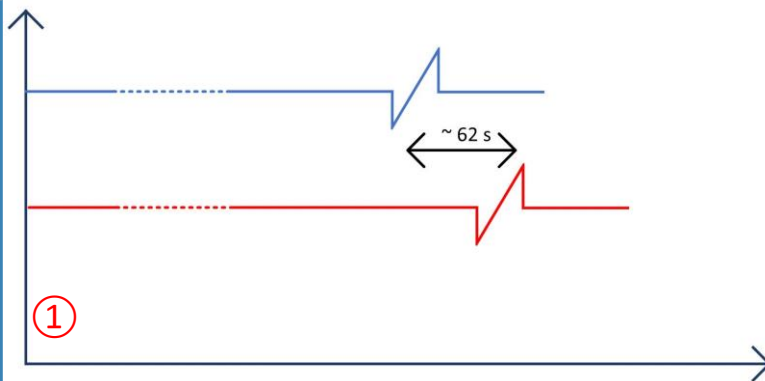DEWETRON

OXYGEN TRAINING
> SYNCHRONIZATION

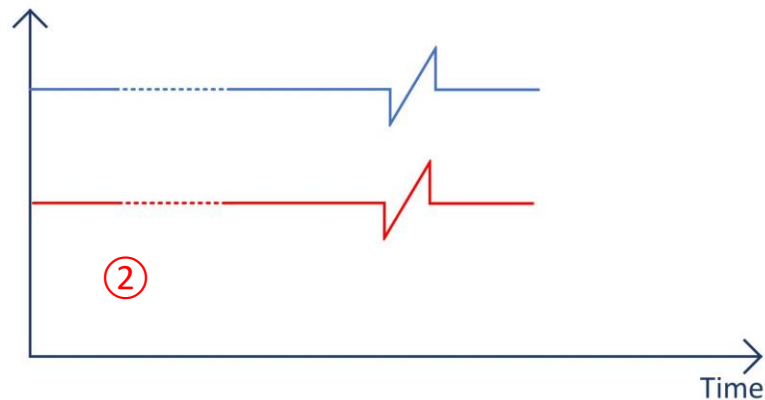# SYNCHRONIZATION – WHY?

① No Synchronization:
- ➢ System A has a timing error of +39ppm
- ➢ System B has a timing error of +15ppm
- ➢ Both systems start data recording at the same time
- ➢ After one month of continuous recording, there is a time shift of ~62 seconds between both systems:

$$30_{days} * 24_{hours} * 3600_{sec} * (0.000039_{ppm} - 0.000015_{ppm}) = 62.2\ sec$$

② Synchronization avoids this problem
- ➢ If system A is the SYNC master and system B is synced as slave to it, both systems will run with an error of 39 ppm
- ➢ The difference will be 0 ppm even after one month

~ 62 s

①

②

Time

SYNCHRONIZATION – TYPE OVERVIEW

External Sync Input	TRION-BASE	TRION-TIMING	TRION-VGPS
IRIG A DC	☒	✓	✓
IRIG B DC	✓	✓	✓
IRIG A AC	☒	✓	✓
IRIG B AC	☒	✓	✓
PTP	☒	✓	✓
GPS	☒	✓	✓
PPS	✓	✓	✓

Sync Type	Accuracy	Absolute Time	Max. Distance	Cable Type	Recommended for
TRION Sync	±60 ns ±5 ns/m	☒	100 m	RJ45 CAT VI	medium distance; low jitter; use between DEWE2 chassis
PTP Slave	±100 ns ±5 ns/m	✓	100 m	RJ45	Medium distance, sync with 3rd party hardware
GPS	±300 ns	✓	-	-	highest distance; use when cable connection is impossible
IRIG-A/B	±2 µs ±5 ns/m	✓	50 m	RG58	medium distance; use with existing IRIG installation
PPS	±2 µs ±5 ns/m	☒	10 m	RG58	low distance

| Device	Mode	Clock Accuracy
TRION-SYNC-BUS	Stand alone, no timing board	50 ppm
	DEWE2 Sync In	Depending on master system
TRION-TIMING	Internal clock	10 ppm
	GPS locked	<< 1 ppm
	IRIG locked	Depending on IRIG source accuracy
	PPS locked	Depending on PPS source accuracy
	PTP locked	Depending on PTP source accuracy

