

Application Note

Recloser contact time measurement with ARCO 400 and BOB2

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Abstract

This application note describes how to measure the contact times of a 27 kV G&W Viper ST recloser, connected to an SEL 651R controller, using an ARCO 400 and BOB2 accessory.

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1 Safety instructions

This Application Note may only be used in conjunction with the relevant product manuals which contain all safety instructions. The user is fully responsible for any application that makes use of OMICRON products.

Instructions are always characterized by a ► symbol, even if they are included in a safety instruction.



DANGER

Death or severe injury caused by high voltage or current if the respective protective measures are not complied with.

- Carefully read and understand the content of this Application Note as well as the manuals of the systems involved before taking them into operation.
- Please contact OMICRON support if you have any questions or doubts regarding the safety or operating instructions.
- Follow each instruction listed in the manuals, especially the safety instructions, since this is the only way to avoid the danger that can occur when working on high voltage or high current systems.
- Only use the equipment involved according to its intended purpose to guarantee safe operation.
- Existing national safety standards for accident prevention and environmental protection may supplement the equipment's manual.

Only experienced and competent professionals that are trained for working in high voltage or high current environments may implement this Application Note. Additionally, the following qualifications are required:

- Authorized to work in environments of energy generation, transmission or distribution, and familiar with the approved operating practices in such environments.
- Familiar with the five safety rules.
- Good knowledge/proficient in working with the OMICRON ARCO 400 test set and ARCO Control software.

The steps described in this application note shall only be performed in a controlled laboratory environment. Further safety considerations, which are not included in this application note, must be taken into account when performing recloser contact time measurements in the field.

2 Introduction

The contact times of a recloser refer to the open and close time of the recloser contacts. The open time is defined as the time between the instant when the opening coil is energized and the instant when the recloser contacts have separated on all poles. Similarly, the close time is defined as the time between the instant when the closing coil is energized and the instant when the recloser contacts touch on all poles.

This document describes how to measure the open and close time of a single phase of a 27 kV G&W Viper ST recloser connected to a SEL 651R controller using the ARCO 400 and the break out box (BOB2) adapter. This is done by measuring the time between the instant when trip/close pulse is sent by the recloser control and the instant when the recloser contacts close or separate (the travelling time of the trip/close pulse from the controller to the trip/close coil is neglected).

To detect the instant when the trip/close pulse is sent by the controller, a binary output of the control unit is programmed to close whenever a trip or close command pulse is sent. The programmed binary output is wetted with a DV voltage and connected in series to one of the binary inputs of the ARCO 400. The instant when the recloser contacts touch or separate is detected by wetting the recloser bushings with a DC voltage and connecting them in series to a second binary input of the ARCO. When a close command is sent by the controller, the ARCO detects a state change in the first binary input and records the time of the event. Soon after the close command is sent, the recloser contacts touch causing the second binary input to see the DC wetting voltage. When the voltage across the second binary input changes from 0 V to the wetting voltage, the binary input changes state and triggers an event. The time between the first and second event is the measured close time of the recloser. Similarly, when a trip command is sent by the controller, the first binary input detects a state change and triggers an event. When the recloser contacts separate, the voltage across the second binary input changes from the wetting voltage to 0 V, triggering a second event. The time difference between the two events is the measured open time of the recloser.

3 Measurement Setup

First disconnect the recloser from any power source. The recloser should remain de-energized during the whole test. Connect the SEL 651R to the G&W Viper ST with the corresponding 32-pin control cable. Place the ARCO 400 test set and BOB2 accessory close to the recloser and control unit. Connect the BOB2 to the ARCO 400 either directly or with an extension cable.

The SEL 651R's output contact 101 (OUT101) is used to detect the instant when the controller sends a trip or close signal to the recloser. Since the ARCO only supports wetted binary inputs and the output contacts of the SEL 651 are dry contacts, the OUT101 contact needs to be wetted with a DC voltage. To do this, connect the positive terminal of the BOB2's Aux DC output to one of the terminals of the SEL 651R OUT101, connect the other terminal of the OUT101 to the positive terminal of the BOB2's binary input 1, and connect the negative terminal of the BOB2's binary input 1 with the negative terminal of the BOB2's Aux DC output.

To detect the opening and closing of the recloser contacts they need to be wetted with a DC voltage and connected in series with binary input 2 of the BOB2. In this application example the contact times of phase A of the G&W Viper ST recloser are measured. Connect the positive terminal of the BOB2's Aux DC output to the phase A source side bushing, connect the phase A load side bushing to the positive terminal of the BOB2's binary input 2, and connect the negative terminal of the BOB2's binary input 2 to the negative terminal of the BOB2's Aux DC output. Figure 1 shows the wiring of the measurement setup.

