TYPE 5762N HIGH RESISTANCE FAULT LOCATOR

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1 SAFETY

The mains plug shall only be inserted in a socket outlet provided with protective earth contact.

2 INTRODUCTION

The 5762N is a portable cable fault locator for determining the position of a single shorting fault between two conductors, or between one conductor and the sheath. The fault is located by manually adjusting a potentiometer to find the null point shown on the meter.

Measuring Principle
The measurement uses a Wheatstone bridge circuit with the two sections of the faulty conductor (either side of the fault) forming one arm and the internal pushbutton potentiometer forming the other. A high input-resistance differential amplifier, connected to the sheath and the potentiometer wiper, driving the meter allows faults of resistance up to 200MΩ to be accurately located. The potentiometer is to be adjusted until the null point is found. A potential of 6V (limited to 1A, or 10A if 10A BOOST button is held) is applied across the bridge arrangement through connectors C1 and C2.

3 CASE DESIGN

The 5762N is housed in a rugged orange case, constructed from a high impact structural copolymer with internal sub-frame. When closed, the case is rated to IP67.

4 MAINTENANCE

Normally no maintenance is required other than cleaning with a moist cloth. Do not use aggressive detergents or solvents.

CAUTION: Before any maintenance, repair or exchange of parts or fuses, the instrument must be disconnected from the mains supply and all power sources. In the event of a fault occurring, the instrument should be returned to our factory or your local Tinsley agent. A mains fuse is fitted to the mains inlet socket on the front panel, and should be replaced if necessary.

CAUTION: Disconnect mains lead and all connecting leads, before removing fuse holder. Replace only with the correct fuse type, T1A 250V IEC127 5 x 20mm

5 TECHNICAL DATA

Battery	:	Yuasa NP2.8-6, 6V 2.8Ah sealed lead-acid
Operating temp	:	0...+40ºC
Storage temp	:	-23...+85ºC
Mains connection	:	85 - 264V AC, 47 - 63Hz
Power consumption	:	9W (when fast charging)
Size	:	270 x 246 x 124 mm
Mass	:	TBC

Measurement

Fault location	:	Shorting faults of up to 200MΩ.
Resolution	:	0.1% of length of cable on test.
Accuracy	:	0.5%, subject to cable uniformity.

6 DESCRIPTION OF CONTROLS

METER

The meter serves two purposes. During fault location, the pushbutton potentiometer is adjusted to zero the meter on the top scale. When the *BATT TEST* button is pressed and held, the meter shows the battery voltage on the lower scale.

PUSHBUTTON POTENTIOMETER

This forms one of the arms of the Wheatstone bridge circuit employed in the 5762N. It is adjusted in the fault location procedure to zero the meter. At that point, the potentiometer displays the fault location, in tenths of one percent of the distance between the P1-cable and P2-cable connections.

IEC MAINS CONNECTOR WITH FUSE HOLDER

The 5762N is battery powered, and contains its own charger, powered from the mains. Either 100, 120, 220 or 240Vac can be used without any adjustment necessary. The fuse is contained in the drawer in this connector.

MEASURING TERMINALS

The terminals are a binding post design, allowing either the direct connection of a cable or the use of a 4mm connector.

Controls

ON/OFF POWER SWITCH

Switches the unit on and off. The LED in the switch will light if the unit is switched on. Note that if the battery charge is not sufficient, the unit will not turn on (See section 7, Battery)

BATT TEST SWITCH

Press and hold while the unit is switched on for the meter to show the current battery voltage. The battery needs recharging if the voltage falls below 5.7V when no cable is being tested.

10A BOOST SWITCH

During operation, a current is passed along the test cable. This current is normally limited to 1A, but it may be necessary to increase this for a higher precision reading (see section 9, fault location). Pressing and holding this button increases the current limit to 10A.

Status lamps

LOW BATTERY

Lights when only 20% charge remains in the battery. It is normal for this to light during cable test even when the battery is more fully charged due to the high drain on the battery.

FAST CHARGE

Lights when the battery is being bulk charged.

CURRENT LIMIT

During operation, a current is passed along the test cable. If the resistance of the cable is low enough for the 5762N to limit the current, this lamp will light.

