

# TraNET® FE 204/404

Data Acquisition Instrument



The family of modular TraNET® data acquisition instruments provides turnkey solutions to many complex measurement problems. TraNET data acquisition systems are flexible, compact and portable. They can be used to solve in situ problems in many different applications like blast, ballistics, automotive, power or transportation systems. With the Continuous Data Recorder mode, a long duration event can be stored to disk, gap free in real-time, and analysed later. If applications require complex triggering across many channels, TraNET® can help you capture sequential blocks of data, without any loss, using the unique ECR Event Controlled Recording mode. The powerful application software

TranAX® not only helps to quickly configure many acquisition channels, but also provides the right post-processing tools to analyse complex waveforms.

The TraNET® FE 204/404 can be equipped the powerful TPCE data acquisition card and is available as 4 to 16 channel device. Larger channel counts can be realized by either synchronizing several TraNET devices or with the TraNET® FE 408 DP device which available also as 32 channel instrument.

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### TraNET® FE 204

TraNET® FE 204 devices are equipped with up to two 4-channel modules or one 8-channel TPCE DAQ module.

On Single Ended modules (SE), two inputs can be linked together for having a differential input. Differential ended modules (Diff) can also be used in single ended mode by using only the positive input.

For more detailed information see the specification table.

#### Dimensions & Weight

- 234 x 76 x 289 mm
- 3.1 kg



### TraNET® FE 404

TraNET® FE 404 devices are equipped with up to four 4-channel modules or two 8-channel TPCE DAQ modules.

On Single Ended modules (SE) two inputs can be linked together for having a differential input. Differential ended modules (Diff) can also be used in single ended mode by using only the positive input.

#### Dimensions & Weight

- 234 x 115 x 289 mm
- 4.3 kg

Model Name	# of Channels		Max. Sample Rate	ADC Resolution	Memory per channel*
	SE	DIFF			
1x4S/02/16	4	2	2 MS/s	16 Bit	32 MS (128 MS)
1x4D/02/16	4	4			
2x4S/02/16	8	4			16 MS (64 MS)
1x8S/02/16	8	4	10 MS/s	14 Bit 16 Bit up to 5 MS/s	32 MS (128 MS)
1x4S/10/16	4	2			
1x4D/10/16	4	4			16 MS (64 MS)
2x4S/10/16	4	2	20 MS/s	14 Bit 16 Bit up to 5 MS/s	32 MS (128 MS)
1x8S/10/16	8	4			
1x4S/20/16	4	2			16 MS (64 MS)
1x4D/20/16	4	4	40 MS/s	14 Bit 16 Bit up to 10 MS/s	32 MS (128 MS)
2x4S/20/16	8	4			
1x8S/20/16	8	4			16 MS (64 MS)
1x4S/40/16	4	2	80 MS/s	14 Bit 16 Bit up to 20 MS/s	32 MS (128 MS)
1x4D/40/16	4	4			
2x4S/40/16	8	4			16 MS (64 MS)
1x8S/40/16	8	4	120 MS/s	14 Bit 16 Bit up to 60 MS/s	32 MS (128 MS)
1x4S/80/16	4	2			
1x4D/80/16	4	4			16 MS (64 MS)
2x4S/80/16	8	4	240 MS/s	14 Bit 16 Bit up to 60 MS/s	32 MS (128 MS)
1x8S/80/16	8	4			
1x4S/120/16	4	2			16 MS (64 MS)
1x4D/120/16	4	4	240 MS/s	14 Bit 16 Bit up to 60 MS/s	32 MS (128 MS)
2x4S/120/16	8	4			
1x4S/240/16	4	2			16 MS (64 MS)
1x4D/240/16	4	4	32 MS (128 MS)		
2x4S/240/16	8	4			

TraNET® 204 FE Device Configurations

Model Name	# of channels		Max. Sample Rate	ADC Resolution	Memory per channel*
	SE	DIFF			
3x4S/02/16	12	6	2 MS/s	16 Bit	32 MS (128 MS)
2x4D/02/16	8	8			
4x4S/02/16	16	8			16 MS (64 MS)
2x8S/02/16	16	8	10 MS/s	14 Bit 16 Bit up to 5 MS/s	32 MS (128 MS)
3x4S/10/16	12	6			
2x4D/10/16	8	8			16 MS (64 MS)
4x4S/10/16	16	8	20 MS/s	14 Bit 16 Bit up to 5 MS/s	32 MS (128 MS)
2x8S/10/16	16	8			
3x4S/20/16	12	6			16 MS (64 MS)
2x4D/20/16	8	8	40 MS/s	14 Bit 16 Bit up to 10 MS/s	32 MS (128 MS)
4x4S/20/16	16	8			
2x8S/20/16	16	8			16 MS (64 MS)
3x4S/40/16	12	6	80 MS/s	14 Bit 16 Bit up to 20 MS/s	32 MS (128 MS)
2x4D/40/16	8	8			
4x4S/40/16	16	8			16 MS (64 MS)
2x8S/40/16	16	8	120 MS/s	14 Bit 16 Bit up to 60 MS/s	32 MS (128 MS)
3x4S/80/16	12	6			
2x4D/80/16	8	8			16 MS (64 MS)
4x4S/80/16	16	8	240 MS/s	14 Bit 16 Bit up to 60 MS/s	32 MS (128 MS)
2x8S/18/16	16	8			
3x4S/120/16	12	6			16 MS (64 MS)
2x4D/120/16	8	8	240 MS/s	14 Bit 16 Bit up to 60 MS/s	32 MS (128 MS)
4x4S/120/16	16	8			
3x4S/240/16	12	6			16 MS (64 MS)
2x4D/240/16	8	8	32 MS (128 MS)		
4x4S/240/16	16	8			

