

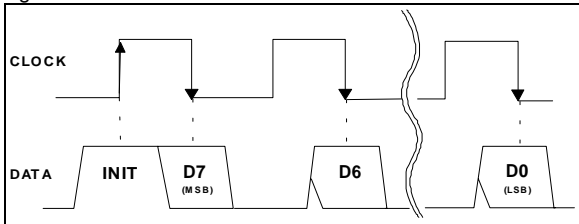
Operating instructions tico 731.2 - DC powered numeric PLC-Display



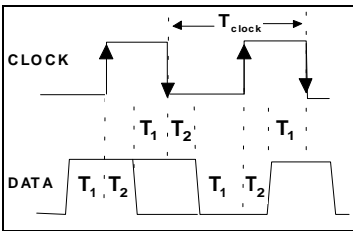
This manual applies to the tico 731.2 with the Article No. **0 732 205**. With its serial interface this numeric LCD display is suitable for PLCs.

1. Description of the Data Interface

The data is transferred bitwise starting with the most significant bit (MSB). Each data bit is clocked in by the falling edge of the CLOCK signal. A HIGH level on DATA during a rising edge of CLOCK initialises the data transfer sequence and cancels a previously started transmission (INIT) and the display is prepared for a new transfer sequence which starts immediately with the next falling edge of CLOCK.



Data Diagram



Timing Diagram

T1: DATA must be stable for at least 5ms **before** a rising or falling edge of CLOCK.

T2: DATA must be stable for at least 0.2ms **after** every edge of CLOCK.

Display Overview:

In the following picture you can see a complete display as is shown during the self test after power up. All segments and special signs are turned on for approx. 3 seconds.



Fig.1

2. Description of the Transfer Protocol

With the first 4 bits of a data transfer sequence you select the transfer mode, which determines how the following bits are interpreted. There are 2 modes:

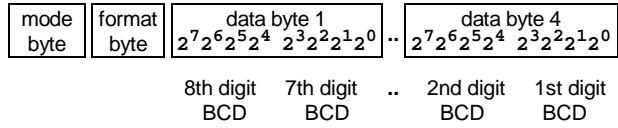
- **BCD mode: sequence length of 6 bytes (0000 ...)**
Each display digit is transferred in BCD (4 bits).
Note: The display is updated only after the last data byte has been transferred.
- **Graphics mode: total seq. length of 9 bytes (0001 ...)**
Bitwise representation of all display segments allows you to create any display readout.
Note: The display updates every time a data byte has been clocked in.

We recommend to precede each data transfer sequence with an INIT bit in order to maintain synchronity.

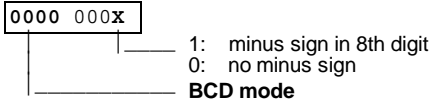
2.1. BCD mode

A digit is represented by its 4-bit numeric value 0..9. Moreover, the values 10..15 allow you to display letters as shown in table 1.

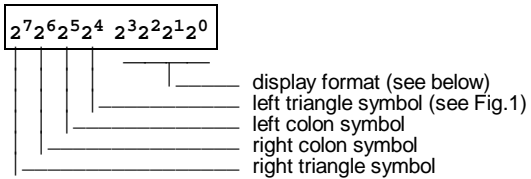
protocol BCD mode:



mode byte (BCD mode):



format byte (BCD mode):



display format: determines the position of the decimal point or the position up to which leading zeros are displayed (no decimal point)

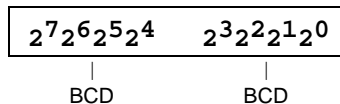
2 ³ .. 2 ⁰	display
0 0 0 0	0
0 0 0 1	0.1
0 0 1 0	0.12
:	:
0 1 1 0	0.123456
0 1 1 1	0.1234567

with decimal point

2 ³ .. 2 ⁰	display
1 0 0 0	0
1 0 0 1	00
1 0 1 0	000
:	:
1 1 1 0	0000000
1 1 1 1	00000000

w/o decimal pt., leading 0s

Bit assignment of data bytes in BCD mode:



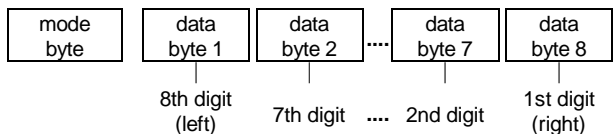
BCD	display	BCD	display	BCD	display	BCD	display
0000	0	0100	4	1000	8	1100	C
0001	1	0101	5	1001	9	1101	d
0010	2	0110	6	1010	A	1110	E
0011	3	0111	7	1011	b	1111	F

table 1: digit values in BCD mode

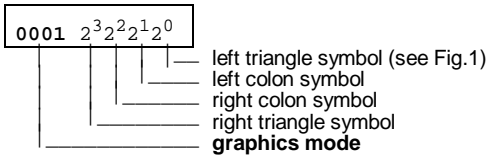
2.2. Graphics mode

In graphics mode one display digit comes in one data byte with the bits assigned to the 7 segments plus the decimal point. 8 digits require 8 data bytes.

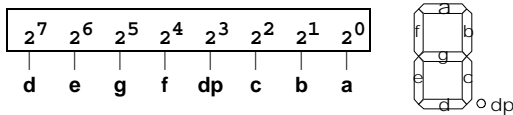
protocol graphics mode:



mode byte in graphics mode:



bits assignment of data bytes in graphics mode:



3. Terminal connection

The display can be driven by a control device with PNP or NPN outputs. If the control device has no internal pullup or pulldown resistors, please connect one additional 10kOhm resistor (1/8W) to either DATA or CLOCK, as follows:

4	DATA	10kOhm resistor (1/8W) to either DATA or CLOCK, as follows:	outputs are PNP	DATA (4) - (2) 0V
3	CLOCK		outputs are NPN	CLOCK (3) - (1) VDC
2	0 V			
1	12..24VDC			

4. Specifications

DC Power Supply	12..24 VDC; +20/-10%
Current consumption	< 10 mA, typ. 5mA @24VDC
Overcurrent protection	external fuse: 0.035 AT
Display	LCD, 8-digit, 7 mm
Input CLOCK	PNP, $f_{max} < 100\text{Hz}$
Input DATA	NPN, pulse duration see timing diagram
Amplitude threshold (CLOCK und DATA)	LOW: < 0.7 V; HIGH: >5 V, max 30 VDC
Front key	no function
Mounting	frontpanel mounted with clamping frame
Front dimension	DIN 48 mm x 24 mm
Panel cut-out	$45^{+0.6} \text{ mm} \times 22^{+0.3} \text{ mm}$
Panel thickness	max. 26 mm
Product depth	60 mm
Protection class	front side IP 54
Operating temperature	-10° C to +50°C
Storage temperature	-20° C to +60°C
General rating	DIN EN 61010 part 1, VDE 0411 part 1
Protection class	according to class II
Overvoltage	category II
Contamination	level 2



This symbol indicates passages in the text which you have to pay special attention to so as to guarantee proper use and preclude any risk.

5. Safety and warning hints

This instrument has been built and tested in accordance with VDE 0411, part1 (EN 61010, part 1), protection class II - Protection Measures for Electronic Measuring Instruments - and has left our works in safe and proper condition.

In order to maintain these conditions and to ensure safe operation, the user must observe the instructions and warnings provided in these operation instructions.

- **Maximum operation voltages must not be exceeded!** To prevent dangerous structure-borne currents, this device has to be run on safety extra-low voltage (SELV). For protection, please use an external fuse (see Electrical Specifications).
- Installation of electrical devices should only be carried out by a qualified electrician.
- Panel mounting devices should only be operated when properly mounted in the panel.
- Connection terminals are to be protected by proper installation.

- The screws of unused connection terminals have to be fully screwed in.
- In order to ensure hand contact safety at the connection terminals, live wires must be connected properly to the connection terminals.
- If safe operation can no longer be ensured, the display must be disabled and secured against accidental operation.
- Application: Industrial processes and control systems. Overvoltage at the connection terminals must be limited to the values within overvoltage category II.
- Installation environment and wiring are influential on the display's EMC: Thus the installer must secure EMC of the whole facility (device).
- In electrostatically threatened areas please take care for neat ESD-protection of plug and connecting cable during installation work.
- Only circuits of the same type are allowed to be connected to the terminals, SELV sources or ELV sources with 1 mm² wiring.

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