

# I/O Module EP22 Family

16 Channel A/D, OPTO-In, OPTO-Out, Key-Matrix

Universal I/O expansion module for BASIC Tiger multitasking computer modules. The EP22 combines often used I/O channels from the analog and the digital world in a single module:

- ♦ Analog Input
- ♦ Opto de-coupled digital input
- ♦ Opto de-coupled digital output
- ♦ Keyboard / switch matrix scan input

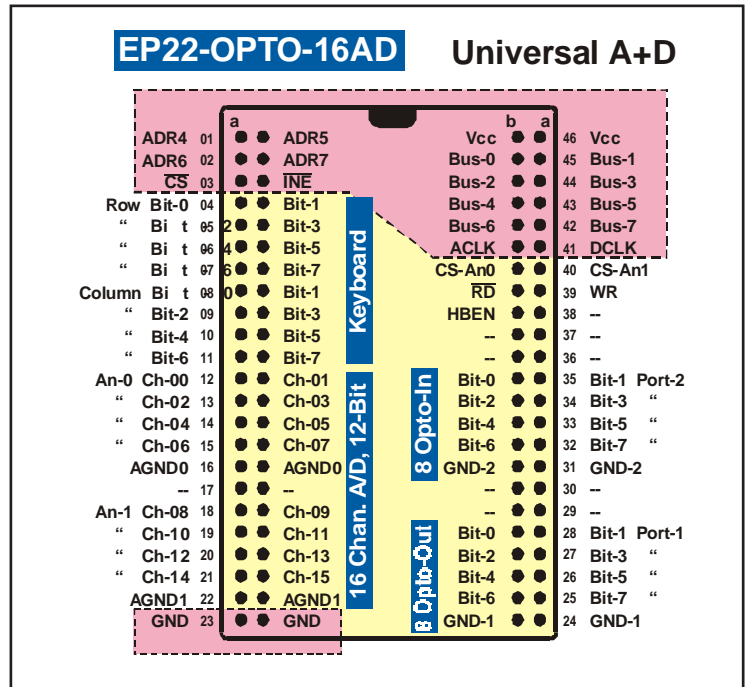
Data acquisition through the EP22 in combination with a BASIC-Tiger, TINY-Tiger or Econo-Tiger makes a powerful and still compact and low costing instrument. The EP22 offers software-programmable input ranges individual for each channel, bundling of various channels to channel groups, calibration and oversampling features for increased accuracy and resolution needs.

The EP22 is used in mobile equipment and industrial control application as

- ♦ production control equipment
- ♦ medical equipment
- ♦ alarm systems
- ♦ data loggers
- ♦ industrial machine control systems
- ♦ quality control systems ...

For further information, detailed literature and manuals in printed or downloadable formats visit:

[www.wilke.de](http://www.wilke.de) or [www.wilke-technology.com](http://www.wilke-technology.com)



## Features

**A/D input:** 16 channel A/D, 12 Bit  
**input range:** for each channel individually programmable: 0...5V, 0...10V, +/-5V, +/-10V  
**Keyboard:** key / switch matrix: up to 8 x 8 keys  
**8 x Opto In:** 5...50mA max, 1.3 V<sub>typ.</sub>  
**8 x Opto-Out:** 24V / 5 mA<sub>typ.</sub>, 40V / 50mA<sub>abs\_max</sub>

## General Specifications

- ♦ Dimensions: approx. 40.6 x 62.2 x 11.4 mm / 1.6 x 2.5 x 0,5"  
92-pin DIP type case  
pin to pin clearance 2.54 mm / 0.1", outer row distance 35.56 mm / 1,4"  
square pins 0.64 x 0.64 mm / 0.025 x 0.025"
- ♦ Weight: approx. 48g / 1.7 ounce
- ♦ Operating temperature: 0°C to +70°C  
Standard: -20°C to +85°C  
Industrial: expanded ranges up to -55°C to 105°C on request  
Expanded:
- ♦ Power supply: 4.5V - 6.0V / 20 / 28 / 32 mA typ. (EP20 / EP21 / EP22)
- ♦ I/O pins: 8 Data Bus + 3 Ctrl +  
8 digital IN, 8 digital out  
16 analog in, 8+8 key-matrix

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## Analog Inputs

♦ Nr. of input channels:

0 channels, Module EP20  
8 channels, Module EP21  
16 channels, Module EP22

♦ Resolution  
Effective Dynamic Resolution

12 Bit  
14 Bit, 2 additional bits by range setting 5V, 10V and 20V swings

♦ Conversion Accuracy

	Standard	Industrial
Integral Nonlinearity:	± 1 LSB max.	± 0,5 LSB max.
Differential Nonlinearity:	± 1 LSB max.	± 1 LSB max.
Offset Error:		
Unipolar:	± 5 LSB max.	± 3 LSB max.
Bipolar:	± 10 LSB max.	± 5 LSB max.
Chan-to-Chan Offset:		
Unipolar:	± 0,1 LSB typ.	± 0,1 LSB typ.
Bipolar:	± 0,5 LSB typ.	± 0,5 LSB typ.
Gain Error:		
Unipolar:	± 10 LSB typ.	± 7 LSB typ.
Bipolar:	± 10 LSB typ.	± 7 LSB typ.
Gain Temperature Coeff:	5 ppm / °C typ.	3 ppm / °C typ.

♦ Dynamic specifications:

Signal to Noise + Distortion Ratio:	70 dB min.	69 dB min.
Total Harmonic Distortion up to 5th harmonic:	-85 dB typ. -78 dB max.	-85 dB typ. -78 dB max.
Spurious Free Dynamic Range:	80 dB min.	80 dB min.

♦ Analog Input:

Channel to Channel Crosstalk, 50 kHz, ±5V:	-86 dBtyp.	-86 dBtyp.
Track Hold Time:	3µs max.	3µs max.
Small Signal Bandwidth:	±10V range ±5V range 0-10V range 0-5V range	5 MHz typ. 2,5 MHz typ. 2,5 MHz typ. 1,25 MHz typ.
Input Current:	±10V range ±5V range 0-10V range 0-5V range	-1200 ... 720 µA max. -600 ... 360 µA max. 720 µA max. 360 µA max.
Dynamic Input Res.	Unipolar Bipolar	21 kΩ typ. 16 kΩ typ.
Input Capacity	40 pF max.	40 pF max.

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## Analog Inputs (cont.)

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>◆ Acquisition time</li> <li>◆ Input Ranges</li> <li>◆ Input Organisation</li> <li>◆ Input Overvoltage Tolerance</li> <li>◆ Temperature Range</li> <li>◆ Buffering</li> <li>◆ Further Features</li> </ul> | <p>&lt; 25 <math>\mu</math>s</p> <p>For each input channel individually programmable input ranges:<br/>0-5V    0-10V    <math>\pm</math>5V    <math>\pm</math>10V</p> <p>Each channel individually accessible.<br/>Any collection of channels can be handled as a channel group for near to synchronous data sampling.</p> <p><math>\pm</math>16,5V</p> <p>standard:        0° ... 70°C<br/>industrial:     -40° ... 85°C<br/>expanded:       -55° ... 105°C</p> <p>acquisition data fully buffered in Tiger computer module</p> <p>Further Data Acquisition functions with EP22 module + BASIC Tigers:</p> <ul style="list-style-type: none"> <li>◆ Individual channel calibration curves in data FLASH</li> <li>◆ Oversampling and window integration for noise reduction and increased resolution to 13 or 14 bit.</li> <li>◆ Individual channel reading and up to 8 channel groups of up to 64 channels each.</li> <li>◆ Power save mode</li> </ul> |
|---|---|

## Digital In- / Outputs

		<b>Testcondition</b>
◆ Min Input Voltage „High“	3.15V	(Vcc = 4,5V)
◆ Max Input Voltage „Low“	1.80V	(Vcc = 6,0V)
◆ Min Output Voltage „High“ (1 HC load)	4.4V	(Vcc = 4,5V)
◆ Max Output Voltage „Low“ (1 HC load)	0.1V	(Vcc = 6,0V)

## Digital OPTO Inputs

◆ Input Type	LED	
◆ Input Current „High“ (read as Bit=1)	5 mA min.	50 mA max.
◆ Input Voltage „High“ (read as Bit=1)	1.3 V max	(@ I = 10 mA)
◆ Input Current „Low“ (read as Bit=0)	< 10 $\mu$ A	
◆ Input Capacitance	30 pF typ.	
◆ Reverse Voltage	5V max	
◆ Input Isolation to all other Ports	2500 Vrms min, 1 minute	

## Digital OPTO OC Outputs

◆ Output Type	Open Collector	
◆ Output Current „Low“ (written Bit = 0)	0.1 $\mu$ A max.	
◆ Output Voltage „Low“ (written Bit = 0)	80V abs. max.	
◆ Output Capacitance	10 pF typ.	
◆ Output Current „High“ (written Bit = 1)	5 mA min.	50 mA abs.max.
◆ Output Voltage „High“ (written Bit = 1)	0.7V max	(@ I = 8 mA)
◆ Output Isolation to all other Ports	2500 Vrms min, 1 minute	