TraNET® 404 FE Device Configurations

\* Values in ( ) are optional

## General Specification

Connection	Ethernet 1 GBit, RJ45 front connector USB3 port for external HD
Harddisk	400 GB SSD
Power Supply	100 V - 250 V, 50/60 Hz
DC Power (Optional)	24 V DC
Power Consumption	~ 40 - 60 W (depends on the installed DAQ card)
Operating Condition	0 .. 45 °C  Rel. Humidity: - Up to 31°C: < 80% , - 31°C ..45°C: decreasing to < 50%  Max. Operating Elevation: 2'000m
Storage Temperature	-20 .. 60 °C
Channel Configuration	TraNET FE 204: 4 SE, 8 SE, 4 DIFF TraNET FE 404: 4 SE, 8 SE, 12 SE, 16 SE, 4 DIFF, 8 DIFF
Recording Modes	Scope, Multi Block, Continuous, Event Controlled Recording (ECR), Dual Sampling Rate (with ECR only)
Digital IO's (TTL)	Trigger In, Trigger Out, External Timebase In, Disarm In, Armed Out, SyncClock Out Optional: 8 Digital Marker Inputs
Synchronisation	SyncLink Port, IEEE 1588 (PTP) Optional: Internal GPS receiver
Software	TranAX 4 LE, TranAX 4 LabVIEW Instrument Driver C++/C#/Python API
Mechanical Specification	TraNET FE 204: 234 x 76 x 289 mm TraNET FE 404: 234 x 115 x 289 mm

## Device Synchronization

The synchronization of several TraNET® FE devices has always been a strength of Elsys measuring devices. With the help of the synchronization unit **SyncLink SLB-8** or **SyncLink 2.0**, several TraNET® FE devices can be precisely synchronized on a sample basis. Not only is the internal timebase of all devices synchronized, but trigger messages are also transmitted with sample accuracy.

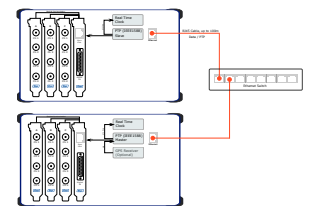
The latest generation MK3 of the TraNET® FE devices now also masters the network synchronization standard **IEEE-1588 (PTP: Precision Time Protocol)** and enables, on the one hand, much simpler synchronization topologies since no additional cables are required for synchronization and, on the other hand, the TraNET® FE devices can be easily synchronized with other data acquisition systems or devices such as high-speed cameras.



SyncLink Synchronization Box

### Specification SyncLink

- Timing precision: < 12.5 ns
- Connector/Cable: RJ45, Cat. 6
- Max Cable length: 50 m



### Specification PTP/GPS/PPS:

- Timing precision: ±2 us  
(PTP: depends on network infrastructure)
- Long time drift: 0 ppm

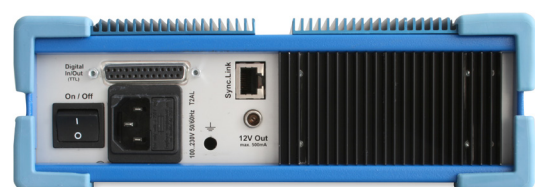
## Dust-Proof

TraNET® FE Dust-Proof devices are the perfect data acquisition instruments for dusty and muddy environment. They do not have any ventilation to the outside, preventing any air flow entering the device.

The Dust-Proof option is available for the 204 or 404 chassis type and all different sampling rates.

### Operating conditions

- Operating Temperature: 0 .. 35 °C, higher temperature possible when free air flow is applied over the instrument.
- Storage Temperature: -20 .. 60 °C
- Rel. Humidity: Up to 31°C: < 80%
- 31°C ..45°C: decreasing to < 50%
- Max. Operating Elevation: 2'000m

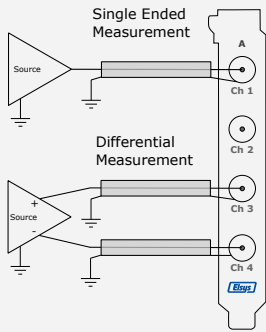


## Data Acquisition Cards

The Elsys TPCE or TPCE-LE measuring cards are used as data acquisition cards in the TraNET® FE 204 and 404. The cards are stably installed in the device and optimally cooled in order to achieve stable measurement accuracy and to guarantee a long service life for the measurement cards.

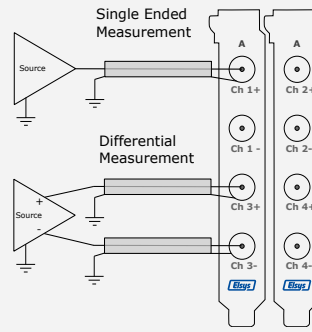
### Single-Ended vs Differential Cards

All TPCE/TPCE-LE cards are available as single-ended (SE) or differential (DIFF) versions. Depending on how many inputs are measured differentially, an SE or DIFF card is worthwhile.



Single-ended cards have one BNC connector per channel where the outside shielding is connected to chassis/protective ground.

Two neighboring channel can be configured per software as differential input stage. In this case the signal must be connected as shown aside.



Differential cards have two BNC connector per channel where the outside shielding is connected to chassis/protective ground.

Single ended measurement can be performed by just using the + input of the BNC pair.

