

Teleprotection Command Tester

TPC-1



User Manual

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Introduction

This manual contains general information about device, technical data, scope of use and description of safe maintenance during tests.

This document is delivered with each TPC-1 tester.

Target users

Telecom engineers, protection system engineers, commissioning engineers responsible for testing and operation protection signaling equipment.

The equipment manual describes the function and applications of TPC tester used for maintenance of teleprotection equipment.

Safety condition

This manual contains general information for safety maintenance of equipment and also comprises important information about safe using to avoid damage or failure of equipment.

Before starting to use TPC-1 tester, please read this manual.

Warranty

The warranty for this appliance is for 1 year from the date of purchase. The appliance has been manufactured with care and meticulously examined before delivery. Please retain your invoice as proof of purchase. In the case of a warranty claim, please make contact by e-mail with our Customer Service.

The warranty covers only claims for material and manufacturing defects, but not for transport damage, wearing parts, cases, cables etc.

The warranty is void in the case of abusive and improper handling, use of force and internal tampering not carried out by our authorized service branch.

Your statutory rights are not restricted in any way by this warranty. The warranty period can be extended by annually regular company inspection and calibrations but not more than 5 years. The other damages and defects at the time of purchase must be reported immediately after unpacking.

Safety compliance

EC Declaration of Conformity – Low Voltage

Compliance was demonstrated to the following specification as listed in the Official Journal of the European Communities:

Low Voltage Directive 2006/95/EC.

EN 61010-1: 2001. Safety requirements for electrical equipment for measurement control and laboratory use.

Equipment type

Test and measurement equipment.

Equipment recycling

Production of this equipment required the extraction and use of natural resources. The equipment may contain substances that could be harmful to the environment or human health if improperly handled at the product's end of life. In order to avoid release of such substances into the environment and to reduce the use of natural resources, we encourage you to recycle this product in an appropriate system that will ensure that most of the materials are reused or recycled appropriately.



This symbol indicates that this product complies with the applicable European Union requirements according to Directives 2002/96/EC and 2006/66/EC on waste electrical and electronic equipment (WEEE) and batteries.

The other

This product has been classified as Monitoring and Control equipment, and is outside the scope of the 2002/95/EC RoHS Directive.

Battery recycling

This product contains a lithium ion (Li-ion) rechargeable battery, which must be recycled or disposed of properly.

Rechargeable Li-Ion batteries are subject to disposal and recycling regulations that differ by different regions or countries. Is necessary check local regulation before disposing batteries.

Place only discharged batteries in a special marked battery container. Use protection tape to cover battery poles, to prevent of short circuits.

Electric shock



This product generate up to 220V DC signals. Because of this touching of outputs during signal generation may cause electric shock, that can be dangerous specially for persons with pacemaker.

1 Scope of delivery

TPC-1 set contains:

- TPC-1 tester
- toolcase
- test cable set
- LC14850(3,7V) rechargeable battery set
- power supply /charger
- equipment manual

1.1 Equipment inspection

After receiving of the TPC-1 testing set is necessary to check delivery set compatibility with order.

1.2 Functional checking

- insert LC14850 batteries into battery socket
- charge batteries if necessary
- switch on tester
- test all touch screen menu icons
- check output voltage presence, adequate to further parameters described in manual
- check cables

If you observe any problems with equipment or with delivery details, please contact with seller or directly with company.

2 Functional description

2.1 2.1 Device description and features

TPC-1 Teleprotection Command Tester is designed as advanced equipment to provide many practical diverse tests of teleprotection devices described in chapter no 4. Schematics of test circuits .

Base tests relise with TPC-1 tester:

- transmission time for teleprotection devices
- command transmission delay
- command duration measurement
- programmable pulse injector with programmable generator
- command operation counter
- programmable pulse count
- manual command injector with command counter and indicator
- receive command tester with counter and receive command indicator
- programmable loopback tester with programmable delay time and loopback counter
- real time clock
- touch screen operation.

Tester is made as a comfortable handheld ABS enclosure prepared to realize wide spectrum test of teleprotection equipment with two different voltage levels (200/48VDC) calibrated during production.