SYNCHRONIZATION – TYPE OVERVIEW

All DEWE2 systems have internally the same clock structure, independent on the amount of slots. The heart of it is the TRION Sync Bus that is connected to every slot of the chassis. The Timing Source for the bus can be the internal time base of the chassis or another DEWE2 System by using the Sync In connector. In case a Timing board is installed in the first Slot (Star * Slot), the TRION Sync Bus can be synchronized to almost every external time source. All cards generate their AD clocks out of the TRION Sync Bus signals separately. That allows different Sample rates settings at board level while still being precisely synchronized
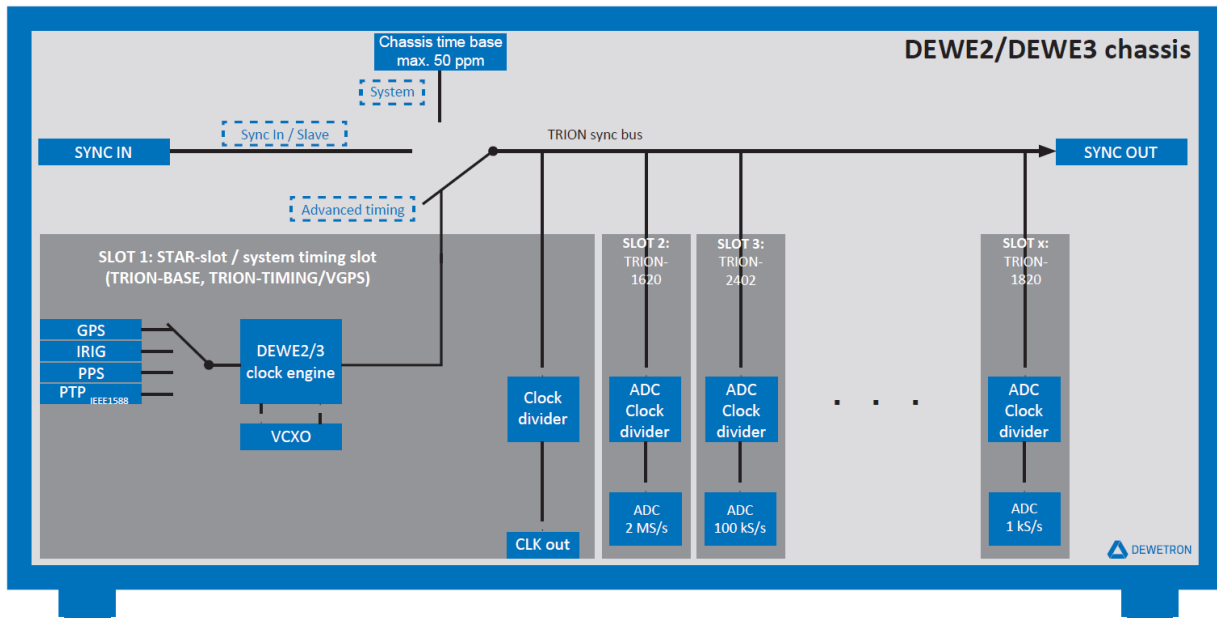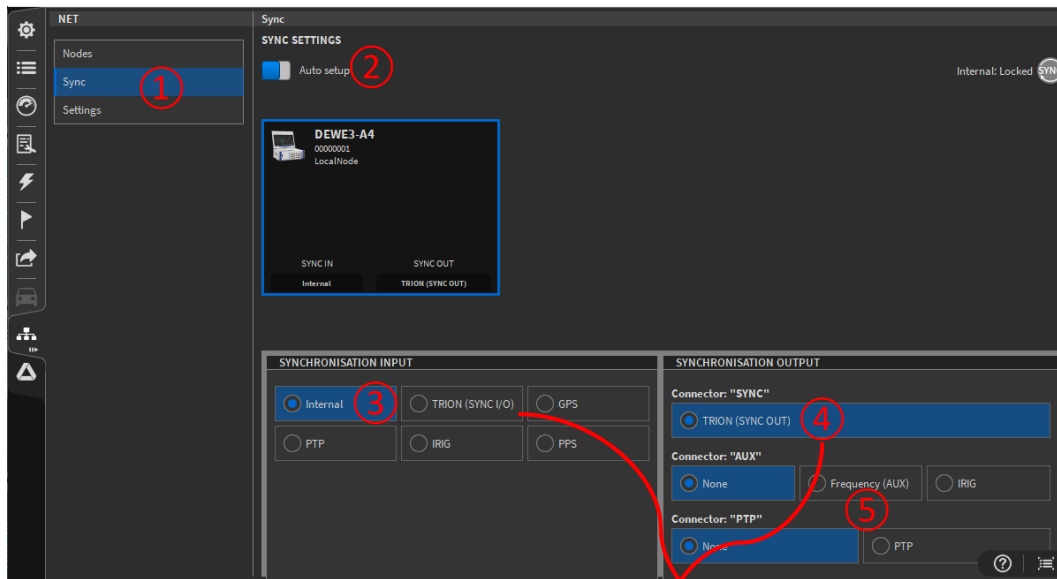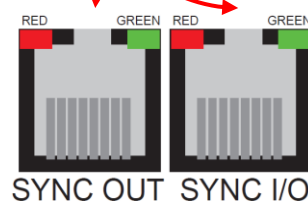
OXYGEN - SYNC SETUP