### 4-Channel vs 8-Channel Cards

8-channel cards are less expensive, but certain resources are distributed over 8 channels that would otherwise be available for 4 channels. For example, the on-board memory for 8-channel cards is only 16 MS per channel as standard and 64 MS is available as an additional option, which would be twice as much for a 4-channel card.

In addition, the maximum data throughput in continuous mode is 160 MS/s per card. This results in a maximum of 20 MS/s per channel for 8-channel cards and 40 MS/s for 4-channel cards.

### 4-Channel

- 32 MS per Channel
- 128 MS per Channel optional
- Max Streaming 4x40MS/s
- Max Streaming LE: 4x10MS/s

### 8-Channel

- 16 MS per Channel
- 64 MS per Channel optional
- Max Streaming 8x20MS/s
- Max Streaming LE: 8x5MS/s

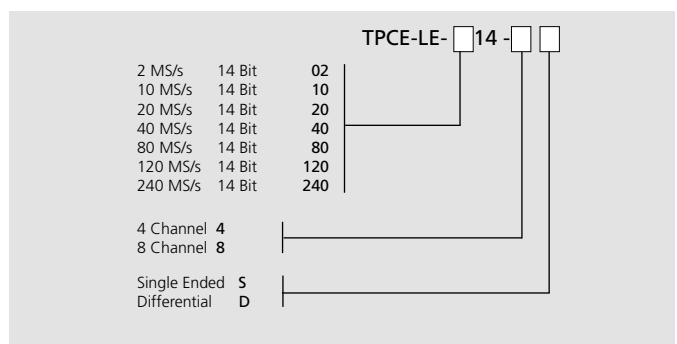
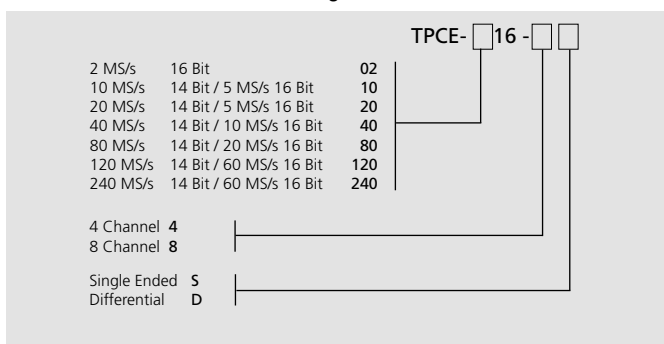
### TPCE vs TPCE-LE

All TPCE cards are available in two different edition, the standard TPCE and the TPCE-LE (Light Edition) version.

The TPCE-LE version has a reduced input range compared to the TPCE version. For fast streaming application, the TPCE version has a PCIe x4 interface which allows higher data throughput to the host computer, TPCE-LE has only a x1 interface. The ADC resolution can be set to 16 Bit at lower sampling rates which is available as option for the TPCE-LE variant. For differential measurement, the Common Mode Rejection Ratio is higher for the TPCE variant than for the TPCE-LE version.

	TPCE	TPCE-LE
<b>Input Range</b>	$\pm 50 \text{ mV} - \pm 50 \text{ V}$	$\pm 100 \text{ mV} - \pm 25 \text{ V}$
<b>PCIe Interface</b>	x4 (160 MS/s max.)	x1 (40 MS/s max.)
<b>Resolution</b>	14 / 16 Bit	14 Bit
<b>CMRR</b>	> 74 dB	> 60 dB

