Westinghouse Canada Inc.
Switchgear and Control Division

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Mailed to: 209, 308 and 357

For Multi-Circuit Testing of Switchboard Relays, Meters and Instruments

Flexitest Switch Type FT-1 and FT-1H

Introduction

The Westinghouse Type FT-1 and FT-1H Flexitest switches are suitable for many test and isolation requirements. In a test application, circuit responses to an applied separate source, with the external circuit safely shorted, can be determined or, with a different test plug, normal "in service" conditions can be measured. In an isolation application, auxiliary relay contacts, or any other contacts, can be isolated from their normal function to allow a whole circuit to be functionally tested without disconnecting any wiring. Also parts of any circuit may be isolated for testing or servicing leaving the rest of the circuit in operation. Each of these applications is described in more detail within.

The Type FT-1 Test Switch is suitable for switchboard mounting and is supplied with a cover. The Type FT-1H Test Switch is suitable for mounting on an adaptor plate which accomodates up to three Type FT-1H Test Switches for mounting on a 19 inch rack panel. A single cover is available to cover up to three Type FT-1H Test Switches.

Application

In simple relay protection circuits separate Flexitest switches may not be necessary if Westinghouse relays in Flexitest cases are used. However, if the protection scheme contains relays supervising other relays, or two types of protection and it is desirable to test the scheme as well as each individual relay, a Flexitest switch can be used.

An example of how the Flexitest switch is applied to a protection circuit can be seen in Figure 3. This example is a two zone phase and ground distance scheme with overcurrent supervision and parallel line compensation. It can be seen that one Flexitest switch is sufficient to short circuit the three current transformers and isolate a three or four wire potential transformer connection. In this circuit a separate test source may now be applied but to insure the security of the parallel line during the test, another Flexitest switch is inserted to isolate the parallel line compensation, and is opened during testing procedures. One Flexitest switch, plus one for isolation if necessary, is sufficient to test the complete protection of each line by inserting a separate source or by determining the normal "in service" conditions. Other types of protection may have the Flexitest switch applied to them in a like manner.

Relays that include mutual reactors have a potential on their voltage terminals as long as dangerous if only the potential circuits is isolated before testing a protection scheme. Therefore, if the potential isolation switches are included in the same assembly as the current shorting switches, as they can be in the Flexitest switch, there is less chance of clearing only half of the circuit before starting to test.

Flexitest switches are often used in all metering circuits to calibrate the instruments with the application of a separate source or to make "in service" measurements. An example of how the Flexitest switch is applied to a normal metering circuit may be seen in Figure 4. This drawing illustrates that one Flexitest switch is sufficient to completely test the metering of each metering location on a switchboard.

To functionally test a protection scheme it is usually necessary to disconnect the wiring from the auxiliary tripping relay, This is true since contacts from this relay may trip or arm equipment which should remain in service during testing. Since it is undesirable from a dependability viewpoint to disconnect wiring for each test, and much more efficient to be able to carry out a test entirely from the front of the board, a Flexitest isolating switch can be placed in series with each auxiliary tripping contact. Figure 5, the D.C. schematic associated with the protection of Figure 3, is a good example of this principle. Opening the Flexitest isolation switch allows the complete functional testing of this scheme without having to disconnect any wiring. This isolating function could be combined with the two pole isolating requirement in the A,C. schematic and placed within one Flexitest switch.

It is sometines desirable to isolate one part of a circuit for testing or calibration while leaving the remaining parts in service. This requiremant could be needed in either relaying or metering circuits. In a relay circuit it may, for example, be desired to test thr primary protection leaving the standby protection in service. This is usually no problem if there are separate current transformers for each type of protection; but if this is not the case, this distinction can be made using one Flexitest switch. In a metering circuit one set of current transformers may supply a signal to both the local metering and to some transducers for remote indication in the control room. Figure 6 shows a case of this type where the local metering may be isolated and calibrated leaving the remote indication connected to the circuit. The watthourmeter in this circuit is in a Flexitest case which allows it to be isolated and tested leaving the rest of the metering operational.

switch, by measuring normal in-service
The remote indication can be separately
and tested according to the same proced
in a separate Flexitest switch.

