

GROUND PROTECTIVE EQUIPMENT

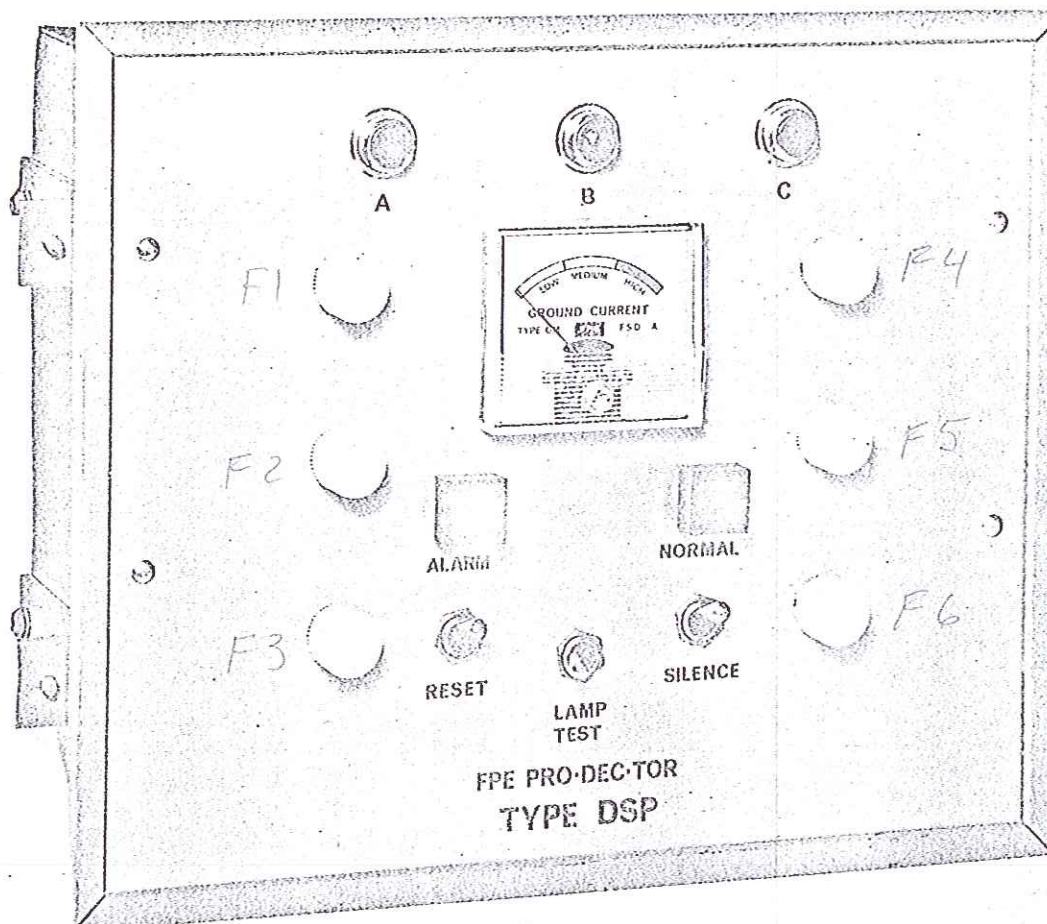
C-4-410

SEPTEMBER, 1970

DESCRIPTIVE SHEET

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TYPE DSP GROUND ALARM/TRIP UNIT



TYPE

DSP Ground Alarm/Trip Unit

APPLICATION

Ungrounded or High Resistance Grounded Systems.

SENSITIVITY

Alarm level — 50% of system artificial neutral or grounding resistor current. Trip out level — 20 times alarm level.

FUNCTIONS

Alarm and indication of which phase is grounded for first ground fault anywhere on the system. Selective trip out protection for second ground fault while first fault persists, but on another feeder on a different phase.