### TPCE and TPCE-LE Product Configurations



## Specifications

### TPCE DAQ Cards

Module Type	TPCE-24016-4	TPCE-12016-4	TPCE-8016-4/8	TPCE-4016-4/8	
Number of Input Channels SE Module	4 single ended or 2 differential software switchable		4-Channel Modules: 4 single ended or 2 differential 8-Channel Modules: 8 single ended or 4 differential		
Number of Input Channels DIF Module	4 single ended or 4 differential software switchable		4-Channel Modules: 4 single ended or 4 differential 8-Channel Modules: 8 single ended or 8 differential		
Max. Sample Rate (all channels are sampled simultaneously)	240 MHz	120 MHz	80 MHz	40 MHz	
Amplitude Resolution	16 Bit up to 60 MHz 14 Bit up to 240 MHz	16 Bit up to 60 MHz 14 Bit up to 120 MHz	16 Bit up to 20 MHz 14 Bit up to 80 MHz	16 Bit up to 10 MHz 14 Bit up to 40 MHz	
Memory 4 Channel Module	Standard: 4 x 32 MWords (= 256 MByte) Optional: 4 x 128 MWords (= 1 GByte)				
Memory 8 Channel Module	-		Standard: 8 x 16 MWords (= 256 MByte) Optional: 8 x 64 MWords (= 1 GByte)		
<b>Input Amplifier</b>					
Measurement Ranges	±50 mV – ±50 V resp. 0.1 V – 100 V (100 V limited to 70 V) in 1, 2, 5 Steps				
Offset	0 – 100 % in steps of 0.1% (Resolution 0.01 %)				
Input Impedance	1 MΩ (± 0.2 %) or 50 Ω (± 0.5 %) // 26 pF (± 5 %)		1 MΩ (± 0.2 %) // 35 pF (± 5 %)		
Coupling	AC / DC software switchable (AC: -3 dB at < 5 Hz), Inputs invertible				
Bandwidth at Range ≥ 1 V	120 MHz	60 MHz	30 MHz	18 MHz	
Bandwidth at Range < 1 V	80 MHz	50 MHz	8 MHz	7 MHz	
Slew Rate (10 – 90 %) @ Range ≥ 1 V	4 ns	6 ns	13 ns	25 ns	
Slew Rate (10 – 90 %) @ Range < 1 V	6 ns	9 ns	50 ns	60 ns	
Settling Time to 1%	< 200 ns	< 200 ns	< 200ns	< 200 ns	
Low Pass Filter (RC-Filter)	2 Steps ( 1 MHz and 100 kHz) software switchable				
Antialiasing-Filter (optional)	200 Hz – 5 MHz, min. 4. order Butterworth, software setable				
Common Mode Range	Differential-Mode: ±8 V or +/-80 V at ranges. > 5 V				
Common Mode Rejection	> 74 dB (DC – 1 kHz); > 60 dB ( – 100 kHz); > 40 dB ( – 5 MHz)				
Range Error (±)	max. 0.1 % typ. 0.07 % (after autocalibration)		max. 0.1 % typ. 0.03 % (after autocalibration)		
Offset Error (±)	max. 0.1 % typ. 0.07 % (after autocalibration)		max. 0.1 % typ. 0.02 % (after autocalibration)		
Offset Drift (±)	max. (0.0100 % + 0.1 mV) per °C, typ. (0.0050 % + 0.03 mV) per °C (will be compensated by autocalibration)				
Input Noise:					
@ max. Sample Rate	< 0.250 mVrms	< 0.200 mVrms	< 0.200 mVrms	< 0.180 mVrms	*2
@ 5 MHz Sample Rate	< 0.120 mVrms	< 0.120 mVrms	< 0.120 mVrms	< 0.110 mVrms	
@ 1 MHz Sample Rate	< 0.070 mVrms	< 0.070 mVrms	< 0.070 mVrms	< 0.060 mVrms	
@ 100 kHz Sample Rate	< 0.040 mVrms	< 0.040 mVrms	< 0.040 mVrms	< 0.040 mVrms	
@ 10 kHz Sample Rate	< 0.025 mVrms	< 0.025 mVrms	< 0.020 mVrms	< 0.015 mVrms	
Signal to Noise Ratio SNR:					
@ max. Sample Rate	58 dB	60 dB	59 dB	62 dB	*3
@ 10 MHz Sample Rate	70 dB	70 dB	62 dB	68 dB	
@ 5 MHz Sample Rate	72 dB	72 dB	66 dB	70 dB	
@ 1 MHz Sample Rate	77 dB	77 dB	69 dB	74 dB	
@ 100 kHz Sample Rate	81 dB	81 dB	79 dB	82 dB	
@ 10 kHz Sample Rate	84 dB	84 dB	89 dB	90 dB	
Channel Isolation (Crosstalk) @ 10 kHz Ranges < 1V	> 74 dB		> 80 dB > 60 dB		
Special : Autocalibration	Auto adjustment of gain and offset in all measurement ranges. (Initiated by software)				
<b>Trigger</b>					
Number of Trigger Channels	4 coupled to analog inputs, pos./neg.Edge, with or without hysteresis, Window IN, Window OUT				
Advanced Trigger (Option)	On all analog inputs: Slew Rate, Pulse Width, Pulse Pause or Period (too short or too long = Missing Event), State (above / below), AND link, Product (trigger signal is calculated from 2 channels)				
External Trigger input	1 per System (TTL), pos. or neg. Edge				
Trigger Delay	-100 % (Pretrigger) to +200 % (Posttrigger) in 1 % steps				
<b>Miscellaneous</b>					
Digital Inputs (Marker)	8 (2 per analog channel) (TTL) Optocoupler Connection Box (5 to 48 V) as additional option				
Ext. Control Inputs (TTL)	Trigger, Arm/Disarm, Ext. Sampling (fmax = 10 MHz), external command to start recording				
Status Outputs (TTL)	Trigger Output, Armed (=True during recording)				
ICP® Sensor Supply (Option)	4mA Integrated Current Power for piezo sensors				