7 BATTERY AND CHARGING

The 5762N is powered by an internal rechargeable battery which is fully charged when delivered. The charge of the battery can be checked by holding the *BATT TEST* button while the unit is switched on. The battery voltage will be shown on the meter.

Low battery warnings

When the battery has less than 20% charge remaining, the *LOW BATT* lamp will light and remain lit when the unit is switched on and no test cable is connected. It is normal for the lamp to light while a cable is tested, even when more than 20% charge remains, because of the large current drain on the battery.

As a fail-safe, the unit will automatically switch off if the battery voltage falls below a pre-set level. This is to prevent deep discharge of the battery. However, to maximise the battery life, the unit should be charged before this point is reached.

The unit will also switch off if left on for about 20-40 minutes to prevent it being accidentally left on. If this happens, just press *ON/OFF* as usual to switch it back on.

Charging

To charge the battery, plug the unit into an AC mains socket (either 100, 120, 220 or 240V can be used without adjusting any settings on the unit). Charging is automatically controlled with built in protection circuits eliminating the possibility of over-charging. The *FAST CHARGE* lamp will light while the battery is bulk charged. The battery will be maintained in a charged state while the unit is still connected to the mains.

The unit should not be used for fault location while charging due to the high current drain on the battery.

It should be noted that if the battery becomes deeply discharged, the charger circuit will automatically trickle-charge the battery and it may be some time before the *FAST CHARGE* lamp comes on. This is a design feature which ensures the batteries are kept in the best possible condition.

Storing
As with all lead-acid batteries, the battery used in the 5762N will slowly self-discharge, so the unit should be fully charged every six months.

Battery Warnings
The internal battery is a sealed lead acid type. Care should be taken when disposing of it and it may be returned to Tinsley for safe disposal. Any local regulations and directions applying to the disposal of such material must be applied.

CAUTION:
Do not dispose of battery in fire.
Do not short circuit battery terminals.
Do not crush, puncture, open, dismantle or otherwise mechanically interfere with the battery.

8 CONNECTIONS

8.1 When both ends of the faulty conductor are together (Figs. 1 - 3)
(as in cable manufacture, or when the cable is on a cable reel)

Strip back the sheath at least 150mm at each end of the conductor. Clean both ends to remove oxides and other impurities.

Connect a current lead to each end of the fault conductor.

Solder a potential lead to each end of the conductor, at least 100mm inside the current leads. The potential leads should make contact around the whole conductor.

Connect one of the current leads to the *C1* terminal on the 5762N and the other to the *C2* terminal. Connect the potential lead at the C1 end of the test cable to the *P1* terminal, and the other potential lead to the *P2* terminal.

Clamp or solder a lead to the sheath if the fault is between conductor and sheath, or to one end of the other conductor if the fault is between conductors. Connect this lead to the *SHEATH* terminal.

8.2 When the ends of the faulty conductor are not available at the same point (Figs. 1-3)

Using sufficiently long insulated leads, connect as described above in section 8.1.

This method is preferable to the alternative described below in section 8.3, as no error will be introduced as a result of variations in the conductors.

8.3 When the ends of the faulty conductor are not available at the same point (alternative method) (Figs. 1 & 4)

A good conductor in the cable of the same type (resistance etc) as the faulty conductor may be used. Connect the good and faulty conductors solidly together at the distant end and adequately insulate the join from earth.

Now connect the near end to the 5762N as section 9.1.

This method effectively doubles the length of the faulty conductor and reduces accuracy by half. Note that when the fault is located, the total distance P1 to P2 is double the length of the cable. Any variation between the conductors will add an error to the measurement.

8.4 Using an external battery for cables of very low resistance (Fig 5)

For cables of very low resistance or very high fault resistance, the current supplied by the 5762N may not be sufficient to achieve the required precision, even when using the 10A boost function. This will manifest itself by the meter not noticeably moving when making fine adjustments to the potentiometer. In this circumstance, an external 6V battery may be used.

CAUTION: Due to the sensitive nature of the inputs, only a battery of 6V or less may be used, and the connections must be made as described below, in the exact same order to avoid damage to the instrument.

