

PRO-N

Pro-N

PROTECTION RELAY

VIRTUAL INPUT/OUTPUTS



Input



Processing



Output

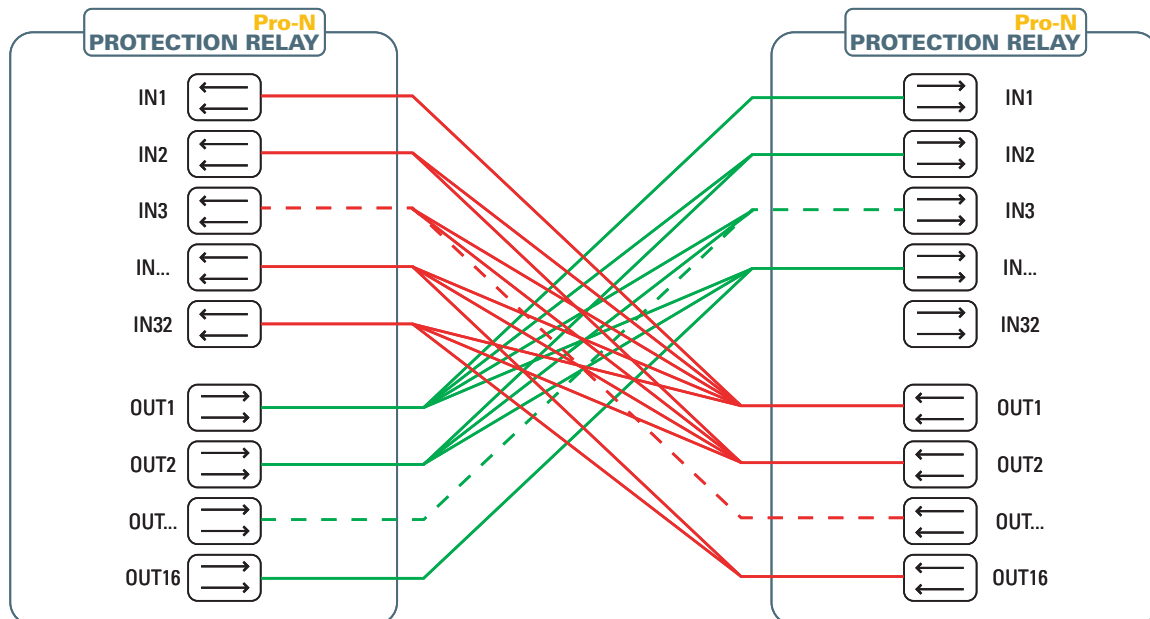
PreFACE

By ThySetter and ThyVisor software tools the type of operation and links between sixteen outputs (Virtual Output - VOUT1 ... 16) and thirty-two virtual inputs (Virtual Inputs - VIN1 ... VIN32) may be defined using RPC or IEC 61850 communication protocols over Ethernet network.

The virtual I / O can be enabled on devices with 3.01 and later firmware version.

The system allows:

- Availability of eight inputs and ten outputs independently programmable by the user
- Simplify wiring using one channel as the Ethernet
- Eliminate the need to install communication devices and / or external conversion
- Significantly reduce costs
- Dynamically change from sw connections and associated functions.



Applications

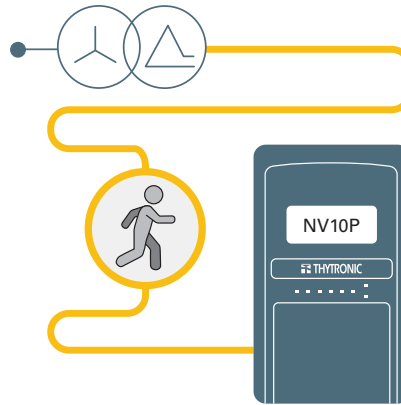
Over Pro-N relay the virtual I / O can be usefully employed for:

- Transmit information between protections installed in significant distance where the traditional connections are critical in terms of reliability.
- Making OR logic for opening control of multiple DDI (simultaneous control of all DDI operated by each SPI) in cases of multiple interface protections (Smart Grids)
- Achieve accelerated logic discrimination in which some protection elements can be blocked by the activation of the downstream protection start; this allows to reduce the clearing time that, in time logic systems require trip time significantly long in correspondence of the power source.
- Circuit breaker commands
- Selection of setting profiles
- Remote trip, etc. ...

