TraNET® FE

High Speed Data Acquisition Device

User Manual

TraNET FE 204
TraNET FE 404
TraNET FE 408 DP
TraNET FE Rack

Elsys

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Legal Notice

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Warning

Lethal voltages exist inside the TraNET instrument. Only qualified technicians of supplier staff are authorized to open the TraNET case. Otherwise warranty will be lost!

Always ensure that power cord is removed before opening the case.

Safety Information

This instrument is intended for indoor use and should be operated in a clean, dry environment. Do not block any ventilation openings.

Make sure this product's operating environment is kept within the parameters as specified in the chapter Operating Condition!

The design of the instrument has been verified to conform to the EN 61010-1 safety standard per the following limits:

- Installation (Over voltage)
- Category II (Main Supply Connector) and Category I (Measuring Terminals)
- Pollution Degree 2
- Protection Class I

Content

1. Introduction

1.1 TraNET Variants

Depending on the number and type of channels, there are a number of different models. These devices operate as LAN servers. For operation, an Ethernet connection to a client computer (e.g. a notebook PC) is required to configure the measurement settings. The measurement itself can also be performed autonomously without an external connection.

TraNET FE 204

TraNET FE 404

TraNET FE 204 with Dust-Proof option

TraNET FE Rack

TraNET FE 408 DP

1.2 Client PC Requirements

For using the data acquisition software TranAX, the following minimal client computer configuration should be advised:

- PC (Notebook, Desktop PC, IPC etc.)
- Intel i5 or better (at least 2.0 GHz recommended)
- Full HD Graphic display 1920x1080 pixels or higher
- 4 GB RAM minimum, recommended 8 GB
- Hard disk with sufficient free space for programs and possible storage of measuring data (at least 100 GB recommended)
- GBIT Ethernet port
- Windows 10/11 Professional, 64 Bit

1.3 Basic Mode of Operation

TraNET FE devices are based on an embedded microcomputer with a hard disk, a Gigabit Ethernet controller and a PCIe bus interface to control the installed TPCE-Modules. The firmware runs under a Linux operating system.

TraNET FE operates via Ethernet Link as a TCP/IP Server. A simple point to point connection to a client PC (e.g. Notebook PC) allows an easy installation. Otherwise it can be connected to any existing LAN and allows remote operation. For establish a WIFI connection, an additional WIFI router must be used.

There are four different operation modes in which the data acquisition instrument can be used. Any of these operation modes are ready to use in all driver interfaces or in the Application software.

Scope

In Scope mode the device runs like an Oscilloscope. Incoming data from the ADC are written into the on-board memory until a trigger condition occurs. After the trigger condition, the measurement continuous until the post-trigger time is over and stops. The length of the measurement is limited by the maximum memory available on the TPCE board.

Multi-Block

Multi-Block Mode works like the Scope mode but with the addition that the available on-board memory is splitted up in several blocks. On each trigger, a new part of the memory is used. This way, the on-board memory can be used more effective than in the Scope mode. The maximum number of blocks is limited by the block size and the available memory.

Continuous

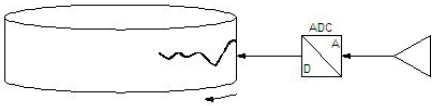
In the Continuous mode incoming data from the ADC's are buffered on the on-board memory an then transfered immediately to the built-in hard disk of the device. The maximum recording length is only limited by the hard disk size. The amount of data produced per second depend on the used sampling rate and the number of activated channels. If the data rate is higher than the PCIe interface or the hard-disk write throughput, some data from the on-board buffer get lost.

ECR (Event Controlled Recording)

(This mode is optional)

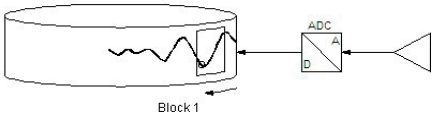
The ECR mode allows targeted acquisition of cyclic or sporadically arising events. This implies that the registration of measuring data only occurs if certain signal conditions (trigger, time window, repetitions, etc.) are fulfilled. Thus many unwanted and unneeded signal data will not be stored.

The digitalized signal will be stored to the on-



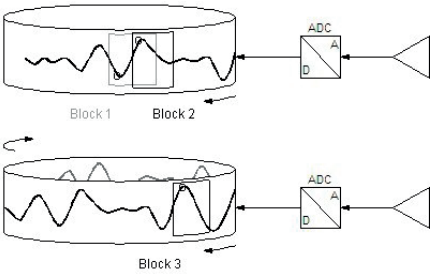
board memory which acts as a ring buffer.

As soon as the trigger is released, a block of



samples will be read from the ring buffer and will be saved to the hard disk.

If a new trigger event within the actual block occurs, a new overlapping block will be saved. If the ring buffer is full, the oldest measurement data will be overwritten with new incoming data. Usually, the overwritten data would be transferred to the hard disk before this happens. If too many events occur in a period of time, the ring buffer may overflow.



ECR Dual Mode

An other feature of ECR is the “Dual Mode”. It allows to store a continuous measurement at a slower sampling rate than the captured blocks. For example fast transient can be captured at 10 MS/s by the triggered blocks while storing slower signals at 100 kHz over a long period of time.

2. PC Connection Guide

The TraNET device communicates over an Ethernet connection with the client PC. This section describes all important points for setting up the connection successfully.

2.1 IP Address Configuration

The factory default adress configuration of a TraNET FE is

Static IP 192.168.0.33

In order to setup up a connection to the TraNET FE device, the client computer must be configured to a static IP address in the same IP range, for example 192.168.0.34. Once a successful connection is established, the IP configuration can be changed on the device web page by typing the IP address of your device in your web browser.

2.2 DHCP

For using a connected DHCP server, activate "DHCP" on the LAN Configuration page and press on "Save". The device will reboot and tries to get a valid IP address from the DHCP server. If the device does not obtain a valid IP address from a DHCP server, the device will assign an Auto IP address in the address range from 169.254.0.0 to 169.254.255.255.
If device is connected to a Windows client through a 1:1 connection, Windows will assign automatically an IP address in the same range as the TraNET.