Connect the *P1*, *P2*, *C2* and *SHEATH* terminals to the cable in the usual way (above).
Switch the 5762N on by pressing *ON/OFF*.
Connect the negative terminal of the battery to the cable, next to the *C2* connection.
Connect the positive terminal of the battery to the other end of the cable, the far side of the *P1* connection.
Locate the fault as section 10.
Disconnect the battery from the *P1* end of the cable.
Switch off the 5762N by pressing *ON/OFF* again.
Remove all other connections.

8.5 Using the Guard terminal with very high resistance faults (Fig. 1)

For very high resistance faults, surface leakage will cause an error. See section 11, Corrections

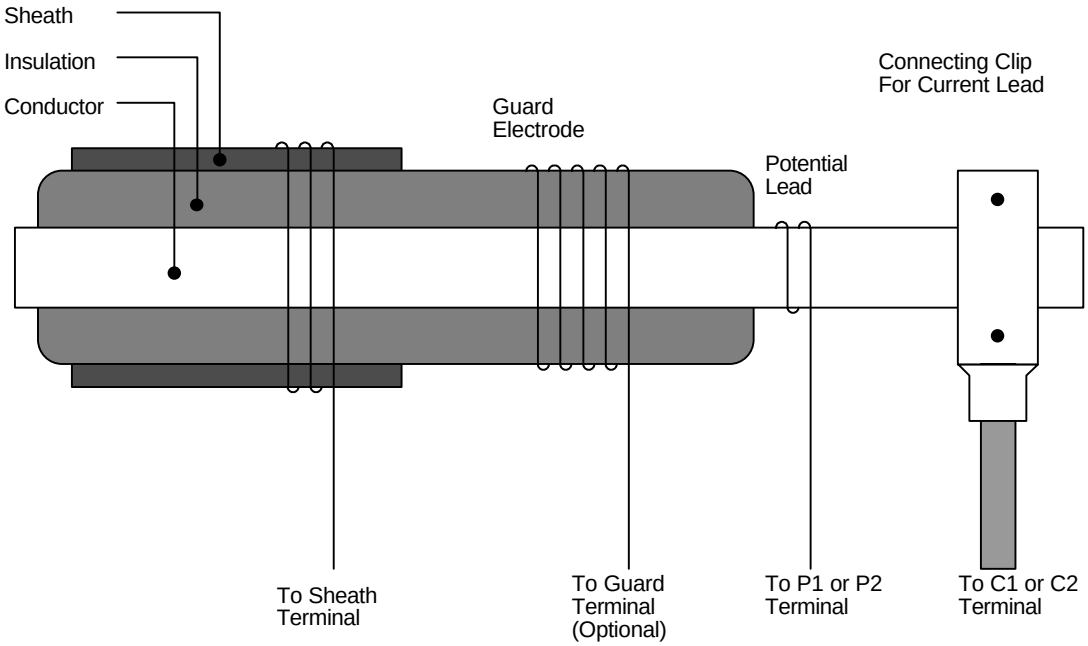

