TraNET® FE
Data Acquisition Instrument

Datasheet

The TraNET FE instrument
turns your computer into a powerful **Data Acquisition System**

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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 automotive, power generation, transportation and train systems.

The TraNET system allows you to monitor a remote engine via LAN, or verify and test an injection system. 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.

General Specification

- Ethernet Connection: Gbit, RJ45 connector
- Hard disk: 200 GB SSD
- Power Supply: 100 V - 250 V, 50/60 Hz
- Power Consumption:
  - TraNET 204 max. 40 W
  - TraNET 404 max. 60 W
- Operating Temperature: 0 .. 45 °C
- Storage Temperature: -20 .. 60 °C
- Rel. Humidity: Up to 31°C: < 80%
- 31°C ..45°C: decreasing to < 50%
- Max. Operating Elevation: 2'000m
- Recording Modes: Scope, Mulit Block, Continuous, ECR
- Dual sample rate recording (with ECR only)
- Digital inputs (Markers)
  (synchronized with analog signals)
- LXI compatible
- IVI-Driver with sample programs for C++/C#, VB and LabVIEW
- Device configuration over embedded Website

Device Synchronisation

Sync-Link

In some time-critical applications it is necessary to synchronize multiple instruments with a common reference clock and a common trigger in order to compare data acquisitions across multiple devices. The TraNET Sync-Link box takes care about these two important tasks.

The Sync-Link box is available in two variants for up to 8 or 16 devices, allowing systems up to 256 inputs. The Sync-Link can also be used with the TraNET PPC or TraNET EPC devices allows systems even up to 1024 inputs.

Specification

- Timing precision: < 12.5 ns
- Connector/Cable: RJ45, Cat. 6
- Max Cable length: 10 m (longer cable on request)

GPS Synchronisation

TraNET FE devices can be equipped with a GPS receiver module for time synchronisation or location tracking.

GPS timing synchronisation allows to sync several TraNET or 3rd part measurement devices without any cable connection between them.

Specification:

- Timing precision: ±2 us
- Long time drift: 0 ppm
- 6 channel GPS C/A-code receiver
- up to 300 m distance to antenna

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 at pages 6/7.

Dimensions & Weight

- 234 x 76 x 289 mm
- 3.1 kg

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

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.

For more detailed information see the specification table at pages 6/7.

Dimensions & Weight

- 234 x 115 x 289 mm
- 4.3 kg

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

** Values in () are optional*

Device Options

DC Powered

TraNET FE devices are equipped with an internal 110/230V AC power supply. Optional the device is available with a DC power supply input. This allows to use 12 V car DC power or solar panels and battery packs.

DC powered TraNET FE are delivered with an external 110/230V AC/DC power supply for using the device at the standard main power line.

Specification:

- Input Voltage: 10 - 36 VDC
- Power Consumtion: 30 - 60 W
  (depends on installed cards)
- Powerplug: SFV 40 *(IEC 60130-9)*

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

Software

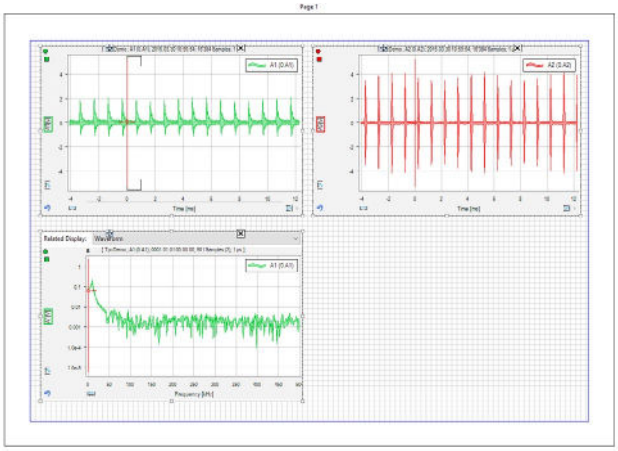
TranAX

TranAX is the universal data acquisition software from Elsys designed for TPCX/TPCE 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 width different scaling and windows function
- 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.
- Curve fitting (Polynomial regression)
- Autosequence-macro's for easy to set up, fast automated measurements
- English and German version