CURRENT SENSORS

Toroidal Zero Phase Sequence Current Sensors* (up to 15kv class)

Catalogue Number	Window Diameter
T2A	1-7/8"
T3 A	2-3/4"
T6A	5-3/4"
T9A	9"

*For rectangular current sensors refer to factory.

The zero phase sequence current sensors are manufactured to very close tolerances and are completely encapsulated in polystyrene insulation which provides an almost indestructible finish.



TYPE DSP GROUND ALARM/TRIP UNIT

USES

The FPE PRO-DEC-TOR Ground Alarm/Trip Unit Type DSP can be applied to any three phase ungrounded or high resistance grounded system to detect, indicate and alarm for a ground fault on any phase in the distribution system.

While the first fault persists should a second ground fault develop on another feeder but on a different phase, instantaneous trip out will be initiated to both faulted feeders.

This unit is also designed to provide selective ground fault protection for those power systems which must retain the maximum system continuity.

Such systems commonly used are the ungrounded or in some cases the high resistance grounded system. A single ground fault does not initiate a trip out and the system can be operated indefinitely under this condition. However, should a second fault then develop on another feeder but on a different phase, severe damage results, possibly bringing about a major outage.

The ungrounded or high resistance grounded system unfortunately invites the second breakdown, because the first fault raises line to ground voltage on the healthy phases to full line to line value. Should the second fault appear on the same feeder, fault currents are high because it constitutes a phase to phase fault which can be readily sensed by the normal over current protective devices. However, in many cases the second fault occurs on another feeder, often some distance away. Under these conditions the ground path impedance is high and as a result, the fault current is of a comparatively low value and cannot be cleared quickly by normal over-current protection.

A typical example is that where severe arcing faults appear in two motors on different feeders and a case on record reports the loss of six motors in one chain reaction breakdown.

Locating and repairing the first ground fault is of prime importance but in most continuous process operations this is not as simple as it sounds, because some portions of such an operation would have to be interrupted.

DESCRIPTION & OPERATION

The FPE Type DSP PRO-DEC-TOR provides alarm indication on appearance of the first ground fault. This is a selective indication as the specific feeder involved is identified by an annunciator push button lamp. This is a memory type indication on which intermittent faults are indicated. Phase indication is provided by three conventional ground lamps on the panel. An alarm relay to operate an external audible alarm is also provided.

An alarm silence switch is provided together with an alarm lamp which remains lighted during alarm silence. A single reset switch mounted on the panel resets all feeder annunciators as well as alarm silence.

Each feeder is assigned an annunciator push button which readily identifies the faulted feeder and provides a method of indicating, on the meter mounted on the panel, the magnitude of the fault current.

Meter indication is LOW/MEDIUM/HIGH, corresponding approximately to 0 - 33%, 34 - 67% and 68 - 100% of artificial neutral or system ground resistor let through. Scaling is approximate to avoid using correction factors when various sizes of zero sequence current transformers, artificial neutrals and system grounding resistors are used.

A lamp test switch is provided to check the condition of the feeder annunciator lamps.

The second protective function of the Type DSP unit is to provide instantaneous trip out.

Should a second ground fault develop on another feeder but on a different phase, while the first fault persists, instantaneous trip out will be initiated to both faulted feeders at a current level higher than the alarm pick up level of the unit. It should be noted that a phase to ground to phase fault is no longer limited or restricted by the grounding resistor or artificial neutral. For this reason the trip level can safely be set at a value higher than the alarm level, thus avoiding nuisance tripping, but can be at a level much lower than that of the standard overload relays and will therefore ensure protection from double ground faults at widely separated locations.

TYPE DSP GROUND ALARM/TRIP UNIT

As indicated, where faults are present on different phases in different feeders, both feeder breakers will trip instantaneously, regardless of which one had suffered the first fault.

In most installations, certain feeders are more essential than others and should a trip out occur where a non essential and an essential feeder are involved, it is most desirable that the essential feeder be retained. The Type DSP unit offers as an option delay triggers for such circuits.