Mechanical Arrangement

All of the functions described above, pe
by a Flexitest switch, are included withi
same type and size of enclosure. Figures
2 give internal schematics of the two typ
switches used in Figures 3 to 6 but other
configurations are possible. In fact, each
switch location for isolating switches or
locations for current shorting switches is
independent and can contain any of the
switch types, or nothing at all. Switch ty
are also easily moved from one switch po
to another. The Flexitest switch enclosur
contain either five current shorting switcl
or ten potential (isolating) switches or an
combination of these switch types.

To enable the Flexitest switch to be easil
mounted on any 19 inch rack panel, thre
switch enclosures mounted horizontally s
by side can be supplied, in a 2 rack unit
adaptor plate, This ability allows static re
to be tested with similar ease to any othe
design.

Flexitest Switch Ordering Information

The Descriptive Bulleting 41-075C contai
complete list of Flexitest switch configur
for which style numbers have been create
The switch configurations are described b
placing a P, for potential or isolating type
a C, for non-shorting; or a CC, to describe
current shorting switches in columns
representing the switch locations illustrat
in Figures 1 and 2, and the photographs
included in the descriptive bulletin. Thus,
relative locations of potential and current
switches can be specified with the aim of
standardizing test procedure. To be certai
obtaining the correct configuration, these
switches should be ordered by style numb

FT-1H Accessories-Ordering Information

Two adaptor plates are available. Adaptor
S No. 745C722G01 is two rack units h
adaptor plate S No. 2682C33G01 is four
rack units high to allow space to accomoda
legend plates below the switches.
The three position cover is style No. 3064A
or 3064A66G02

Test Plugs

There are two different tests that can be dc
to any circuit, so there are two different ty
of test plugs: the separate source test plug a
the series test plug.

To use the separate source test plug with a

circuiting the CT circuits. When this test plug is pushed into the switch, its insulating tongue isolates the current circuits and at the same time provides ten convenient screw terminals electrically connected to the isolated circuit. The connection of a desired test circuit is now a simple matter

The same separate source test plug is able to be used in all Flexitest switch configurations, and also in all Westinghouse relays. Since these separate source test plugs are standard and very inexpensive a time saving idea is to have enough on hand to keep them connected to the testing equipment permanently. This is one advantage to be gained by standardizing on one Flexitest switch configuration.

In service testing can be accomplished in two ways; with either a series test plug or with separate current and potential test probes. To accomplish this test the current switch blades must be pulled open but the current shorting and potential switches must be left closed. The series test plug then makes contact with the closed potential switch blades and inserts a pair of terminals in each current circuit, to which first an ammeter must have been connected. Different Flexitest switch configurations require a different arrangement of the current and potential probes within the series test plug. Therefore another advantage to be gained by standardizing on a few Flexitest switch configurations is that a minimum of series test plug styles is required. To accomplish this test, one circuit at a time, an individual current circuit test plug is available. This plug consists of a handle around one of the same current probes contained within the series test plug. The FT case Instruction Leaflet 41-076D contains a section drawing showing the series current test probe in operation. This same drawing shows the lug available on all of the switch blades to enable a clip to be attached to measure the potential in each separate circuit.

Test Plug Ordering Information
The separate source test plug is standard for all applications and thus has only one style number 1164046. This test plug is available from stock.

There are many series test plug styles which are listed in the Flexitest switch Descriptive Bulletin 41-075C. Some of these test switches are available from stock but the probe positions are especially easy to move if the required configuration is not readily available.

The individual current circuit test plug has the style number 0784618G04.

Other Applications
Due to the demands of an electrical circuit or the test requirements of a particular customer other applications and connections of the Flexitest switch are needed. Some examples of these requirements, but by no means an

If the electrical circuit demands a delta connection for the current transformers the external connection of the Flexitest switch, if required, would be as shown in Figure 7. For illustrative purposes, Figure 7 shows a two winding star-delta transformer differential scheme.

If neutral current measurement is part of a customers test procedure this measurement can be accomplished by the installation of four current shorting switches within a switch enclosure. The external connection of a switch of this type would be as shown in Figure 8.

There are many other specific uses and applications of the Flexitest switch. For assistance in any application problem, contact your nearest Westinghouse representative.

