UNION SWITCH & SIGNAL

AN ANSALDO SIGNAL COMPANY

1000 Technology Drive
Pittsburgh, PA 15219-3120

645 Russell Street
Batesburg, SC 29006

SM-6348

DC Flasher Relay PN-150F

PART NUMBER N322530-701

SERVICE MANUAL

Installation■

Operation■

Maintenance■

November 2003
Revision 1

PROPRIETARY NOTICE

IMPORTANT NOTICE

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REVISION INDEX

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	March 1985	Original issue	
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NOTE

This manual displays the most recent revision number for its information. Manuals distributed with revision numbers 0.0 or less (or without a revision number) do not contain the most up-to-date product information.

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1 GENERAL INFORMATION

1.1 Introduction

This manual provides the service information for the PN-150F plug-in DC Flasher Relay. This special relay is normally used to flash the lamps in Highway Crossing Signal Systems, however, it can be used in wayside applications needing a flash function.

1.2 Description

The PN-150F is an electronically driven biased DC relay. The flasher electronics module that drives the relay mounts to the rear of the relay mounting base (See Figure 2-1). The module uses quick disconnect wiring to facilitate field replacement if necessary. The flash rate is set externally to either forty-five or sixty flashes per minute.

A failure of the electronic module results in steady energy to one signal or erratic flashing. It is not necessary to remove the relay to replace the module.

1.3 Specifications

Table 1-1. PN-150F Specifications

PART NO.	CONTACTS	COIL	SYSTEM POWER	FLASH RATE
X451018-3001	6 FB	60 ohms	8 – 12VDC @ 0.2 amp	45 or 60 ± 5 flashes/minute
Contacts – Silver alloy-to-silver alloy front and back rated at 25 amp AC load with three Front and three Back contacts wired in parallel. Power – DC power may be from battery or rectified DC current.				

1.4 Relay Ordering Options

Table 1-2. Ordering Options

PART NO.	DESCRIPTION
N322530-701	PN-150F
X-451018-3001	PN-150F with flasher module and mounting hardware.
X-451018-3002	Flasher module and mounting kit only.
X-451018-3003	PN-150F, Flasher module mounting kit Relay mounting base with mounting hardware Contact receptacle spring – 18-#10 (lamp wiring) and 4-#14-16 (control wiring).

1.4.1 Electrical Specifications

Coil Resistance: 60 ohms

Contact Rating: 4.0 amps at 10 volts AC per contact.

Intended use is for contacts 1F, 2F, and 3F to be connected in parallel and 1B, 2B, and 3B to be connected in parallel (See Figure 2-2).

Each bank of three contacts can handle a 25-amp max. AC load at 10 volts when wired as shown in Figure 2-2.

1.4.2 Mechanical Specifications

Relay Dimensions:	Height – 7 - 1/16" (17.93 cm) Width – 2 - 7/16" (6.19 cm) Depth – 8 - 7/32" (20.88 cm)
Mounting Base:	N451376-0305
Temperature:	– 40° to 185°F (85° C)
Indexing:	Refer to Section 2.3.
Weight:	6 - 3/4 Lbs.
Mounting Base Weight:	9.5 oz.
Mounting Base Dimensions:	Height: 7 - 15/16" (20.16 cm) Width: 2 - 7/16" (6.19 cm) Depth: 1 - 25/32" (4.52 cm)

1.5 Safety

Read and thoroughly understand this manual before attempting any of the procedures listed. Pay particular attention to:

WARNING

and

CAUTION

These headings may appear throughout this manual. Caution statements indicate conditions that could cause damage to equipment. Warning statements indicate conditions that could cause physical harm, serious injury, or loss of life. Always observe standard precautions familiar to trained electrical technicians. Always adhere to all safety regulations stipulated by the railroad.

2 INSTALLATION

2.1 General

The relay plugs directly into a mounting base that is secured to the equipment rack (See Figure 2-3).

2.2 Mounting Base

Secure the mounting base to the rack using the furnished hardware. At the rear of the mounting base the wiring terminates to solderless receptacle contact springs.

Select the flash rate before mounting the flasher module to the mounting base.

For 45 Flashes Per Minute (FPM), place the jumper between terminals 4 and 5. For 60 FPM, no jumper is required.

Secure the flasher module to the mounting base as shown in Figure 2-1. On the N451376-0305 base, this is done with self-tapping screws (8-32 x 3/8").