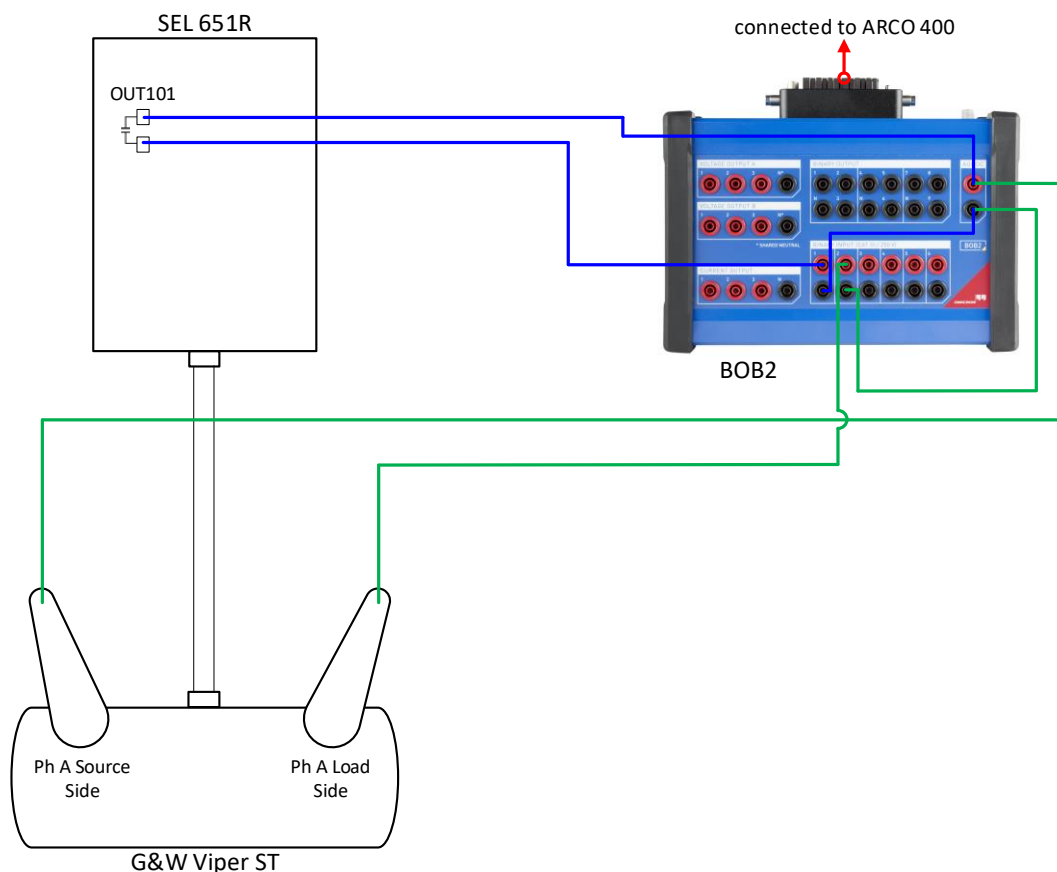


Figure 1: Wiring of the recloser contact time measurement with ARCO 400 and BOB2 adapter.

Once all the connections have been made, power on the SEL 651R and the ARCO 400.

4 Programming the SEL 651R Output Contact

Output contact OUT101 of the SEL 651R control unit needs to be programmed so that it closes whenever a single or three phase trip or close command is sent out by the controller. To do this, connect your PC to the control unit with the SEL AcSELERator® Quickset software and then read the settings of the controller. In the Quickset settings editor navigate to the active logic group and select Output Contact Equations to display the equations of all available output contacts (see Figure 2).

