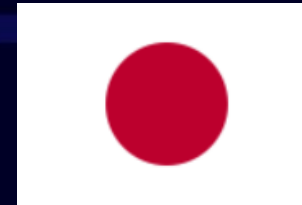


Paris Session 2022



Solution for Communication Delay Times under a New Process Bus-based System using oversampling

SC B5 PS2 Q2.06

What are the key innovation for an intelligent algorithm based protection and how to address challenges during the application of the proposed protection schemes?

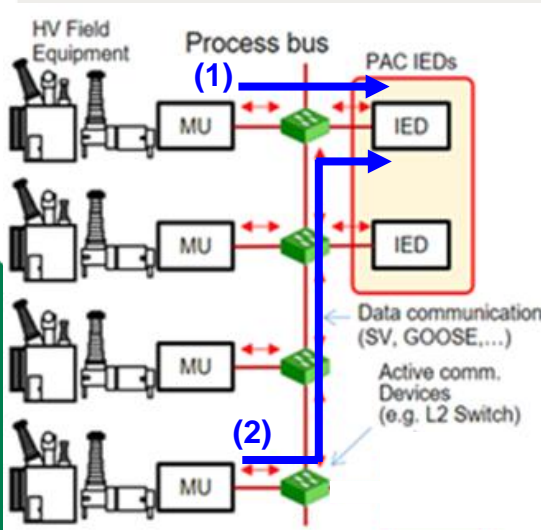
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Issues and solutions for process bus-based system using oversampling

Issues :

In case of making time synchronisation unnecessary, asynchronous error may occur and protection performance may be affected.



For instance, shown in Figure 1, SV data (2) are expected to be delayed more than SV data (1).

Delay times and errors are shown in the below table :

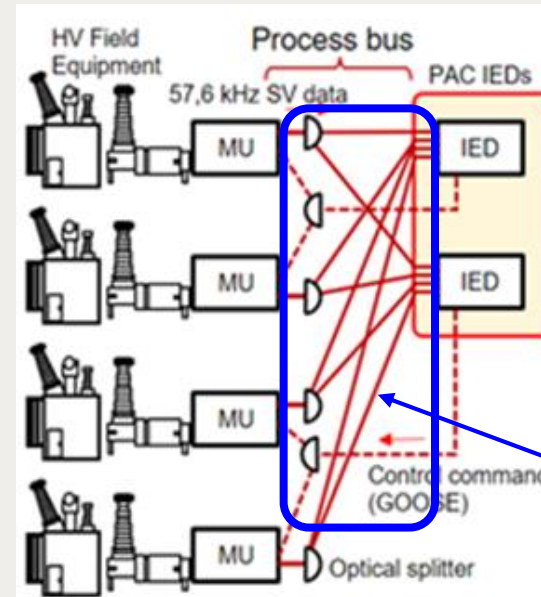
Delay times[μ s]	errors[%] (60Hz)
20	0.8
100	3.8
* 500	18.8

* quoted from PES-TR76

Figure 1. Example of process bus-based system applying active devices

Solutions :

Comm channels are constructed with **optical splitters**. Optical splitter has a passive device's features:
 - **little communication delay time and jitter**
 - **the delay time is only due to the channel length**



excluding active devices and only constructed with passive devices

Figure 2. Example of a new system applying optical splitters

it can be expected that the influence on the relay operation will be extremely small.

Verification test result

Condition :

- Input 60 Hz, 5 A penetration current to each MU which operates under asynchronous condition.
- IED receives these asynchronous SV data and measures differential current.
- Asynchronous error is recognised as the differential current value.

