

ZX20T



Operating Manual

FPGA-based High-Speed Micro-PLC

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This document is the original document.

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All information without guarantee.

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1. About this Document






1.1 Validity

This document is applicable to the programmable logic controllers ZX20T Art. no.: 589000), ZX20TP (Art. no.: 589002) and ZX20TC (Art. no.: 589003).

1.2 Target Group

Qualified electricians, assembly, commissioning and service personnel having the corresponding know-how of components for the automation technology.

1.3 Legend

Symbol / Representation	Meaning
	Document in printed form
	Document can be downloaded from www.zander-aachen.de
	Document on USB flash drive
 Warning, Caution	Safety notes Warning against possible hazards Caution: Possibility of damage to life and property
	Important information
TIP	Tip / Useful information

2. General Safety Instructions



Warning,
Caution

- Only authorised expert personnel may install the device and put it into operation, i.e. personnel which
 - is well-acquainted with correct technical handling of the electrical machine equipment,
 - is familiar with the applicable regulations concerning occupational safety and accident prevention,
 - has read and understood the operating manual and the programming manual, if required.
- In case of incorrect connection or inappropriate use, the safe functioning of the device during the machine operation will no longer be guaranteed. This can result in fatal injuries or serious material loss.
- Please observe the national guidelines which are valid for the commissioning of the device.
- The electrical connection of the device must take place only when the voltage supply is switched off. This also applies to the connected sensors and actuators.
- The wiring of the device must be done in conformance with the instructions given in this operating manual.
- The person, who installs the device and puts it into operation, must be adequately protected against electrostatic charge (earthing strap or ESD shoes along with ESD flooring).
- Opening of the device and any manipulations to the device are not allowed; and shall result in loss of warranty and warranty claims.
- Please observe all the relevant safety guidelines and standards.
- Non-observance of the safety guidelines may lead to death, severe injuries and serious material damage.
- Please read the operating manual before use and preserve it carefully. Please ensure that the operating manual is always available at the time of assembly, commissioning and maintenance work.

3. About this device

3.1 Scope of Delivery and Accessories

Scope of Delivery

- Micro-PLC ZX20T (Order No. 589000), ZX20TP (Order No. 589002) or ZX20TC (Order No. 589003)
- 4 plug-in terminal blocks (inserted into the device at delivery)
- This operating manual

Required Accessories

**Note:**

For the program evaluation and programming of the micro PLC, you will need the EX_PRESS 5 software package, which is available separately.

Description	Item	Order Number
EX_PRESS 5	USB flash drive	589092

3.2 Appropriate use

The ZX20T, ZX20TP and ZX20TC PLCs have been designed for the use in machines and plants meant for industrial use. They must be installed in switch cabinets or appropriate housings, minimum degree of protection IP54. The approved operating parameters for use must be complied with (see section "technical data").

3.3 Disclaimer and warranty

If the abovementioned conditions for appropriate use are not complied with or if the safety instructions are not followed or if any maintenance operations are not carried out as required, this shall lead to an exclusion of liability and loss of warranty

3.4 Function

The function of the device depends upon the user program loaded. The logic stored in this program determines how the input signals are evaluated and the outputs are switched.

**Note:**

The user shall be responsible for the integration of the device in the overall system. For this purpose, verify the correct electrical installation and the correct programming of the ZX20T, ZX20TP or ZX20TC

