

K&K FXE / FXQE80

Company: <http://www.kplusk-messtechnik.de/index.html>



Installation CD is in the ResLab (cabinet/computer manual)!

Upgrade der Zählerkarten 2018

1. Die Zählerkarte **FXE02 (alt)** wurde zu einer **FXE07 (neu)** ersetzt. Die FXE02 war zu alt und konnte nicht upgegradet werden.
 1. Sync-Fähigkeit mit PPS
 2. Wird als Master-Zähler verwendet
2. Die Zählerkarte **FXE04** wurde upgegradet:
 1. USB-LAN-Buchse
 1. USB-Nummer: 000000EA (kann verändert werden)
 2. Ergänzung der Sync-Verkettung
 3. Wird weiterhin als Slave-Zählerkarte verwendet
3. Allgemein:
 1. Nun können bis zu 4 unabhängige User einen Kanal benutzen
 2. Der Zähler kann als TCP-Server verwendet werden
 3. Die acht Eingänge können 4kHz - 132MHz zählen anstatt bis 65MHz
 4. Verbindung mit dem Computer ist mit USB und LAN möglich anstatt Serial

Counter

- Possible range: 4kHz - 65MHz
- Recommended Input: 4-17 dBm (1-5V)

Program

Default Settings: 8 Com Ports
Trimmer: Auto Trimmer
Measurement Method: Phase

Intervall length

You can change the length of the *interval*:

- Range: $\sim 1 \text{ ms} - 1 \text{ s}$
- For shorter length [shortest: 1ms] the memory would fill up very fast.
- Don't forget to adapt the length in the program *Allan-Live with time graph!*

Select your measuring method

Difference between π - and Λ -measurement. Set under *Report Mode*:

- π -measurement = *Phase*
- Λ -measurement = *Phase Average (usually)*

" Please note that I distinguish between the raw measurement results generated by the hardware, and the reports to the PC which are produced by the microprocessor. Internally, the FXE counters continuously take raw measurements of the phase (relative to the 10MHz reference) of each channel every millisecond.

The on-board microprocessor can evaluate these raw measurements in different modes for presentation to the PC. I shall try to describe this by giving examples for each mode, where $P_c(i)$ shall be the current raw 'P'hase measurement of channel 'c' at millisecond 'i', and I assume a report interval of 1s (=1000ms):

a) Instantaneous phase report mode: The on-board microprocessor reports to the PC at the selected report interval only the latest raw measurement result. All other intermediate results are ignored. Measurements reported (@ interval 1s) will be

```
Pc( i )
Pc(i+1000)
Pc(i+2000)
Pc(i+3000) ...
```

b) Averaged phase report mode: The on-board microprocessor calculates the average of all raw measurements taken during the report interval and reports to the PC at the end of the interval. All raw measurements contribute to the reported result. This helps to reduce measurement noise. Results reported (@ interval 1s) will be

```
Sum(n=0..999){Pc( i + n )}/1000
Sum(n=0..999){Pc(i+1000+n)}/1000
Sum(n=0..999){Pc(i+2000+n)}/1000
Sum(n=0..999){Pc(i+3000+n)}/1000 ...
```

c) Phase difference report mode: Inter-channel phase differences $P_c - P_1$ are reported. These differences are the 'best possible' measurements, as any uncertainties of the reference cancel and most temperature effects cancel, as they are common to all channels. Measurements reported (@ interval 1s) will be

```
Pc( i ) - P1( i )
Pc(i+1000) - P1(i+1000)
Pc(i+2000) - P1(i+2000)
Pc(i+3000) - P1(i+3000) ...
```

d) Averaged phase difference report mode: Inter-channel differences of averaged phase Pc-P1 are reported. Measurements reported (@ interval 1s) will be

```
Sum(n=0..999){Pc( i + n ) - P1( i + n )}/1000
Sum(n=0..999){Pc(i+1000+n) - P1(i+1000+n)}/1000
Sum(n=0..999){Pc(i+2000+n) - P1(i+2000+n)}/1000
Sum(n=0..999){Pc(i+3000+n) - P1(i+3000+n)}/1000 ...
```

e) Frequency report mode: Frequency is Phase advance per time. The on-board microprocessor calculates the difference of the current phase measurement and the measurement taken one report interval earlier, and divides it by the report interval. Measurements reported (@ interval 1s) will be

```
[Pc( i ) - Pc(i-1000)]/1000ms
[Pc(i+1000) - Pc( i ) ]/1000ms
[Pc(i+2000) - Pc(i+1000)]/1000ms
[Pc(i+3000) - Pc(i+2000)]/1000ms ...
```

