

Operating instructions for tico 731.4 and tico 731.5

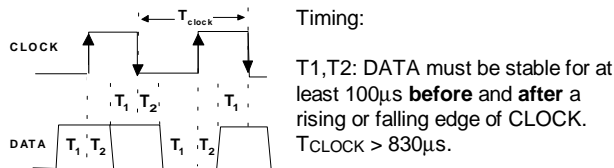
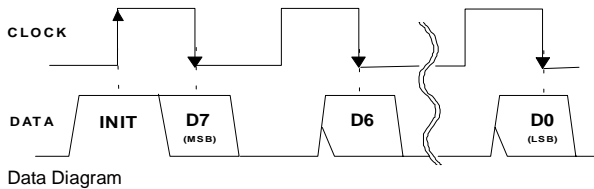
- DC powered numeric PLC-Display



With its serial interface this numeric display is suitable for PLCs.
 0 731 405: 8 LCD digits, 8 decimal points, 4 additional symbols
 0 731 505: 6 LED digits, 6 decimal points.
 A transistor output can be activated by the front key.

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.



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 synchrony.

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	Format Byte	data byte 1*	..	data byte 4
		2 ⁷ 2 ⁶ 2 ⁵ 2 ⁴ 2 ³ 2 ² 2 ¹ 2 ⁰		2 ⁷ 2 ⁶ 2 ⁵ 2 ⁴ 2 ³ 2 ² 2 ¹ 2 ⁰
		8.Stelle BCD		1.Stelle BCD

* 0 731 505: data byte 1 must contain value 0.

mode byte (BCD mode):

0000 000x ; x=1: minus sign in leftmost digit

format byte (BCD mode):

Bit	LCD (0 731 405) see graphic on the left	LED (0 731 505)
2 ⁷	▼ (triangle under 2)	rightmost decimal point
2 ⁶	colon 3 4 : 5 6 : 7 8	3rd decimal pt. from right
2 ⁵	colon 3 4 : 5 6 : 7 8	5th decimal pt. from right
2 ⁴	▼ (triangle under 7)	no effect
2 ³ -2 ⁰	display format (see below)	

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	2 ³ .. 2 ⁰	display
	0 0 0 0	0	1 0 0 0	0
	0 0 0 1	0 . 1	1 0 0 1	00
	0 0 1 0	0 . 1 2	1 0 1 0	000
	:	:	:	:
LED	0 1 0 1	0 . 1 2 3 4 5	1 1 0 1	000000
	0 1 1 0	0 . 1 2 3 4 5 6	1 1 1 0	0000000
LCD	0 1 1 1	0 . 1 2 3 4 5 6 7	1 1 1 1	00000000

with decimal point

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

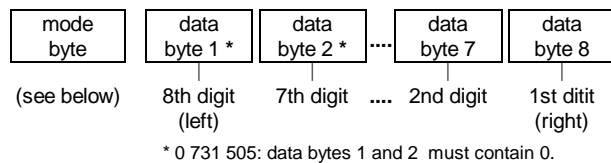
table 1: digit values in BCD mode

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.

Notice the difference between LCD and LED!

protocol graphics mode:

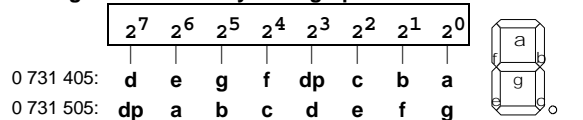


* 0 731 505: data bytes 1 and 2 must contain 0.

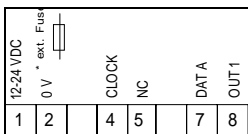
mode byte in graphics mode:

Bits	LCD (0 731 405)	LED (0 731 505)
2 ⁷ -2 ⁴	0001	
2 ³	▼ (triangle under 2)	no effect on LED version
2 ²	colon 3 4 : 5 6 : 7 8	
2 ¹	colon 3 4 : 5 6 : 7 8	
2 ⁰	▼ (triangle under 7)	

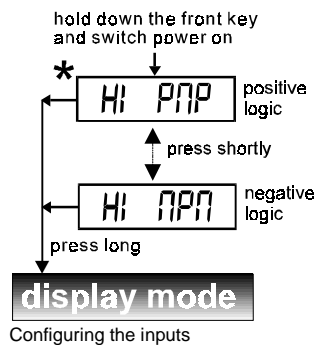
bits assignment of data bytes in graphics mode:



3. Terminal connection and configuration



The display can be driven by a control device with PNP or NPN outputs. The polarity of CLOCK and DATA can be configured accordingly as shown on the right.



☞ With the inputs configured to PNP the signal level is positive as shown in the data diagram on the first page. With NPN the signal level is inverted, i.e. negative logic.
* PNP is the factory default.

⊙ While pressing the front key in display mode you activate the transistor output OUT1.

4. Specifications

DC Power Supply	12..24 Vdc; +20/-10%
Current consumption	0 731 405:<20mA, ext.fuse 0,035AT 0 731 505:<150mA, ext.fuse 0,15AT
Display	0 731 405: LED 6-digit 7,6 mm 0 731 505: LCD 8-digit, 7 mm
Inputs (CLOCK and DATA)	PNP or NPN configurable, transfer rate max. 1200Bd
Amplitude threshold	Low/High:< 0,7V / >5V, max 30Vdc
Output OUT1	PNP, $U_{max}=V_{DC}-2V$, $I_{max}=10mA$
Front key	a) Configuration menu on power up b) activates OUT1 while pressed
Mounting	frontpanel mounted with clamping frame
Front dimension	DIN 48 mm x 24 mm
Panel cut-out	$45 + 0.6$ mm x $22 + 0.3$ 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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HENGSTLER

Hengstler GmbH
Postfach 11 51
D-78550 Aldingen
Germany
Tel. +49-7424-89 462
Fax +49-7424-89 470



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