The TPC-1 can become a basic testing tool necessary to proper testing and commissioning of teleprotection devices. This tester is created with idea to help operating personnel, during tests , commissioning, troubleshooting and for daily measurement protection signaling equipment.

2.2 Device parameters

2.2.1 Electrical parameters

- power supply	14,8V (4xLC14850 rechargeable batteries) dedicated charger 16,8V DC
- battery operation time	min 2,5 h
- output voltage	200 VDC (+/- 10%) 110 VDC (+/- 10%) *Optional 48 VDC (+/- 10%) *Optional
- output power	max 4W
- output current	max 20 mA
- input level voltage	48 V internal source (+/- 10%)
- input current	1 mA

2.2.2 Response time measurement parameters

- response time measure range	max 2 s
- input command duration	max 5 s
- start button triggering	yes

2.2.3 Pulse generator parameters

- pulse duration range	1..5000 ms
- pulse break range	1..5000 ms
- pulse count range	0..9999 pulses (0 - no limitation)
- OUT counter range	0..65535
- IN counter range	0..65535
- interactive counters reset	yes
- start button triggering	yes

2.2.4 Manual command tester parameters

- manual pulse triggering	yes
- continuous output	yes
- OUT counter range	0..65535

- IN counter range	0..65535
- interactive counters reset	no
- start button triggering	yes

2.2.5 Loopback mode parameters

- loopback delay range	0..5000ms
- loopback counter range	0..65535
- interactive counter reset	no
- start button triggering	yes