Figure 1: Connections to end of conductor

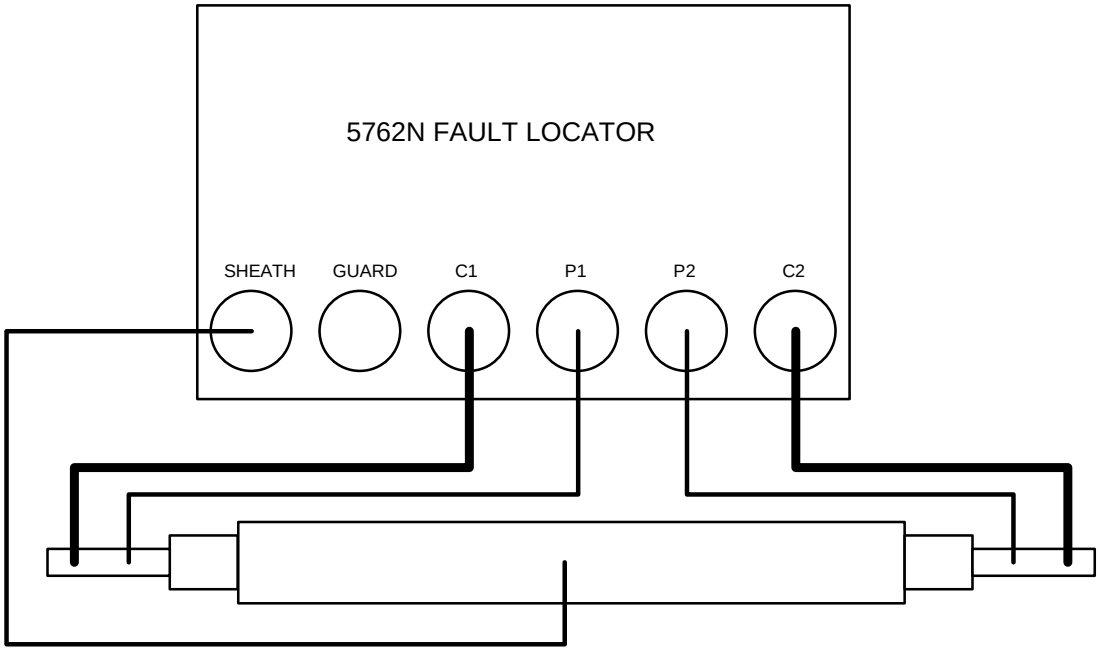

Figure 2: Both ends of cable are accessible. Fault is to sheath

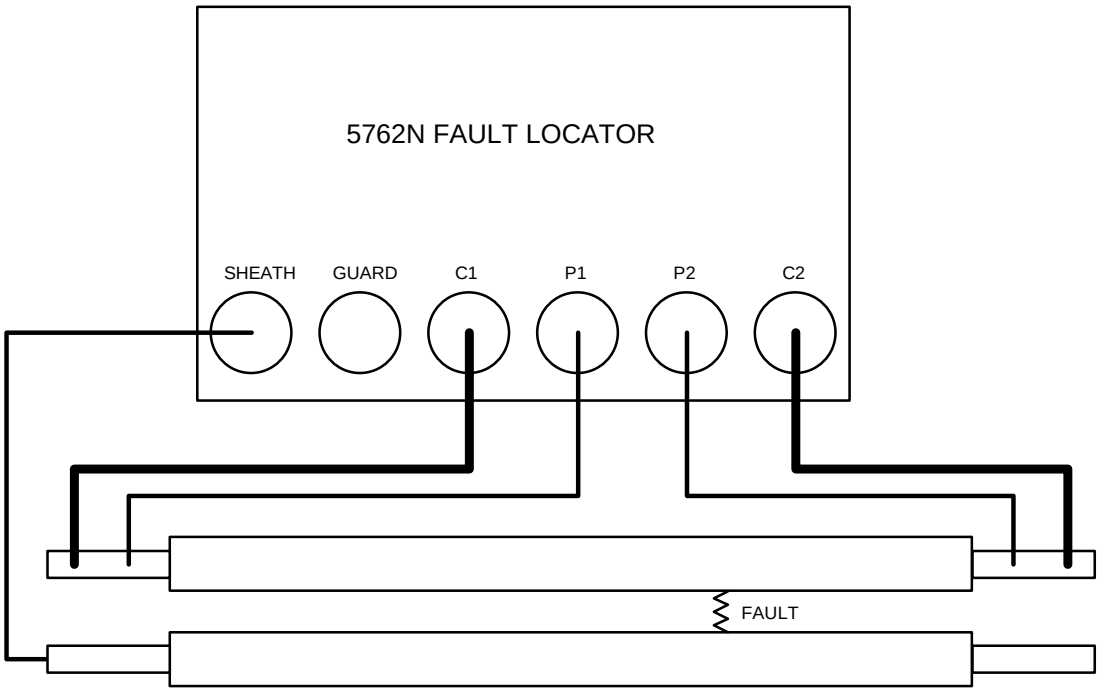

Figure 3: Both ends of cable are accessible. Fault is to other conductor

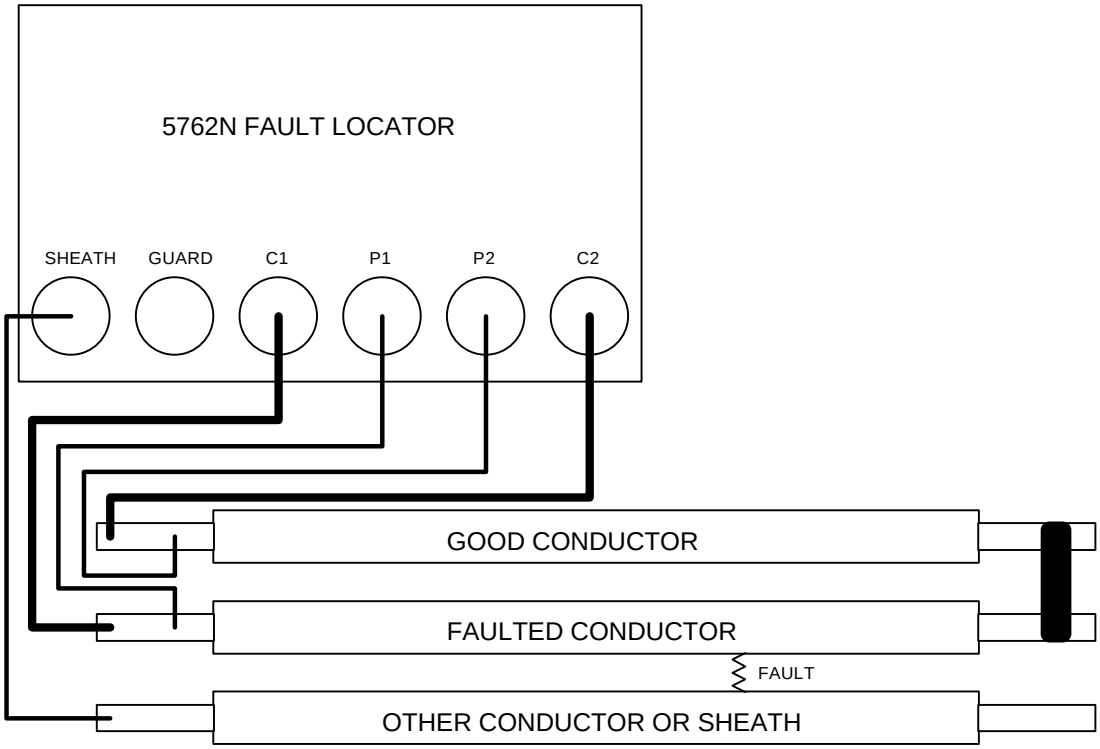

Figure 4: Both ends not accessible (Alternative method of connection)