In operation, should an essential feeder be operating in fault and a non essential circuit then develop the second fault, the non essential feeder breaker only will trip instantaneously. If two time delayed essential feeders are in fault, then the less essential feeder only would trip out after the pre-determined time.

Should the non essential feeder breaker fail to trip, say due to a burnt out shunt trip coil, then the essential breaker would trip after the pre-determined time and therefore provide backup protection.

Time delay triggers are available in the following pre-set delays which provide the user with four choices:

- | | |
|----------------------|-----------------|
| 1. Non essential | — instantaneous |
| 2. Minimum preferred | — 0.2 seconds |
| 3. Medium preferred | — 0.4 seconds |
| 4. Maximum preferred | — 0.6 seconds |

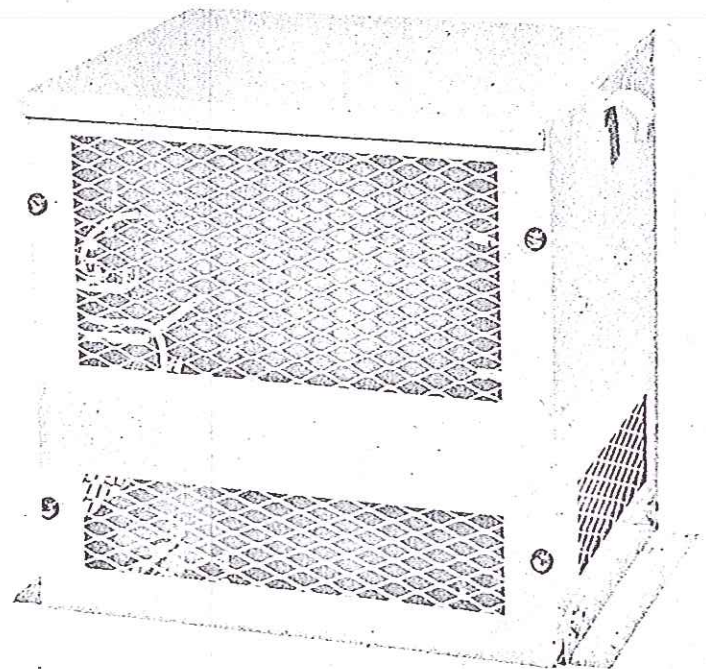
At the initial planning of the power distribution system it is not necessary to decide on an order of importance for the various circuits. All delay triggers of the Type DSP unit are of the plug in design and are interchangeable. The user may alter the preference at any time by simply interchanging delay triggers. The individual feeder annunciator lamps are colour coded to match the delay triggers so the user can arrange the lamp lenses on the front panel to act as a reminder of the preference he has selected. Should a double ground fault take place on two feeders before the panel can be viewed, two annunciator lamps will be lighted indicating that the tripout was caused by a ground fault rather than an overload.

The FPE Type DSP PRO-DEC-TOR is designed for flush mounting in a switchboard or panel enclosure and is available in three basic units, 6 circuits, 12 circuits, and 18 circuits. The three phase indicating lamps dominate the top of each panel followed by the alarm and normal lamps, meter, reset

silence and test switches. These elements are basic regardless of the number of feeders used. The feeder annunciator push buttons are typically arranged with three feeder annunciators per column then left and right in an array corresponding to the actual placement of the feeder breakers in the typical arrangement of each switchboard column.

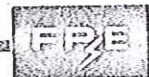
Each feeder element requires only one current sensor to actuate the alarm and trip circuit. For typical installations involving the delta power system an artificial neutral grounding unit must always be supplied and installed on the system.

The benefits derived in system stability when the artificial neutral is used cannot be over emphasized. The otherwise ungrounded system suffers severely from over voltages caused by stray leakages, stray capacitive charging currents and arcing ground faults.