① Open The *System Settings* and navigate to *Sync* tab

② Uncheck the *Auto Setup* to edit the *Synchronization Input* (③) settings

③ Select the proper Synchronization source (selection depending on availability and TRION board in first slot)

④ Sync signal is output via TRION-SYNC-OUT connector (always enabled)

⑤ TTL signal output (i.e. to trigger GigE cameras) (availability depending on TRION board in first slot)

Auto Setup denotes *TRION (SYNC I/O)* as source if signal connected to *SYNC I/O* plug and *Internal* otherwise

OXYGEN - SYNC OPTIONS OF DIFFERENT SYNC SOURCES

① *Internal* → No further options

② *SYNC I/O* → No further options

③ *GPS* → Specify a correction limit between 10 ns and 500 ms

④ *PTP* → Specify a correction limit between 10 ns and 500 ms, Specify the proper delay mechanism and protocol type

⑤ *IRIG* → Specify a correction limit between 10 ns and 500 ms and the proper IRIG code

⑥ *PPS* → Specify a correction limit between 10 ns and 500 ms and optionally invert received signal
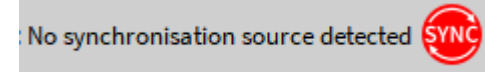
SYNCHRONISATION INPUT

② ③
① Internal	TRION (SYNC I/O)	● GPS ③
PTP	IRIG	PPS

CorrLimit 0.01 ms

SYNCHRONISATION INPUT

Internal	TRION (SYNC I/O)	GPS
● PTP ④	IRIG	PPS

CorrLimit 0.01 ms
DelayMechanism End To End
Protocol UDP_IPv4

SYNCHRONISATION INPUT

Internal	TRION (SYNC I/O)	GPS
PTP	● IRIG ⑤	PPS

CorrLimit 0.01 ms
IrigCode CodeB_DC

SYNCHRONISATION INPUT

Internal	TRION (SYNC I/O)	GPS
PTP	IRIG	● PPS ⑥

CorrLimit 0.01 ms
InvertedInput False

Locked SYNC
→ Locked when *Internal* is used

No synchronisation source detected SYNC
→ NO correct sync signal received by HW
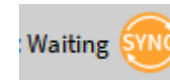
Waiting SYNC
→ Sync signal received but not synchronized yet

Locked SYNC
→ Sync signal received and sync'd

DEWETRON

SYNCHRONIZATION – SYNC LOST DURING RECORDING

The TRION-TIMING-V3 is designed for continuously measuring data, even if the external time base source is temporary not available. Especially in GPS mode that could easily happen. In that case the TRION-TIMING-V3 generates a notifying event and continues measuring on its internal time base. This internal time base has been adjusted to the external reference while the sync was stable.

That minimizes the drift in free-run mode. (Typically far below 1 ppm). Only when the environmental conditions change dramatically during a longer non-synced period of time, it might go up to a maximum of 10 ppm.