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## 8 x 8 Key / Switch Matrix

- ◆ No of Rows
- ◆ No of Columns
- ◆ Type of Rows
- ◆ Type of Columns
- ◆ Max. Key Resistance for „ON“ state
- ◆ Min. Key Resistance for „OFF“ state
- ◆ Max. Key Voltage
- ◆ Max. Key Current

- ◆ Functions through driver LCD1

1 ... 8 non-used key positions are  
 1 ... 8 software-masked-out - or ignored if applicable  
 Source  
 Drain  
 2 K $\Omega$   
 100 K $\Omega$   
 Vcc  
 < 1mA

Scan frequency: 1000 Columns / sec  
 Soft-Debounce: 32 ms typ. (through driver or application prog.)

Key Attributes, Auto Repeat, Shift, CTRL and other details:  
 → see device driver description and examples

## ADR map of module

- ◆ Base-ADR by pin programming
- ◆ Possible Base-ADRs through Inputs: ADR4,5,6,7

ADR-Bit Inputs: A4, A5, A6, A7

00H - ADR-Range: 00 ... 0F  
 10H - ADR-Range: 10 ... 1F  
 20H - ADR-Range: 20 ... 2F  
 30H - ADR-Range: 30 ... 3F  
 40H - ADR-Range: 40 ... 4F  
 50H - ADR-Range: 50 ... 5F  
 60H - ADR-Range: 60 ... 6F  
 70H - ADR-Range: 70 ... 7F  
 80H - ADR-Range: 80 ... 8F  
 90H - ADR-Range: 90 ... 9F  
 A0H - ADR-Range: A0 ... AF  
 B0H - ADR-Range: B0 ... BF  
 C0H - ADR-Range: C0 ... CF  
 D0H - ADR-Range: D0 ... DF  
 E0H - ADR-Range: E0 ... EF  
 F0H - ADR-Range: F0 ... FF

- ◆ Base-ADR +0:  
 Base-ADR +1:  
 Base-ADR +2:  
 Base-ADR +3:

OPTO-Output Port  
 OPTO-Input Port

Base-ADR +4:  
 Base-ADR +5:  
 Base-ADR +6:  
 Base-ADR +7:

-  
 -  
 -  
 -

Base-ADR +8:  
 Base-ADR +9:  
 Base-ADR +A:  
 Base-ADR +B:

Column-0, Data-Bits 0...7 = Row 0 ... 7, Non-Pressed-Key = „1“  
 Column-1                    ”  
 Column-2                    ”  
 Column-3                    ”

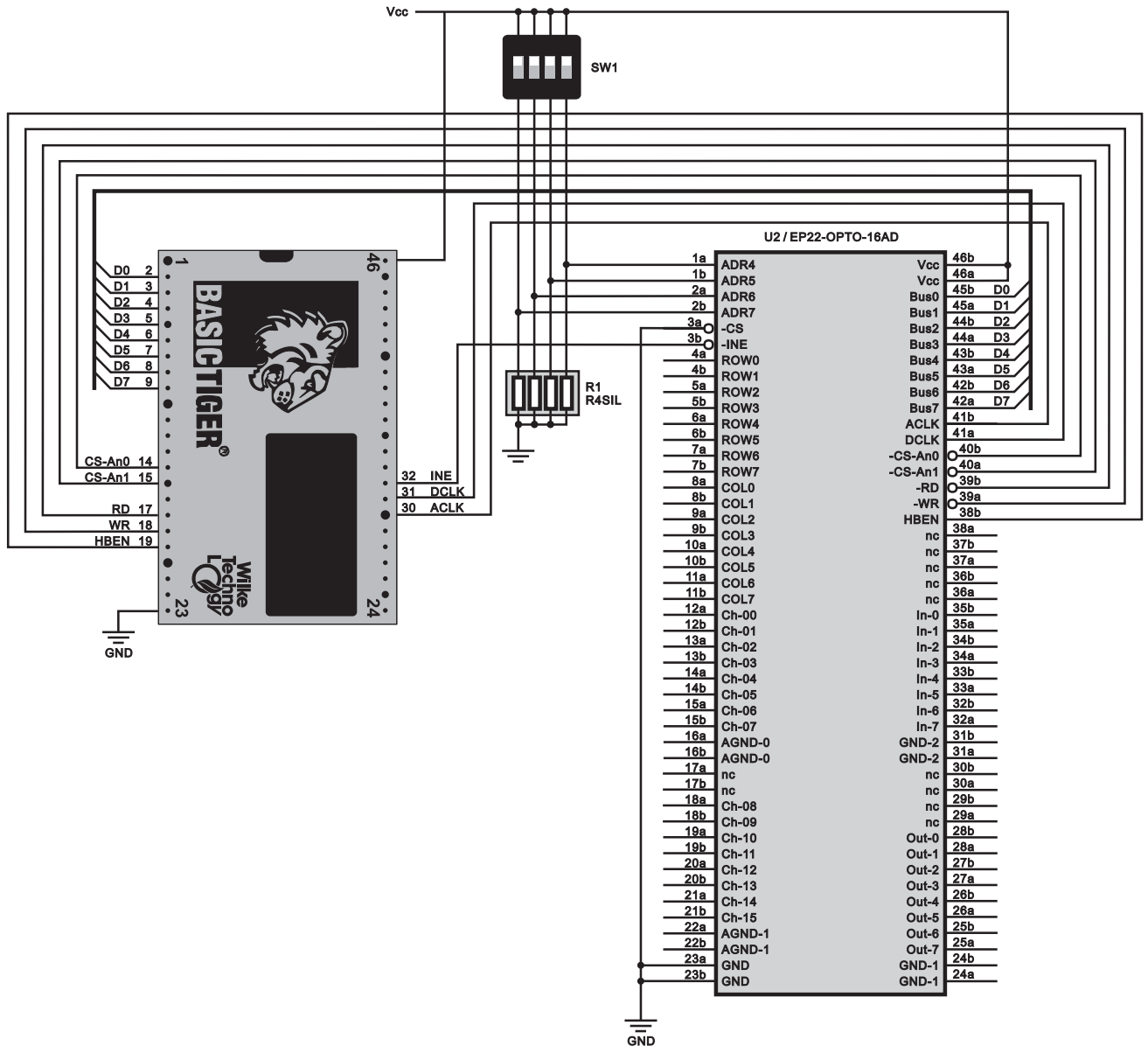
Base-ADR +C:  
 Base-ADR +D:  
 Base-ADR +E:  
 Base-ADR +F:

Column-4                    ”  
 Column-5                    ”  
 Column-6                    ”  
 Column-7                    ”

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## Connection diagram



Sample connection diagram for connecting a EP22 I/O module to a BASIC-Tiger module. The port addresses of the module start with 0 if all DIP switches are "OFF", so the lowest possible base address is set.

Data Sheet

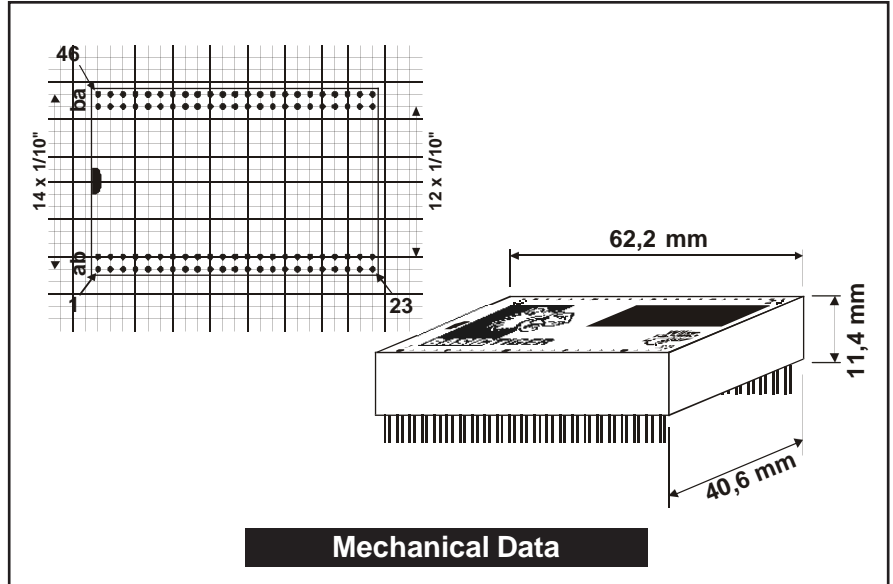
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Remarks:

CS pin is recommended to be tied to GND.



EP22 Family Modules						
Type	Analog In	Opto In	Opto Out	8x8 Matrix	Strd.	Indu.
EP20-OPTO	0	8	8	64 keys	✓	
EP21-OPTO-8AD	8	8	8	64 keys	✓	
EP22-OPTO-16AD	16	8	8	64 keys	✓	
EP20-OPTO-I	0	8	8	64 keys		✓
EP21-OPTO-8AD-I	8	8	8	64 keys		✓
EP22-OPTO-16AD-I	16	8	8	64 keys		✓

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