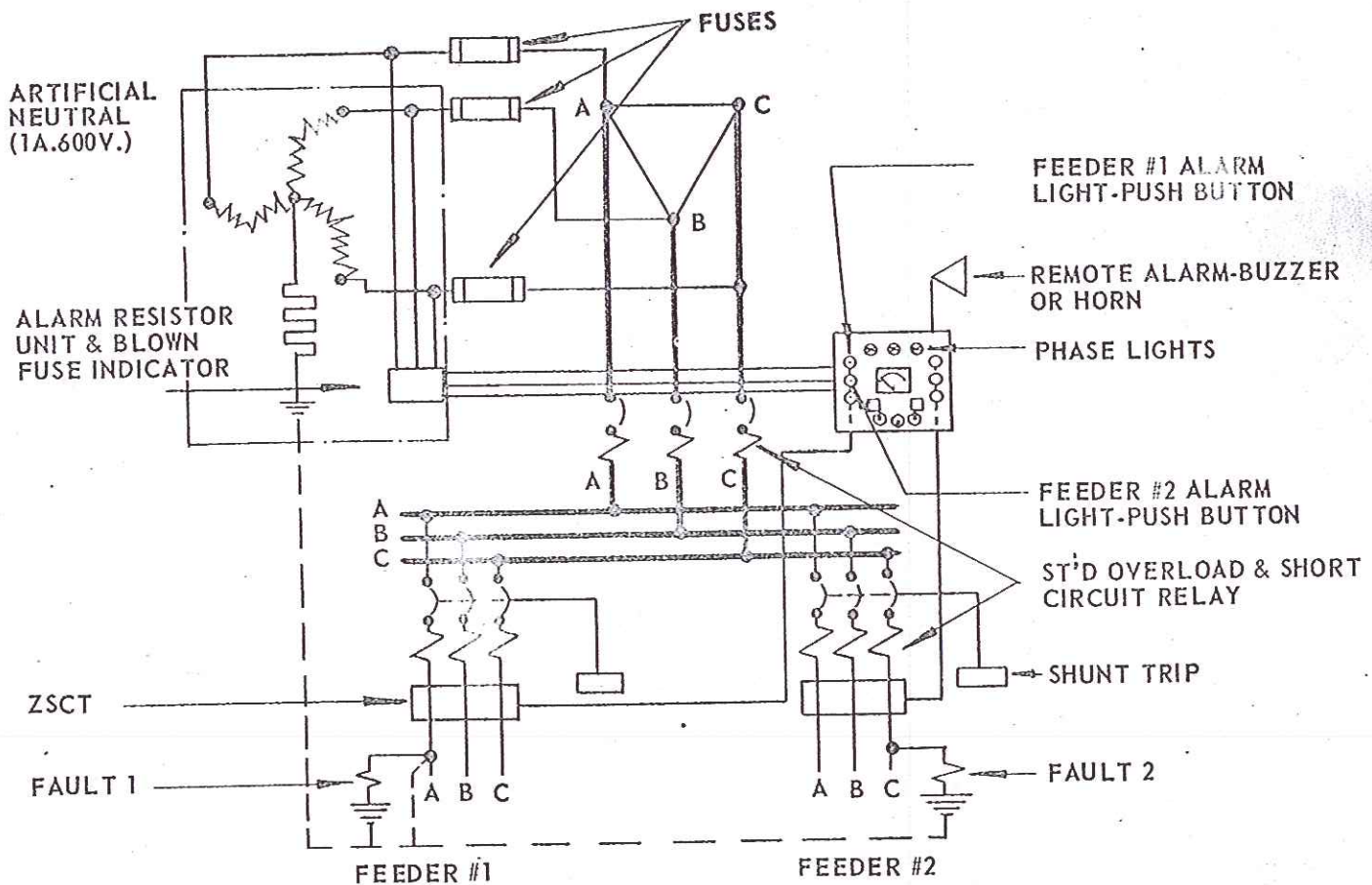


ARTIFICIAL NEUTRAL

GROUND PROTECTIVE EQUIPMENT



TYPE DSP GROUND ALARM/TRIP UNIT

SYSTEM CONNECTION DIAGRAM
600V 3 ϕ 3W UNGROUNDED

Single Fault Condition

Phase "a" to ground fault feeder #1 — alarm sounds; phase "a" light goes out; phase "b" and "c" lights bright. Feeder #1 alarm light "on". If button is pressed fault current can be read on meter.