Module Type	TPCE-2016-4/8	TPCE-1016-4/8	TPCE-0516-4/8	TPCE-0216-4/8	
Number of Input Channels SE Module	4-Channel Modules: 4 single ended or 2 differential 8-Channel Modules: 8 single ended or 4 differential				
Number of Input Channels DIF Module	4-Channel Modules: 4 single ended or 4 differential 8-Channel Modules: 8 single ended or 8 differential				
Max. Sample Rate (all channels are sampled simultaneously)	20 MHz	10 MHz	5 MHz	2 MHz	
Amplitude Resolution	16 Bit up to 5 MHz 14 Bit up to 20 MHz	16 Bit up to 5 MHz 14 Bit up to 10 MHz	16 Bit up to 5 MHz	16 Bit up to 2 MHz	
Memory 4 Channel Module	Standard: 4 x 32 MWords (= 256 MByte) Optional: 4 x 128 MWords (= 1 GByte)				
Memory 8 Channel Module	Standard: 8 x 16 MWords (= 256 MByte) Optional: 8 x 64 MWords (= 1 GByte)				
<b>Input Amplifier</b>					
Measurement Ranges	±50 mV – ±50 V resp. 0.1 V – 100 V (100 V limited to 70 V) in 1, 2, 5 Steps				
Offset	0 – 100 % in steps of 0.1% (Resolution 0.01 %)				
Input Impedance	1 MΩ (± 0.2 %) // 35 pF (± 5 %)				
Coupling	AC / DC software switchable (AC: -3 dB at < 5 Hz), Inputs invertible				
Bandwidth at Range ≥ 1 V	10 MHz	5 MHz	2.5 MHz	1 MHz	
Bandwidth at Range < 1 V	6 MHz	4 MHz	2.5 MHz	1 MHz	
Slew Rate (10 – 90 %) @ Range ≥ 1 V	40 ns	70 ns	80 ns	180 ns	
Slew Rate (10 – 90 %) @ Range < 1 V	70 ns	80 ns	80 ns	180 ns	
Settling Time to 1%	< 200ns	< 200 ns	< 300 ns	< 500 ns	
Low Pass Filter (RC-Filter)	2 Steps (1 MHz and 100 kHz) software switchable				
Antialiasing-Filter (optional)	200 Hz – 5 MHz, min. 4. order Butterworth, software setable				
Common Mode Range	Differential-Mode: ±8 V or +/-80 V at ranges. > 5 V				
Common Mode Rejection	> 74 dB (DC – 1 kHz); > 60 dB (– 100 kHz); > 40 dB (– 20 MHz)				
Range Error (±)	max. 0.1 % typ. 0.03 % (after autocalibration)				
Offset Error (±)	max. 0.1 % typ. 0.03 % (after autocalibration)				
Offset Drift (±)	max. (0.0100 % + 0.1 mV) per °C, typ. (0.0050 % + 0.03 mV) per °C (will be compensated by autocalibration)				
Input Noise:					
@ max. Sample Rate	< 0.080 mVrms	< 0.080 mVrms	< 0.060 mVrms	< 0.060 mVrms	*2
@ 5 MHz Sample Rate	< 0.060 mVrms	< 0.060 mVrms	< 0.060 mVrms	-	
@ 1 MHz Sample Rate	< 0.030 mVrms	< 0.030 mVrms	< 0.030 mVrms	< 0.030 mVrms	
@ 100 kHz Sample Rate	< 0.020 mVrms	< 0.020 mVrms	< 0.020 mVrms	< 0.020 mVrms	
@ 10 kHz Sample Rate	< 0.010 mVrms	< 0.010 mVrms	< 0.010 mVrms	< 0.010 mVrms	
Signal to Noise Ratio SNR:					
@ max. Sample Rate	67 dB	70 dB	72dB	72 dB	*3 *4
@ 10 MHz Sample Rate	70 dB	70 dB	-	-	
@ 5 MHz Sample Rate	72 dB	72 dB	72 dB	-	
@ 1 MHz Sample Rate	79 dB	79 dB	79 dB	79 dB	
@ 100 kHz Sample Rate	84 dB	84 dB	84 dB	84 dB	
@ 10 kHz Sample Rate	90 dB	90 dB	90 dB	90 dB	
Channel Isolation (Crosstalk) @ 10 kHz Ranges < 1V	> 80 dB > 60 dB				
Special : Autocalibration	Auto adjustment of gain and offset in all measurement ranges. (Initiated by software)				
<b>Trigger</b>					
Number of Trigger Channels	4 or 8, coupled to analog inputs, pos./neg.Edge, with or without hysteresis, Window IN, Window OUT				
Advanced Trigger (Option)	On all analog inputs: Slew Rate, Pulse Width, Pulse Pause or Period (too short or too long = Missing Event), State (above / below), AND link, Product (trigger signal is calculated from 2 channels)				
External Trigger input	1 per System (TTL), pos. or neg. Edge				
Trigger Delay	-100 % (Pretrigger) to +200 % (Posttrigger) in 1 % steps				
<b>Miscellaneous</b>					
Digital Inputs (Marker)	8 resp. 16 (2 per analog channel) (TTL) Optocoupler Connection Box (5 to 48 V) as additional option				
Ext. Control Inputs (TTL))	Trigger, Arm/Disarm, Ext. Sampling (fmax = ¼ of the max sample rate), external command to start recording				
Status Outputs (TTL)	Trigger Output, Armed (=True during recording)				
ICP® Sensor Supply (Option)	4mA Integrated Current Power for piezo sensors				

