Smart Substation IEC 61850
GOOSE Logical Strategy Of Verification

(Measuring Instruments Section：Li Kun Hung , Cheng Tung Yi)

I. Preface：

In accordance with the government energy policy, Taiwan Power Company (TPC) is committed to promoting and developing smart grids. The international standard, IEC 61850, integrating intelligent electronic devices (IEDs), information engineering, and network communication, offers the interoperability and flexibility needed in a smart grid. The IEC standard defines the necessary information models in substation automation and unifies the communication protocol of IEDs to make interoperability possible. Therefore, TPC power supply branches were successively planning to integrate the IEC 61850 GOOSE logical strategy (2023/06/15 revised edition) (Fig. 1~3) to substations in order to prevent multiple accidents resulting in tripping expansion and simplify operating procedures.

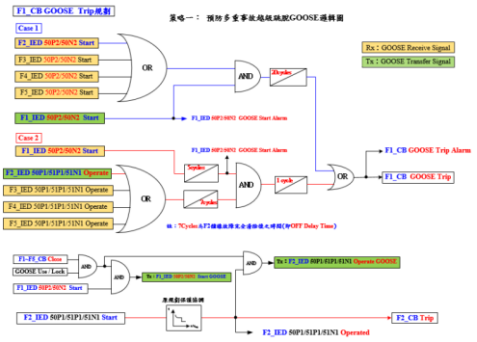

Fig. 1 Strategy1：Logic of preventing multiple accidents leading to tripping expansion

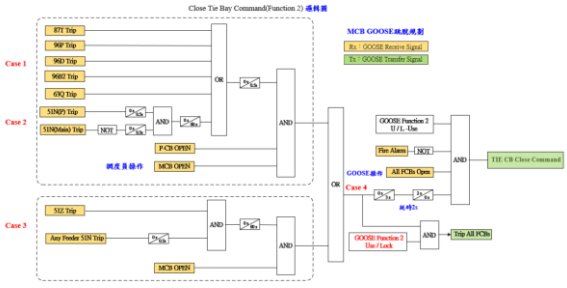

Fig. 2 Strategy2：Logic of Auto Tie-CB

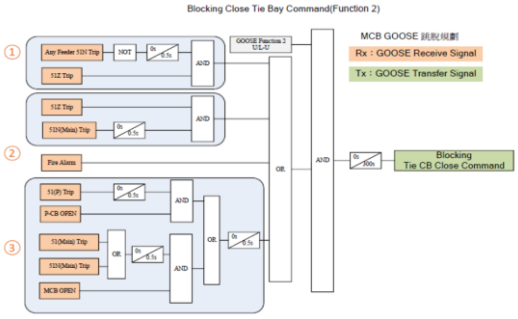

Fig. 3. Strategy2：Logic of Blocking Tie-CB

II. Test methods and hardware introduction ：

Our group used a testing instrument, Omicron CMC356, with the software Test Universe. Both of them have IEC 61850 Level A certifications, thereby ensuring the accuracy and reliability of test data. (Fig.4~5)。

Fig. 4 Hardware and software Level A certification

Fig. 5 Hardware and software Level A certification

First, we import the SCD (System Configuration Description) file to Omicron Station Scout to observe the relationship of every IEDs' publication and subscription (Fig.6~7).

Fig. 6 Station Scout Hardware connect

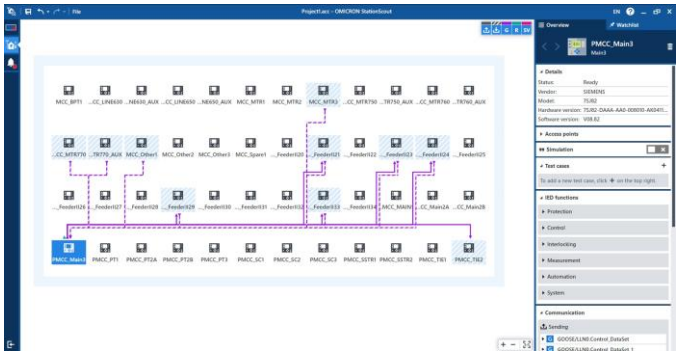

Fig7. IED subscribe and publish

We simulate the IEDs' publication and subscription by importing the SCD file in Goose Configuration (Fig 8~11).