Double Fault Condition on Two Feeders & Different Phases

Phase "a" on feeder #1 Both feeders tripped instantly if no discrimination is required. Alternatively —

Phase "c" on feeder #2 only feeder #1 or #2 trip out if discrimination is provided. The second faulted feeder serves as a back up protection after a predetermined time in case the first breaker failed to clear the fault.

TYPE DSP GROUND ALARM/TRIP UNIT

VOLTAGE RATING

The FPE DSP Ground Alarm/Trip Unit can be used on any system up to and including 13,800 volts. For voltages above 2,300 and up to 13,800 volts, phase indication is obtained from system equipment potential transformers, which must be adequately loaded to swamp out potential transformer magnetizing current. For systems up to and including 2,300 volts, the FPE artificial neutral includes a resistance unit to provide phase indication. This signal resistance unit also acts as a blown fuse indicator for the artificial neutral protective fusing. It is recommended that HRC fuses of adequate interrupting capacity in suitable holders, be installed between the system bus and the artificial neutral.

When the system is "Star" connected, high resistance grounded, a separate alarm resistor unit FPE Type DDR must be used to obtain the required phase indication.

Feeder sensing is obtained by the use of toroidal zero sequence current transformers around the feeder cables and can be used on any system up to and including 13,800 volts.

A single phase, 120 volts, 60 Hz, 25 VA power supply is required to operate the relay and remotely mounted alarm.

CONTROL CONTACT RATINGS

The DSP Ground Alarm/Trip Unit includes a common N.O. or N.C. alarm contact and a N.O. or N.C. trip contact for each feeder circuit.

These contacts are rated:

10 AMPS @ 125 volts ac

1/4 AMPS @ 125 volts dc

CONNECTION DIAGRAM (see page 6)

The external connection diagram shown is for a six circuit DSP unit. The DSP Ground Alarm/Trip Unit is also available in 12 and 18 circuit devices.

TESTING

A test unit Type DDT-DSP can be provided that will completely test the type DSP unit to determine the alarm and trip pick up levels. Where time delay triggers are used tests can be performed to check the levels selected.

These tests are conducted by the primary injection method.

TYPICAL SPECIFICATION

A Ground Alarm/Trip Unit shall be provided to alarm and to indicate which phase has grounded on the first phase to ground fault anywhere on the system.

The alarm level shall be 50% of the system artificial neutral or grounding resistor current.

Individual feeder indication shall be provided in the form of annunciator push buttons to readily indicate which feeder has faulted. A meter shall be incorporated to enable the operator to determine the magnitude of the ground fault current by operating the feeder annunciator push button.

Should a second ground fault develop while the first fault persists, instantaneous trip out shall be provided for both faulted feeders at a level of 20 times the alarm level. Provision shall be made in the Ground Alarm/Trip Unit to readily install, at any time, delay triggers set at either 0.2, 0.4 or 0.6 seconds, to provide feeder trip out selectivity with feeder breaker back up protection.

Each feeder shall be equipped with a toroidal zero sequence current transformer to provide feeder alarm and trip out.

A 600 volt - amp artificial neutral shall be provided for stabilization of system voltages. This artificial neutral shall be fused and shall incorporate an alarm resistor unit type DDR, to provide a signal to the Alarm/Trip Unit, and to provide blown fuse indication.