TPCE-LE DAQ Cards

Module Type	TPCE-LE-24014-4	TPCE-LE-12014-4	TPCE-LE-8014-4/8	TPCE-LE-4014-4/8	
Number of Input Channels SE Module	4 single ended or 2 differential software switchable		4-Channel Modules: 4 single ended or 2 differential 8-Channel Modules: 8 single ended or 4 differential		
Number of Input Channels DIF Module	4 single ended or 4 differential software switchable		4-Channel Modules: 4 single ended or 4 differential 8-Channel Modules: 8 single ended or 8 differential		
Max. Sample Rate (all channels are sampled simultaneously)	240 MHz	120 MHz	80 MHz	40 MHz	
Amplitude Resolution	14 Bit up to 240 MHz (16 Bit up to 60 MHz optional)	14 Bit up to 120 MHz (16 Bit up to 60 MHz optional)	14 Bit up to 80 MHz (16 Bit up to 20 MHz optional)	14 Bit up to 40 MHz (16 Bit up to 10 MHz optional)	
Memory 4 Channel Module	Standard: 4 x 32 MWords (= 256 MByte) Optional: 4 x 128 MWords (= 1 GByte)				
Memory 8 Channel Module	-			Standard: 8 x 16 MWords (= 256 MByte) Optional: 8 x 64 MWords (= 1 GByte)	
<b>Input Amplifier</b>					
Measurement Ranges	±100 mV – ±25 V resp. 0.2 V – 50 V in 1, 2, 5 Steps				
Offset	0 – 100 % in steps of 0.1% (Resolution 0.01 %)				
Input Impedance	1 MΩ (± 0.2 %) or 50 Ω (± 0.5 %) // 26 pF (± 5 %)		1 MΩ (± 0.2 %) // 35 pF (± 5 %)		
Coupling	AC / DC software switchable (AC: -3 dB at < 5 Hz), Inputs invertible				
Bandwidth at Range ≥ 1 V	120 MHz	60 MHz	30 MHz	18 MHz	
Bandwidth at Range < 1 V	80 MHz	50 MHz	8 MHz	7 MHz	
Slew Rate (10 – 90 %) @ Range ≥ 1 V	4 ns	6 ns	13 ns	25 ns	
Slew Rate (10 – 90 %) @ Range < 1 V	6 ns	9 ns	50 ns	60 ns	
Settling Time to 1%	< 200 ns	< 200 ns	< 200ns	< 200 ns	
Low Pass Filter (RC-Filter)	2 Steps ( 1 MHz and 100 kHz) software switchable				
Antialiasing-Filter (optional)	200 Hz – 5 MHz, min. 4. order Butterworth, software setable				
Common Mode Range	Differential-Mode: ±8 V or +/-80 V at ranges. > 5 V				
Common Mode Rejection	> 60 dB (DC – 1 kHz); > 54 dB ( – 100 kHz); > 40 dB ( – 20 MHz)				
Range Error (±)	max. 0.1 % typ. 0.07 % (after autocalibration)		max. 0.1 % typ. 0.03 % (after autocalibration)		
Offset Error (±)	max. 0.1 % typ. 0.07 % (after autocalibration)		max. 0.1 % typ. 0.02 % (after autocalibration)		
Offset Drift (±)	max. (0.0100 % + 0.1 mV) per °C, typ. (0.0050 % + 0.03 mV) per °C (will be compensated by autocalibration)				
Input Noise:					
@ max. Sample Rate	< 0.250 mVrms	< 0.200 mVrms	< 0.200 mVrms	< 0.180 mVrms	*2
@ 5 MHz Sample Rate	< 0.120 mVrms	< 0.120 mVrms	< 0.120 mVrms	< 0.110 mVrms	
@ 1 MHz Sample Rate	< 0.070 mVrms	< 0.070 mVrms	< 0.070 mVrms	< 0.060 mVrms	
@ 100 kHz Sample Rate	< 0.040 mVrms	< 0.040 mVrms	< 0.040 mVrms	< 0.040 mVrms	
@ 10 kHz Sample Rate	< 0.025 mVrms	< 0.025 mVrms	< 0.020 mVrms	< 0.015 mVrms	
Signal to Noise Ratio SNR:					
@ max. Sample Rate	58 dB	60 dB	59 dB	62 dB	*3
@ 10 MHz Sample Rate	70 dB	70 dB	62 dB	68 dB	
@ 5 MHz Sample Rate	72 dB	72 dB	66 dB	70 dB	
@ 1 MHz Sample Rate	77 dB	77 dB	69 dB	74 dB	
@ 100 kHz Sample Rate	81 dB	81 dB	79 dB	82 dB	
@ 10 kHz Sample Rate	84 dB	84 dB	89 dB	90 dB	
Channel Isolation (Crosstalk) @ 10 kHz Ranges < 1V	> 74 dB		> 80 dB > 60 dB		
Special : Autocalibration	Auto adjustment of gain and offset in all measurement ranges. (Initiated by software)				
<b>Trigger</b>					
Number of Trigger Channels	4 coupled to analog inputs, pos./neg.Edge, with or without hysteresis, Window IN, Window OUT				
Advanced Trigger (Option)	On all analog inputs: Slew Rate, Pulse Width, Pulse Pause or Period (too short or too long = Missing Event), State (above / below), AND link, Product (trigger signal is calculated from 2 channels)				
External Trigger input	1 per System (TTL), pos. or neg. Edge				
Trigger Delay	-100 % (Pretrigger) to +200 % (Posttrigger) in 1 % steps				
<b>Miscellaneous</b>					
Digital Inputs (Marker)	8 (2 per analog channel) (TTL) Optocoupler Connection Box (5 to 48 V) as additional option				
Ext. Control Inputs (TTL)	Trigger, Arm/Disarm, Ext. Sampling (fmax = 10 MHz), external command to start recording				
Status Outputs (TTL)	Trigger Output, Armed (=True during recording)				
ICP® Sensor Supply (Option)	4mA Integrated Current Power for piezo sensors				