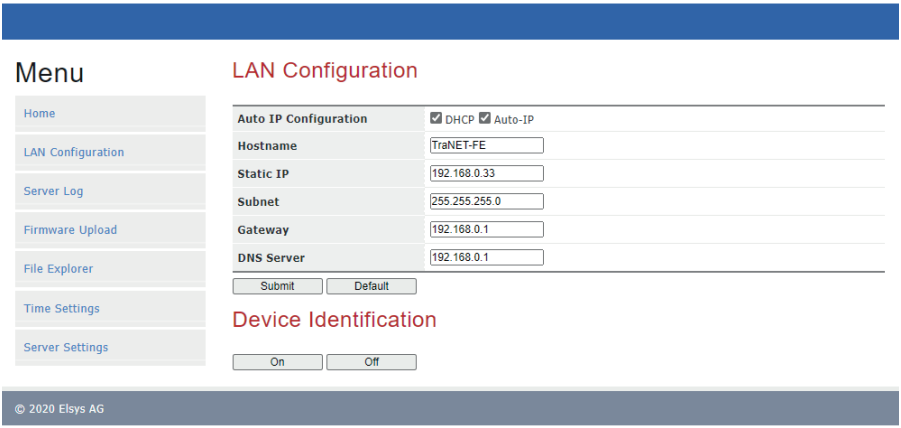
You can't connect to the device?

Someone has maybe already changed the IP address already. Set the device to DHCP and AUTO IP mode:

- Switch off the TraNET FE device, press and hold the button in the hole next to the LED "Ready", power-on the device and wait until the LED "Ready" blinks permanently.

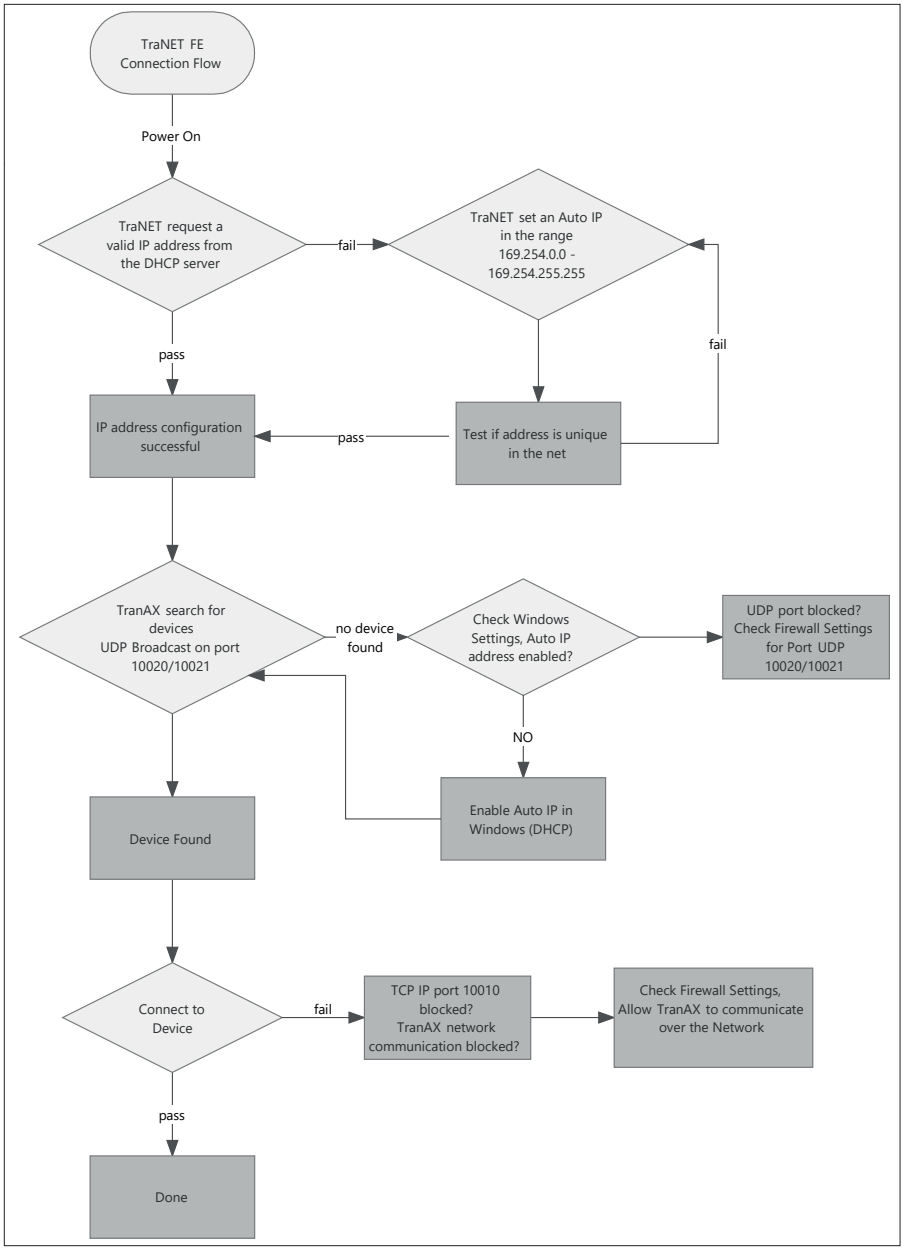
  Alternatively, the button can also be pressed during runtime for at least 4 seconds. LED "Ready" will stop flashing (stays green or off). DHCP and Auto-IP will be set, after approx. 10 seconds. The green LED "Ready" starts flashing again. IP Settings now have changed to DHCP and AUTO IP mode.

- Network settings on the computer have to be set to DHCP too!



LAN Configuration Website

By clicking on the “On” button under “Device Identification” the NET LED on the device will starting blinking. This can be used for verifying that you are connected to the right device. Click on “Off” for leaving the blinking mode



Ethernet Troubleshooting Flowchart

3. Network Drive

The data from the internal SSD or external USB drive can be accessed over a shared network drive. Just type:

"\\IPAddress" (ex. \\192.168.0.33)

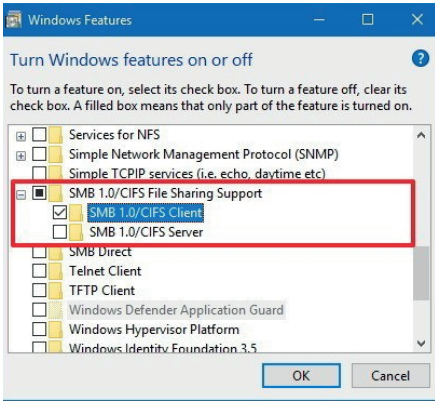
in your address field of the Windows File Explorer and you will see the shared folder "Measurement Data".