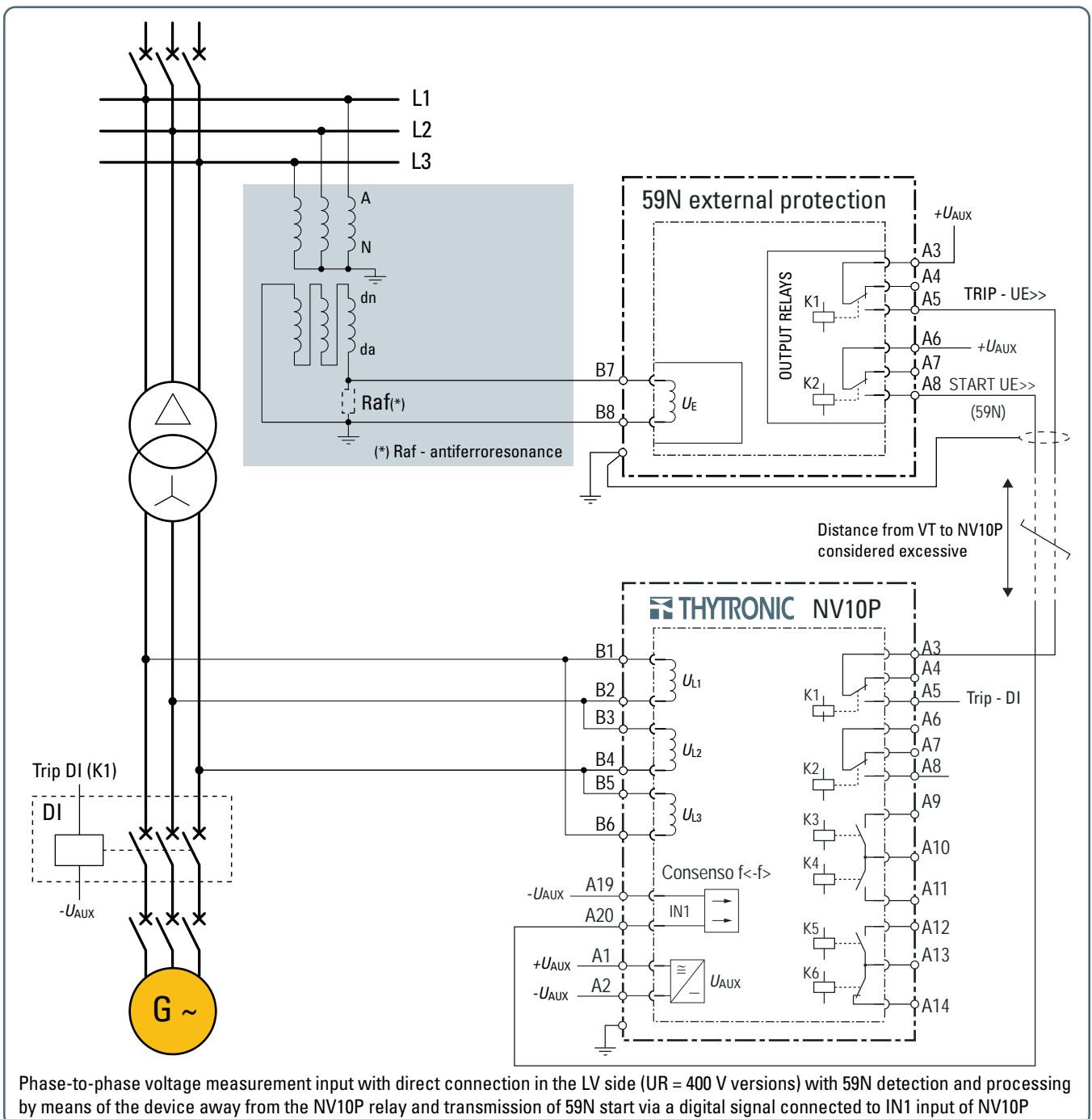
In the examples presented below the 1) and 2) applications are described made with traditional wiring and with the virtual I/O circuits.