Module Type	TPCE-LE-2014-4/8	TPCE-LE-1014-4/8	TPCE-LE-0514-4/8	TPCE-LE-0214-4/8	
Number of Input Channels SE Module	4-Channel Modules: 4 single ended or 2 differential 8-Channel Modules: 8 single ended or 4 differential				
Number of Input Channels DIF Module	4-Channel Modules: 4 single ended or 4 differential 8-Channel Modules: 8 single ended or 8 differential				
Max. Sample Rate (all channels are sampled simultaneously)	20 MHz	10 MHz	5 MHz	2 MHz	
Amplitude Resolution	14 Bit up to 20 MHz (16 Bit up to 5 MHz optional)	14 Bit up to 10 MHz (16 Bit up to 5 MHz optional)	14 Bit (16 Bit Optional)	14 Bit (16 Bit Optional)	
Memory 4 Channel Module	Standard: 4 x 32 MWords (= 256 MByte) Optional: 4 x 128 MWords (= 1 GByte)				
Memory 8 Channel Module	Standard: 8 x 16 MWords (= 256 MByte) Optional: 8 x 64 MWords (= 1 GByte)				
<b>Input Amplifier</b>					
Measurement Ranges	±100 mV – ±25 V resp. 0.2 V – 50 V in 1, 2, 5 Steps				
Offset	0 – 100 % in steps of 0.1% (Resolution 0.01 %)				
Input Impedance	1 MΩ (± 0.2 %) // 35 pF (± 5 %)				
Coupling	AC / DC software switchable (AC: -3 dB at < 5 Hz), Inputs invertible				
Bandwidth at Range ≥ 1 V	10 MHz	5 MHz	2.5 MHz	1 MHz	
Bandwidth at Range < 1 V	6 MHz	4 MHz	2.5 MHz	1 MHz	
Slew Rate (10 – 90 %) @ Range ≥ 1 V	40 ns	70 ns	80 ns	180 ns	
Slew Rate (10 – 90 %) @ Range < 1 V	70 ns	80 ns	80 ns	180 ns	
Settling Time to 1%	< 200ns	< 200 ns	< 300 ns	< 500 ns	
Low Pass Filter (RC-Filter)	2 Steps ( 1 MHz and 100 kHz) software switchable				
Antialiasing-Filter (optional)	200 Hz – 5 MHz, min. 4. order Butterworth, software setable				
Common Mode Range	Differential-Mode: ±8 V or +/-80 V at ranges. > 5 V				
Common Mode Rejection	> 60 dB (DC – 1 kHz); > 54 dB ( – 100 kHz); > 40 dB ( – 1 MHz)				
Range Error (±)	max. 0.1 % typ. 0.03 % (after autocalibration)				
Offset Error (±)	max. 0.1 % typ. 0.03 % (after autocalibration)				
Offset Drift (±)	max. (0.0100 % + 0.1 mV) per °C, typ. (0.0050 % + 0.03 mV) per °C (will be compensated by autocalibration)				
Input Noise:					
@ max. Sample Rate	< 0.080 mVrms	< 0.080 mVrms	< 0.060 mVrms	< 0.060 mVrms	*2
@ 5 MHz Sample Rate	< 0.060 mVrms	< 0.060 mVrms	< 0.060 mVrms	-	
@ 1 MHz Sample Rate	< 0.030 mVrms	< 0.030 mVrms	< 0.030 mVrms	< 0.030 mVrms	
@ 100 kHz Sample Rate	< 0.020 mVrms	< 0.020 mVrms	< 0.020 mVrms	< 0.020 mVrms	
@ 10 kHz Sample Rate	< 0.010 mVrms	< 0.010 mVrms	< 0.010 mVrms	< 0.010 mVrms	
Signal to Noise Ratio SNR:					
@ max. Sample Rate	67 dB	70 dB	72dB	72 dB	*3 *4
@ 10 MHz Sample Rate	70 dB	70 dB	-	-	
@ 5 MHz Sample Rate	72 dB	72 dB	72 dB	-	
@ 1 MHz Sample Rate	79 dB	79 dB	79 dB	79 dB	
@ 100 kHz Sample Rate	84 dB	84 dB	84 dB	84 dB	
@ 10 kHz Sample Rate	90 dB	90 dB	90 dB	90 dB	
Channel Isolation (Crosstalk) @ 10 kHz Ranges < 1V	> 80 dB > 60 dB				
Special : Autocalibration	Auto adjustment of gain and offset in all measurement ranges. (Initiated by software)				
<b>Trigger</b>					
Number of Trigger Channels	4 or 8, coupled to analog inputs, pos./neg.Edge, with or without hysteresis, Window IN, Window OUT				
Advanced Trigger (Option)	On all analog inputs: Slew Rate, Pulse Width, Pulse Pause or Period (too short or too long = Missing Event), State (above / below), AND link, Product (trigger signal is calculated from 2 channels)				
External Trigger input	1 per System (TTL), pos. or neg. Edge				
Trigger Delay	-100 % (Pretrigger) to +200 % (Posttrigger) in 1 % steps				
<b>Miscellaneous</b>					
Digital Inputs (Marker)	8 resp. 16 (2 per analog channel) (TTL) Optocoupler Connection Box (5 to 48 V) as additional option				
Ext. Control Inputs (TTL))	Trigger, Arm/Disarm, Ext. Sampling (fmax = ¼ of the max sample rate), external command to start recording				
Status Outputs (TTL)	Trigger Output, Armed (=True during recording)				
ICP® Sensor Supply (Option)	4mA Integrated Current Power for piezo sensors				

\*1) At 16 bit modules, the resolution will be reduced to 14 bits at sample rates over 1/4 of the max. sample rate.

\*2) The input noise depends on the sample rate.