If a password request is shown, just type "Elsys" as user without any password.

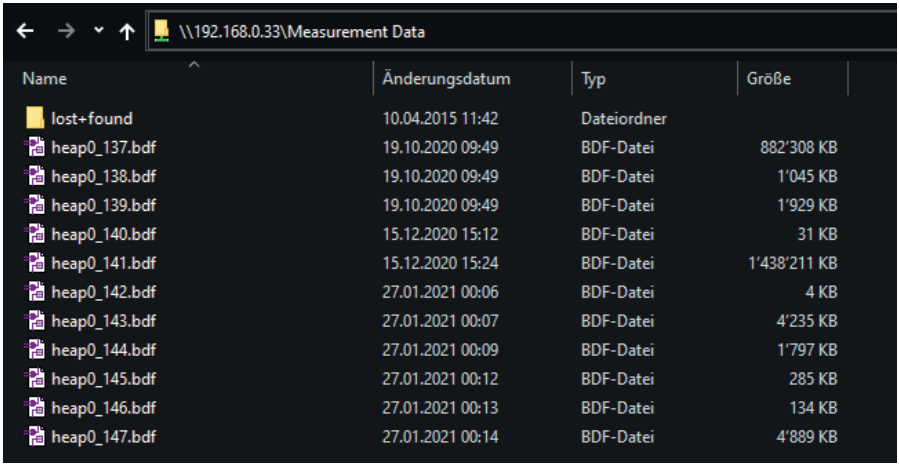
Files generated during the measurement are named with the extension .tmp and can't be removed. They will be renamed after terminating the measurement.

3.1 SMB 1.0 Access

TraNET devices of the generation 2 are using the samba file sharing protocol SMB 1.0. This version is not longer supported by Windows 10 by default. For accessing Gen. 2 devices, the SMB 1.0/CIFS client support must be activated manually in the Windows Feature Settings:



Enable SMB 1.0 on Windows 10 or newer



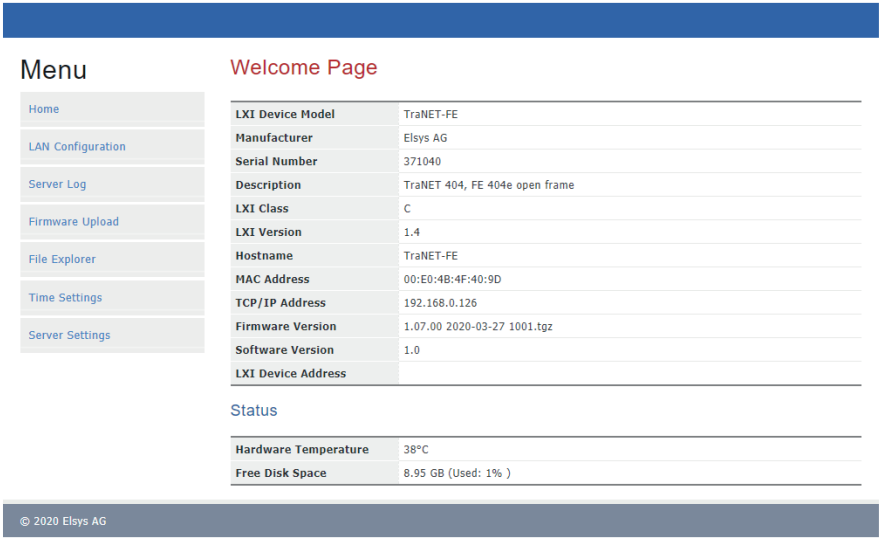
Measurement data heap files on the network drive

4. Device Configuration

Several device settings can be changed over the built-in web page as mentioned in the IP configuration chapter. The web page can be accessed over

http:\\IPAddress

The welcome page shows device information, LAN configuration status, Firmware version and general hardware state like CPU temperature.



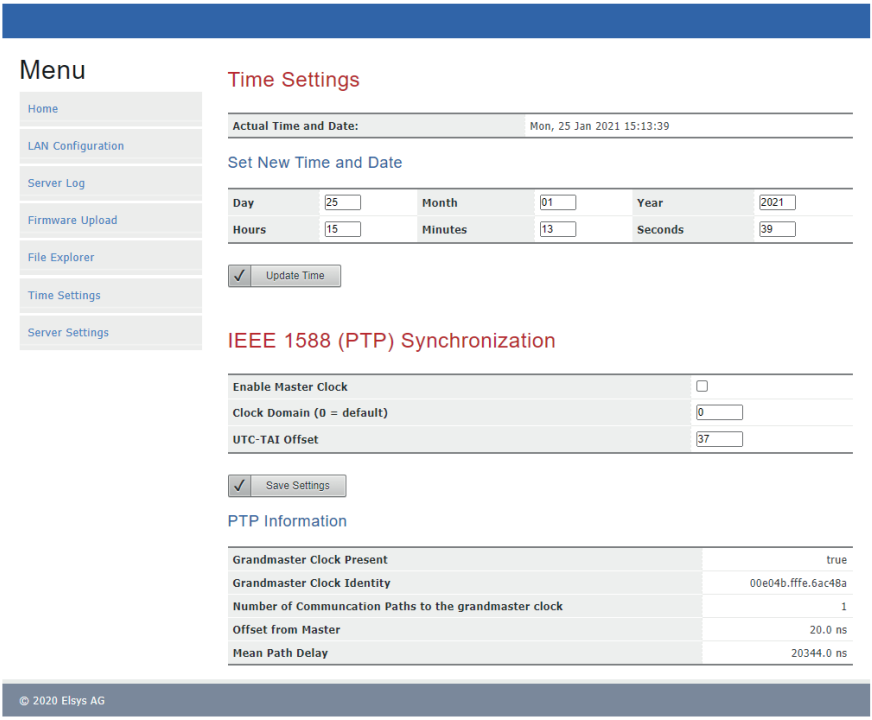
Startup web page on the TraNET FE device

4.1 Time and Synchronization

The TraNET FE device is equipped with a real time clock which is battery driven. This time is used for:

- Generating the “Last calibrated on” time stamp
- Generating timestamps for log entries in the system log file
- Base-time for the measurement start and trigger time if the measurement is started by autostart.