3.5 Device Diagram

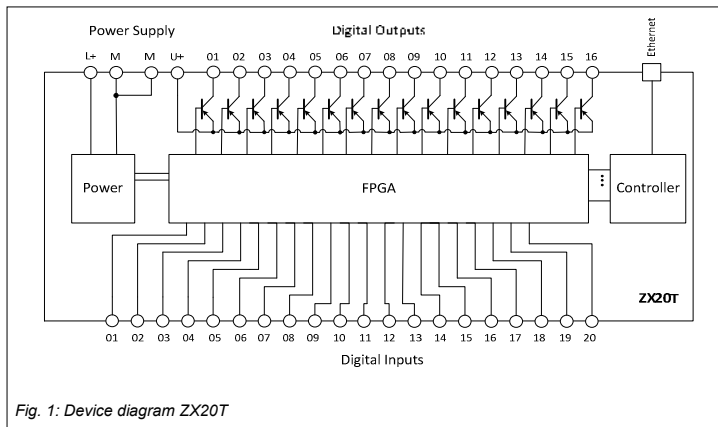


Fig. 1: Device diagram ZX20T

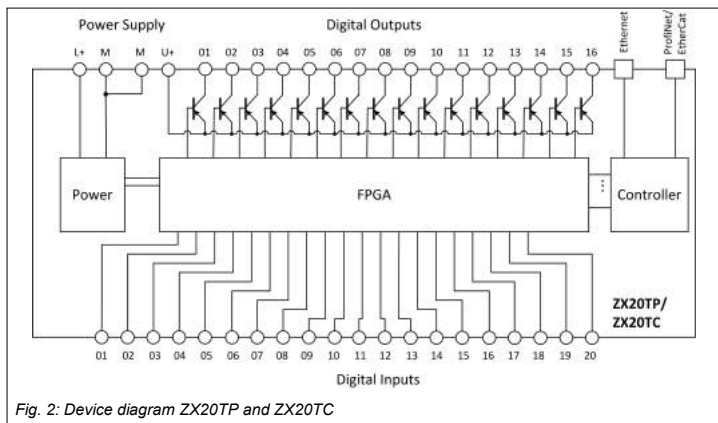


Fig. 2: Device diagram ZX20TP and ZX20TC

4. Mounting

The ZX20T, ZX20TP and ZX20TC devices are designed in such a way that they can be easily installed.

Please note that:

- The device must be installed in a switch cabinet or a suitable housing with a degree of protection of at least IP54
- Mount on a mounting rail 35mm in conformance with EN 60715 (profile rail)
- Maintain a mounting distance of minimum 5 mm from the adjacent devices, which generate heat.
- Ensure that there is sufficient heat dissipation in the switch cabinet.
- Keep enough place for the wiring.
- Keep the ZX20T, ZX20TP or ZX20TC away from devices or components, which carry high voltage or cause strong electrical interference.

4.1 Mounting on the Profile Rail

The device is placed straight on the profile rail (see Fig. 3). Then press the device with the ball of the thumb onto the profile rail (see Fig. 4) till both the orange-coloured slide locks are latched in place (above and below).

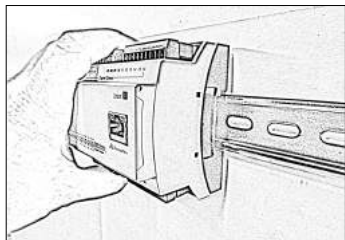


Fig. 3: Placing the device on the profile rail

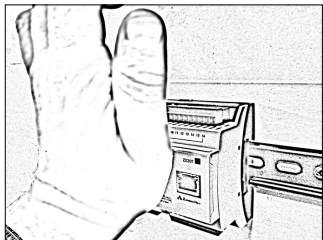


Fig. 4: Pressing the device onto the profile rail

4.2 Removal from the Profile Rail

Pull out both the orange-coloured slide locks (above and below) one after the other using a screwdriver (blade width max. 3.5 mm) (see Fig. 5). By doing this, the device gets detached from the profile rail and can be removed .



Fig. 5: Pulling out the slide locks

5. Electrical connection



Warning


- The operating voltage must correspond to the specifications given in the chapter "Technical Data".
- The voltages at the digital inputs must correspond to the specifications given in the chapter "Technical Data".
- The voltage connected to the voltage input for the digital outputs ("U+") must correspond to the specifications given in the chapter "Technical Data".
- Do not connect any external voltage to the digital outputs.
- At the time of wiring, the supply voltage of the device must be disconnected. The supply voltage to all the sensors and actuators must also be disconnected.

Non-observance of these specifications can cause severe damage to the electronic components of the device! This will result in loss of warranty and warranty claims.

Also note that:

- All electrical connections must be insulated from the mains either using safety transformers (SELV/PELV) in conformance with IEC 61558-2-6, with limited voltage output in the event of error, or using equivalent insulation measures.
- Under inductive loads, all outputs must have a sufficiently effective protection circuit. The outputs must be protected with a free-wheeling diode.
- Do not install the signal and communication lines in the same cable track as the AC supply voltage lines or lines subject to severe interference. Maintain a minimum distance of 20 cm from such cable tracks.
- It is recommended to use Ethernet-cable of the Category Cat.7 for networking.
- Tighten the screws of the connecting terminals with 0.6 ... 0.8 Nm tightening torque.

