

KL-3400

Real Time Clock

Datasheet V 3.2



**Up to fifteen high precision timing inputs -
combined to an output more precise and stable than any of the input signals**

Key Features

The KL-3400 RTC is designed to provide a stable clock signal based on

- the short term frequency stability of the built-in OCXO
- the medium term frequency stability of a set of atomic clocks, like Cesium or Maser
- the long term timing accuracy of an external 1pps signal or a built-in GPS receiver

Amongst other features

- up to 3, 7, 11 or 15 input signals, depending on configuration
- GUI to define weight and offset of each clock
- 3 frequency outputs and 3 1PPS outputs
- each ensemble clock can have it's individual weights
- faulty clocks can be removed automatically

Description

The KL-3400 is a high precision timing system, built for laboratory use, providing a stable and robust time scale as reference for other equipment. KL-3400 is a clock generator for extreme demands for stability and security. Combining several precision oscillators allows to compensate their differences and to recognize faulty oscillators.

The system outputs high precise and stable 10MHz Frequency and 1 Puls per Second (1PPS) signals based on an Oven Crystal Oscillator (OCXO) that is disciplined to an ensemble of high quality clocks and a GNSS receiver as external 1PPS source.

The KL-3400 RealTime Clock is the most accurate Ensemble Clock on the market - developed and designed by K+K Messtechnik GmbH, in cooperation with Lange-Electronic GmbH, with support from Physikalisch-Technische Bundesanstalt, Braunschweig, Germany and with financial support from the Federal Ministry of Economics.

Software clock algorithms are well established, e.g. in combining stable atomic clocks that are actually scattered all around the world, to form virtual time scales (like UTC), which are normally distributed to users by bulletin in retrospect only.

In contrast to such 'paper clock' approach, we have investigated the hardware requirements and actually built what we call a 'real time clock', i.e. a device, which accepts the output signals of various stable clocks and optionally a 1PPS timing signal (plus possibly some bulletin information and strategic operator decision), and from these generates an optimised output clock signal under the control of software clock algorithms.

Lange-Electronic GmbH
Rudolf-Diesel-Str. 29a
82216 Gernlinden
GERMANY

Tel. +49 - 8142 - 284582-0
Fax +49 - 8142 - 284582-2
www.lange-electronic.com
info@lange-electronic.com

PRECISION - OUR BUSINESS.

KL-3400 Real Time Clock

Datasheet V 3.2 p.2



The purpose of the KL-3400 Real Time Software Clock is to provide a stable clock signal based on the short term frequency stability of the built-in OCXO, the medium term frequency stability of a set of atomic clocks, and the long term timing accuracy of a GPS timing receiver, which - within reasonable limits - will continue its phase track even if one of the contributing clocks fails.

Benefits from the Software Clock are:

- Improved stability as compared to a single atomic clock due to ensemble averaging over a set of up to 15 clocks
- Automatic steering to UTC(GPS)
- Additional phase and/or frequency steering on operator command
- Continuous consistency check among the atomic clocks
- Robustness against clock failures
- Easy clock maintenance without interruption of the Software Clock output signal

Product features:

- Increased stability compared to a single atomic clock by controlling and averaging up to 15 atomic clocks
- Automatic time scale steering based on UTC(GNSS) or a local laboratory time base
- Additional phase and frequency offsets by user commands
- Permanent supervising of all connected atomic clocks
- Automatic removal of faulty clocks
- No interruption of the output signal during maintenance procedures
- PC connection via LAN
- Comes complete with controlling and visualization software
- Specific customer adaption possible

Lange-Electronic GmbH
Rudolf-Diesel-Str. 29a
82216 Gerlinden
GERMANY

Tel. +49 - 8142 - 284582-0
Fax +49 - 8142 - 284582-2
www.lange-electronic.com
info@lange-electronic.com

PRECISION - OUR BUSINESS.