2.3. Device description

Enclosure

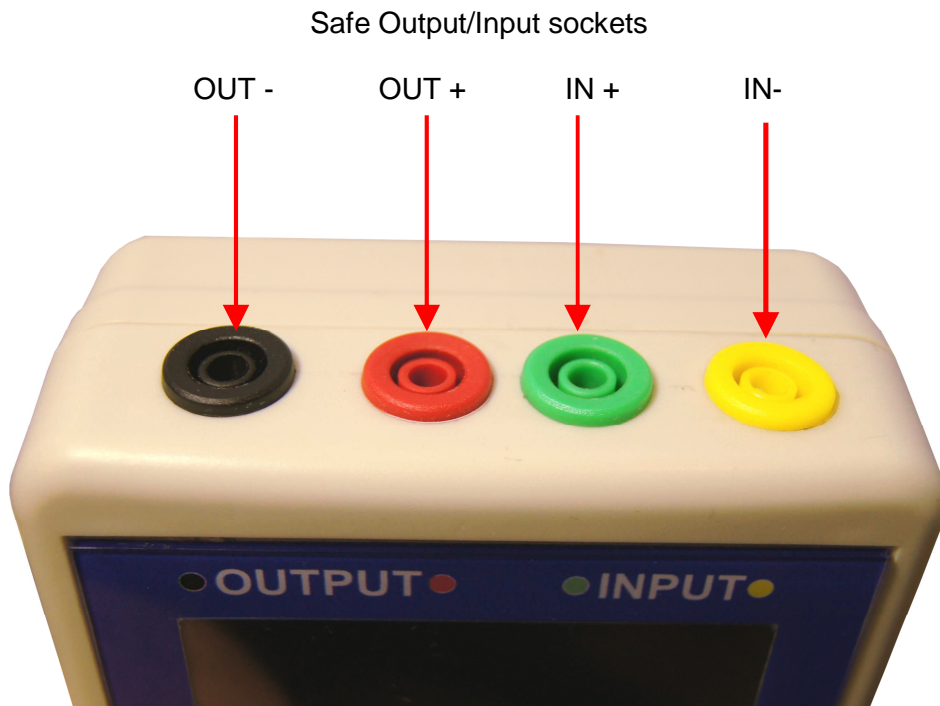


Fig. 1 Top view

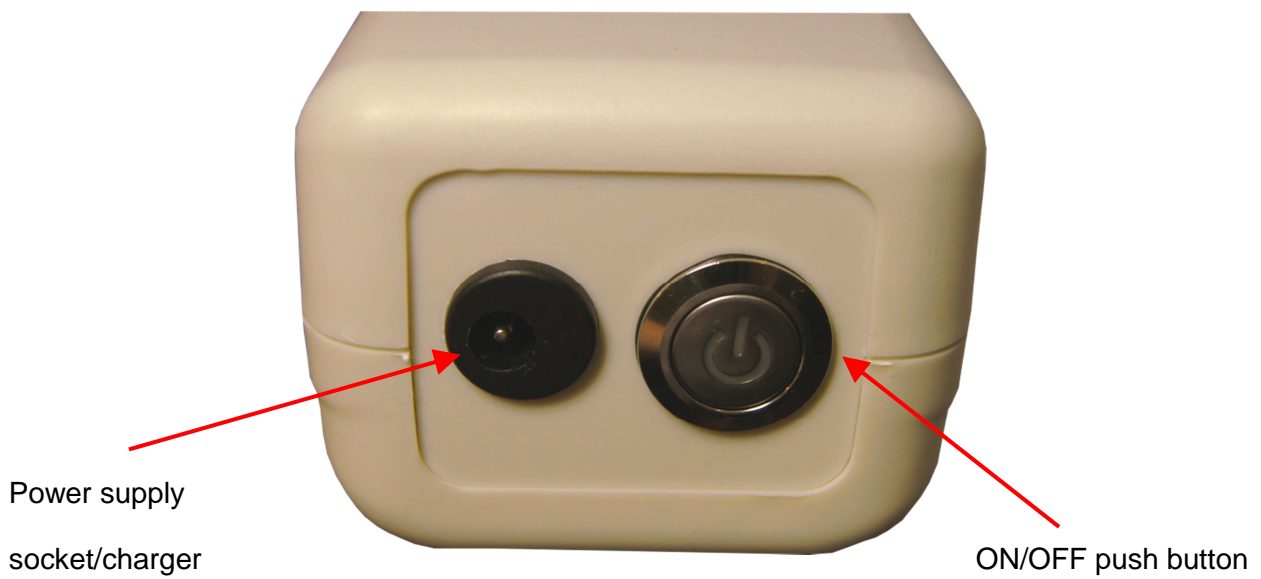


Fig. 2 Rear view



Fig. 3 Front view



Fig. 4 Bottom view

3 TPC-1 Handling description

TPC-1 teleprotection tester is designed to battery operation or/and to work with external dedicated power supply, which can be used as a battery charger.

You can not use another power supply to power device. Using different power supply can damage sensitive internal circuits.



Ensure that there is no external voltage on TPC-1 input or output. It may cause damage of TPC-1.

3.1 Power on device

Important - before turn on device

Insert batteries to battery socket - Fig.4 (use only dedicated 3,7 Li-Ion LC14500 series rechargeable batteries) connect dedicated charger to power supply socket - Fig.2. Charging batteries process will start immediately. Proper charging process is being signaling with red LED on power supply. Power supply LED will change to green as soon as charging process is finished.

Please pay attention to the polarity when inserting battery to socket. Wrong battery polarity can destroy tester.

You can use the device immediately when power supply is connected to the power supply socket - Fig. 2. Battery charger allows to use TPC-1 during charging process.

Press ON/OFF button to turn device on - Fig.2

- the unit will perform an internal test and on display will show up start screen



Fig. 5 Start screen

This screen allows to go to main menu of tester.

You can switch to main menu screen by pressing of touchscreen (Fig.5) or pressing start button (Fig.2)

3.2 Main menu

After touchscreen or start button pressing on display you can see main menu screen - Fig.6.



Fig. 6 Main menu screen

Main menu screen allows switch to the following modes of tester

- time response measure mode
- pulse generator mode
- manual command triggering mode
- loopback mode
- response measurement parameters setup and time & date setup

3.2.1 Response time measurement mode

Press the icon

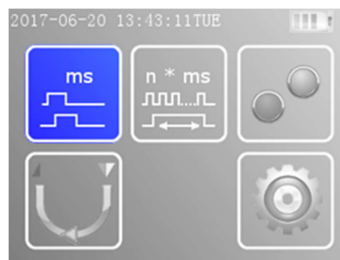


Fig. 7 Switching to response time measurement mode

The switch to response time measurement is after pressing the icon. The menu changes to the next screen.