When the synchronization has established again the TRION-TIMING checks if the internal time base error is still below the pre-programmed restart limit.
> ① If yes, it starts resyncing by slightly changing the time-base until the time stamps matches again exactly. That prevents from gaps in the data file due to resync. That might take a while because the maximum readjusting speed is 100 ppm.
> ② If for some reason a hard resync is needed the restart limit could be set to a low value. In that case the datafile will be interrupted.

7
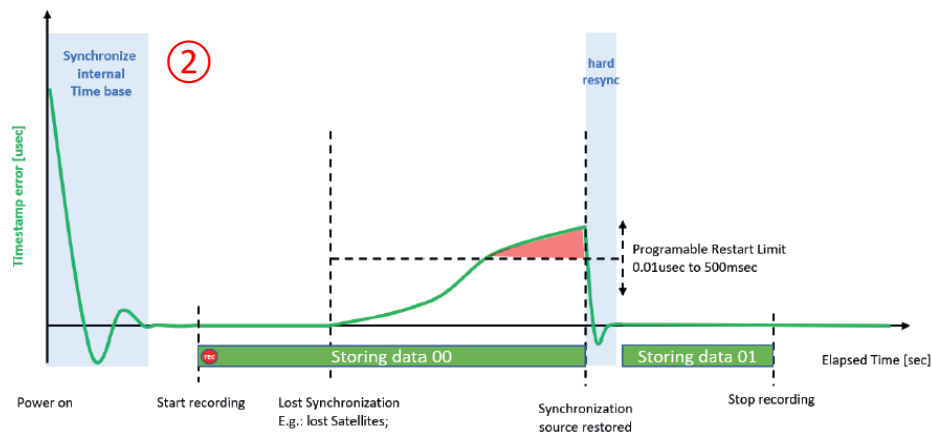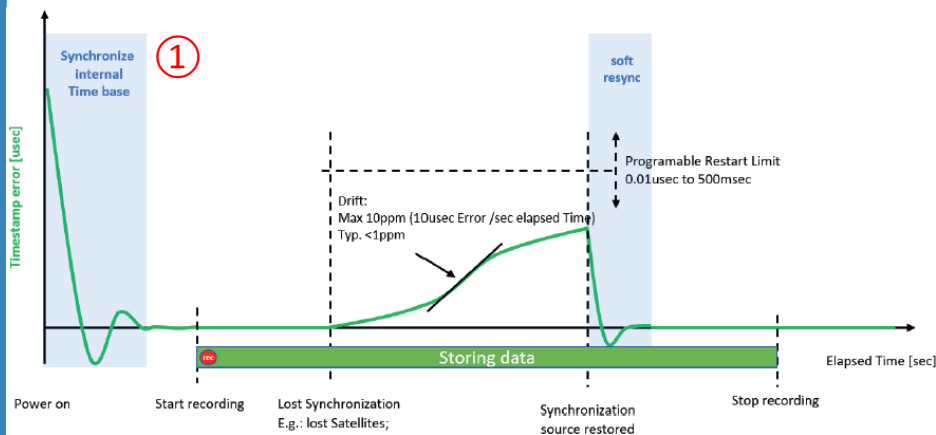
IRIG MASTER