References

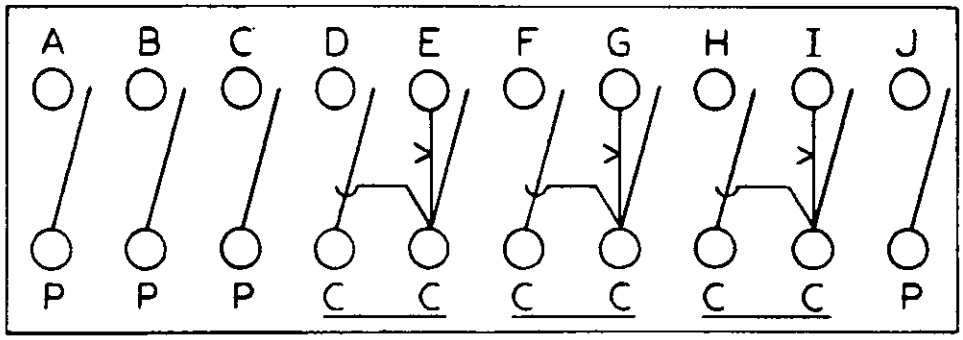
Descriptive Bulletin 41-075C Flexitest Switch.

Descriptive Bulletin 41-075 Universal Flexitest Cases.

Instruction Leaflet 41-076D Relays in Flexitest Cases.

Price List 41-020 (E) Pages 173 and 174.

Figure 1 — Flexitest switch internal scheme (Dwg. 3092A90)

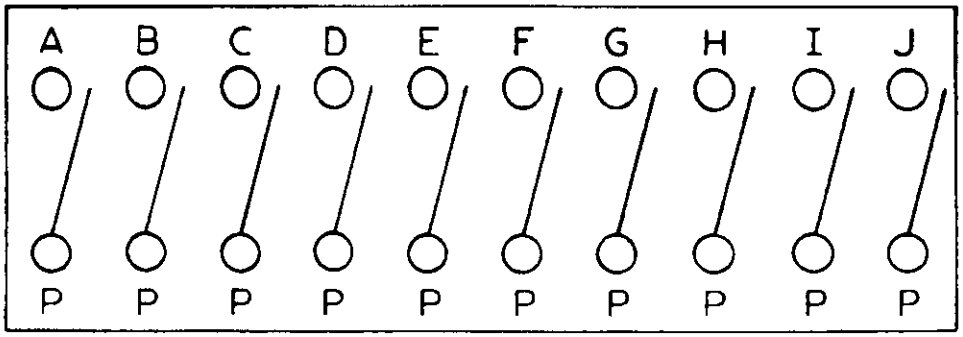


Front View

Internal schematic of FT-1 switch style No. 129A514G01. This switch is used for standard current and potential circuit test applications.

This drawing shows switch location and switch types used in the ordering information tables in D.B. 41-075C.

Figure 2 — Flexitest switch internal scheme (Dwg. 3092A91)



Front View

Internal schematic of FT-1 switch style No. 129A501G01. This switch is used for circuit isolation.

This drawing shows switch location and switch types used in the ordering information