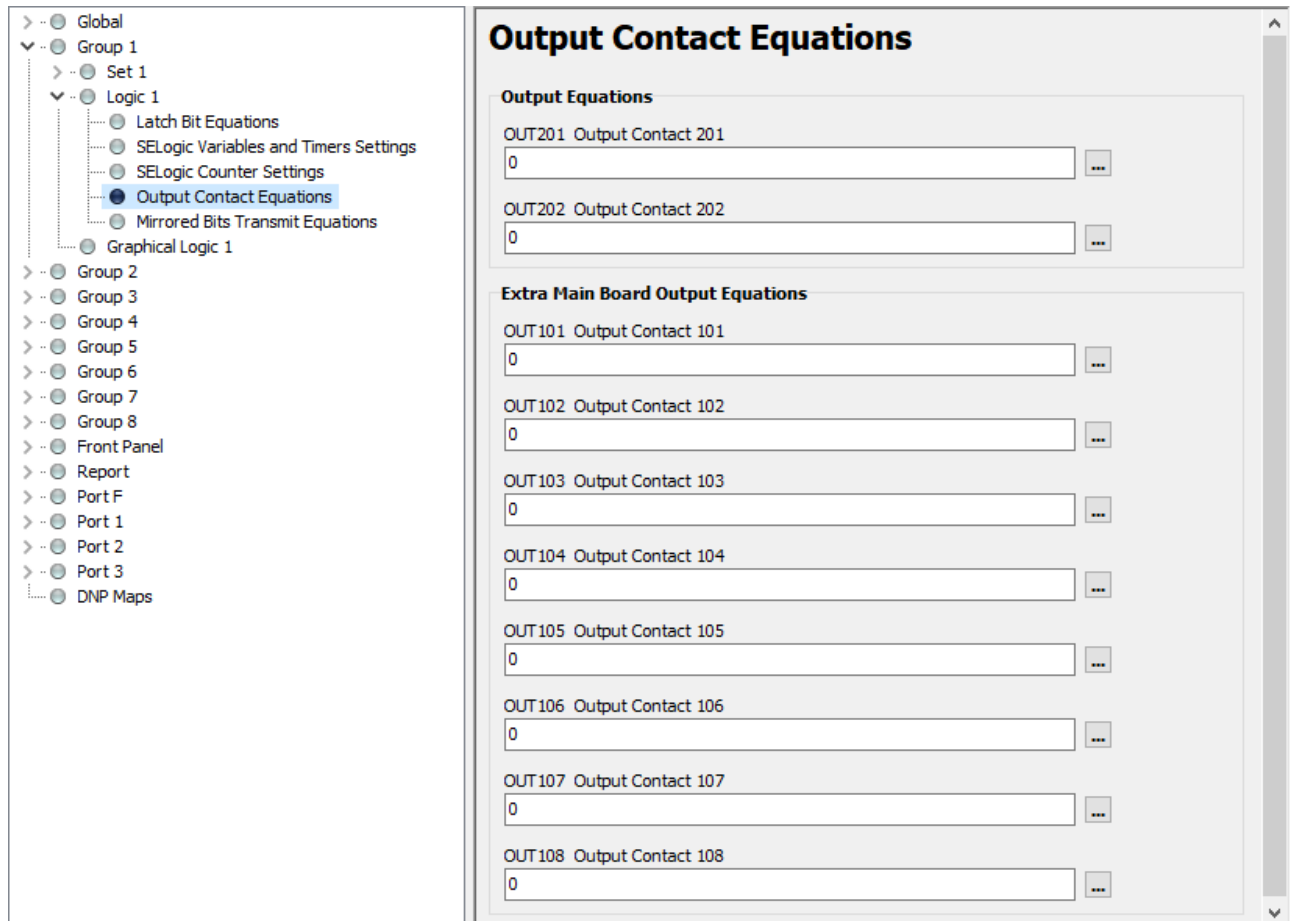



Figure 2: Output contact equations of the SEL 651R controller shown in AcSELERator® Quickset.

Press the  button next to output contact 101 to open the its equation window and then add the single and three phase trip and close logic bits to the OUT101 output contact equation (see logic bits enclosed in red box in Figure 3).