By default, the absolute measurement start time is taken from the client computer from which the measurement is started (normally the computer on which TranAX is running). See “Use Local Time” on the Server Settings Page for using the TraNET FE real time clock as reference.



Time settings configuration page

IEEE 1588 (PTP) Synchronization

With the release of the MK3 of the TraNET FE device, it is possible to synchronize several TraNET FE or 3rd part devices with the help of the PTP time synchronization protocol.

The TraNET FE can either be the master clock or a client clock. If any master clock is available in the network, the TraNET FE will automatically sync on that clock, when the clock is running in the same clock domain.

Settings:

- Enable Master Clock: The TraNET FE device will act as grandmaster clock source
- Clock Domain: Only clocks running in the same clock domain get synchronized
- UTC-TAI Offset: PTP is based on the TAI time. The RTC is UTC. This parameter compensates the time difference between these two clocks. In 2021, the offset is 37s.

PTP Status Information:

- Grandmaster Clock Present: true if a grandmaster clock was detected and synchronized.
- Grandmaster Clock Identity: The ID of the grandmaster clock or the ID of the own clock if the clock from the device act as grandmaster.
- Number of Communication Paths: shows how many connection path exist between the device and the grandmaster clock.
- Offset from the Master: Indicated the actual time difference between the device clock and the master clock.
- Mean Path Delay: Travel delay of any network package between the device and the master clock.

In order to use the PTP as time reference for a measurement in TranAX, the following additional settings must be set up:

- Activate “Use Local Time” on the Server Settings Page
- Activate “PPS Sync” in the Control Panel of TranAX
- Select “Ethernet (PTP)” as Pulse per Second Source on the Server Settings Page.

By activating the “PPS Sync”, the measurement is started precisely on the Pulse per Second signal from the PTP hardware, for having exact starting times on each connected device.

The precision and stability of the PTP synchronization depends on the used network devices (switch, routers, cables) and traffic load on the network!

4.2 Measurement Settings

Device

- Name: Set the device name as visible in TranAX
- Description: Additional information about the device helping to identify the device in the network.
- Server port: TCP Port, should only be changed if it is in conflict with another application in the network. Default 10010

Measurement Settings

- BDF File Path: select if BDF files are stored to the internal or the external USB drive.
- Nr. Of BDF Files: Defines how many old heap files will be preserved when several consecutive measurements were started. If set to 0, on each new continuous or ECR measurement the last heap file gets overwritten.
- Auto Start at Power Up: The device starts the measurement automatically with the last settings when the device powers up.
- Start Autosequence at Power Up: If any remote autosequence/MFC are stored on the device, enabling this option will automatically start the autosequence after power up.
- Use Local Time: if enabled, the absolute measurement time is taken from the device real time clock (RTC), otherwise the client computer from which the measurement is started acts as time reference.

For using PTP or GPS synchronization, option must be enabled!

Synchronization Settings

- SyncLink 2 extra Delay: Additional delays for compensating daisy-chained SyncLink 2 connection.
- Pulse Per Second (PPS) Source:
  Selects the source of the PPS signal for timebase synchronization: -
  Ethernet (PTP) uses the PPS from the PTP hardware
  - GPS (internal) uses the PPS from the integrated GPS receiver (Optional)
  - External Timebase Input for using any external PPS signal connected to the Ext-IO input "External Timebase".

Attention: For using the PPS synchronization,"PPS Sync" must be activated on the TranAX Control Panel.

2-in-1 Configuration

2in1 mode allows splitting up the device in 2 independent devices. The device must be built up with at least two TPCE cards. One card can be separated from the rest of the device. This option is only available on request.

- Option Code: a valid option code is needed for enabling 2in1
- Enable: activates 2in1
- Board Number: selects which board is split from the main device setup.
- 2in1 Server Port 2: communication port for the second device, default 10011

LXI Trigger Settings

TraNET FE device can be either source or receiver of UDP-based LXI trigger messages. The configuration of the trigger is done in the control panel of TranAX.

- LXI Trigger Broadcast address:
  The UDP address at which the trigger message will be sent to.
- LXI Trigger Master address: not used.

Advanced Settings

The advanced settings configures some low level device parameters for continuous or ECR measurement.

- Memory Page Size: Defines the chunk size at which measurement data are stored in the BDF file. Max allowed size is 512k. At slow sampling rates, this value can be lowered for storing the data more often to the disk.

- Number of Pages: Number of page reserved by default in the device memory.

- Max Number of Pages: Maximum number of pages allowed to be reserved for the measurement buffer.

- Save Interval Time in seconds: time interval at which the buffered memory page are stored to the disk even if the page size is not reached.

- Enable Hardware ECR Retrigger: Enables the hardware retrigger block for having lower system load during fast trigger bursts.

Measurement Settings

Device

Name	TraNET-FE
Description	TraNET FE 404
Server Port	10010
Simulate Hardware	☐

Measurement Settings

BDF Recording Path	Internal Storage
Nr. of BDF Files	3
Auto Start at Power Up	☐
Start Autosequence at Power Up	☐
Autosequence Tpc5 Data Path	
Use Local Time	☐

Synchronization Settings

SyncLink 2 extra Delay	0
Pulse per Second (PPS) Source	Ethernet (PTP)

✓ Save

2in1 (Board of 2nd Device)

Option Code	
Enable	☐
Board Number	1
2in1 Server Port 2	10011

LXI Settings

LXI Trigger Broadcast Address	224.0.0.1
LXI Trigger Master Address	

Advanced Settings

Attention: Changes in these settings can influance the performance of your measurement system!