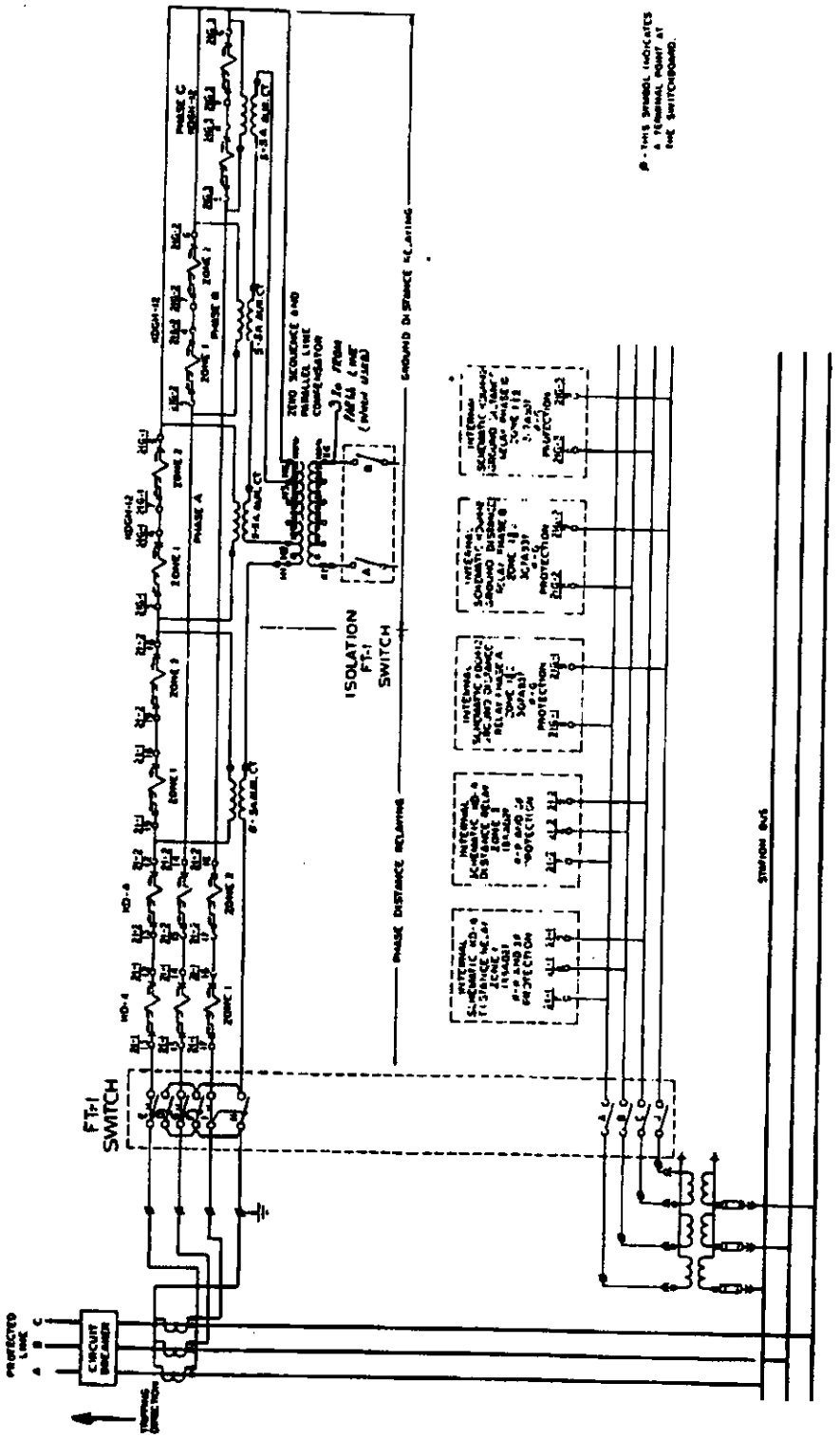


Figure 3 — Flexitest switch application A.C. protection scheme testing (Dwg. 195D396-2)