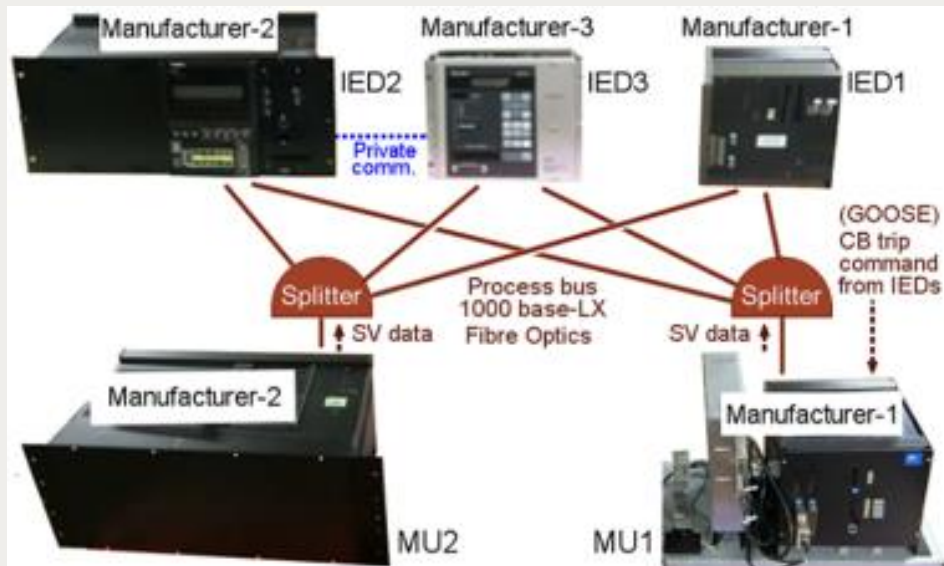


Figure 3. Multi vendor's MUs and IEDs configuration under verification test

Test result :

- Each SV instantaneous current ("MU1-I" and "MU2-I") shows same waveform
- maximum differential current was up to +/- 0.2% per input

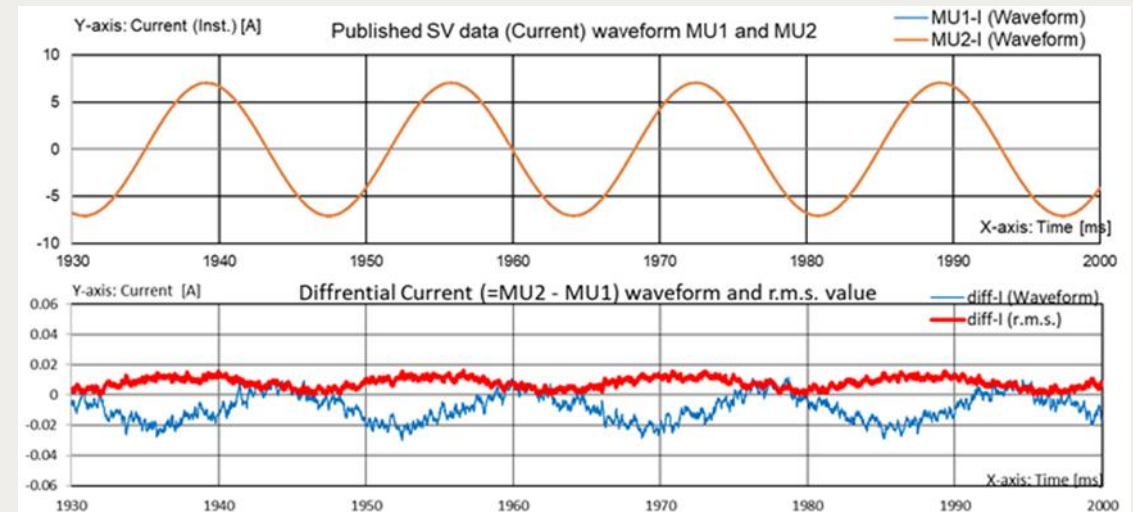


Figure 4. Example of SV data waveform and instantaneous differential current



Meeting accuracy requirements for many usual protection relays

Conclusions

- Asynchronous error due to the communication delay times is very small in the proposed system
 - maximum differential current was up to +/- 0,2% per input at the verification test



- Proposed system will work properly as process bus- based protection system.
Features :
 - advantage that time synchronisation is not necessary
 - using optical splitters, passive device