Example 1

The application with NV10P protective relay in which the measurement of residual voltage is not available on the relay interface due to the high distance from NV10P relay to VTs is proposed.

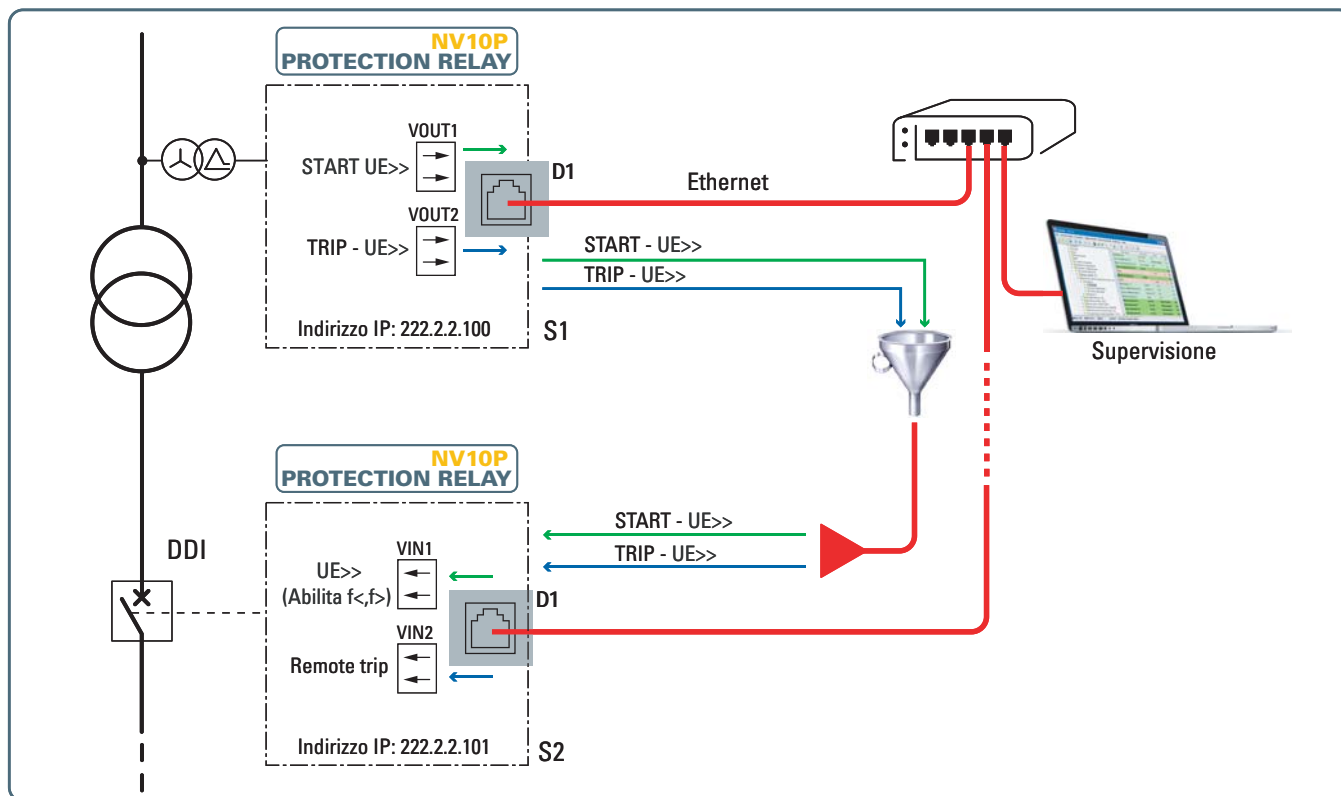


The diagram shows a solution that uses relays, logic inputs and connections pilot wires to transmit 59N start and trip information to the interface relay (S2) from a relay (S1) installed in MV.



Phase-to-phase voltage measurement input with direct connection in the LV side ($U_R = 400$ V versions) with 59N detection and processing by means of the device away from the NV10P relay and transmission of 59N start via a digital signal connected to IN1 input of NV10P

Alternatively to the method where relays, logic inputs and connections pilot wires are employed to transmit the information of 59N start and trip between the relays S1 and S2, the diagram below shows the solution that utilizes the I / O virtual circuitry by means of messages on Ethernet network.