> Option to output IRIG B DC signal
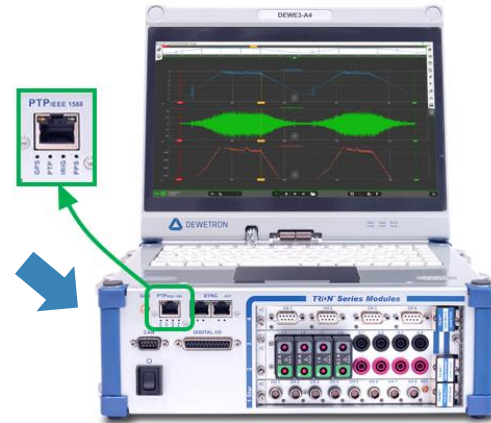
> TRION-TIMING-V3, -VGPS-V3 or Chassis Controller required
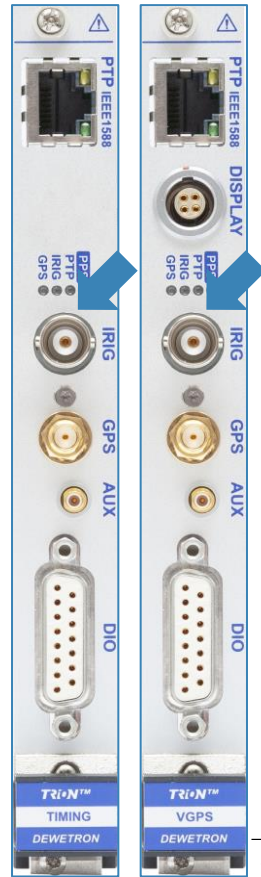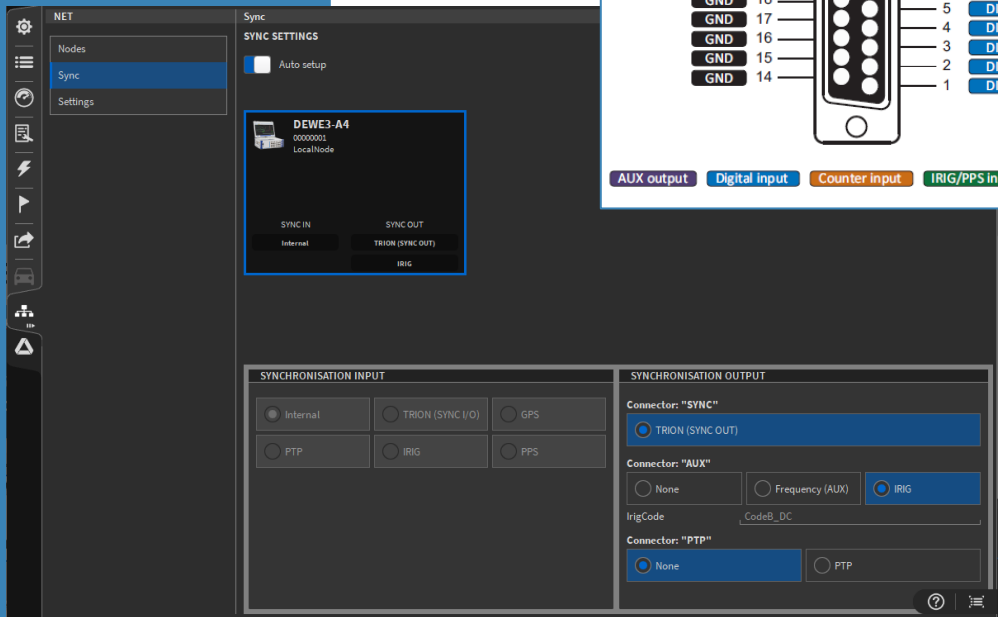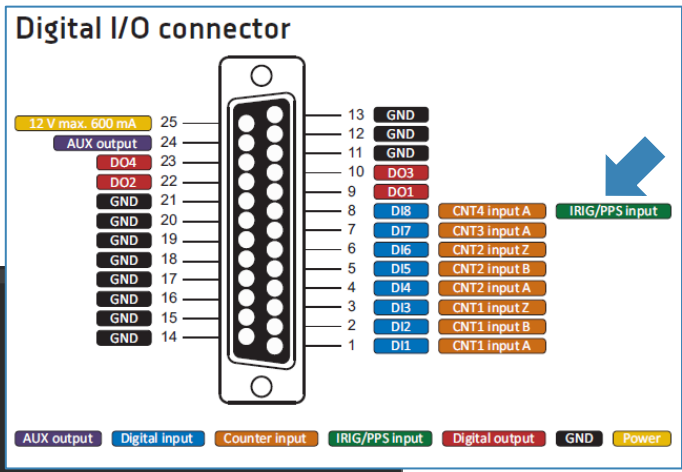
PTP MASTER

> Option to output PTP IEEE1588 signal

> Option available for chassis controller

> License option: no hardware changes necessary to activate PTP Master Out option

Chassis Controller

Option available when licensed

SYNCHRONISATION OUTPUT

Connector: "SYNC"

- ⦿ TRION (SYNC OUT)

Connector: "AUX"

- ⦿ None | ○ Frequency (AUX) | ○ IRIG

Connector: "ETH"

- ○ None | ⦿ PTP

| DelayMechanism | End To End |
| Protocol | UDP_IPv4 |