically isolated from the signal ground. This means that no interfering equalizing current can flow.



The user must carry a reference potential from the device that supplies the incremental data in addition to the signal lines.



# 6.3 Layout



# Input connector X0

Supply of the incremental signals K0, K1, K2 and their negated signals, as well as an optional supply of the signal source (encoder) with 5 V (optional) or with 11...30 V.



The signal source can only be supplied via input connector X0 if the voltage has been supplied to operating mode selector connector X7.

#### Mode selector connector X7

The operating mode of the device can be set using the corresponding jumper coding (see chapter Operating modes). The device power supply and the signal source are also fed in via this connector.

#### Output connectors X1...X6 for channels 1 to 6

The incremental signals on channels 1 to 6 can be tapped at 5 V or 11...30 V levels according to the bridge coding of the mating connectors.

The input levels of the incremental tracks can be selected according to the operating mode of the device:

Operating Mode 1:	Differential 5 V,	11.	30 V
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**Operating Mode 2:** 11...30 V Push-Pull (single-phase)

**Operating Mode 3:** 11...30 V Open-Collector (single-phase)

**Operating Mode 4:** 11...30 V Open-Emitter (single-phase)

For explanations of the operating modes, see chapter 7.1 "Operating Modes".

# 6.4 Connection

#### 6.4.1 Incremental input X0

Pin no.	Pin name	Function	Level
1	K0	Input zero pulse	5 V diff., 11 V30 V
2	K0/	Input zero pulse, negated	5 V diff., 11 V…30 V
3	K1	Input signal 1	5 V diff., 11 V30 V
4	K1/	Input signal 1, negated	5 V diff., 11 V…30 V
5	K2	Input signal 2	5 V diff., 11 V…30 V
6	K2/	Input signal 2, negated	5 V diff., 11 V30 V
7	n.c.	-	-
8	5VE-O	Encoder supply 5 V	5 V / 0,5 A (optional)
9	USE-O	Encoder supply US	11 V30 V
10	0VE-O	Encoder supply 0 V	0 V

## 6.4.2 Mode selector connector X7

Pin no.	Pin name	Function	Level
1	USE-I	Input encoder supply	11 V30 V
2	0VE-I	Input encoder supply	0 V
3	5VE-O	Encoder supply 5 V	5 V / 0,5 A (optional)
4	HTL +	Coding HIGH-level	11 V30 V
5	P-UP	Pull-Up resistor	11 V30 V
6	HTL -	Coding HIGH-level	0 V
7	P-DN	Pull-Down resistor	0 V
8	n.c.	-	-
9	US-I	Output supply US	11 V30 V
10	0V-I	Output supply 0 V	0 V

# 6.4.3 Incremental output X1...X6

Pin no.	Pin name	Function	Level
1	K0	Output zero pulse	5 V diff., 11 V30 V
2	K0/	Output zero pulse, negated	5 V diff., 11 V30 V
3	K1	Output signal 1	5 V diff., 11 V30 V
4	K1/	Output signal 1, negated	5 V diff., 11 V30 V
5	K2	Output signal 2	5 V diff., 11 V30 V
6	K2/	Output signal 2, negated	5 V diff., 11 V30 V
7	0V-I	Output supply 0 V	0 V
8	5V-O	Output coding signal supply 5 V	5 V
9	US-O	Output coding signal supply US	11 V30 V
10	UP-I	Input coding signal supply	5 V / 11 V30 V



# 6.5 Block Diagram



# 7 Commissioning

# 7.1 Operating Modes

## 7.1.1 Operating Mode 1, Differential 5 V, 11...30

This operating mode corresponds to the basic configuration of the device for differential signal input levels. The device requires all incremental tracks (K0, K1, K2 and their negated signals) for this operating mode.

As this operating mode is the basic configuration of the device, no jumpers are required on the operating mode selector plug X7.

#### Principle diagram for input circuit



## 7.1.2 Operating Mode 2, 11...30 V Push-Pull (single-phase)

This operating mode is designed for single-phase push-pull operation. The device requires the incremental tracks K0, K1 and K2 with high levels (11...30 V). In order to generate the reverse potential of the differential input, a corresponding coding must be carried out in connector X7:

#### Connector X7



#### Principle diagram for input circuit





## 7.1.3 Operating Mode 3, 11...30 V Open-Collector (single-phase)

This operating mode is designed for single-phase open collector operation. The device requires the incremental tracks K0, K1 and K2 with high levels (11...30 V). In order to generate the reverse potential of the differential input, a corresponding coding must be carried out in connector X7; in addition, a pullup resistor must be connected internally for this operation:

**Connector X7** 

#### Principle diagram for input circuit



#### 7.1.4 Operating Mode 4, 11...30 V Open-Emitter (single-phase)

This operating mode is designed for single-phase open-emitter operation. The device requires the incremental tracks K0, K1 and K2 with high levels (11...30 V). In order to generate the reverse potential of the differential input, a corresponding coding must be carried out in connector X7; in addition, a pulldown resistor must be connected internally for this operation:



1

#### Principle diagram for input circuit



# 7.2 Setting the output level

The output level can be selected separately for each channel by means of a corresponding bridge coding in the mating connector:

#### 1. 5 V output level

# 2. 11...30 V output level





Jumper 1: 8/10





Jumper 1: 9/10