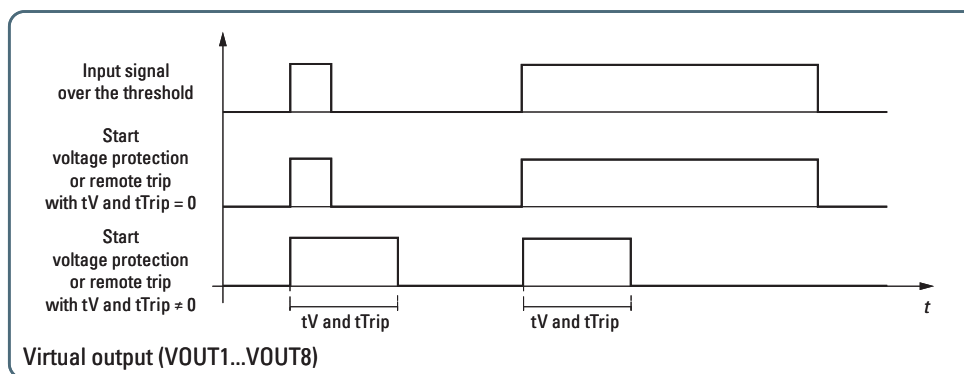


S1 outputs

Two outputs are programmed as:

- VOUT1, used in the example as start signal of the second threshold of 59N protection of S1 (Start UE>>) in order to activate the first threshold of minimum and maximum frequency (restrictive thresholds) of the S2 protection
- VOUT2, used in Example as trip signal of the second threshold of 59N protection of S1 (Trip UE>>) in order to control the opening of the interface device by means of remote tripping of the S2 protection.

The outputs are activated by the input signal (UE >> start and / or remote trip) and stay active (also in case of drop of the input signal) for the duration of an adjustable time (t_V and t_{Trip}).



S2 inputs

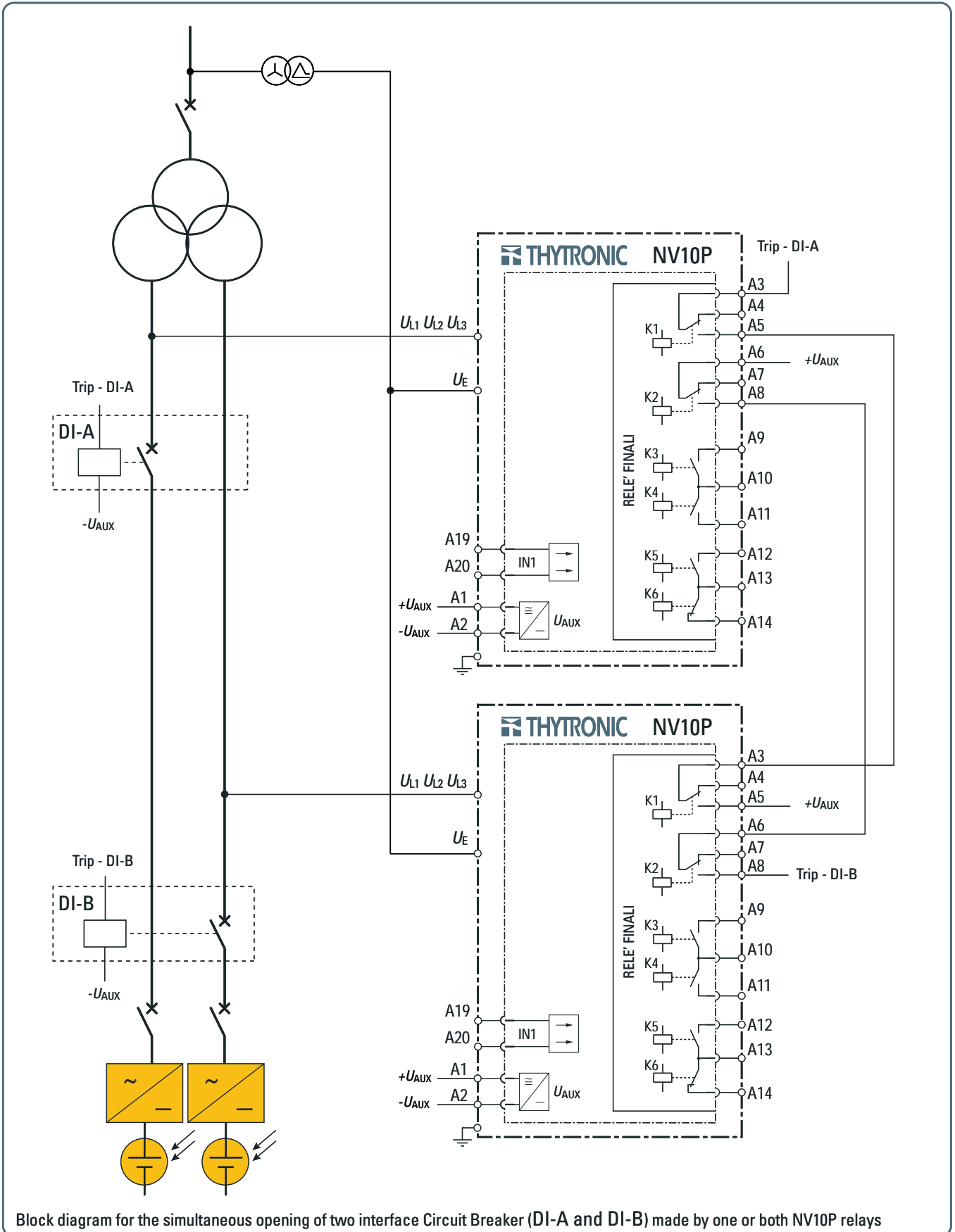
For each of the eight virtual inputs one function may be associated that can be activated by the selected input; in the example the enable of the first threshold of under and over frequency is programmed when an earth fault in MT arises (UE>> start active on the S1 protection) at the input virtual VIN1 and remote trip connected to the VIN2 virtual input of the S2 protection relay.