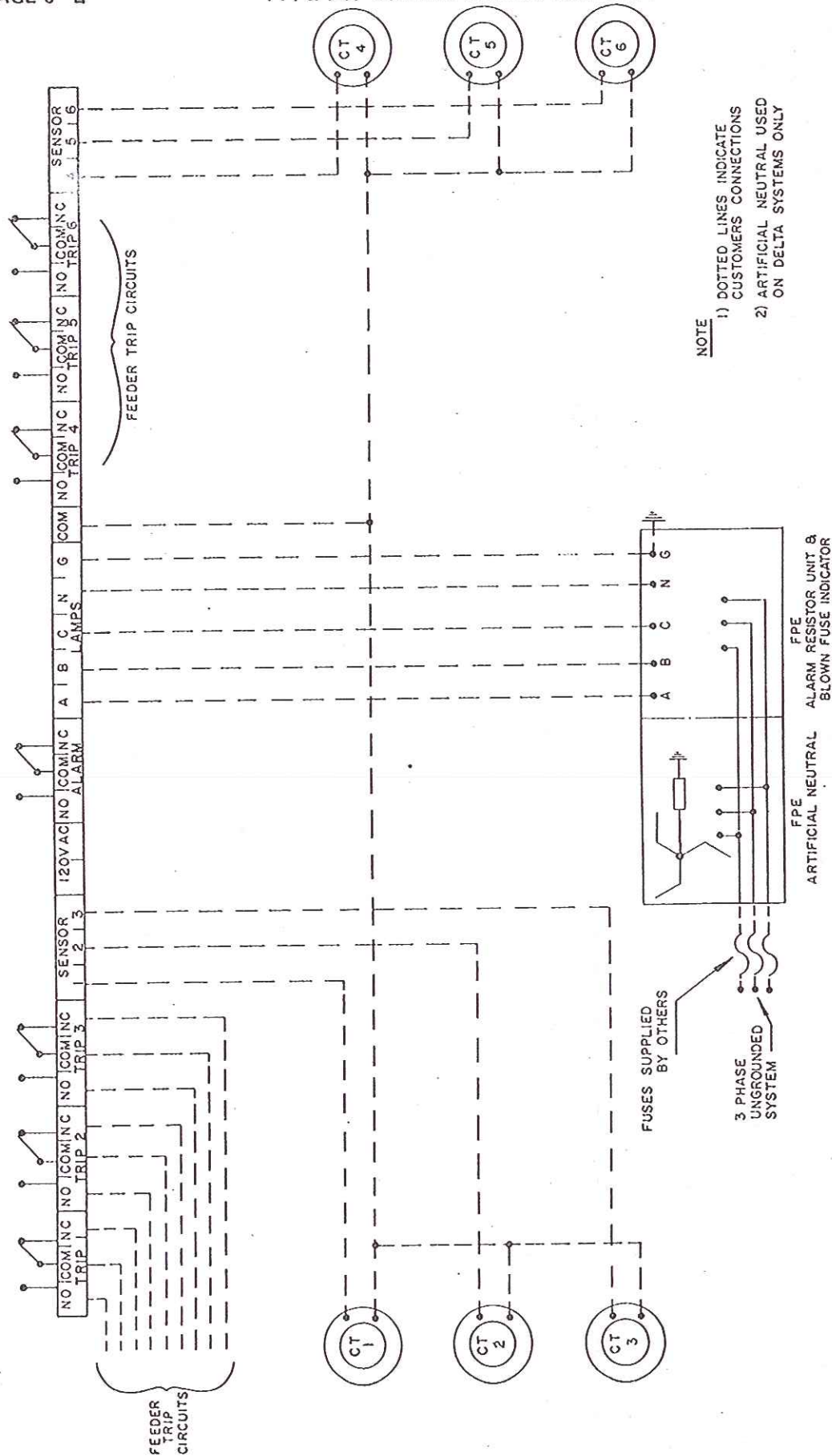
The Ground Alarm/Trip Unit shall be FPE Type DSP.