TranAX Waveform Display



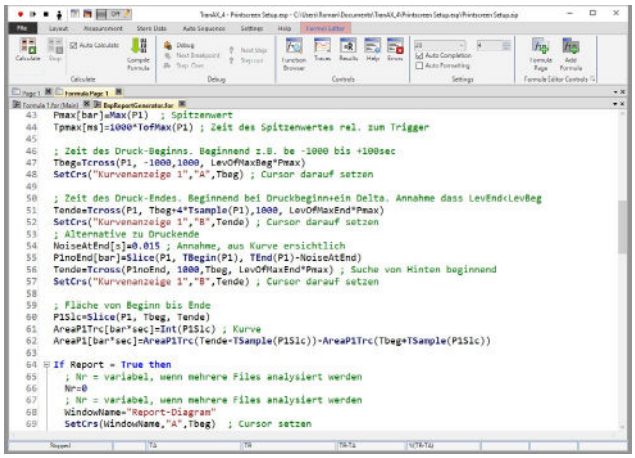
Documentation Page

LabVIEW Instrument Driver

Elsys provides a LabVIEW instrument driver which is fully compliant with the NI driver design guidelines. The instrument drivers provides the following features:

Key Features:

- Ready-made measurement flow-control VI's for scope, multliblock, continuous and ECR measurement modes
- Express VI's for amplifier and trigger settings
- VI's for data readout
- Express VI's for setup the connection to the modules/instruments

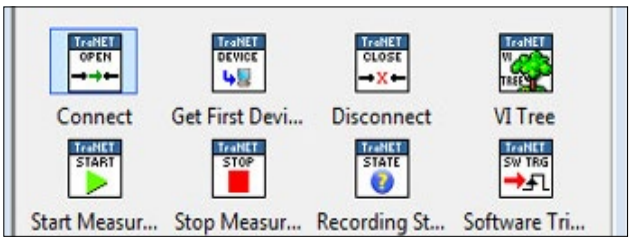


```
Pmax[bar]=Max(P1)  ; Spitzenwert
Tpmax[ms]=1000*TofMax(P1) ; Zeit des Spitzenwertes rel. zum Trigger

; Zeit des Druck-Beginns. Beginnend z.B. be -1000 bis +100sec
Tbeg=Tcross(P1, -1000,1000, LevOfMaxBeg*Pmax)
SetCrs("Kurvenanzeige 1","A",Tbeg) ; Cursor darauf setzen

; Zeit des Druck-Endes. Beginnend bei Druckbeginn+ein Delta. Annahme dass LevEnd<LevBeg
Tende=Tcross(P1, Tbeg+4*Tsample(P1),1000, LevOfMaxEnd*Pmax)
SetCrs("Kurvenanzeige 1","B",Tende) ; Cursor darauf setzen
; Alternative zu Druckende
NoiseAtEnd[-]=0.015 ; Annahme, aus Kurve ersichtlich
P1noEnd[bar]=Slice(P1, TBegin(P1), TEnd(P1)-NoiseAtEnd)
Tende=Tcross(P1noEnd, 1000,Tbeg, LevOfMaxEnd*Pmax) ; Suche von Hinten beginnend
SetCrs("Kurvenanzeige 1","B",Tende) ; Cursor darauf setzen

; Fläche von Beginn bis Ende
P1Slc=Slice(P1, Tbeg, Tende)
AreaP1Trc[bar*sec]=Int(P1Slc) ; Kurve
AreaP1[bar*sec]=AreaP1Trc(Tende-TSample(P1Slc))-AreaP1Trc(Tbeg+TSample(P1Slc))

If Report = True then
  ; Nr = variabel, wenn mehrere Files analysiert werden
  Nr=0
  ; Nr = variabel, wenn mehrere Files analysiert werden
  WindowName="Report-Diagram"
  SetCrs(WindowName,"A",Tbeg)  ; Cursor setzen
```

Formula Editor for Post-Processing

C++/C# TpcAccess API

TpcAccess API is based on a client/server architecture and can be integrated in any custom specific software. It handles all network traffic and synchronisation task when several clients are connected to the same device.