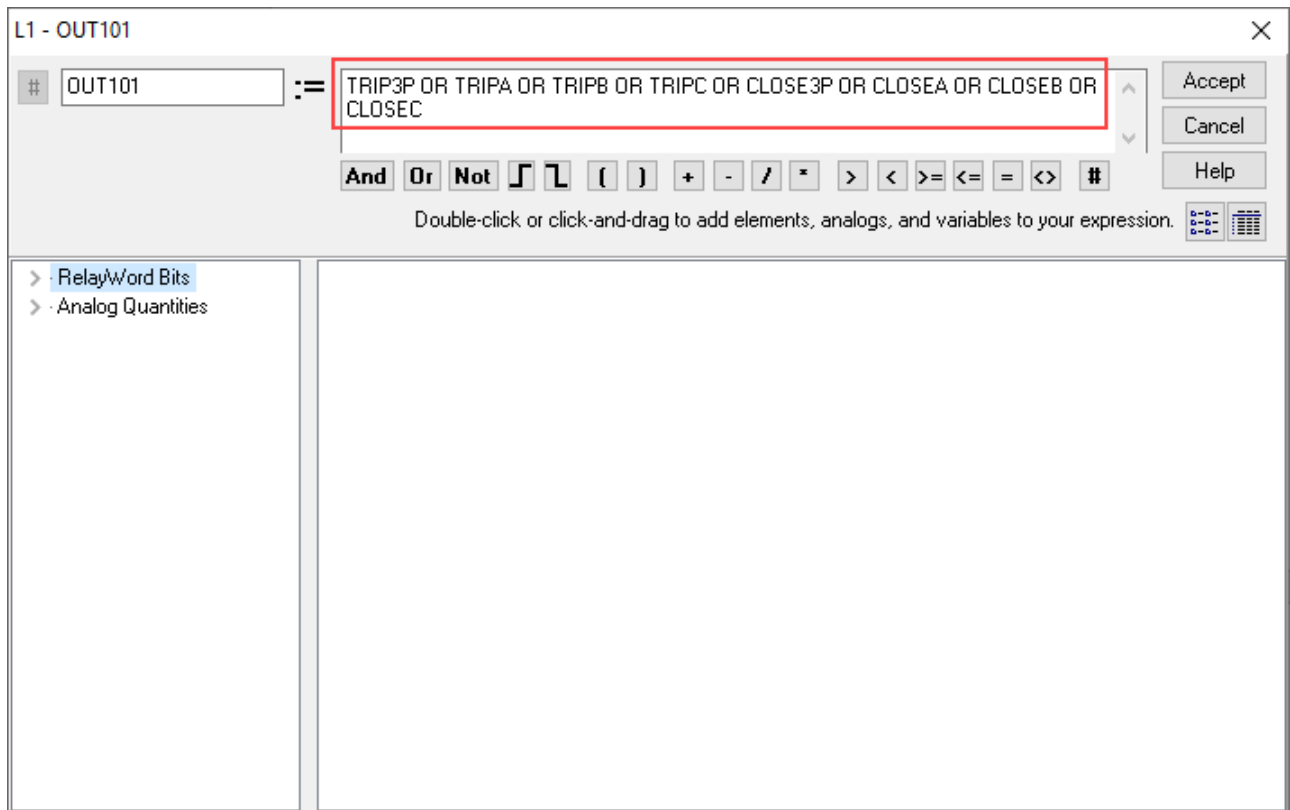


Figure 3: Output equation of SEL 651R OUT101 contact shown in AcSElerator® Quickset;

Save the changes and then send the active settings to the control unit. Wait until the controller downloads the settings and resets.

NOTE: In the application described in this document, binary output contact 101 (OUT101) of the SEL 651R is used to detect the instant when a trip or close command is sent by the controller. However, any other available output contact of the control unit could have been used for the same purpose.

5 Contact Time Measurement

5.1 Setup Software

Connect to the ARCO 400 with ARCO Control. Select to operate the ARCO in manual mode and in the Controller Selection screen select and apply the Generic 3-Phase TS controller option (see Figure 4).

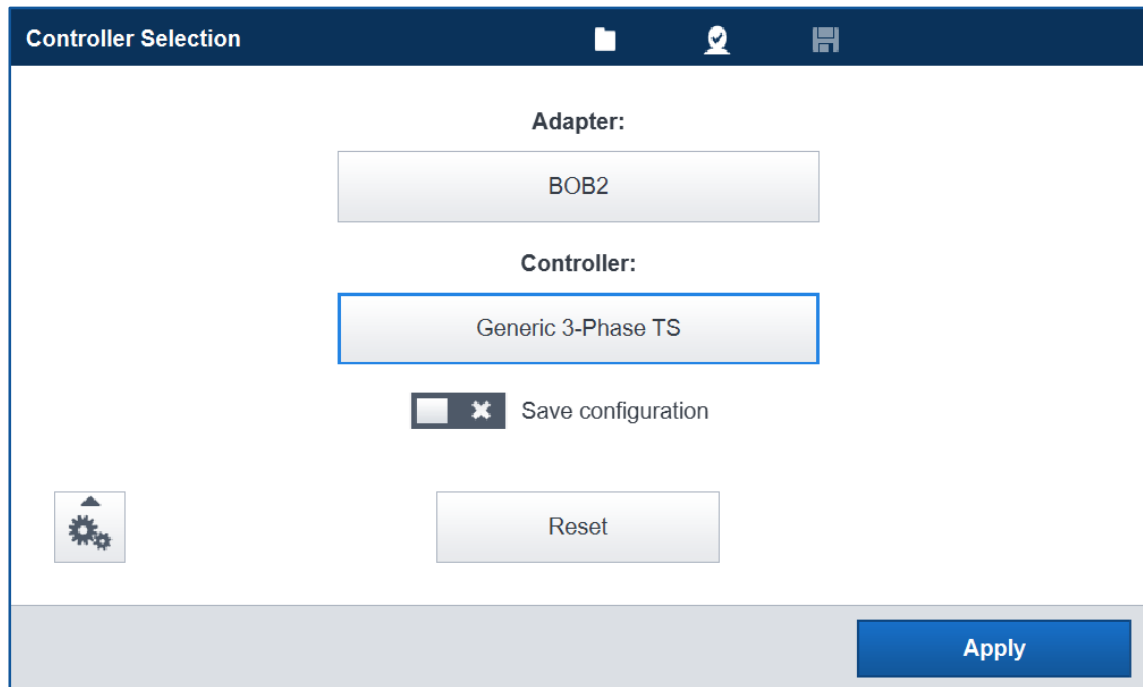


Figure 4: ARCO Control Controller Selection screen with BOB2 Generic 3-Phase TS configuration selected.

In the Hardware Configuration screen, click on the Aux DC button and then activate the auxiliary DC supply. Set the Aux DC output voltage to any value above the ARCO's configured binary input nominal range (see Figure 5). The default binary input nominal range for the BOB2 configuration is 24 V.