This mode allows you to measure delay time from rising edge of output pulse to rise edge input pulse expressed in milliseconds. The maximum measuring range is 2000 ms. This value for teleprotection testing is sufficient. Measurement in broadest range is not necessary in case teleprotection equipment.

Next function in this mode is measurement of input pulse duration. The maximum measure range is 5000 ms. This test allows you to measure prolongation time on teleprotection's outputs.

Measurement methods and connection diagrams are described in part 4 of this manual.

The response time test is triggered by pressing of start button on tester. If everything is well connected we get the following measurement result Fig.8

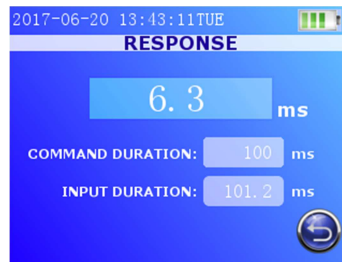


Fig. 8 Response time measurement result

Response time measurement is not possible in case of wrong tester connection to circuit to be tested. In this case, the shows following screen Fig.9

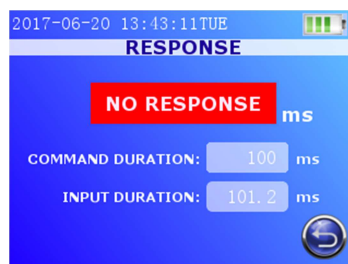


Fig. 9 Result in case of wrong test circuit

In case of a short circuit on input of the tester, also measure of response time is not possible, This case is shows next screen Fig 11



Fig. 10 Result in case of short circuit on input

3.2.2 Pulse generator mode

Press the icon

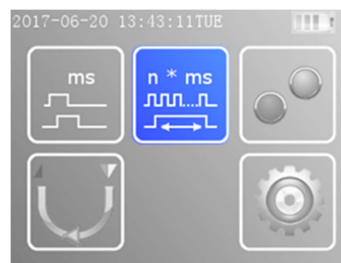


Fig. 11 Switching to pulse generation mode

The switch to pulse generator mode is after pressing the icon. The menu changes to the next screen.

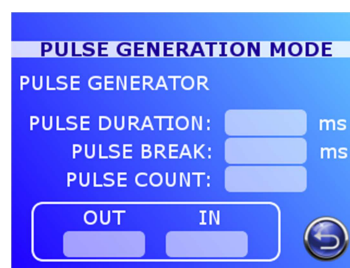


Fig. 12 Pulse generation mode screen

This mode allow TPC-1 to work as a function generator of square wave with defined pulses. It is possible to define duration and break time of output pulses.

Generator can operate in two operating modes - free running mode and specified number of output pulses.

Free running mode is active when **PULSE COUNT** is set to 0. To start generation you press the start button or touch ON/OFF switch on touchscreen. To stop generation you use again start button or ON/OFF switch.

Pulse generator outputs the pulses according to settings of “pulse break” and “pulse duration” parameters. The number of pulses sent is displayed on the OUT counter, received on IN counter (Fig.13).

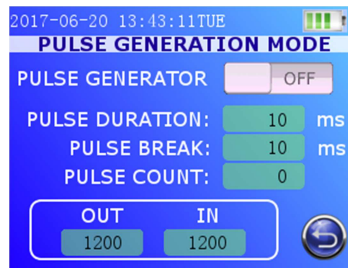


Fig. 13 Example of free running mode with loopback condition

Specified number of output pulses mode is active if the **PULSE COUNT** is different from 0.

The number of output pulses is equal the number entered in **PULSE COUNT** field.

Generation in this mode start by pressing start button or ON/OFF switch on touchscreen and ends when defined number of pulses is generated.

The amount of sent pulses, in present mode, is from 1 to 6000.

The input in this mode works as a monitor of incoming pulses. All pulses received are counted in receive counter. The input and output counter work independently. Range of counters is defined as 65535 pulses. The counter are not memorized, and after leaving the function are deleted. Additionally at any time, input and output counters can be erased.