f) Averaged frequency report mode: Averaged frequency is advance of averaged phase per time. The on-board microprocessor calculates the difference of the currents averaged phase and the averaged phase calculated one report interval earlier. Measurements reported (@ interval 1s) will be

```
[Sum(n=0..999){Pc( i + n )} - Sum(n=0..999){Pc(i-1000+n)}]/1000ms
[Sum(n=0..999){Pc(i+1000+n)} - Sum(n=0..999){Pc( i + n ) } ]/1000ms
[Sum(n=0..999){Pc(i+2000+n)} - Sum(n=0..999){Pc(i+1000+n)}]/1000ms
[Sum(n=0..999){Pc(i+3000+n)} - Sum(n=0..999){Pc(i+2000+n)}]/1000ms ...
```

By just re-arranging these sums you can also write

```
... = Sum(n=0..999){[Pc(i+n) - Pc(i-1000+n)]/1000}
```

Hence, averaged frequency can be thought of either as 'advance of averaged phase' or as the average over 1000 non-averaged frequencies (@ interval 1s), in 1ms spacing.

Consequently, data measured during two(!) report intervals contribute to the averaged frequency value reported.

"

Start a measurement

Push buttons before measurement to erase RAM:

1. *Clear Buffer*-button = Reset
2. Rename the data file in KK_FXE Folder
3. Start new measurement via "Häckchen" at *Frequency*

K+K FX80 / FXE / FXQ / FXC

Header: 1800, Lost: 0

Phase	Frequency	Phase Difference
3374163571617.2659668 Pd	32024005.6568926 Hz	0.5937500 Pd
1996854383475.2776114 Pd	20000000.0514396 Hz	-203602334396.2901924 Pd
5378469280694.6436846 Pd	51013919.6178184 Hz	323028772229.5865436 Pd
3827174769205.7714599 Pd	36292547.3526854 Hz	73405557397.6836711 Pd
2872787900480.1860776 Pd	27315246.7837548 Hz	-79299255342.7034616 Pd

LC: 166645719.4625908 Hz

7020; \$1800
1800; 3374163571617.2659668; 1996854383475.2776114; 5378469280694.6436846; 3827174769205.7714599;
2872787900480.1860776

Text
Graph
Persist

Lin.Comb.

Clr

Data Transmission
Serial Port: COM6
Channels: #1...#5
Interval: 500ms

Log Files

☐ Phase
☒ Frequency
☐ Phase Diff.
☐ Debug

ext. uPS:
☐ off
☐ on
☒ Trim

Scrambler

Report Mode

Phase Average
Test Error Version
Clear Buffer Re-Center

Frequency Conversion

(for PhaDiff calculation
from Phase data only)
☒ off
☐ convert 5MHz to 10MHz
☐ convert 10MHz to 5MHz

Decimal Separator

☐ WINDOWS setting
☐ always '.'
☒ always ','

Graph

Scale: 200 E-12/div PhDiff relFre ☒ absFre

☒ Channel 1 ☐ Channel 2 ☐ Channel 3 ☐ Channel 4
☐ Channel 5 ☐ Channel 6 ☐ Channel 7 ☐ Channel 8
☐ Channel 9 ☐ Channel10 ☐ Channel11 ☐ Channel12

For understanding and communication with PTB

The figure contains three handwritten sketches on a light blue background:

- Top Left:** A plot labeled "TT-Zählung" (TT counting) showing a square wave signal. Below it is a plot labeled "A-Zählung" (A counting) showing a triangular wave signal. The x-axis for the A-Zählung is labeled "Gate Time".
- Top Right:** A plot labeled "Phase" showing a noisy signal. Below it is a plot labeled "Phase Average" showing a smooth, decaying curve.
- Bottom Right:** A log-log plot of Allan deviation. The y-axis is labeled "Allan" and the x-axis is labeled "Gate Time". The plot shows several lines with slopes of $1/2$, $1/3$, and $1/2$. The lines are labeled "TT-Zählung", "A-Zählung", and "Phase". The plot also includes labels for "Report Mode", "Allan Mode (ModAdev / ADEV)", and "Gate Time".

At the bottom left, there is handwritten text:

Log File: Frequency
Scrambler: Off

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