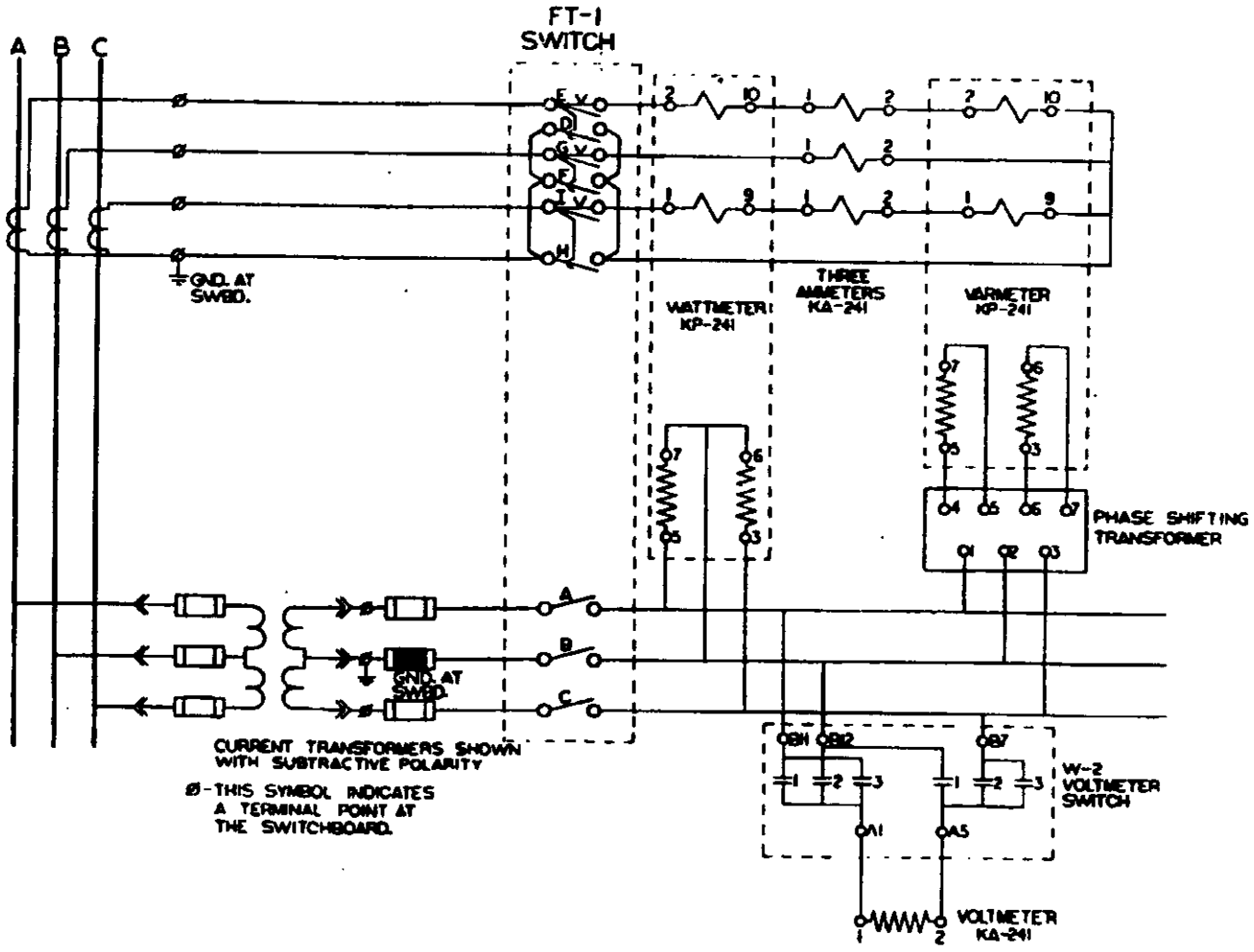


Figure 4 — Flexitest switch application A.C. metering calibration and testing (Dwg. 742C980)