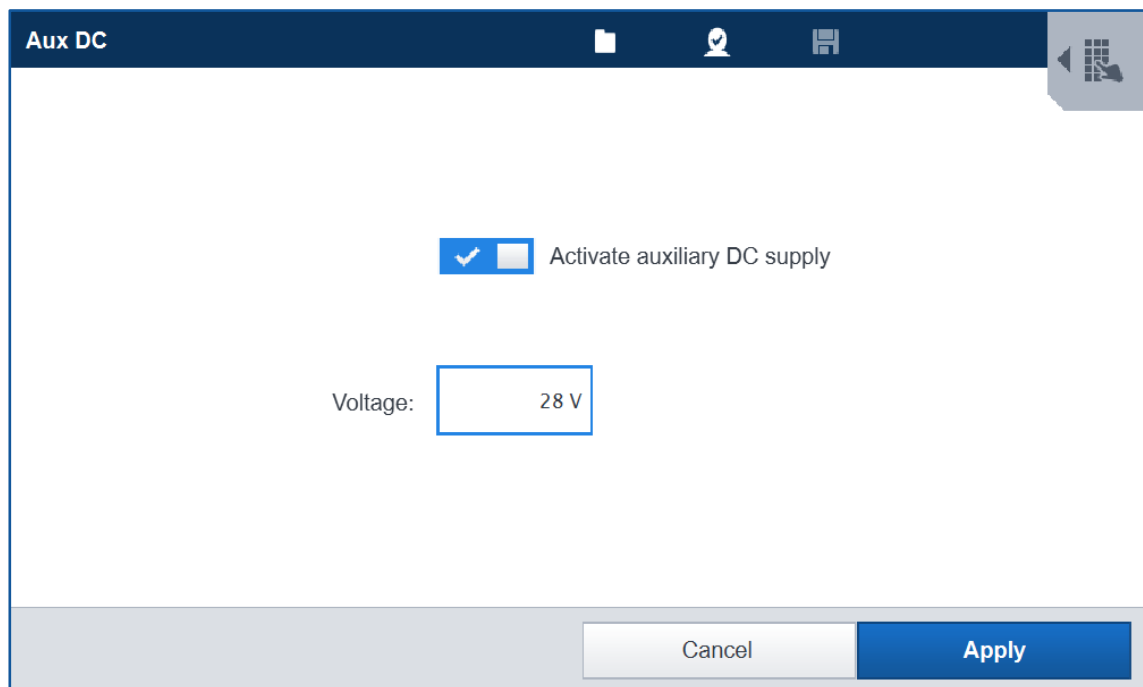


Figure 5: ARCO Control Aux DC screen.

Apply the hardware configuration and then open the Direct tool. Set the phase currents to 0 A and set the close signal of phase A as the “Off on trigger” signal, as shown in Figure 6.

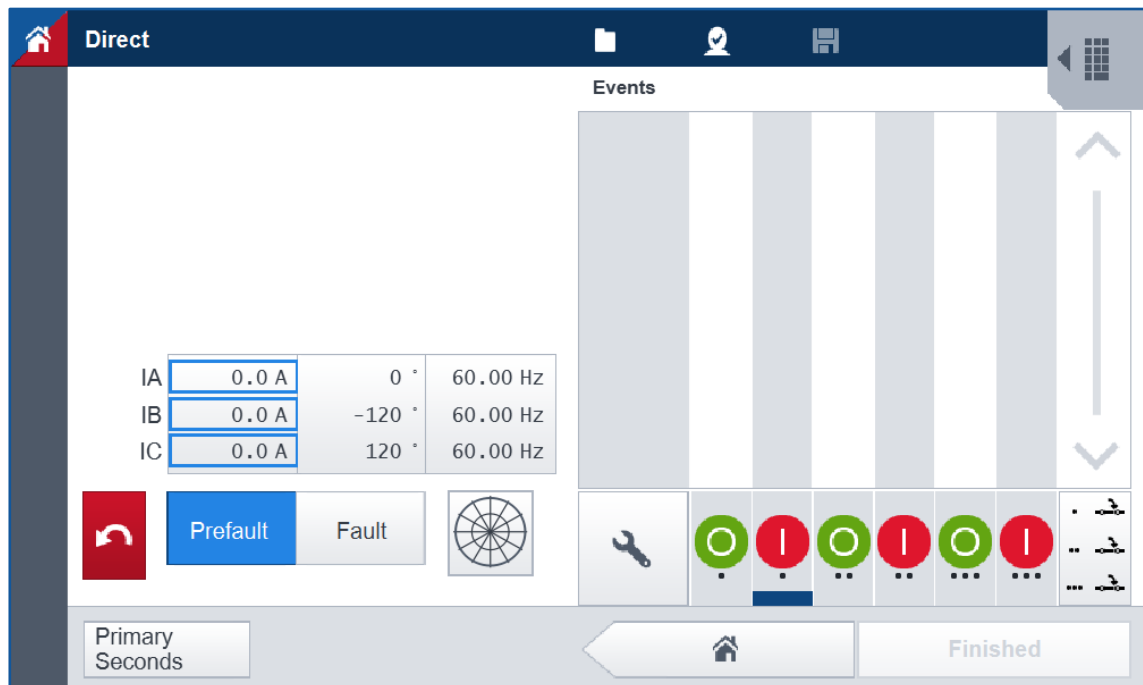


Figure 6: ARCO Control Direct tool setup.