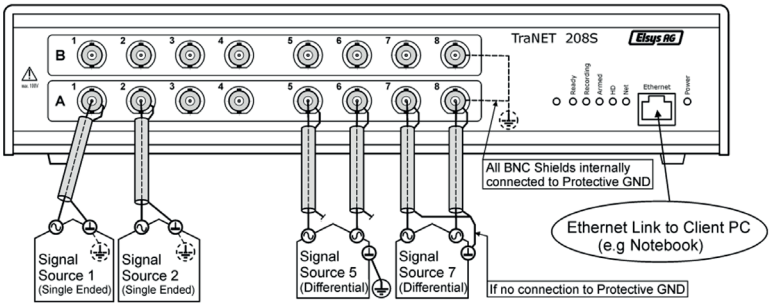
Memory Page Size	131072
Number of Pages	128
Max Number of Pages	256
Save Interval Time (in s)	130
Enable Hardware ECR Retrigger	☐

General device and measurement settings

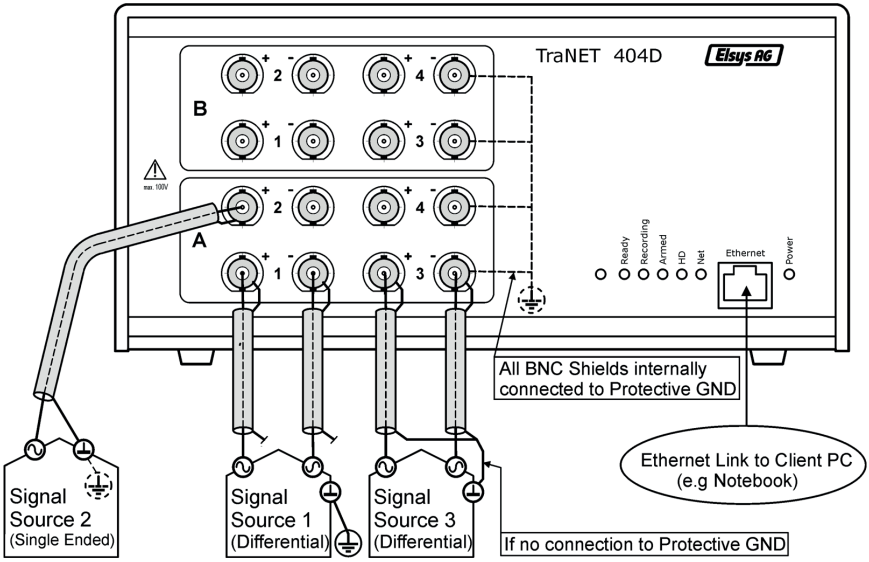
5. Hardware Specification

5.1 Signal Inputs, Pin Assignments

Analog Inputs



TraNET FE with Single Ended Inputs
Channel 5 (6), 7 (8) are configured by software to differential inputs.
BNC 5, 7 = Positive, 6,8 = Negative inputs.



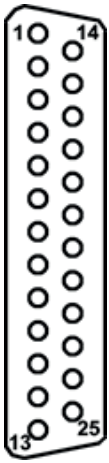
TraNET FE with Differential Inputs
Channel 2 is used as single ended input. The corresponding negative input can be left open or shorted.

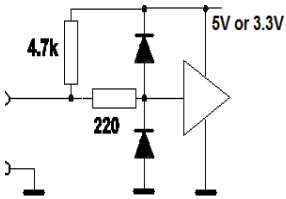
Read View (e.g. TraNET 204)

Digital In / Out / Marker

D-SUB Connector 25 pol. Female

Pin		Pin Name	Description	Spec.
1		Trigger out		5 V TTL
	14	Armed out (active low) Sync Clock out	Functionality set in TranAX	5 V TTL
2		-	Reserved	
	15	Disarm in (active low)		5 V Pull-Up
3		Start Record in		5 V Pull-Up neg. Slope
	16	Trigger in		5 V Pull-Up
4		Timebase in or PPS source	Fmax = ¼ of the max. sample rate	5 V Pull-Up
	17	+5V		
5		GND		
	18	A1	Marker Inputs (optional)	3.3 V Pull-Up
6		A2		
	19	A3		
7		A4		
	20	A5		
8		A6		
	21	A7		
9		A8		
	22	B1		
10		B2		
	23	B3		
11		B4		
	24	B5		
12		B6		
	25	B7		
13		B8		



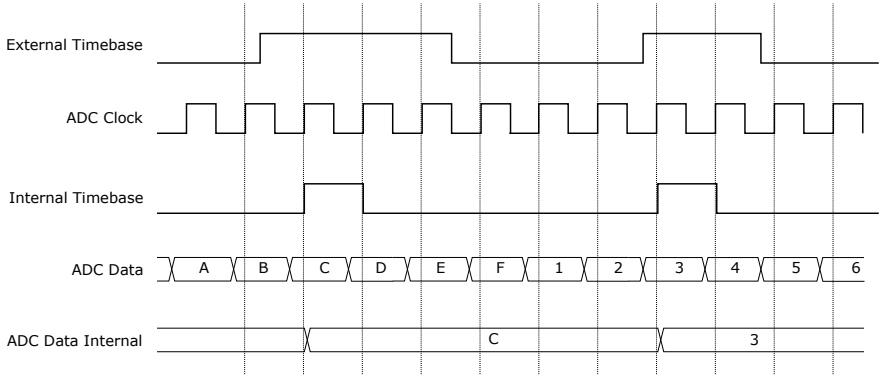


Input protection on all digital Inputs and Outputs: Maximum 10 V

External Timebase

The External Timebase can be used for capturing the measurement data at a specific moment. The external timebase is not a reference clock but will be synchronized to the internal ADC sampling clock. Therefor the external timebase must be at least two time slower than the ADC clock.

If the External Timebase is used as PPS source, the timebase functionality is disabled.



5.2 USB Interface

Starting with revision 3 of the TraNET FE, the device provides a USB 3 interface for connecting any external storage devices like USB sticks or USB SSD drives.

The external drive can be used as backup drive for copy internal BDF files from continuous measurements if no fast Ethernet connection is available. It is also possible to set the external drive as standard drive for storing the BDF file directly during the measurement.

Maximum data throughput depends on the used external drive. In all cases, only USB Gen. 3.x devices must be used!

External Drives must be formated in exFAT file format!