GROUND PROTECTIVE EQUIPMENT



TYPE DSP GROUND ALARM/TRIP UNIT

TYPE DSP CONNECTION DIAGRAM
6 CIRCUIT UNIT



GROUND PROTECTIVE EQUIPMENT



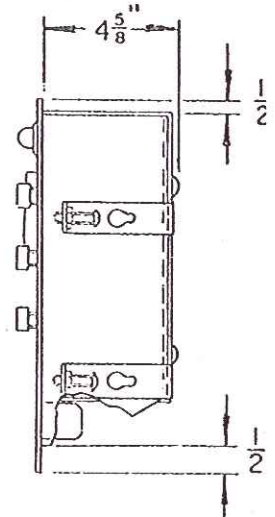
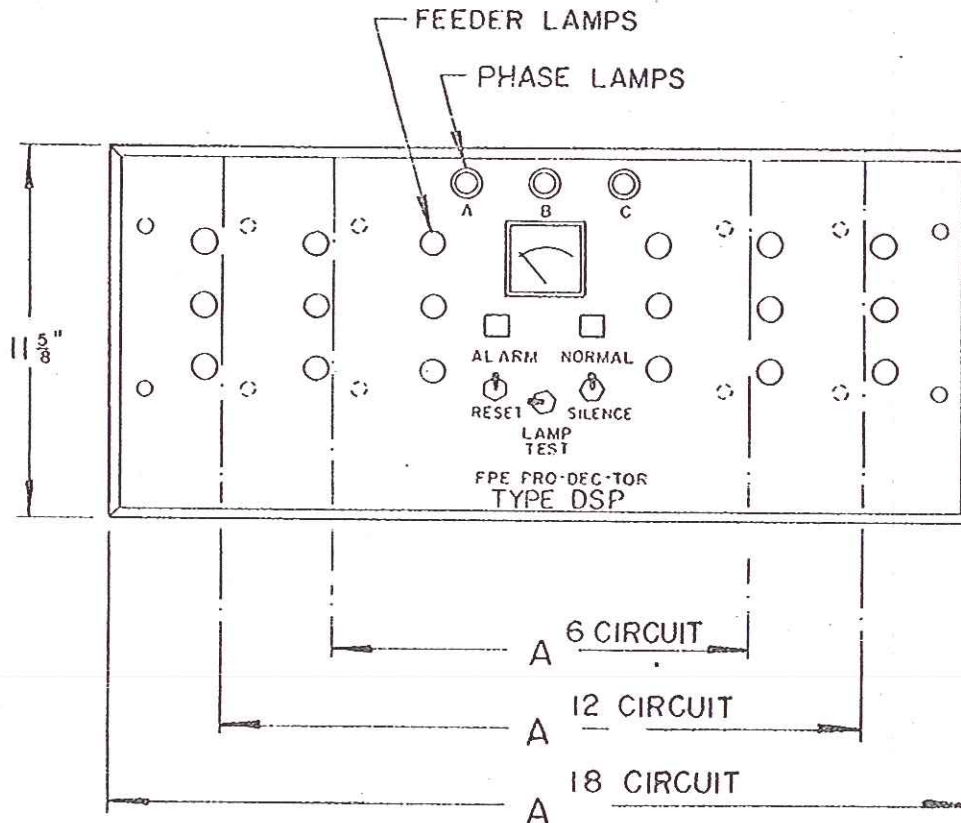
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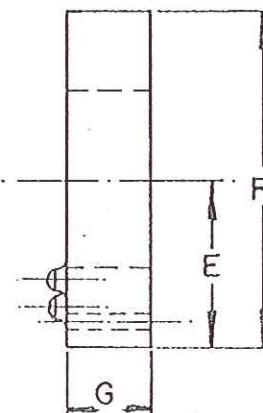
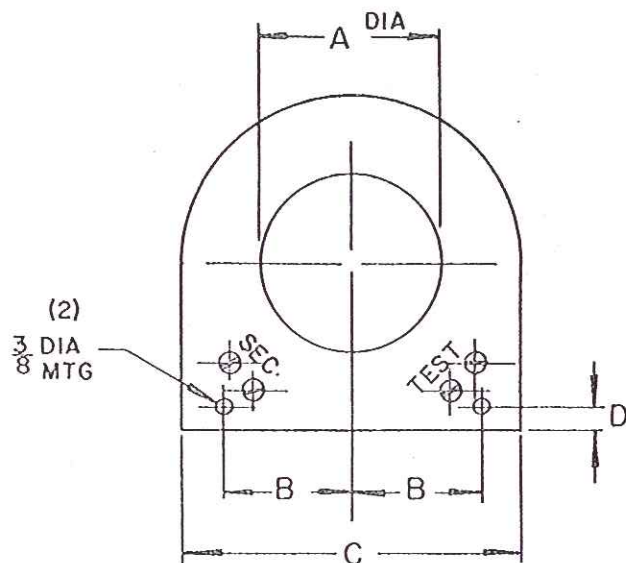
TYPE DSP OUTLINE DIMENSIONS