5.1 Connecting terminals

Klemme	Beschreibung
L+	Positive voltage supply U_B
M (2 equivalent terminals)	0V connection of the supply voltage and the voltage for the dig. outputs as well as 0V potential for digital and analogue inputs and analogue outputs
U+	Positive voltage for the digital outputs
Digital Input 01..20 / 01..12	Digital inputs
Digital Output 01..16 / 01..12	Digital outputs
 ZANDER NET	Ethernet interface
PROFINET IO-Device	PROFINET interface (only ZX20TP)
EtherCAT Slave	EtherCAT interface (only ZX20TC)

5.2 Safety against Failures

- The operating voltage L+/M is reverse polarity protected.
- All the digital outputs are short-circuit protected.

5.3 Protection of the Voltage Supply

The line for the positive operating voltage to the device (terminal L+) must be protected with an appropriate fuse (see chapter "Technical Data").

5.4 Inputs

Both the device variants "ZX20T", "ZX20TP" and "ZX20TC" have digital inputs. These are accessible via the lower two terminal blocks. The inputs do not have a galvanic isolation to the supply voltage, i.e. their 0V reference potential is identical with the 0V potential of the supply voltage (terminal "M").

5.4.1 Digital Inputs

The "ZX20T" device variant provides 20 digital inputs, whereas the "ZX20AT" has got 12 digital inputs. These can be reached via the connecting terminals "Digital Input, 01..20 or 01..12".

**Note:**

In the "Structured Text", input variables for digital inputs can be assigned to the abovementioned connecting terminals via the keyword "AT", that is through "In_01", "In_02", ... , "In_20" designations. Further information on the issue you will find in the programming manual, which is also available as a PDF file on the USB flash drive enclosed with the "EX_PRESS 5"

If another voltage source as the operating voltage is used for generating input signals, the 0V potential of this voltage source must be connected with the 0V potential of the operating voltage with low-resistance as far as possible (connecting terminal "M"). A SELV/PELV voltage source must be used in conformance with IEC 61558-2-6 with limiting of the output voltage in the event of fault.

**Note:**

Please observe the permissible voltage range and the maximum switching capacity for the digital outputs given in the "Technical data".

For processing very fast input signals, it is recommended that they should be guided through shielded cables installed away from lines subject to severe interference. Here, connect the cable shield on one side to a shield rail, which is on the PE potential, as close as possible to the terminals of the PLC (low-resistance connection).

For input signals that are not so time-critical, the interference in the corresponding inputs can be suppressed with software technology, whereby these are allotted a

"debouncing time" in the user program.

**Note:**

Precise information for programming the debouncing time is given in the programming manual, which is also available as a PDF file on the USB flash drive enclosed with the "EX_PRESS 5" software package.

5.5 Outputs

Both the device variants "ZX20T" and "ZX20AT" provide digital outputs, whereas the "ZX20AT" variant also has got analogue outputs. These are accessible via the upper two terminal blocks. The outputs do not have a galvanic isolation for the supply voltage, i.e. their 0V reference potential is identical with the 0V potential of supply voltage (connecting terminal "M").

5.5.1 Digital outputs

The "ZX20T" device variant has got 16 digital outputs, whereas the "ZX20AT" provides 12 digital outputs. These can be reached via the connecting terminals "Digital Output, 01..16 or 01..12".

If the outputs are enabled, the voltage generated at the connecting terminals "U+" and "M" are interconnected (p-switching). The voltage at "U+" and "M" can deviate from the supply voltage U_B ; permitted voltage range: see "Technical Data". Inactive outputs have high-resistance. All the digital outputs have continuous short-circuit protection.

While controlling inductive loads, a protective circuit must be available in the form of a free-wheeling diode.

**Note:**

In the "Structured Text", output variables for digital outputs can be assigned to the abovementioned connecting terminals via the keyword "AT", that is through the "Out_01", "Out_02", ... , "Out_16" designations. Further information on the issue you will find in the programming manual, which is also available as a PDF file on the USB stick enclosed with the "EX_PRESS 5" software package.