5.3 Operating Condition

Specification	TraNET 204 TraNET 404 TraNET Rack	TraNET 408 DP or Option DP	Option DP AC
Operating Temperature:	0 – 45° C	0 – 35° C	-20° – 50° C
Storage Temperature:	-20 – 60° C		
Rel. Humidity:	humidity < 80%, non condensing		
Max. Operating Elevation:	2'000 m		

5.4 EMC Condition

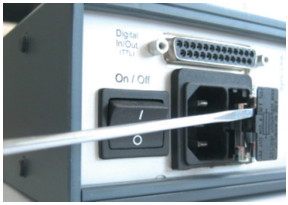
Emission
The TraNET FE is suitable for use in domestic establishments (Class B) and in establishments directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

Attention: The emission limits can be exceed the limits allowed by Class B when external components are attached to the device.
In order to comply with the limits, the housing must be grounded via the additional ground connection on the rear side of the device.

Connected sensors must be grounded so that the cable shield is closed.

Immunity
The TraNET FE is design for an Industrial electromagnetic environment.

Applied standard: EN 61326-1



Changing the inlet protection fuse

5.5 Power Supply

AC (internal) Power Supply:
100 - 240 V, 50/60 Hz

DC External Power Supply:
24 V DC

DC devices must be used by the delivered external power supply of type:
Mean Well GST120A24

Power Consumption:
- TraNET 204 max. 40W
- TraNET 404 max. 60W
- TraNET 408 DP max. 120W

Inlet Protection Fuse
(AC variants only)
Type 5x20mm, the indicated type with labeled rated values must be used only.
There is one fuse active only. The other place may contain a spare fuse.

5.6 Dimensions

Case	Dimensions (WxHxD)	Weight
TraNET 204	234 x 76 x 289 mm	3.1 kg
TraNET 404	234 x 115 x 289 mm	4.3 kg
TraNET Rack	482 x 132 x 450 mm	8.5 kg
TraNET 408 DP	328 x 115 x 289 mm	6.2 kg

6. Data Acquisition Card Specification

6.1 TPCE DAQ Card

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)		
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	 58 dB 70 dB 72 dB 77 dB 81 dB 84 dB	 60 dB 70 dB 72 dB 77 dB 81 dB 84 dB	 59 dB 62 dB 66 dB 69 dB 79 dB 89 dB	 62 dB 68 dB 70 dB 74 dB 82 dB 90 dB	*3
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)				
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				

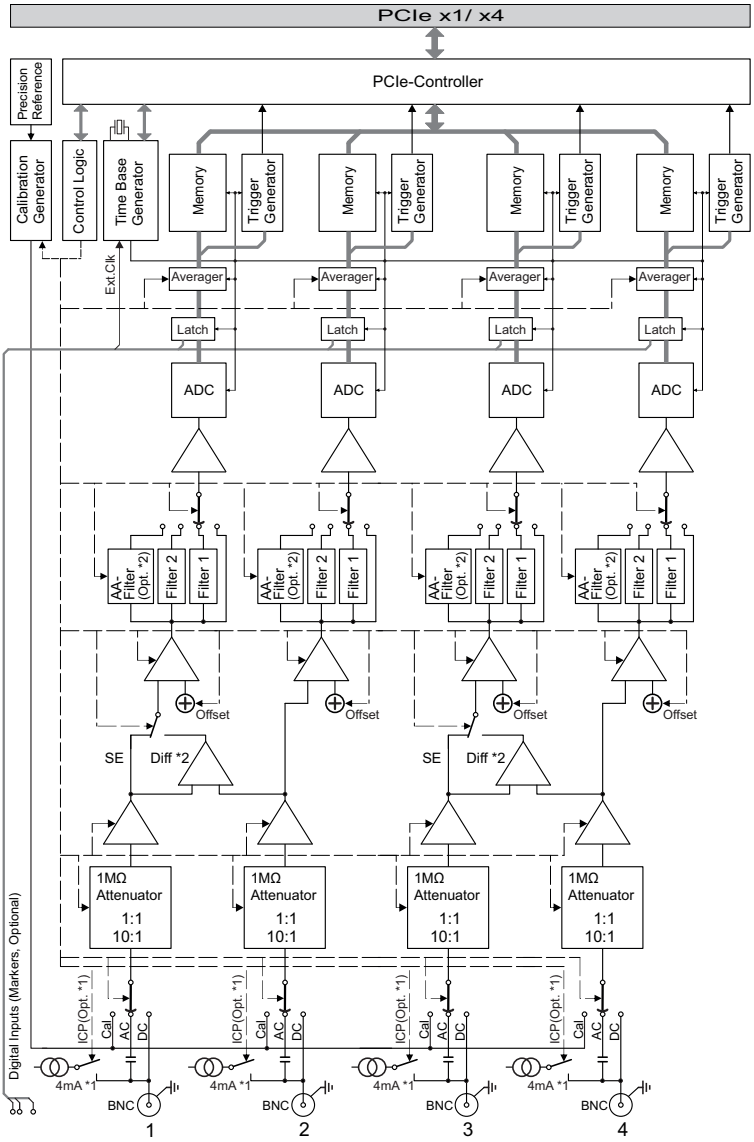
Module Type	TPCE-2016-4/8	TPCE-1016-4/8	TPCE-0516-4/8	TPCE-0216-4/8	
Number of Input Channels SE Module	4-Channel Modules: 4 single ended or 2 differential 8-Channel Modules: 8 single ended or 4 differential				
Number of Input Channels DIF Module	4-Channel Modules: 4 single ended or 4 differential 8-Channel 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				

6.2 TPCE-LE DAQ Card

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)		
Input Amplifier					
Measurement Ranges	±100 mV – ±25 V rsp. 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 @ 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	 58 dB 70 dB 72 dB 77 dB 81 dB 84 dB	 60 dB 70 dB 72 dB 77 dB 81 dB 84 dB	 59 dB 62 dB 66 dB 69 dB 79 dB 89 dB	 62 dB 68 dB 70 dB 74 dB 82 dB 90 dB	*3
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)				
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-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 optiona)	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)				
Input Amplifier					
Measurement Ranges	±100 mV – ±25 V rsp. 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 @ 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				

6.3 TPCE Block Diagram



*1) ICP/IEPE optional for TPCE and TPCE-LE. Current is fixed at 4 mA / 6mA / or 12 mA.

TPCE-xx16-8S-DP: ICP/IEPE is included and programmable from 4 to 20 mA per channel.

*2) Differential Input configuration only available for TPCE and TPCE-LE boards.