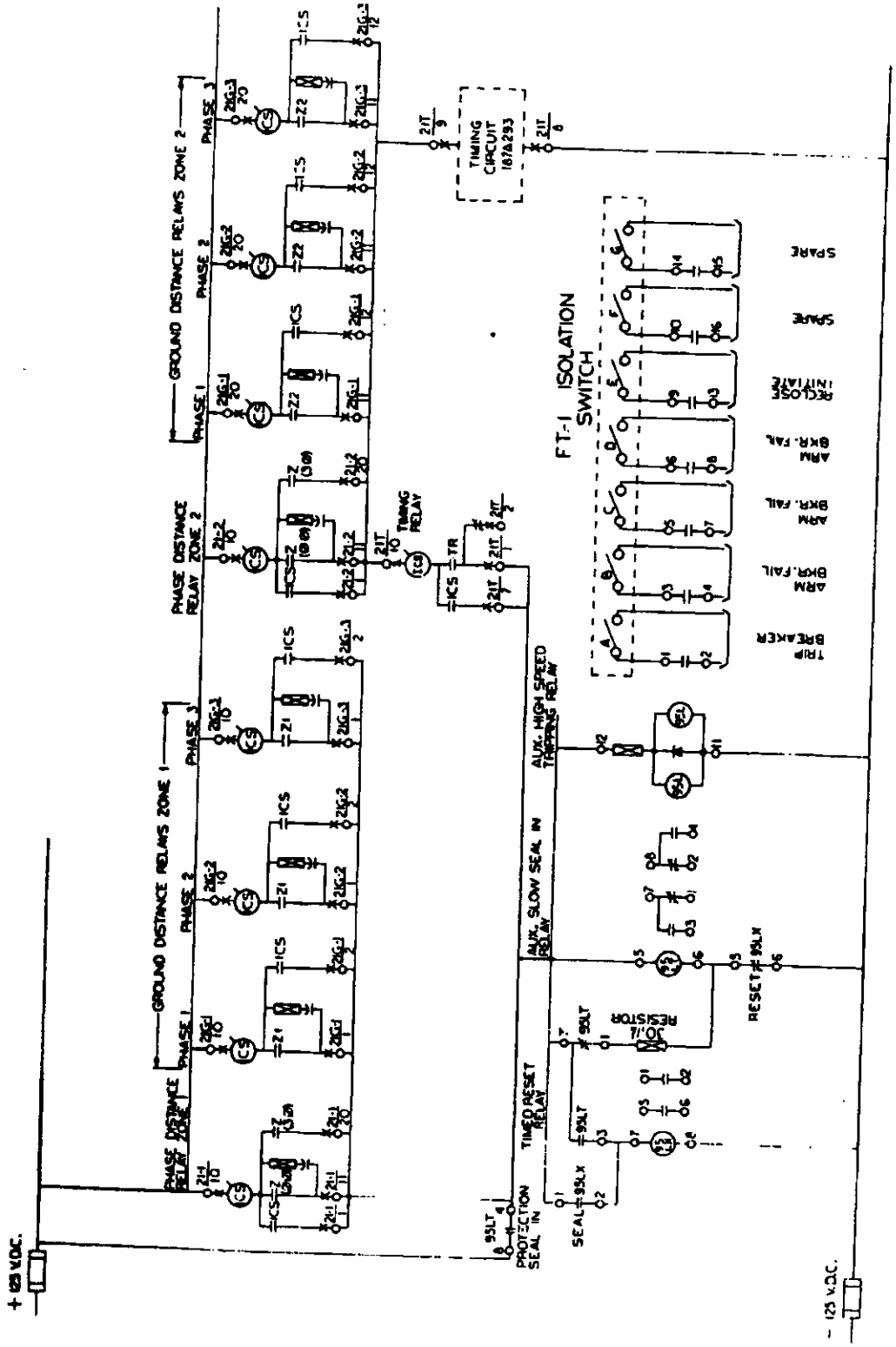


Figure 5 — Flexitest switch application D.C. protection scheme isolation (Dwg. 742C981 - 2)