Links (virtual pilot wires)

After defining the input and output circuits the virtual links must be created.

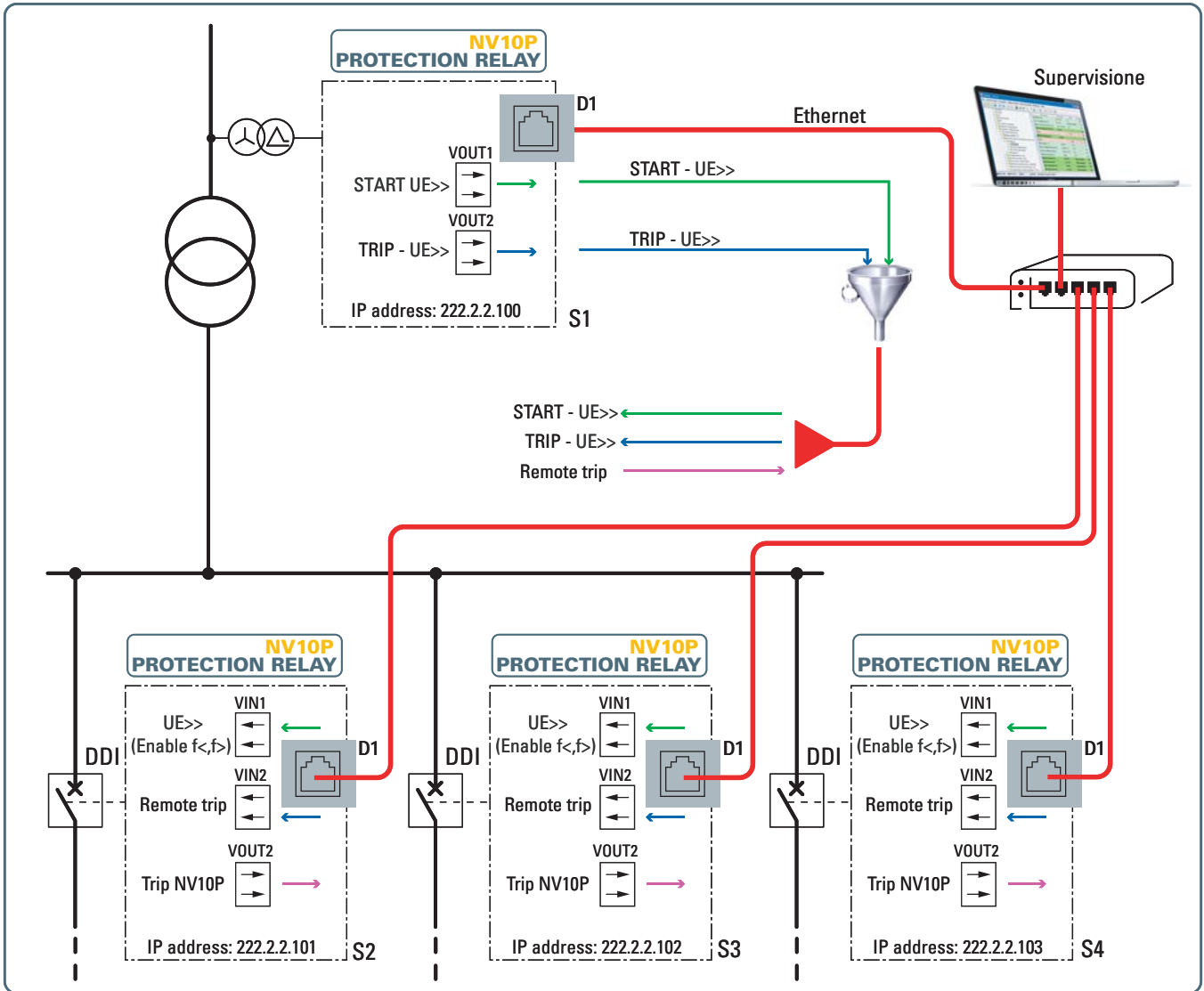
Example 2

The diagram shows the traditional solution that uses relays, logic inputs and pilot wires connections to realize the logical OR for the opening command of two DDI (simultaneous control of both DDI operated by each interface relay).
 The logical OR is realized driving each circuit breaker by the series connection of two output relays (a relay for each CB); can easily understand the added complication for implementation of the logic when further protection interfaces are mounted, (in addition the need to implement the logic concerning the measurement of residual voltage, as described in Example 1, must be considered).



Block diagram for the simultaneous opening of two interface Circuit Breaker (DI-A and DI-B) made by one or both NV10P relays

The diagram shows an example that uses the virtual I / O circuits where the S1 relay transmits the information relating to the 59N function to relay S2, S3 and S4 and simultaneously the OR logic for the command of the interface devices is achieved.



S1 outputs

The VOUT1 and VOUT2 outputs must be programmed as in Example 1 to transmit information about to the 59N protection, processed by the S1 relay to relay S2, S3 and S4 where the measure of residual voltage is missing:

- Start, used as a start signal of the second threshold of 59N protection (S1) in order to activate the first threshold of under and over frequency (81U and 81O) of the protections S2, S3 and S4.
- Trip, used in Example as trip signal of the second threshold of 59N protection (S1) in order to control the opening of the interface device by means of remote tripping of protections S2, S3 and S4