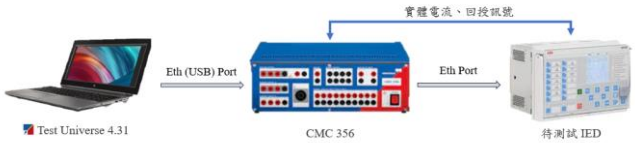

Fig. 8 GOOSE Testing of hardware connections

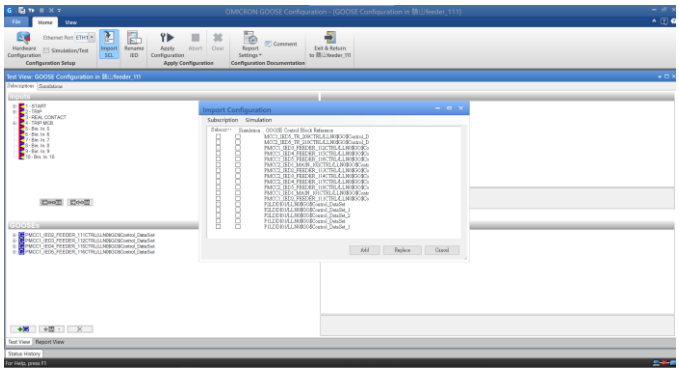

Fig. 9 Chose Publish and Subscribe GOOSE packet

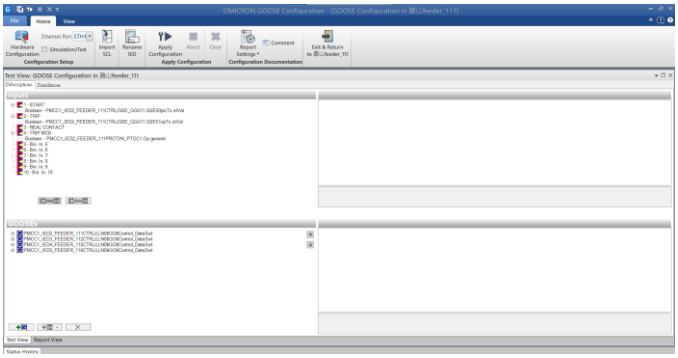

Fig. 10 Simulation of Publish GOOSE tag

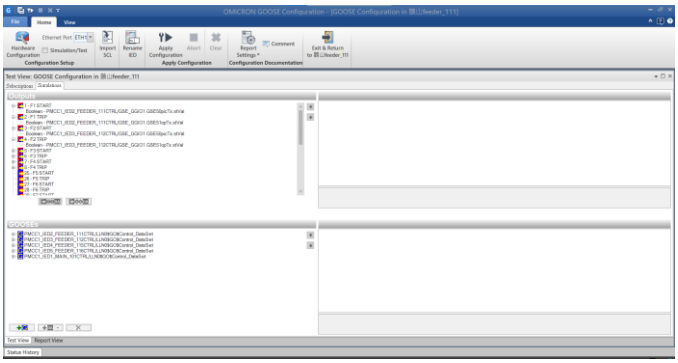

Fig.11 Subscribe GOOSE Tag

After completing the GOOSE publication and subscription, we coded the conditions of GOOSE logical strategy in State Sequencer (Fig12~14). Software State Sequencer can be used to simulate fault current, publish and subscribe packets, acquire the action time, etc.

We then wrote all possible logic in the test software to check whether the action time and locking time of the strategy were correct.

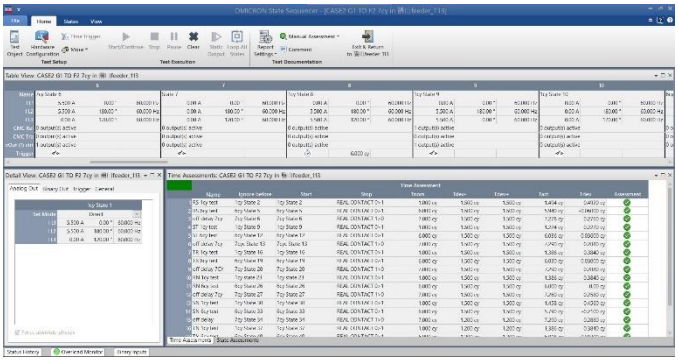

Fig.12 Test sequences (i)

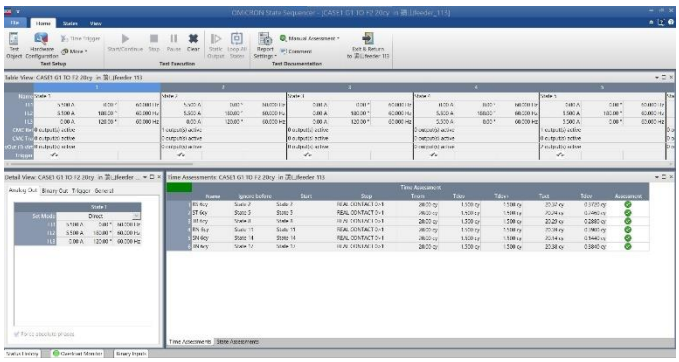

Fig. 13 Test sequences Test sequences (ii)

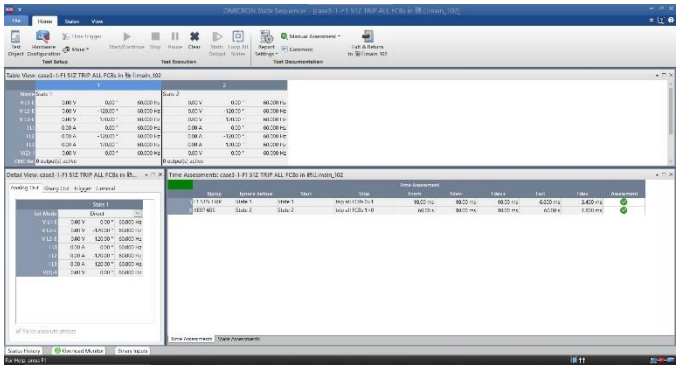

Fig.14 Test sequences (iii)

III. Conclusion：

IEC 61850 communication protocol plays a very important role in smart substation. Our group uses Omicron CMC356 and Station Scout to comprehensively check if the manufacturers comply with TPC plans and requirements when coding IED GOOSE logic. With that, we can prevent multiple accidents resulting in tripping expansion and simplify operating procedures.