Specifications:

Internal Time Base

Type: Oven Controlled Oscillator (OCXO)
 ADEV, 1sec: <2.5E-13
 Phase Noise: 1 Hz ≤ -116 dBc/Hz
 10 Hz ≤ -144 dBc/Hz
 100 Hz ≤ -157 dBc/Hz
 1 kHz ≤ -160 dBc/Hz
 10 kHz ≤ -160 dBc/Hz
 Ageing, per Year: <5E-8
 Frequency: 10MHz,

optional: Low Phase Noise OCXO
 ADEV, 10sec: 3x10-13
 Aging, per Year: ± 3x10-8

Optional Rubidium Standard available

Measurement Resolution

Single shot: Phase: 12,2 ps
 Frequency: 1,2E-11 @ 1sec
 Average: Phase: 0,4 ps @ 1sec
 Frequency: 4E-13 @ 1sec

Internal PC

internal single board PC (Windows10)
 with KL-3400 configuration application
 (accessible over LAN, Remote Display or external display, keyboard and mouse)

Interfaces

USB 2,0, USB 3.0
 LAN 10/100/1000 Gigabit Ethernet port (X40)
 DP (Display Port, can be used for VGA and HDMI, adaptor required)

Inputs

up to 3, 7, 11 or 15 Clock Signals (tbd when ordering)
 Format: 0..10dBm, square wave or sine wave
 Frequency: 5 or 10MHz
 Connector: SMA

1PPS

Format: 1.5 ... 5V, rising edge on-time
 Duration: >100ns
 Connector: SMA

Outputs:

Clock Signals (3)
 levels: 3-13dB into 50Ω, adjustable
 Frequency: 10 MHz
 Harmonic Distortion: ≤ -50dBc @ 13 dB
 Format: sine wave
 Connector: SMA
 Spurious: < -80dBc @ 13 dB
 Add Phase Noise: < 3dB

1PPS (3)

Format: TTL level compatible min.
 2,8V@50Ohms
 On-Time: rising edge
 Duration: 100µs
 Connector: SMA

Electrical

Input power: 100 – 240 VAC
 50 – 60 Hz
 Fuse: 5 AT
 Connector: IEC C14

Environmental

Temperature: 0°C to + 55°C (operating)
 -20°C to + 70°C (storage)
 Humidity: up to 95% relative (non condensing)
 Weight: approx. 8 kg

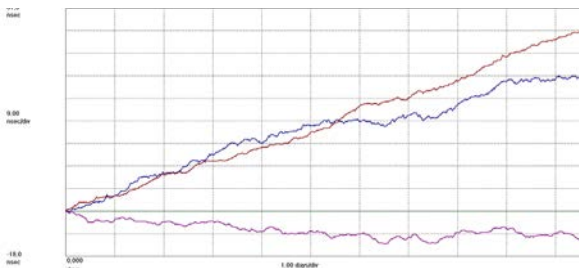
Chassis

3HU, 19" rack-mount unit cabinet in reference to DIN41494-5 / IEC297-3.

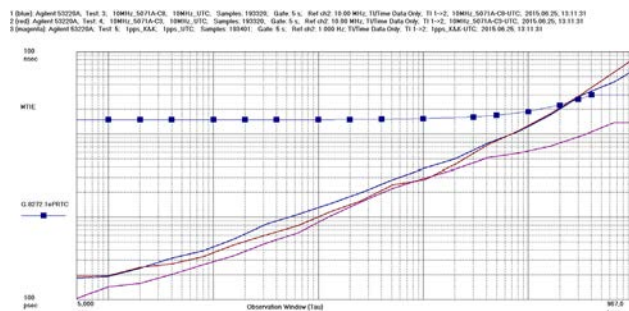
Dimension:

433,0 mm x 132,5 mm x 400,0 mm (W x H x D)
 front width 483,0 mm ± 0,5 mm with mounting brackets
 (including connectors and handles)

2 free running Cs-Clocks versus RTC using 1PPS from GPS receiver



Same Cs - Clocks – MTIE



pictures courtesy of Telekom/Imlau

Software definition of clocks

The weight and offset of each clock can be defined via GUI.

Lange-Electronic GmbH
 Rudolf-Diesel-Str. 29a
 82216 Gernlinden
 GERMANY
 Tel. +49 - 8142 - 284582-0
 Fax +49 - 8142 - 284582-2
 www.lange-electronic.com
 info@lange-electronic.com