Elsys Tool Box in LabVIEW

TPCE Module Specification

Module Type	TPCE-24016-4	TPCE-12016-4	TPCE-8016-4	TPCE-4016-4	
Number of Input Channels SE Module	4 single ended or 2 differential software switchable		4 single ended or 2 differential software switchable		
Number of Input Channels DIF Module	4 single ended or **4 differential** software switchable		4 single ended or **4 differential** software switchable		
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 (per Module)	Standard: 4 x 32 MWords (= 256 MByte) Optional: 4 x 128 MWords (= 1 GByte)				
Input Amplifier					
Measurement Ranges	±50 mV – ±50 V rsp. 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 @ 5 MHz Sample Rate @ 1 MHz Sample Rate @ 100 kHz Sample Rate @ 10 kHz Sample Rate	 < 0.250 mVrms < 0.120 mVrms < 0.070 mVrms < 0.040 mVrms < 0.025 mVrms	 < 0.200 mVrms < 0.120 mVrms < 0.070 mVrms < 0.040 mVrms < 0.025 mVrms	 < 0.200 mVrms < 0.120 mVrms < 0.070 mVrms < 0.040 mVrms < 0.020 mVrms	 < 0.180 mVrms < 0.110 mVrms < 0.060 mVrms < 0.040 mVrms < 0.015 mVrms	*2
Signal to Noise Ratio SNR: @ max. Sample Rate @ 10 MHz Sample Rate @ 5 MHz Sample Rate @ 1 MHz Sample Rate @ 100 kHz Sample Rate @ 10 kHz Sample Rate	 59 dB 62 dB 66 dB 69 dB 79 dB 89 dB	 62 dB 68 dB 70 dB 74 dB 82 dB 90 dB	 67 dB 70 dB 72 dB 76 dB 84 dB 92 dB	 70 dB 70 dB 72 dB 76 dB 84 dB 92 dB	*3
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)				
Trigger					
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				
Miscellaneous					
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)				
Input Amplifier					
Measurement Ranges	±50 mV – ±50 V rsp. 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 @ 5 MHz Sample Rate @ 1 MHz Sample Rate @ 100 kHz Sample Rate @ 10 kHz Sample Rate	 < 0.080 mVrms < 0.060 mVrms < 0.030 mVrms < 0.020 mVrms < 0.010 mVrms	 < 0.080 mVrms < 0.060 mVrms < 0.030 mVrms < 0.020 mVrms < 0.010 mVrms	 < 0.060 mVrms < 0.060 mVrms < 0.030 mVrms < 0.020 mVrms < 0.010 mVrms	 < 0.060 mVrms - < 0.030 mVrms < 0.020 mVrms < 0.010 mVrms	*2
Signal to Noise Ratio SNR: @ max. Sample Rate @ 10 MHz Sample Rate @ 5 MHz Sample Rate @ 1 MHz Sample Rate @ 100 kHz Sample Rate @ 10 kHz Sample Rate	 67 dB 70 dB 72 dB 79 dB 84 dB 90 dB	 70 dB 70 dB 72 dB 79 dB 84 dB 90 dB	 72dB - 72 dB 79 dB 84 dB 90 dB	 72 dB - - 79 dB 84 dB 90 dB	*3 *4
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)				
Trigger					
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				
Miscellaneous					
Digital Inputs (Marker)	8 rsp. 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				

*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

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