Counters can be deleted by pressing appropriate counter field and confirming (Fig 14)

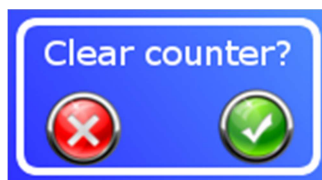


Fig. 14 Reset counter

Note

Because of display refreshing time, counters status does not refreshing immediately for pulses shorter then 5 ms. Counters refreshing follows just after stopping pulse generator.

For pulses 5 ms and longer, display refreshing follows immediately.

3.2.3 Manual command test mode

Press the icon



Fig. 15 Switching to manual command test mode

The switch to command test mode is after pressing the icon. The menu changes to the next screen (Fig. 16)

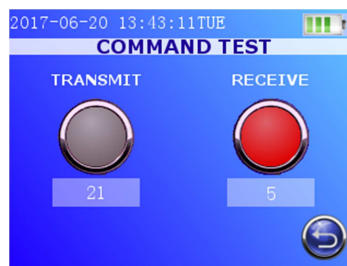


Fig. 16 Manual command test mode screen

This mode allow you manually send and receive commands. Commands, in this mode, are triggered when you press the start button. The number of sending or receiving commands are displayed in the command counters. Command counters can not be deleted in this window. Command counters are deleted when you leaving this menu.

Sending continuous commands is also possible in this mode. Sending continuous command is possible by pressing the transmit indicator on the touchscreen. The next press of transmit indicator or by pressing start button turns off the continuous command sending mode.

3.2.4 Loopback mode

Press the icon



Fig. 17 Switching to loopback mode

The switch to loopback mode is after pressing the icon. The menu changes to the next screen (Fig. 18)

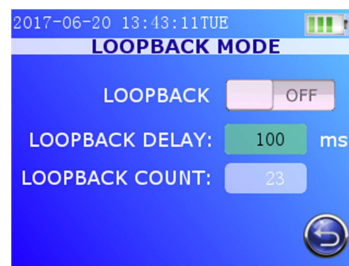


Fig. 18 Loopback mode screen

In this mode it is possible to use tester as a programmed loopback command retransmitter.

“Loopback count” field show number of retrasmitted commands.

Range of delay of loopbacked commands : 1..5000 ms

3.2.5 Setup (settings) mode

Press the icon



Fig. 19 Switch to setup mode

The switch to setup mode is after pressing the icon. The menu changes to the next screen (Fig. 20)



Fig. 20 Setup screen for 220V and 48V output voltage level

In this mode it is possible to define command duration pulse for time response measurement and loopback mode. The setup of pulse time is possible by the pressing “command duration” field and input the proper value. Maximum possible command duration value is 1000 ms.

Here setup of command output voltage level is possible to configure. Standard voltage level are predefined as a 48/220 VDC with tolerance +/- 5%.

Additionally the screen menu, allows real time clock setup. To setup clock press upper part of display. The display will show numeric pad to enter proper date and time in format 20YY-MM-DD HH-MM-SS. If the time has been correctly entered press the confirmation key, if not press cancel key (Fig.21)



Fig. 21 Time setup keypad

3.2.6 High voltage mode

The tester TPC-1 can work with two different output voltage levels. Typically they are 48 and 220 V switched in settings mode. (Fig 20).

In this mode, a high-voltage icon appears on the main screen (Fig.22)

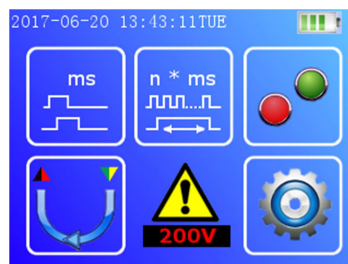


Fig. 22 High voltage information on main screen

In addition, the information bar in all operating modes changes from grey to red color, as shown in the example (Fig. 23)



Fig. 23 Low/high voltage information bar - example



Pay attention that presence of high voltage (200V) can destroy low voltage inputs of the device being tested.

3.2.7 Battery indicator

The battery level indicator is located the top right corner of the display and is present in all test modes.

The indicator approximate battery charge level.