5.2 Perform Measurement

To measure the open contact time, first close the recloser using the controller's front panel close push button. Slide down the ARCO Control play button to run the Direct tool and then open the recloser using the controller's front panel open push button. The direct tool records a phase A trip event followed by a phase A close event and then turns off, as shown in Figure 7. The first recorded phase A trip event corresponds to the trip signal sent by the controller and the first recorded phase A close event corresponds to the opening of the phase A recloser contacts. The time difference between these two events (shown enclosed in a red box in Figure 7) is the phase A open contact time of the recloser. In the example shown in Figure 7 the measured phase A open contact time is 14.8 ms.

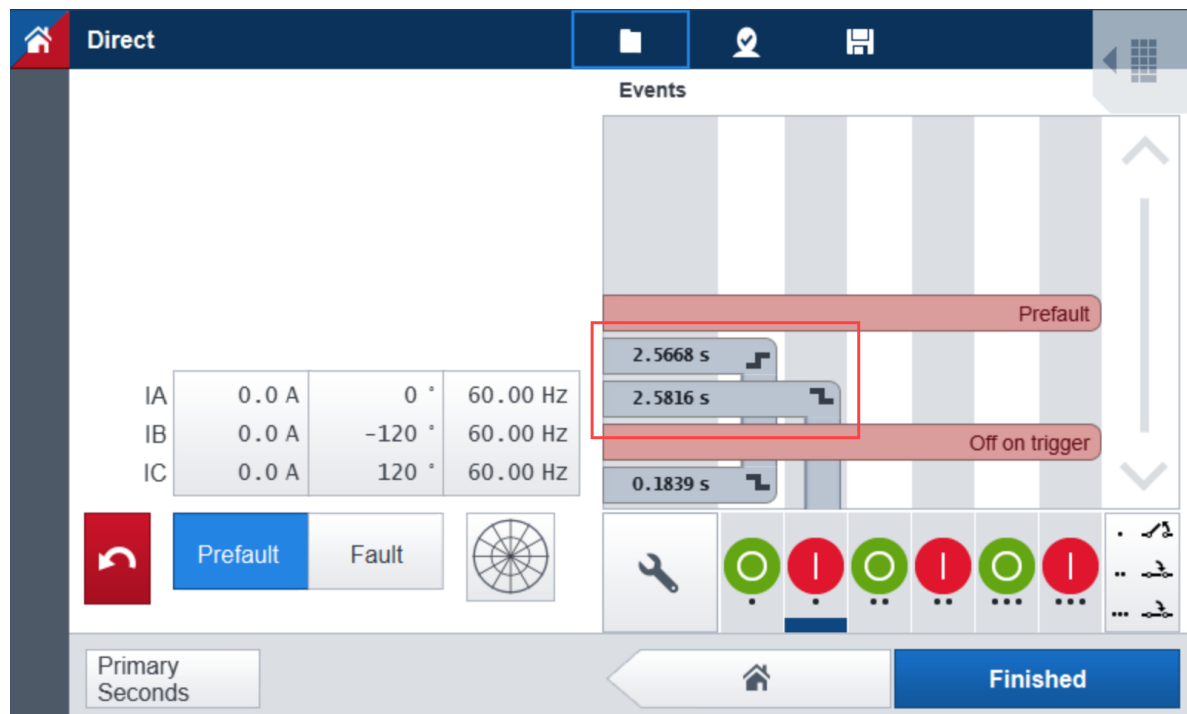


Figure 7: Recloser open time measurement in ARCO Control Direct tool.

To measure the close contact time first open the recloser by pressing the controller's front panel open push button. Slide down the ARCO Control play button to run the Direct tool and then close the recloser using the controller's front panel close push button. The Direct tool records a phase A trip event followed by a phase A close event before turning off, as shown in Figure 8. In this case the first recorded phase A trip event corresponds to the close signal sent by the controller and the first recorded phase A close event corresponds to the closing of the phase A recloser contacts. The time difference between these two events (enclosed in a red box in Figure 8) is the phase A close contact time of the recloser. In the example shown in Figure 8 the measured phase A close contact time is 30.5 ms.