CAT NO	NO OF FEEDERS	"A"	MT'G. CUTOUT	
			WIDTH	HEIGHT
DSP-6	6 CIRCUITS	13 ¹ / ₈ "	12 ¹ / ₈ "	10 ⁵ / ₈ "
DSP-12	12 "	20 ¹ / ₈ "	19 ¹ / ₈ "	
DSP-18	18 "	27 ¹ / ₈ "	26 ¹ / ₈ "	

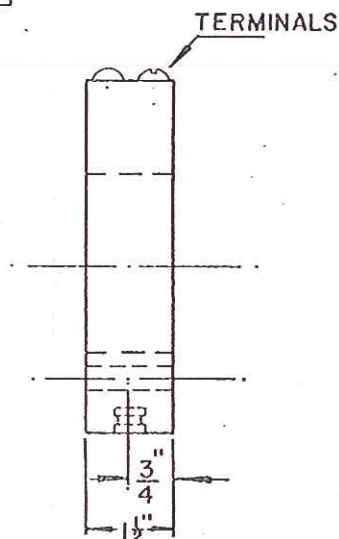
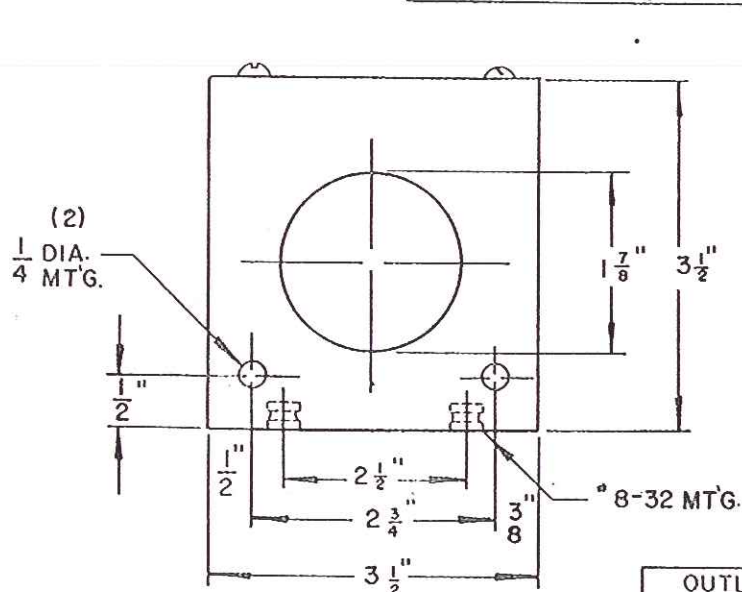


TYPE DSP GROUND ALARM/TRIP UNIT



T 9A	9"	5"	12"	1"	6"	12"	2"
T 6A	5 3/4"	3 3/8"	8"	3/4"	4 1/4"	8 1/4"	1 1/2"
T 3A	2 3/4"	2 1/4"	5 1/2"	1/2"	2 3/16"	5 3/16"	1 1/2"
CAT No	A	B	C	D	E	F	G

OUTLINE DIMENSIONS
GROUND SENSORS
- T 3A T 6A, T 9A -



OUTLINE DIMENSIONS
GROUND SENSOR
- T 2A -



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