Fig. 24 Position of battery indicator

3.2.8 Value input.

You can parametrize the parameters of the tester. For this, an interactive the keypad is used. Keypad appears after selecting the parameter to be changed.

Enter values by means confirmation key, cancel values, by means cancel key. (Fig. 25)



Fig. 25 Numerical keypad

4 Schematics of test circuits.

4.1 Time response measurement diagrams

In this mode, the measurement can be performed in two ways.

First method is useful for use in labs when devices are placed in one room and connected for example to each other via available link.

This method is called the direct measurement method. The result of measurement directly informs about command delay transmission time. (Fig. 26)

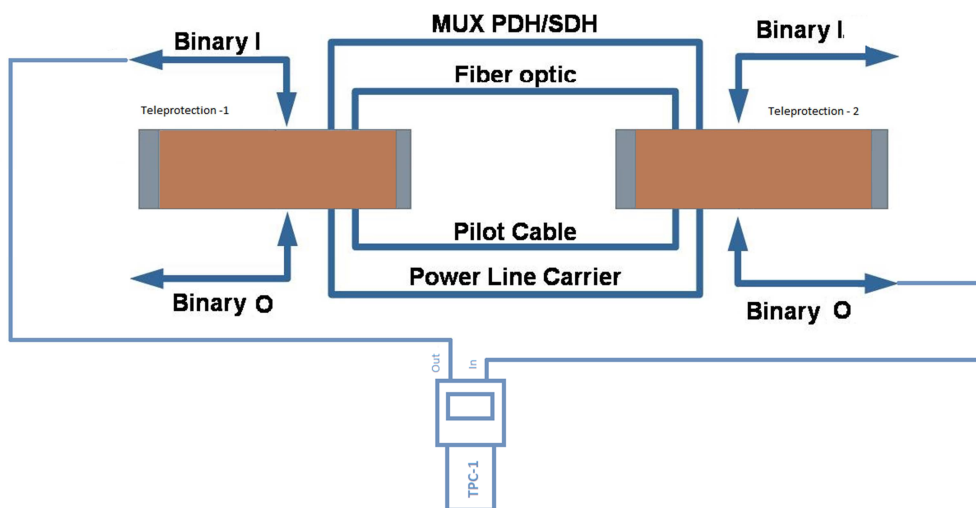


Fig. 26 Direct measurement method diagram

Second method is useful in real working condition of teleprotection system on site, when devices are connected to the transmission system or fibers.

This method is called loopback measurement method. This method needs supply on opposite site via another TPC-1 tester or voltage source module VS-1 (Fig 27).

In case of using another TPC-1 tester, necessary is to start loopback mode with loopback delay - 0 ms (Fig 28).

The result of delay transmission time measurement must be divided by 2 to have a real value. To proper measurement of transmission delay time configuration of both teleprotection subrack must be qual.

Detailed description about the setting loopback mode you can find at section 3.2.1