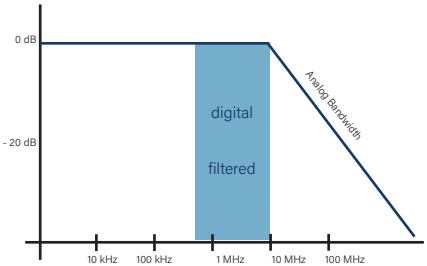
6.4 TPCE-DP DAQ Card

Specification	TPCE-2016-8S-DP		TPCE-8016-8S-DP	
Number of Input Channels	8			
Max. Sampling Rate (all channels are sampled simultaneously)	20 MS/s		80 MS/s	
Amplitude Resolution	16 Bit		16 Bit up to 20 MS/s 14 Bit up to 80 MS/s	
Memory per (Module)	8 x 64 MS			
Input Amplifier				
Input Ranges	±100 mV, ±200 mV, ±500 mV, ±1 V, ±2.5 V, ±5 V, ±12.5 V, ±25 V Offset Settings: 0 - 100 %			
Input Impedance	1MΩ (± 0.2 %) // 42 pF (± 5 %)			
Input Coupling	DC / AC / ICP (IEPE)			
ICP / IEPE Current Settings	4 - 20 mA software setable per channel			
Bandwidth	10 MHz		20 MHz	
Slew Rate (10 – 90 %)	50 ns		12.5 ns	
Low Pass Filter	100 kHz / 1 MHz 2nd Order Low Pass, software selectable per channel			
DC Range Error (±)	< 1 ‰ FS (after autocalibration)			
Offset Error (±)	< 1 ‰ FS (after autocalibration)			
Offset Drift (±)	< (0.100 ‰ + 0.1 mV) per °C			
Input Noise (± 100 mV Range) @ max. Sample Rate @ 5 MHz Sample Rate @ 1 MHz Sample Rate @ 100 kHz Sample Rate @ 10 kHz Sample Rate	< 50 µVrms < 30 µVrms < 20 µVrms < 9 µVrms < 5 µVrms		< 100 µVrms < 30 µVrms < 20 µVrms < 9 µVrms < 5 µVrms	
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	± 2.5 V 69 dB 72 dB 74 dB 80 dB 85 dB 87 dB	± 5 V 66 dB 69 dB 71 dB 76 dB 81 dB 81 dB	± 2.5 V 63 dB 72 dB 74 dB 80 dB 85 dB 87 dB	± 5 V 61 dB 69 dB 71 dB 76 dB 81 dB 81 dB
Channel Crosstalk @ 1 MHz	> 74 dB		> 74 dB	

TPCE-2016-8S-DP and TPCE-8016-8S-DB can only be installed in TraNET FE 408 DP devices!

6.5 Standard Filter

On each channel a Low-Pass First Order Filter with 100 kHz or 1 MHz bandwidth can be activated. The analog bandwidth of the amplifier itself is set around the half of the maximum sampling rate, eg. 10 MHz for a 20 MHz board.



When the cards are used below the maximum sampling rate an internal digital filtering is done (Averaging of the oversampled signal) . Therefor an Anti-Aliasing Filter is not needed in the most situations. The picture above shows a 20 MHz card used at 1 MHz. High frequency noise above 10 MHz is filtered by the analog bandwidth of the amplifier with 20 dB/dec. Noise between 500 kHz and 10 MHz is digital filtered with signal averaging.

6.6 Trigger Logic

Elsys DAQ cards are available with two different trigger packages, the standard trigger package and the Advance Trigger package:

Standard Trigger

- Positive/Negative Slope
- Window In/Out

Advanced Trigger Package

- all Standard Trigger
- Pulse > & Pulse <
- Delay > & Delay <
- Slew Rate Trigger
- State Trigger
- AND Trigger linking
- Trigger on multiplied signals (Power Trigger)
- Trigger on Marker Inputs

Each channels can be the trigger source at once. The first channel which detects a trigger will trigger the measurement. One external Slope trigger is available on the 25-Pol D-SUB connector

6.7 Anti-Aliasing Filter Module

Anti-Aliasing Filters are an option and must be installed at fabrication time.

(TPCE Option AAF-4 or AAF-8).

Cut-off (-3 dB) f_0	f0 Tol. [±%]	Filter Type	Order	Stop band Attenuation @ f > 4*fo	Passband Ripple (max.) @ f < 0.6*fo	Additional Gain and Offset	
						Error [±%]	Drift [ppm/°C]
200 Hz	5	Butterw.	6	> 54 dB	± 0.2 dB	0.1	50
300 Hz	5	Butterw	6	> 54 dB	± 0.2 dB	0.1	50
500 Hz	5	Butterw	6	> 54 dB	± 0.2 dB	0.1	50
700 Hz	5	Butterw	6	> 54 dB	± 0.2 dB	0.1	50
1 kHz	5	Butterw	6	> 54 dB	± 0.2 dB	0.1	50
1.5 kHz	5	Butterw	6	> 54 dB	± 0.2 dB	0.1	50
2 kHz	5	Butterw	6	> 54 dB	± 0.2 dB	0.1	50
3 kHz	5	Butterw	6	> 54 dB	± 0.2 dB	0.1	50
5 kHz	5	Butterw	6	> 54 dB	± 0.2 dB	0.1	50
7 kHz	5	Butterw	6	> 54 dB	± 0.2 dB	0.1	50
10 kHz	5	Butterw	6	> 54 dB	± 0.2 dB	0.1	50
15 kHz	5	Butterw	6	> 54 dB	± 0.2 dB	0.1	50
20 kHz	5	Butterw	6	> 54 dB	± 0.2 dB	0.1	50
30 kHz	5	Butterw	6	> 54 dB	± 0.2 dB	0.1	50
50 kHz	5	Butterw	6	> 54 dB	± 0.3 dB	0.1	50
70 kHz	10	Butterw	6	> 54 dB	± 0.4 dB	0.1	50
100 kHz	10	Butterw	6	> 54 dB	± 0.5 dB	0.1	50
200 kHz	10	Butterw	6	> 54 dB	± 0.5 dB	0.1	50
500 kHz	20	Elliptic	5	> 48 dB	± 0.5 dB	0.3	200
1 MHz	20	Elliptic	5	> 42 dB	± 0.5 dB	0.3	200
2 MHz	10	Butterw	4	> 42 dB	± 0.5 dB	0.2	100
5 MHz	10	Butterw	4	> 42 dB	± 0.5 dB	0.2	100