S2, S3 e S4 inputs

The enable of the first threshold of under and over frequency (81U and 81O) is set to the occurrence of an earth fault (start UE >> active on S1 protection) on the VIN1 virtual input and the remote trip on the VIN2 virtual input protection on S2, S3 and S4 relays that drive the circuit breaker interface.

S2, S3 and S4 outputs

The output VOUT2 must be set to carry out the logical OR for the opening command of all the circuit breaker interfaces (simultaneous control of all the CBs function from each NV10P):

- Trip, used in the example as a trip signal of the protection functions of S1 in order to control the opening of the interface device by means of remote tripping of protections S2, S3 and S4

Links (virtual pilot wires)

After defining the input and output circuits the virtual links must be created.

Final remarks

Compared to the method with inputs and outputs and connections between relay made with pilot wires, the method that uses the virtual inputs and outputs, in addition to the simplicity of the wiring and the possibility of making connections over long distances (Ethernet network) is able to realize interactive logics by means of tens of pilot wires whose wiring can be programmed and changed as desired.

Ethernet ports

The virtual I / O make use of RPC or IEC 61850 communication protocols over Ethernet network, therefore, the Pro_N and Pro-Next relays must be equipped with RJ45 interface for connection to copper local area network or FX interface for connection to fiber-optic local network. Connections to the TX (RJ45) port must be made with shielded cable FTP Cat.5e or higher category.