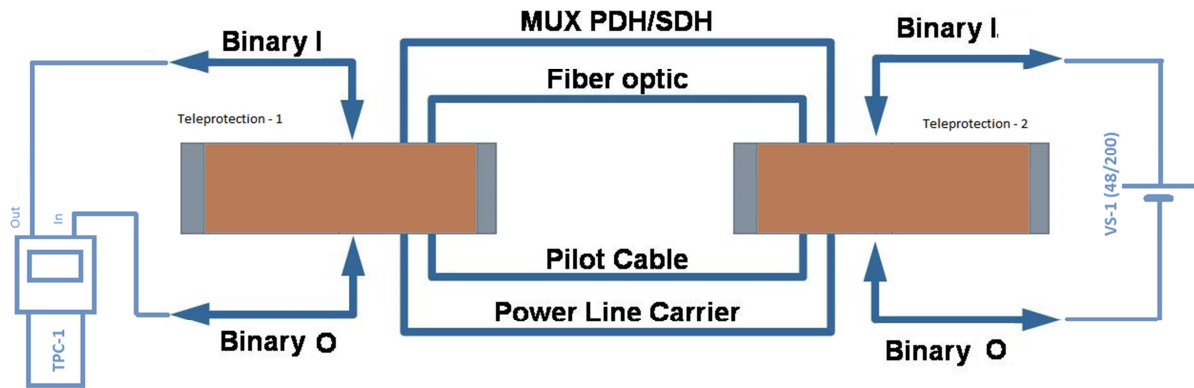


Fig. 27 Loopback measurement method diagram with external source module VS-1

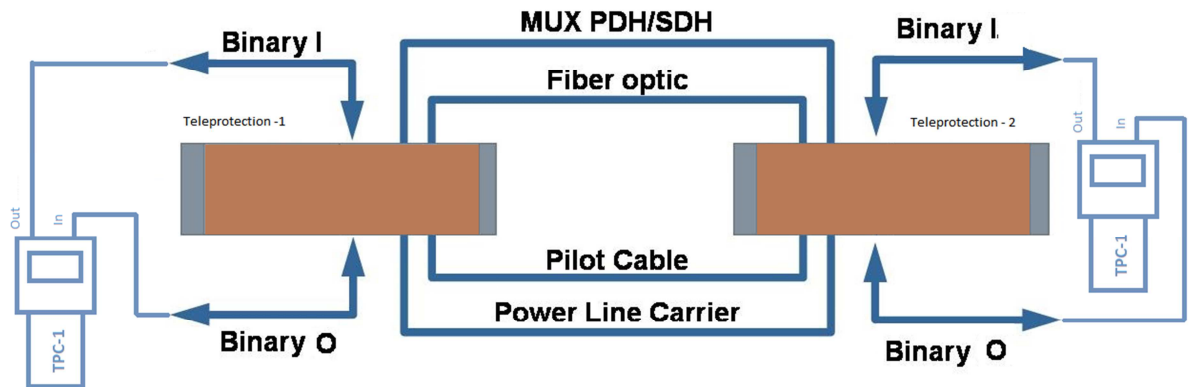


Fig. 28 Loopback measurement method schematic with two TPC-1 testers

4.2 Pulse generation mode schematics

This mode can be useful for longer testing of teleprotection equipment. It allows to estimate dependability of transmitted command via teleprotection line. Also using this mode we can estimate, if time filters programmed in equipment works properly.

The internal counters informs about count of transmitted and received commands.

The mode is helpful to estimate if teleprotection equipment has tendency to command merging. Detailed description you can find at section 3.2.2.

As in section 4.1 in this case, the test circuit diagrams for the individual test are valid.

Fig. 29 shows a diagram for testing direct connected teleprotection equipment in labs.

Fig. 30 shows a diagram for site testing teleprotection equipment in loopback condition.

Fig. 31 shows a diagram for site testing teleprotection equipment in loopback condition using another TPC-1 tester.