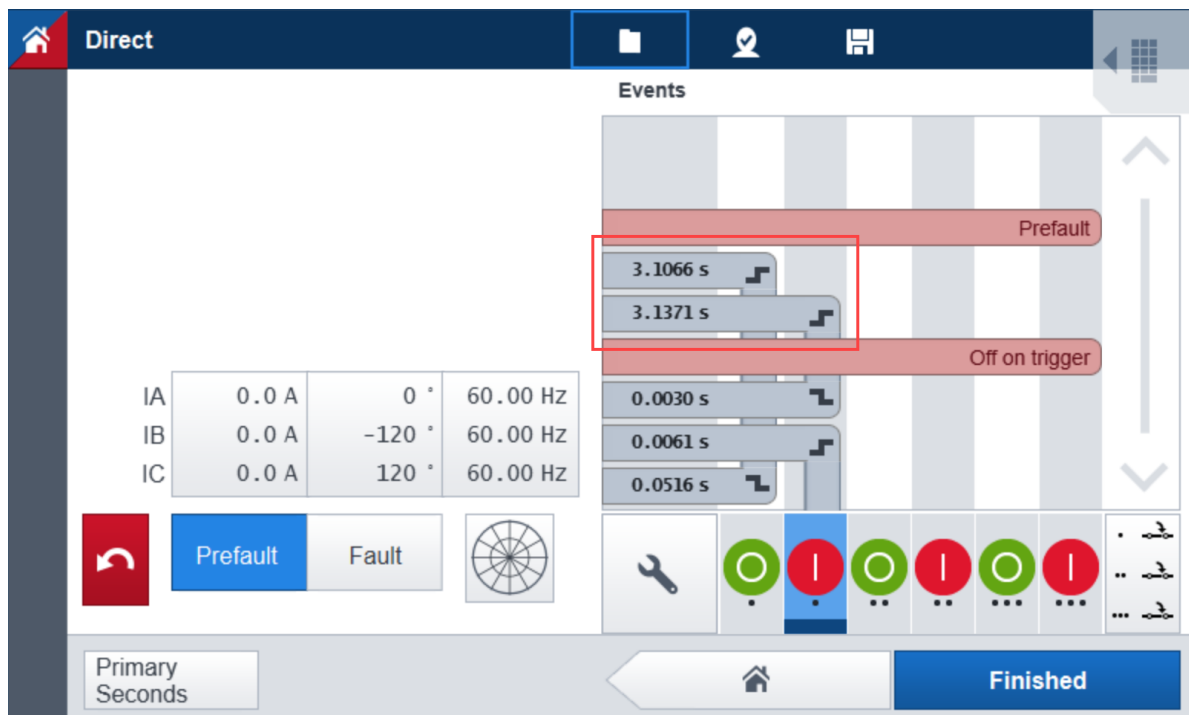


Figure 8: Recloser close time measurement in ARCO Control Direct tool.

6 Annexes

Figure 9 to Figure 11 show the setup of the contact time measurement of phase A of a 27 kV G&W Viper ST recloser, connected to an SEL 651R controller, using an ARCO 400 and BOB2 accessory.