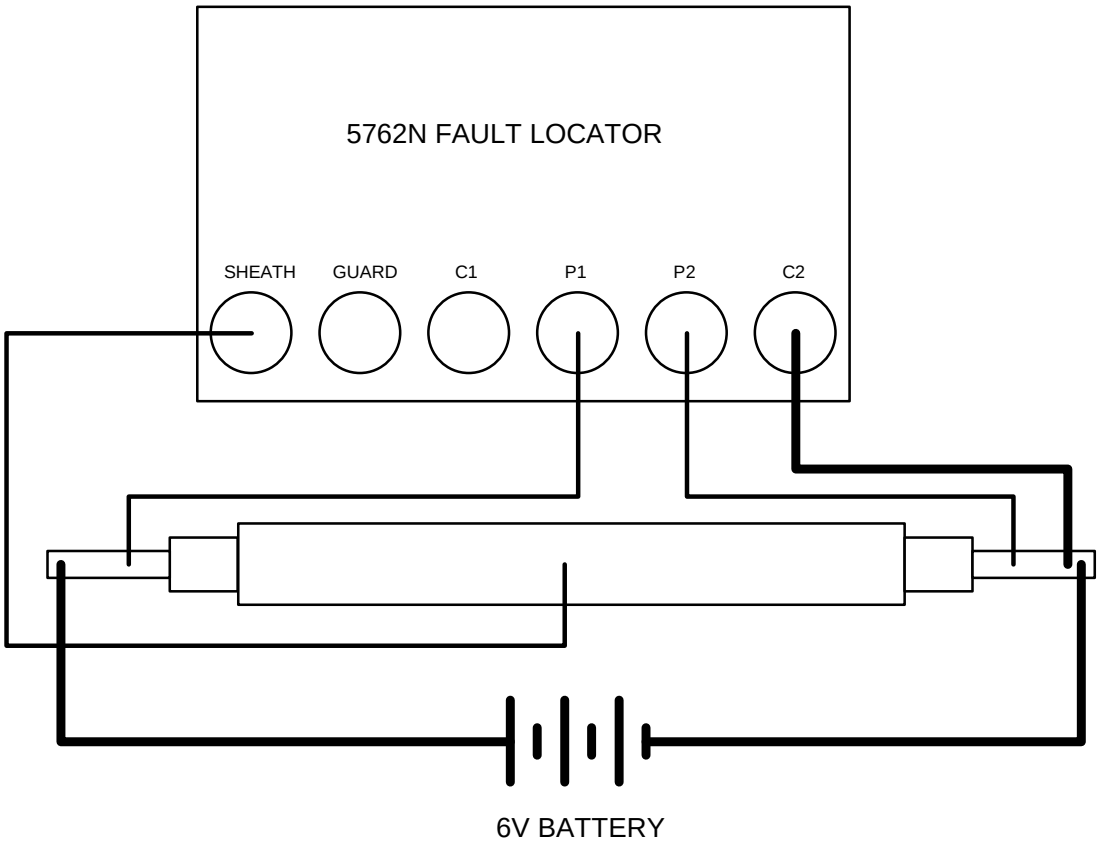

Figure 5: Use of external battery

9 FAULT LOCATION

It is easiest to begin with the potentiometer set to 000.

With the appropriate connections made (section 8), switch on the 5762N by pressing *ON/OFF*. Adjust the pushbutton potentiometer for zero reading on the meter.

If the *CURRENT LIMIT* lamp lights, the cable current is being limited to the default 1A. In this case, if fine adjustment of the potentiometer does not make a noticeable change to the meter, press and hold *10A BOOST* to raise the current limit to 10A. Continue adjustment of the potentiometer.

Once the meter has been zeroed, switch the unit off by pressing *ON/OFF*.

The potentiometer will show the location of the fault in tenths of one percent of the distance from the connection of the P1 lead to the connection of the P2 lead. For example ‘354’ on the potentiometer shows the fault location to be 35.4% of the P1-P2 distance along the cable being tested.

Note that the longer the unit is switched on with a test cable connected, the more the battery will drain. This is especially the case when the *10A BOOST* button is pressed. It is therefore preferable to keep measurement time to a minimum.

10 CORRECTIONS

11 CORRECTION FOR SURFACE LEAKAGE

For very high resistance faults, the effect of surface leakage on the test cable must be taken into account. This can be eliminated by connecting guard electrodes to the insulation at each end of the conductor, and connecting these to the *GUARD* connector on the 5762N.

Correction for internal cable leakage
In the extreme, where the fault resistance approaches the normal insulation resistance of the cable, the normal internal leakage current will affect the reading. Making the assumption that this leakage is uniformly distributed along the cable and makes the apparent position of the fault move towards the centre of the cable, the true fault location can be found using the following equation:

$$x = \frac{\frac{y.r}{100} - \frac{R}{2}}{r - R}.100\%$$

where

x = true fault location, in % of distance from the P1 connection to the P2 connection

y = apparent fault location, in %.

r = insulation resistance of the faulty conductor, ideally measured on a good conductor in the same cable.

R = apparent fault resistance in parallel with the insulation resistance of the faulty conductor.

The quantities r and R should be measured after the same period of electrification as is used in location of the fault.

12 NOTES

For best results, precautions should be taken to avoid secondary leakage paths. The unit and test leads should all be insulated from earth by separate sheets of insulating material such as polythene. It may also be advisable for the operator to insulate themselves from earth by standing on a sheet of insulating material when the instrument is balanced and should stand still.

When locating very high resistance faults, any people moving in the vicinity of the test equipment or the cable can cause a transient disturbance of the balance, making it difficult to obtain a reading. This is caused by electrostatic charges on their clothing and they should stand still while the measurement is being made.

Owing to the high sensitivity of the instrument, a balance can often be obtained on a sound conductor. This balance is due to the normal cable leakage current and will result in a reading of approximately 50% in a cable of uniform insulation quality at a uniform temperature. For this reason, the existence of a fault should be established by insulation resistance measurement before using the attempting to locate the fault.