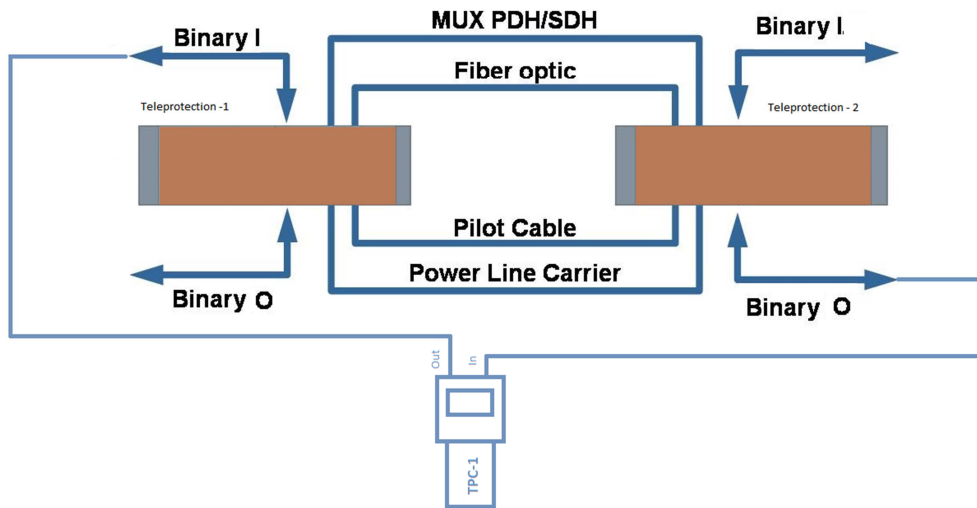


Fig. 29 Direct testing method diagram

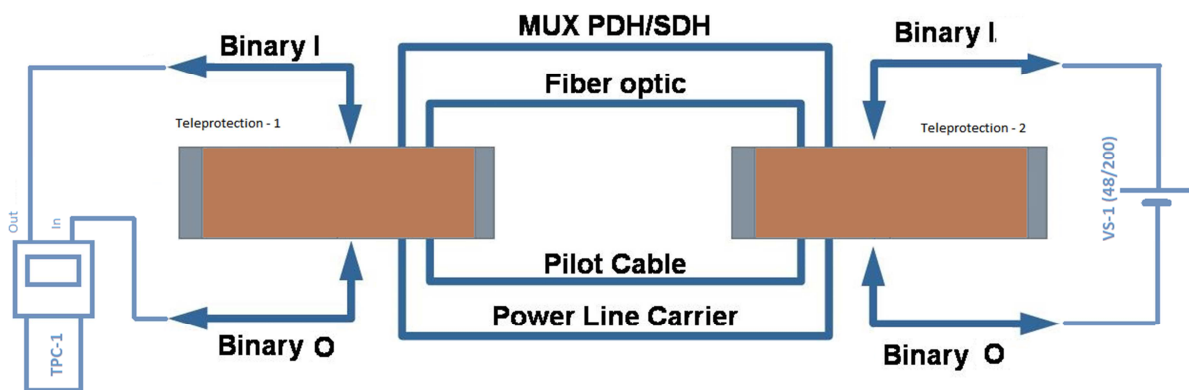


Fig. 30 Loopback testing method with external source module VS-1

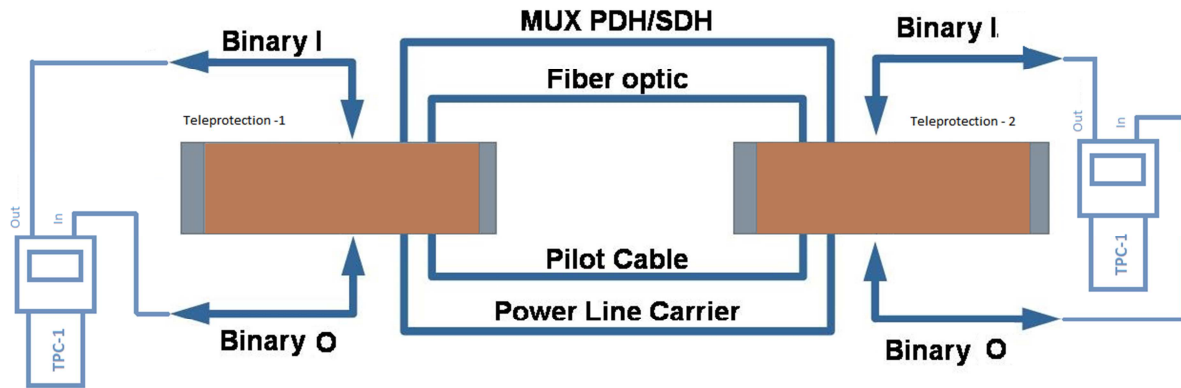


Fig. 31 Loopback measurement method diagram with two TPC-1 testers

4.2.1 Manual command test mode diagram

This mode allows for manual triggering and receiving commands.

Connect two TPC-1 according to fig. 31. Both testers should be set in Command test mode (see section. 3.2.3).

Each command input/output should be check to confirm correct wiring and software settings of teleprotection equipment.

4.2.2 Loopback mode diagram

Loopback functionality is show on previous sections schematics Fig. 28 and Fig. 30.

This functionality is very useful for monitoring incoming command and retransmitting them back to input of teleprotection equipment with programmed delay. This allows for the commissioning engineers estimate symmetry of transmission link, and linear response because of delay of triggering inputs.

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MANUAL

Teleprotection Command Tester TPC-1