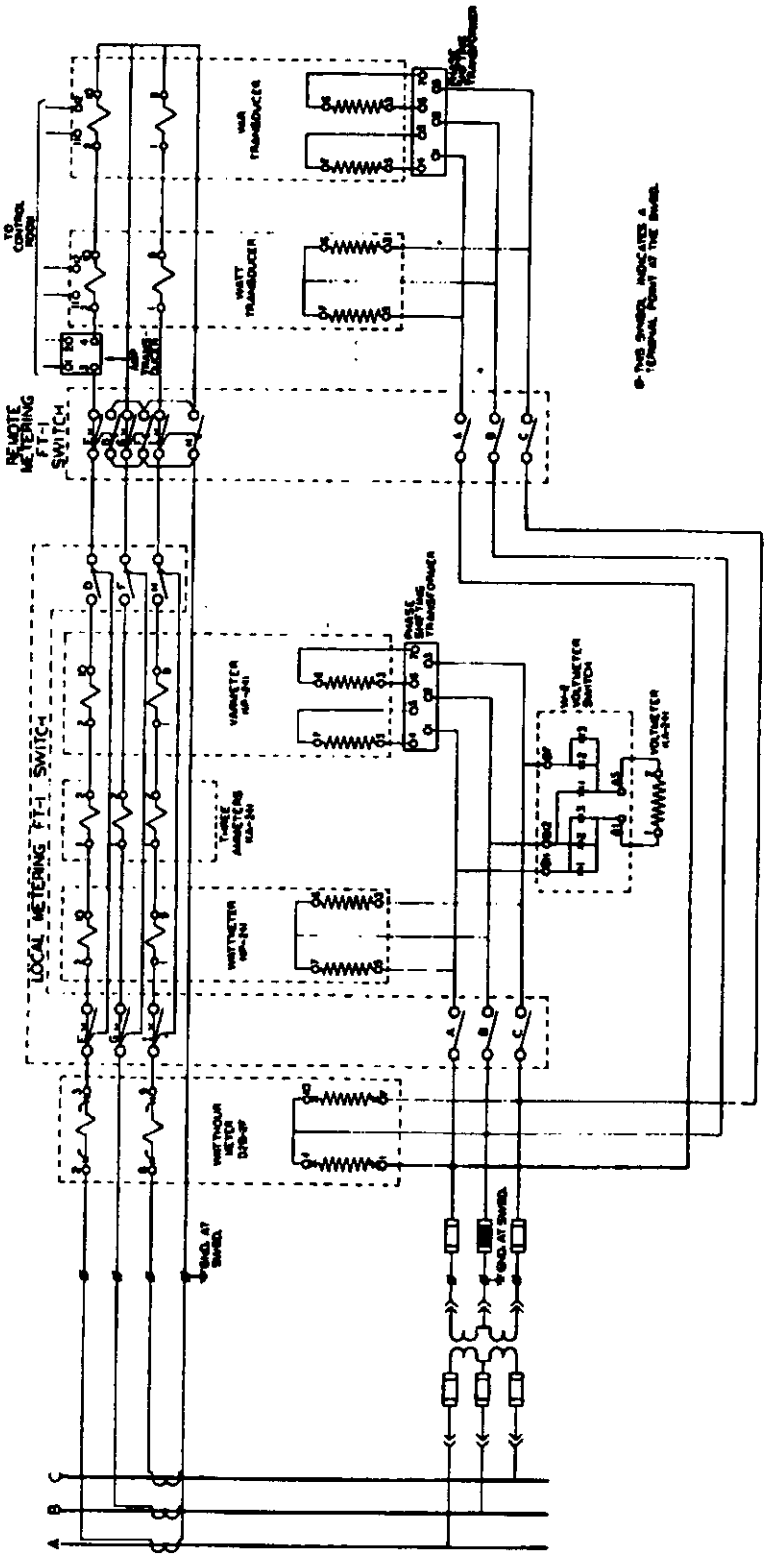


Figure 6 — Flexitest switch application partial circuit isolation and testing (Dwg. 195D397)

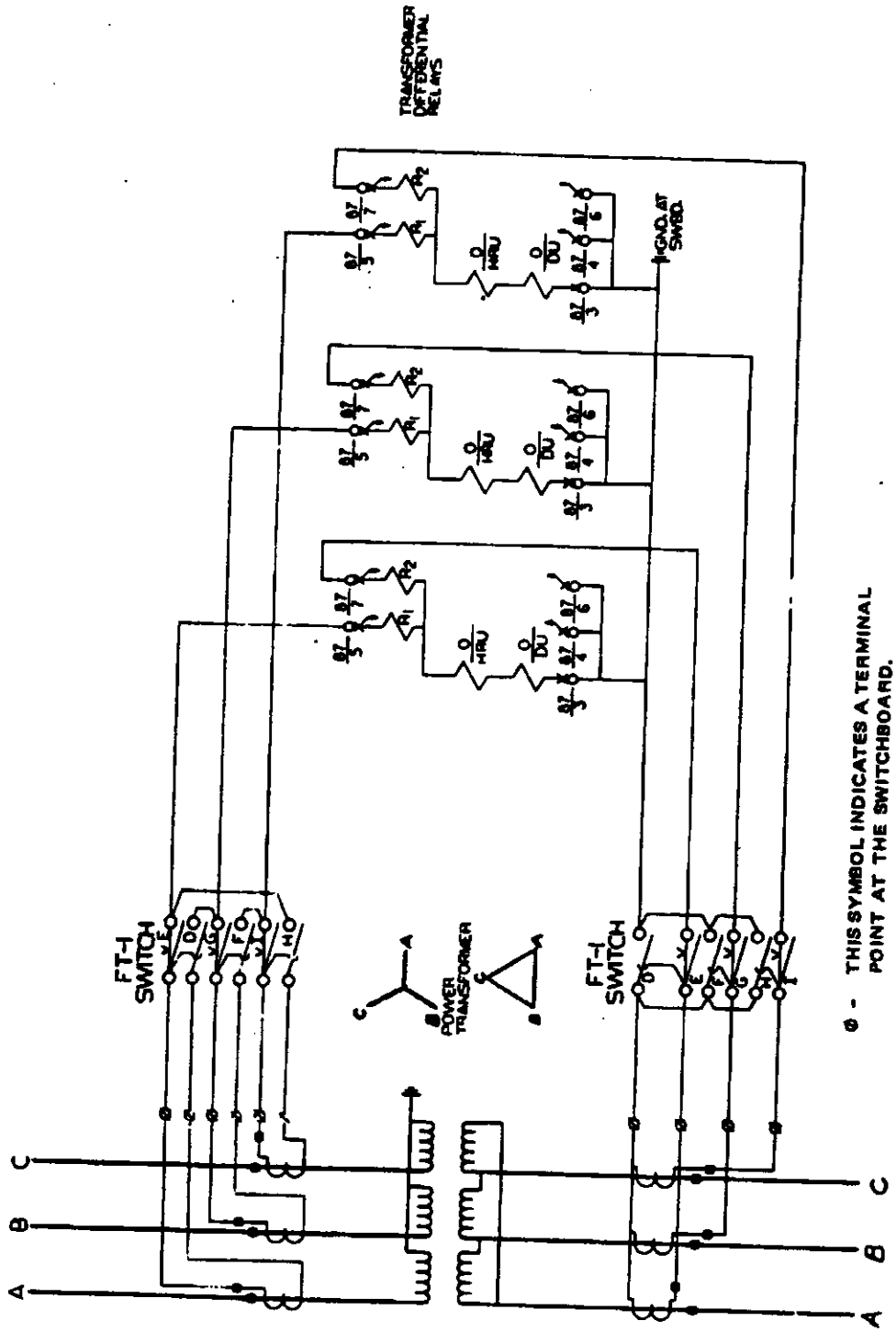


Figure 7 — Flexitest switch application delta connection (Dwg. 7420982 - 2)