6. Programming

The "EX_PRESS 5" programming system, which is separately available, is required for the evaluation of the program and for uploads to the PLC. The program is created in the PLC programming language "Structured Text".

**Note:**

The programming user manual, in which the "EX_PRESS 5" programming system is described in detail, is available in the form of a PDF document on the USB flash drive, enclosed within the program package

You can download the final program via the Ethernet interface, which is marked on the device with "ZANDERNet". The connection with the PC can take place as a point-to-point connection or the PC and PLC can be part of a bigger network, connected to one another via switches or hubs. Several ZX20T PLCs may be found in this network.

**Important information:**

The download of the final program into the PLC is only possible, if there is no exchange of data via the PROFINET or EtherCAT interface at the same time.

Every ZX20T, ZX20TP or ZX20TC PLC has got a label with the corresponding MAC address, with which it is identified by the PC in the network. This ensures that every PLC contains the program meant for it.

For security reasons, programming of Zander PLCs via Internet is not possible.

7. Networking

7.1 Networking via ZANDER NET

Several ZX20T PLCs can exchange data via the Ethernet interface "ZANDER NET" and can thus, be operated as a distributed controller system.

**Note:**

Detailed information for networking of several ZX20T is given in the programming manual, which is available as a PDF file on the USB flash drive enclosed within the "EX_PRESS 5" software package

7.2 Networking via PROFINET

The "ZX20TP" can be integrated into a PROFINET-Network as a "PROFINET IO Device". It acts as a subsystem and exchanges data with a "PROFINET IO Controller".

One of the two RJ45 connectors of the "PROFINET IO Device" interface has to be connected to a "PROFINET IO Controller" via an Ethernet cable. Both of the connectors are functionally equivalent. Thus it is possible to connect a further "PROFINET IO Device" due to an integrated network switch.

The GSDML file must be integrated into the "PROFINET IO Controller" configuration by its configuration software. The input and output data, which is exchanged with the "PROFINET IO Controller", must be configured in this software as follows: Input data assigned to Slot 5 and output data to Slot 1. The maximum size of input and output data is 64 bytes each. For further information, please, read the manual of the configuration software of the used "PROFINET IO Controller".

**Note:**

The GSDML file is provided as an XML file on the USB flash drive enclosed within the "EX_PRESS 5" software package.

In order to verify your configuration, use the LEDs at the front of the device (cf. table on page 20).

7.3 Networking via EtherCAT

The “ZX20TC” can be integrated into an EtherCAT-Network as an “EtherCAT Slave”. It acts as a subsystem and exchanges data with an “EtherCAT Master”.

Connect the right RJ45 port (“IN”) with the “EtherCAT Master” or with the “OUT” port of a previous “EtherCAT Slave”. If a further “EtherCAT Slave” shall be installed in the line, then connect it with the left port (“OUT”) of the ZX20TC.

The EDS file must be integrated into the “EtherCAT Master” configuration by its configuration software. The maximum size of input and output data, which can be exchanged with the “EtherCat Master”, is 64 bytes each. For further information, please, read the manual of the configuration software of the used “EtherCAT Master”.

**Note:**

The EDS file is provided as an XML file on the USB flash drive enclosed within the "EX_PRESS 5" software package

In order to verify your configuration, use the LEDs at the front of the device (cf. table on page 21).

8. Commissioning

Before the final commissioning of the PLC, a qualified expert must verify that the previous steps "Electrical Connection", "Programming" and "Networking" have been completed correctly. In a first step, it is recommended to run the program while the supply voltage of the actuators is switched off. You can verify the correct functioning by watching the LEDs for the inputs and outputs (see section 9: "Monitoring").



Warning:

A faulty electric connection or programming may lead to unpredictable operating states and may result in severe or even fatal injuries and serious material damage.

The ZX20T, ZX20TP and ZX20TC PLCs are **not** suitable for carrying out tasks pertaining to functional safety. One can not completely rule out the possibility of malfunctioning or unpredictable operating states. If there is a possibility of dangerous movements or hazardous situations in the overall system, a risk evaluation must be carried out in conformance with the machine directive. If additional measures have to be taken with respect to functional safety, approved safety components such as emergency stop devices or safety door monitoring systems must be installed, which ensure a safe shutdown of the corresponding drives, independent of the ZX20T, ZX20TP or ZX20TC PLC. Suitable components required for this purpose can be obtained from ZANDER.