\*3) At 14 bit modules the SNR will be reduced by 2 dB

\*4) At 8-channel modules the SNR will be reduced by 3 dB

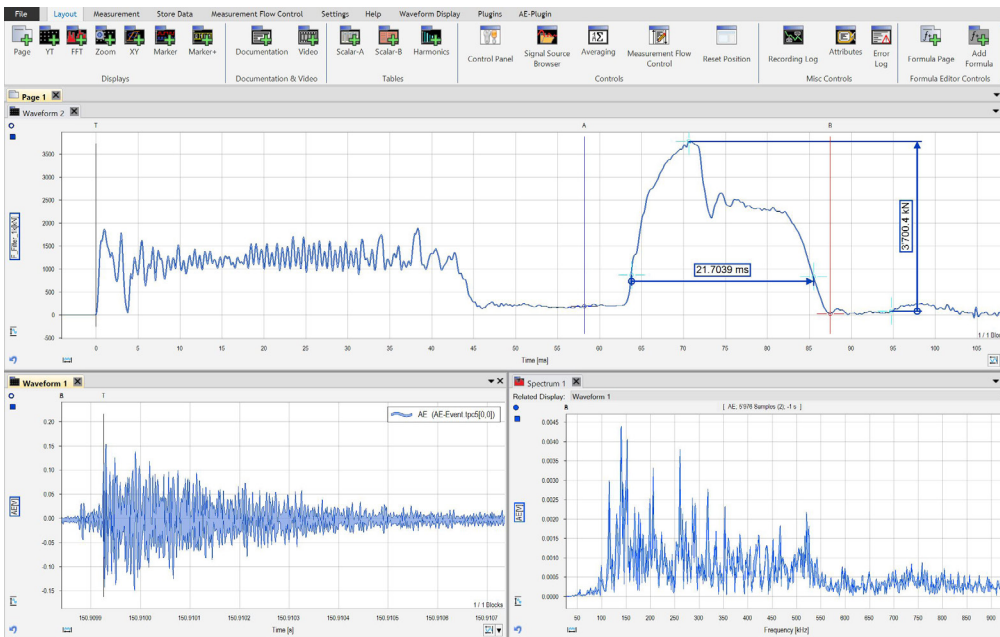
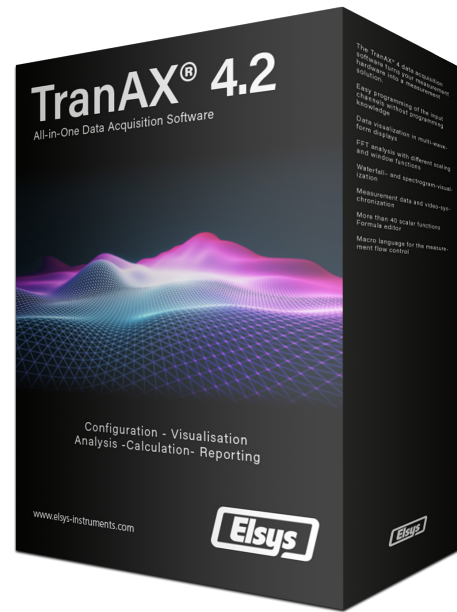


## TranAX® 4

TranAX® 4 is the universal data acquisition software from Elsys designed for all types of data acquisition cards and the turnkey TraNET® data acquisition instruments.

### Key Features

- Configures quick and easy many analog input channels, no programming required
- Data visualization in Multi-Waveform displays
- Several cursor for easy data readout and reporting
- X-Y data display
- FFT Analysis
- Spectrogram and Waterfall diagrams
- Measurement data - video synchronization
- More than 40 scalar functions to measure any significant waveform parameter on time or FFT curves
- Powerful formula editor for more than 60 mathematics functions, syntax highlighting, for-loops, array calculations, string manipulations, etc.
- Python integration
- Measurement Flow Control macro's for easy to set up, fast automated measurements
- Documentation Generator
- English, German and Chinese version



### TranAX® Waveforms

The measurement curves can be displayed individually without any programming effort. Any number of curves can be displayed per waveform. The waveforms can in turn be arranged on a page.

The envelope curve algorithm running in the background calculates reduced data sets, allowing even very large files of several GB to be displayed quickly.

### Control Panel

The Control Panel - Scope:tps.xml interface shows the following configuration:

Ch.	Name	Mode	Coupl.	Range	Offset	Input Range	Filter	Trigger Mode	Link	Level	Hyst.	Factor	Constant	Sensitivity	Phys. Range	Avg
A1	A1	SE	DC 1M	10	50	-5..5 V	Off	+Slope	OR	1V	0.5V	1	0	-	-5..5 V	14 bit
A2	A2	SE	DC 1M	10	50	-5..5 V	Off	+Slope	OR	1V	0.5V	1	0	-	-5..5 V	14 bit
A3	A3	SE	DC 1M	10	50	-5..5 V	Off	+Slope	OR	1V	0.5V	1	0	-	-5..5 V	14 bit
A4	A4	SE	DC 1M	10	50	-5..5 V	Off	+Slope	OR	1V	0.5V	1	0	-	-5..5 V	14 bit

Main Input Amplifier: Mode (Off), Coupling (DC 1M), Input Range (10 V), Offset (50.0 %), Invert (Off).

Physical Scaling: Factor (1), Sensitivity (1 V / V), Constant (0), Unit (V).

Physical Input Range: -5..5 V, Channel Name (A1).

Filter: Low Pass (OFF).

Averaging: Off (14 Bit / 16 Bit).

### Additional Tools and APIs

- Waveform Viewer
- Excel TPC5 Importer
- File Converter Tool
- ActiveX/.NET Remote
- LabVIEW Instrument Driver
- C++/C#/Python API
- Excel Report Generator

## Additional Accessories

### Digital Input/Output BNC Box

The BNC break-out box simplifies access to the additional digital control and marker signals.

Available Signals:

Trigger In, Trigger Out, Armed Out, Disarm In, Ext. Timebase In, Ext. Start In, 8x Marker In



### Precision High-Voltage Attenuators

The precision attenuators allow measurements up to 1000 V with a much higher precision than standard oscilloscope probes.

- 20 : 1, 100 : 1 and 1000 : 1 attenuators
- 2 or 3 channel per box
- up to 1000 V Vmax

### SyncLink Box

To connect several TraNET® FE, EPC or PPC devices to a large measuring system, the devices must be synchronized with each other. The SLB-8 connects up to 8 TraNET devices. All connected devices run with a sample accurate reference clock. In addition, trigger events are signaled, which means that each measurement input can be used as a trigger source for the remaining inputs on all connected devices.