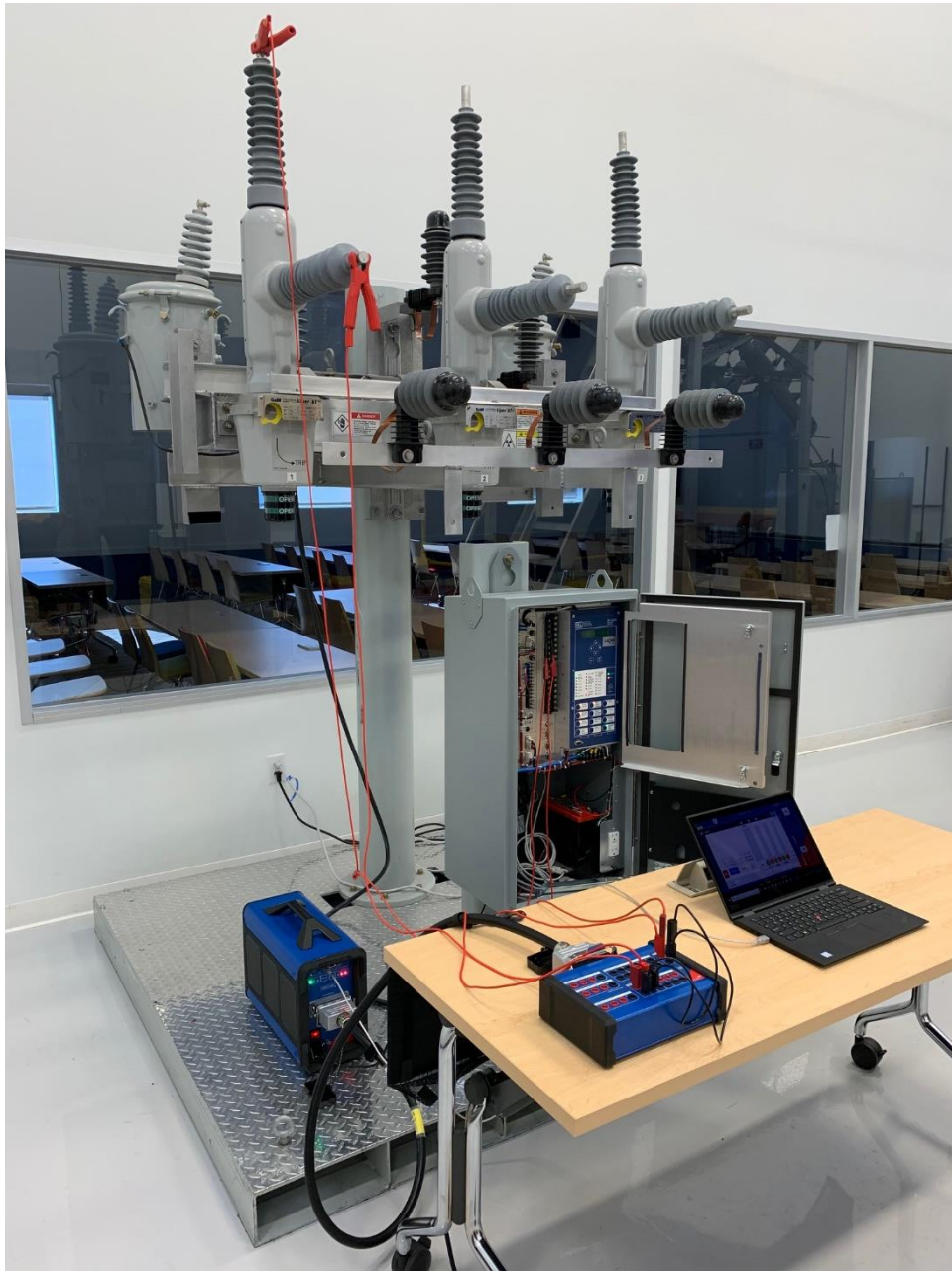


Figure 9: Overall setup of the recloser contact time measurement with ARCO 400 and BOB2 accessory.

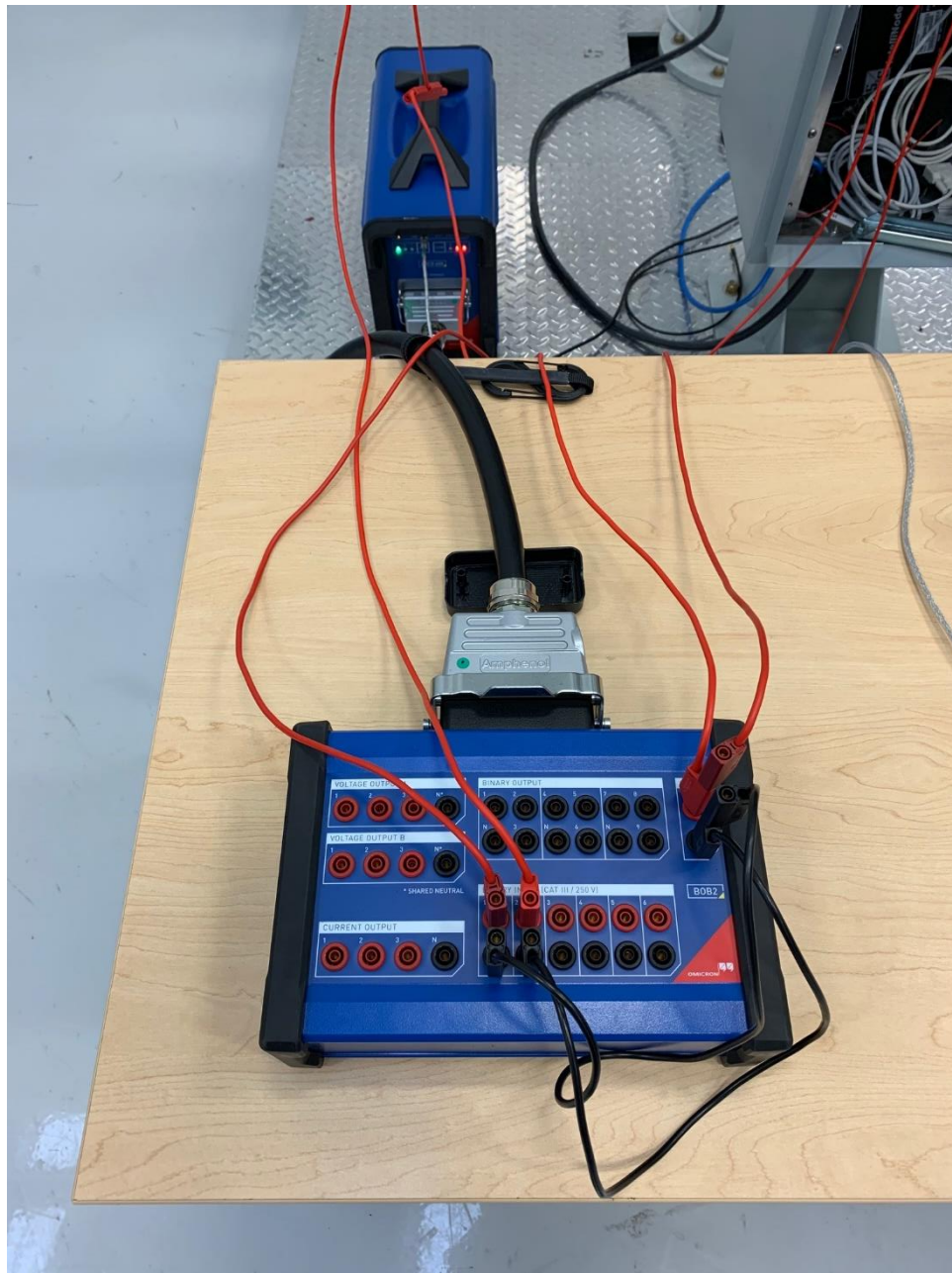


Figure 10: Connections on the BOB2 accessory.



Figure 11: Connection of the SEL 651R OUT101 contact.

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