7. Software API

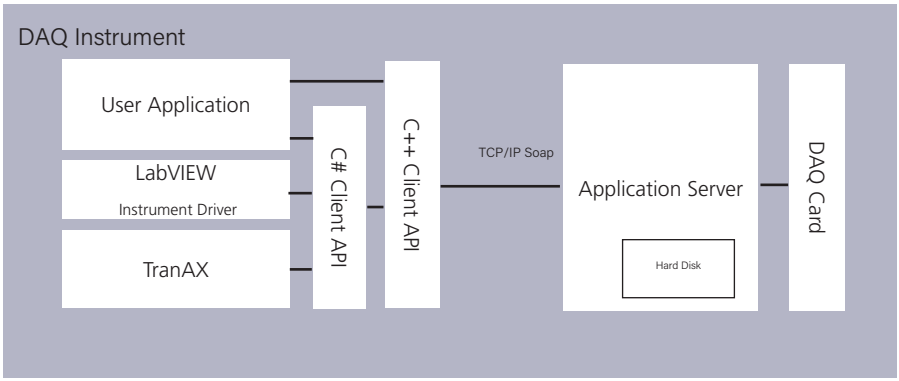
All DAQ cards as also the TraNET devices are based on the same Server-Client Software architecture. Any client application can access the data acquisition device over an IP address either locally or over a network. This way distributed measurement set-ups can be easily built-up.

The lowest level accessible from a user application is a C++ interface. This interface handles all network communication between the Application and the Application Server.

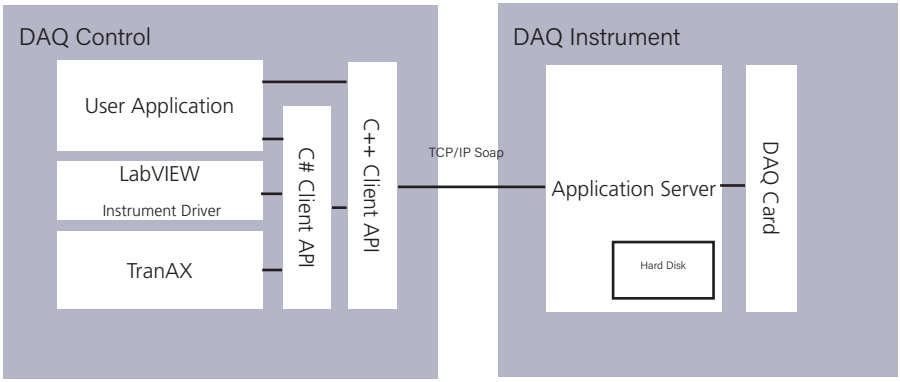
C# Applications can access a high level API for easy software integration. Several application can access the same device on the same time and get updated about any status change of the device automatically.

For more information visit:
https://www.elsys-instruments.com/en/rdk-tp-caccess/

https://github.com/elsysdaq/tpcaccess



Control/DAQ Software runs on machine where the DAQ cards are installed



Control/DAQ Software runs on a different machine and controls multiple DAQ instruments.

8. Accessories

The following accessories are available for the TraNET FE devices.

8.1 BNC-IO Box

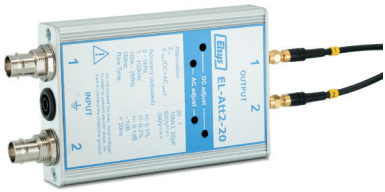
The BNC IO box can be connected to all TraNET devices via the 25-pin D-Sub connector and provides easy access to the digital IO signals.

8.2 SyncLink

To connect several TraNET FE, EPC or PPC devices to a large measuring system, the devices must be synchronized with each other. The SyncLink 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.

8.3 Attenuators

Elsys offers various passive high-voltage attenuators which are ideally suited to the input ranges of TraNET devices. Voltage measurements up to 1,000 Vrms are therefore possible.



8.4 RODAS

The RODAS measurement system is an outdoor data acquisition solution based on the TraNET FE data acquisition instruments. The TraNET FE devices are installed in a 19" housing on a mechanically damped frame inside the RODAS housings. An integrated heating/cooling system allows the operation in a wide temperature range. In addition, the whole housing incl. cable entry is designed in protection class IP 65. Several RODAS systems can be connected and synchronized via glass cables. Contact us for more detailed specifications.

EU Declaration of Conformity

Declaration Number: 231012

The Manufacturer:
Elsys AG
Mellingerstrasse 12
5443 Niederrohrdorf
Switzerland

Declare that the product: **TraNET FE 204 | TraNET FE 404 | TraNET FE 408 DP**
TraNET FE Rack

4 to 32 channel data acquisition device with voltage, IEPE or charge input channel type and 2 to 240 MS/s max sampling rate.

is conformal to the following directives and standards:

Product Standards:
IEC 61326-1:2020 (ed.3.0)
CISPR 11:2015 class B
CISPR 11:2015/AMD1:2016 class B
CISPR 11:2015/AMD2:2019 class B
CISPR 32:2015 class B
CISPR 32:2015/AMD1:2019 class B

Basic Standards:
EN 61000-3-2:2019
IEC 61000-3-2:2018/AMD1:2020
EN 61000-3-3:2013+AMD:2019
IEC 61000-3-3:2013
IEC 61000-3-3:2013/AMD1:2017
IEC 61000-3-3:2013/AMD2:2021
EN 61000-4-2:2009
IEC 61000-4-2:2008
EN 61000-4-3:2020
IEC 61000-4-3:2020
EN 61000-4-4:2012
IEC 61000-4-4:2012
EN 61000-4-5:2014+A1:2017
IEC 61000-4-5:2014
IEC 61000-4-5:2014/AMD1:2017
EN 61000-4-6:2014IEC 61000-4-6:2013 (ed 4.0)
EN 61000-4-8:2010
IEC 61000-4-8:2009
EN 61000-4-11:2020
IEC 61000-4-11:2020

This declaration of conformity is issued under the exclusive responsibility of the manufacturer.

Niederrohrdorf, 09.10.2023

Elsys AG
Roman Bertschi