9. Monitoring

The front side of the ZX20T, ZX20TP and ZX20TC PLCs have got LEDs, which enable easy monitoring and are also useful for troubleshooting, if required. A blue LED with the "Pwr" marking indicates the supply of operating voltage. The states of all digital inputs can be seen at the "Digital Input" LEDs, whereas the states of the digital outputs are displayed by the "Digital Output" LEDs (see Fig. 6).



Fig. 6: LEDs on the front side of the device for monitoring (here: ZX20T)

The types ZX20TP and ZX20TC have got two additional RJ45 connectors each with two LEDs and three further LEDs below the ZANDER logo. The following tables show the possible states of the LEDs and their meaning:

ZX20TP:

LED	Colour	State	Sense
SYS	green	On	Bus module is active
	green/ yellow	Flashing green/yellow	Bus module is booting
	yellow	On	
	-	Off	Device is deactivated or Bus module is defective
BF	red	On	No configuration; No/ bad Connection
	red	Flashing with a period of 2 Hz	No data exchange
	-	Off	No failure
SF	red	On	Watchdog time out; System failure
	red	Flashing with a period of 2 Hz	DCP-Signal-Service is activated via Bus
	-	Off	No failure
Link Ch0 Ch1	green	On	Connected to Ethernet
	-	Off	No Connection to Ethernet
RX/TX Ch0 Ch1	yellow	Flashing	Active data exchange

ZX20TC:

LED	Colour	State	Meaning
SYS	green	On	Bus module is active
	green/ yellow	Flashing green/yellow	Bus module is booting
	yellow	On	Bus module is booting
	-	Off	Device is deactivated or Bus module is defective
ERR	red	Flashing	Invalid configuration
	red	Single Flash	Local failure: The slave device application changed the EtherCAT state autonomously.
	red	Double Flash	Process data Watchdog Timeout
	-	Off	No failure
RUN	green	Flashing	The device is in the Pre-Operational state
	green	Single Flash	The device is in the Safe-Operational state
	green	On	The device is in the Operational state
	-	Off	The device is in the INIT state
L/A IN L/A OUT	green	On	Connected to Ethernet
	green	Flashing	Active data exchange
	green	Off	No Connection to Ethernet
L/A IN L/A OUT	yellow	Off	This LED is not used.

10. Maintenance, Repair and Replacement

Provided the device has been commissioned properly, maintenance work is not required. Only the manufacturer may carry out repairs on the device. If the user opens the device, this will result in loss of warranty and warranty claims.

If replacement is necessary, it must be ensured that the new PLC is equipped with an identical user program before re-commissioning.

11. Service

For service requirements, please contact:

H. Zander GmbH & Co. KG
Am Gut Wolf 15
52070 Aachen
Germany

Service line:

Within Germany:
(0241) 910501-16
Other countries:
+49 241 910501-16

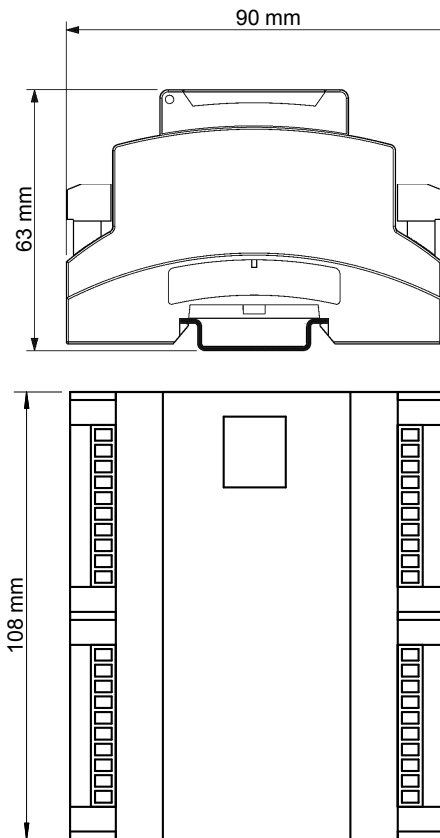
E-Mail:

info@zander-aachen.de

Internet:

www.zander-aachen.de

12. Dimensional Drawing



13. Technical Data

Electrical Data

Operating voltage U_B (terminals „L+“ and „M“)	DC 24 V
Voltage tolerance	$\pm 15\%$
Current consumption at U_B ZX20T/ ZX20TP, ZX20TC (all inputs enabled / no load)	approx. 60 mA / approx. 160 mA
Power consumption at U_B ZX20T/ ZX20TP, ZX20TC (all inputs enabled / no load)	approx. 1,5 W / approx. 3,9 W

Digital Inputs

Number of digital inputs	20
Input voltage	18 - 30 V
Input current	7 mA
Galvanic isolation	no
Low-level	< 5 V
High-level	> 18 V
Noise suppression	configurable (see prog. user manual)
Max. switching delay	0 \rightarrow 1: 1 μ s; 1 \rightarrow 0: 1 μ s
Max. switching frequency	500 kHz

Digital Outputs

Number of digital outputs at ZX20T	16
Structure	Short-circuit-proof PNP transistors
Switching capacity per output	DC 10 - 30 V; 500 mA
Galvanic isolation	no
Short-circuit-proof	yes
Switching time	0 \rightarrow 1: 7 μ s; 1 \rightarrow 0: 7 μ s *
Output voltage at "1" (max. load)	„U+“ - 0,5 V

Environmental Data

Ambient temperature	0 °C to 50 °C
Storage temperature	-20 °C to 80 °C
Humidity rating	93% RH at +40 °C, non-condensing
Vibrations acc. to EN 61131-2	Frequency: 5 - 8.4 Hz, 3.5 mm amplitude Frequency: 8.4 - 150 Hz, accel.: 1.0 g_0
Shock resistance acc. to EN 61131-2	Acceleration: 15 g_0

Mechanical Data

Degree of protection	IP20
Assembly	Mounting rail acc. to EN 60715 TH35
Cable cross-section	0.25 - 2.5 mm ²
Dimensions (W x H x D)	108 x 90 x 62 mm
Weight	210 g
Housing material	Polycarbonate
Type of connection	Plug-in connecting terminals

*) The switching times specified for the digital outputs are only applicable to a load current of minimum 250mA. For smaller load currents, the switching time is higher; the load current can be increased via a parallel connection of an additional resistance.

14. Declaration of Conformity



Hersteller: H. ZANDER GmbH & Co. KG
Producer: Am Gut Wolf 15 • 52070 Aachen • Deutschland
Fabricant:

Produktgruppe: Speicherprogrammierbare Steuerungen
Product Group: Programmable Logic Controllers
Groupe de produits: Automates Programmables Industriels

Produkt Name	Anbringung der CE-Kennzeichnung
Product Name	Affixing of CE marking
Nom du produit	Application du marque CE
ZX20T.....	2016
ZX20TP.....	2016
ZX20TC.....	2016

Die Produkte stimmen mit den Vorschriften folgender Europäischer Richtlinien überein:
 The products conform with the essential protection requirements of the following European directives:
 Les produits sont conformes aux dispositions des directives européennes suivantes:

2014/30/EU : EMV Richtlinie
 2014/30/EU : EMC directive
 2014/30/EU : Directive «CEM»

Die Übereinstimmung der bezeichneten Produkte mit den Vorschriften der o.a. Richtlinie wird, falls anwendbar, nachgewiesen durch die vollständige Einhaltung folgender Normen:
 If applicable, the conformity of the designated products is proved by full compliance with the following standards:
 Le strict respect des norme suivantes confirme, s'il y a lieu, que les produits désignés sont conformes aux dispositions de la directive susmentionnée.

EN 61131-2:2008-04

Dokumentationsbeauftragte/r: Christiane Nitschak
 Documentation manager
 Autorisé à constituer le dossier technique

Aachen, den 15.03.2016



Dipl.-Ing. Walter Zander
 Geschäftsführung
 General Manager
 Director



Dipl.-Ing. Alfons Austerhoff
 Leiter CE-Konformitätsbewertung
 Manager for EC declaration of conformity
 Responsable évaluation de conformité CE

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