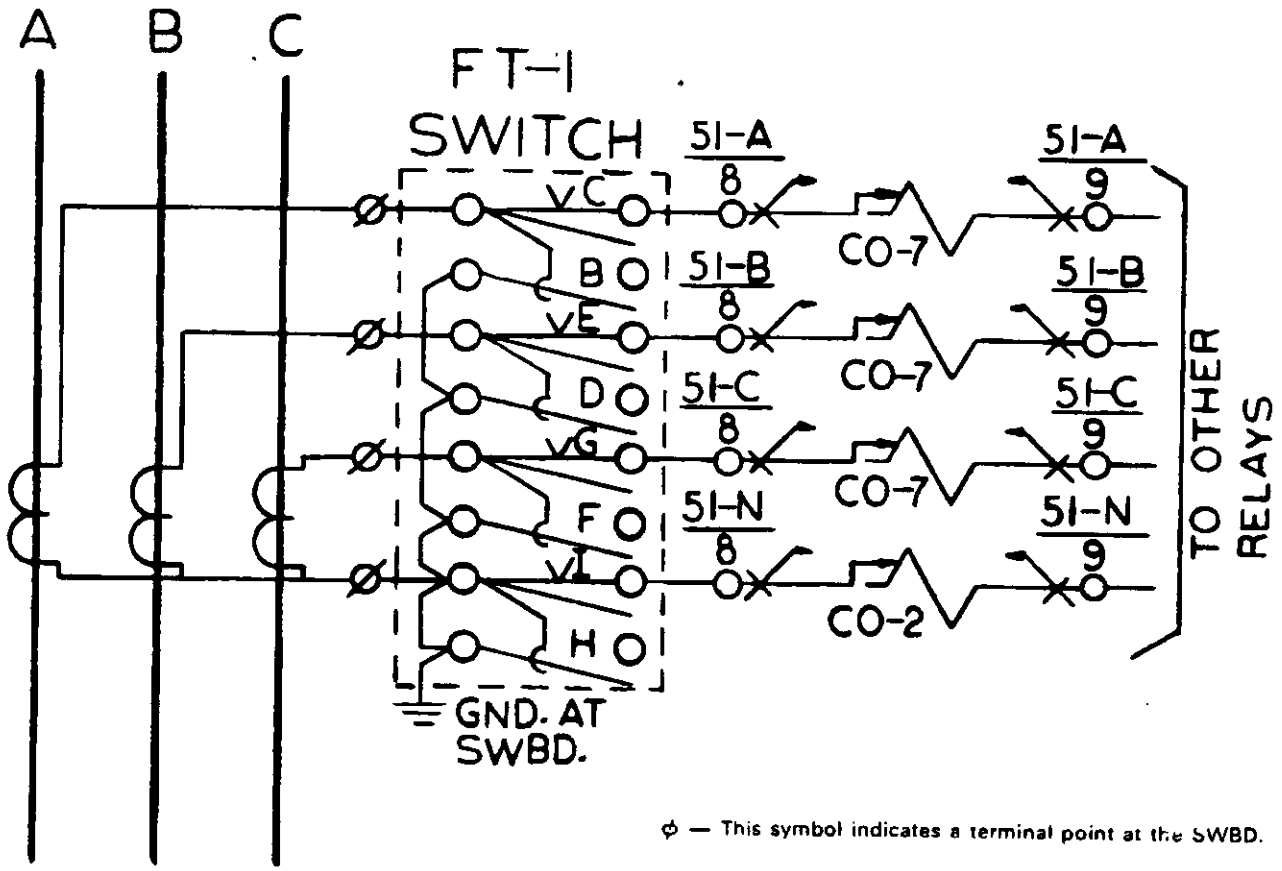


Figure 8 — Flexitest switch application measurement of neutral currents (Dwg. 3092A92)