NOTE

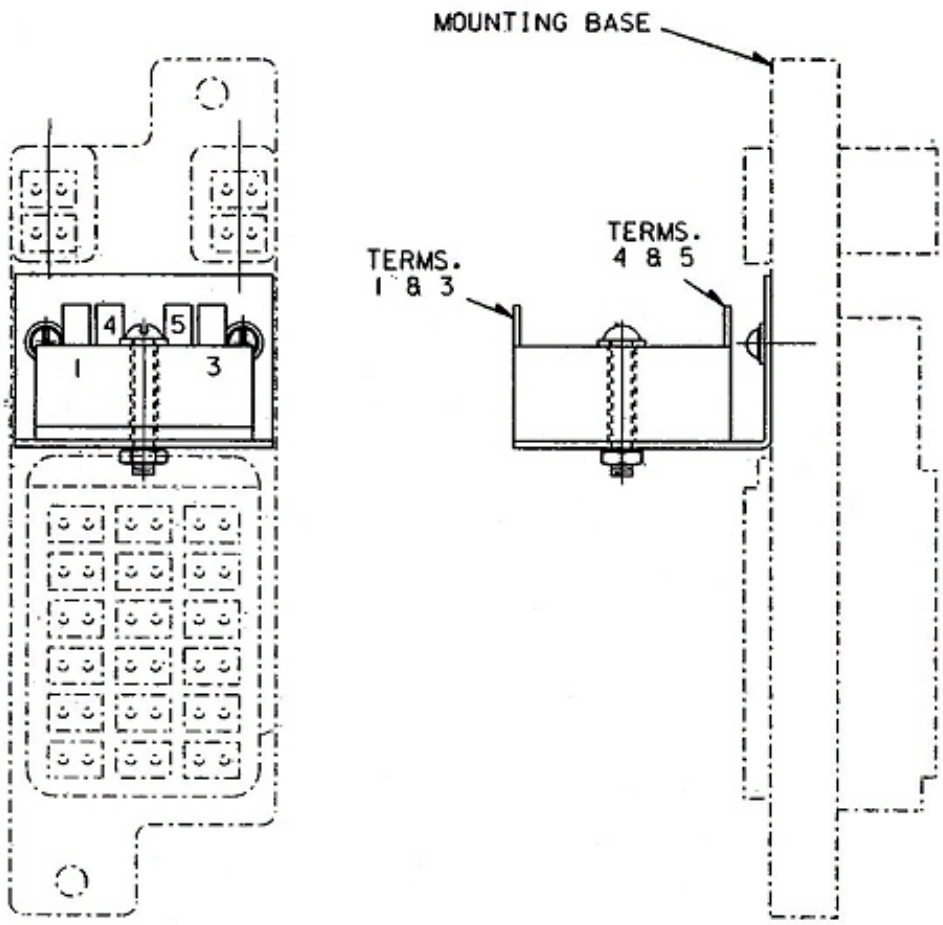
Be careful not to over-tighten the screws to avoid stripping the threads.

Once the module is mounted, wire the module and relay as shown in Figure 2-1 and Figure 2-2.

The varistor across the power input (B10 and N10), shown in Figure 2-2 provides a degree of transient protection. A USG-A lightning arrester should also be used for secondary protection.

2.3 Relay Indexing

Indexing pins are factory installed on the relay base. The pin pattern is unique for each type of relay. An indexing plate with holes corresponding to the relay indexing pins is supplied with the relay. This plate is attached to the relay mounting base during initial installation. The index plate prevents the insertion of different type of relay since its keying will be incorrect. A typical plug-in relay with indexing pins and mounting base with index plate is shown in Figure 2-3.



Mounting of Module and Bracket

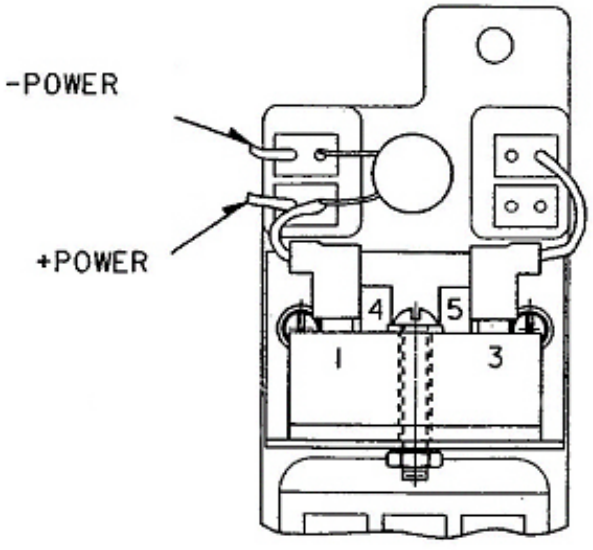


Figure 2-1. Electronic Flasher Module Mounting

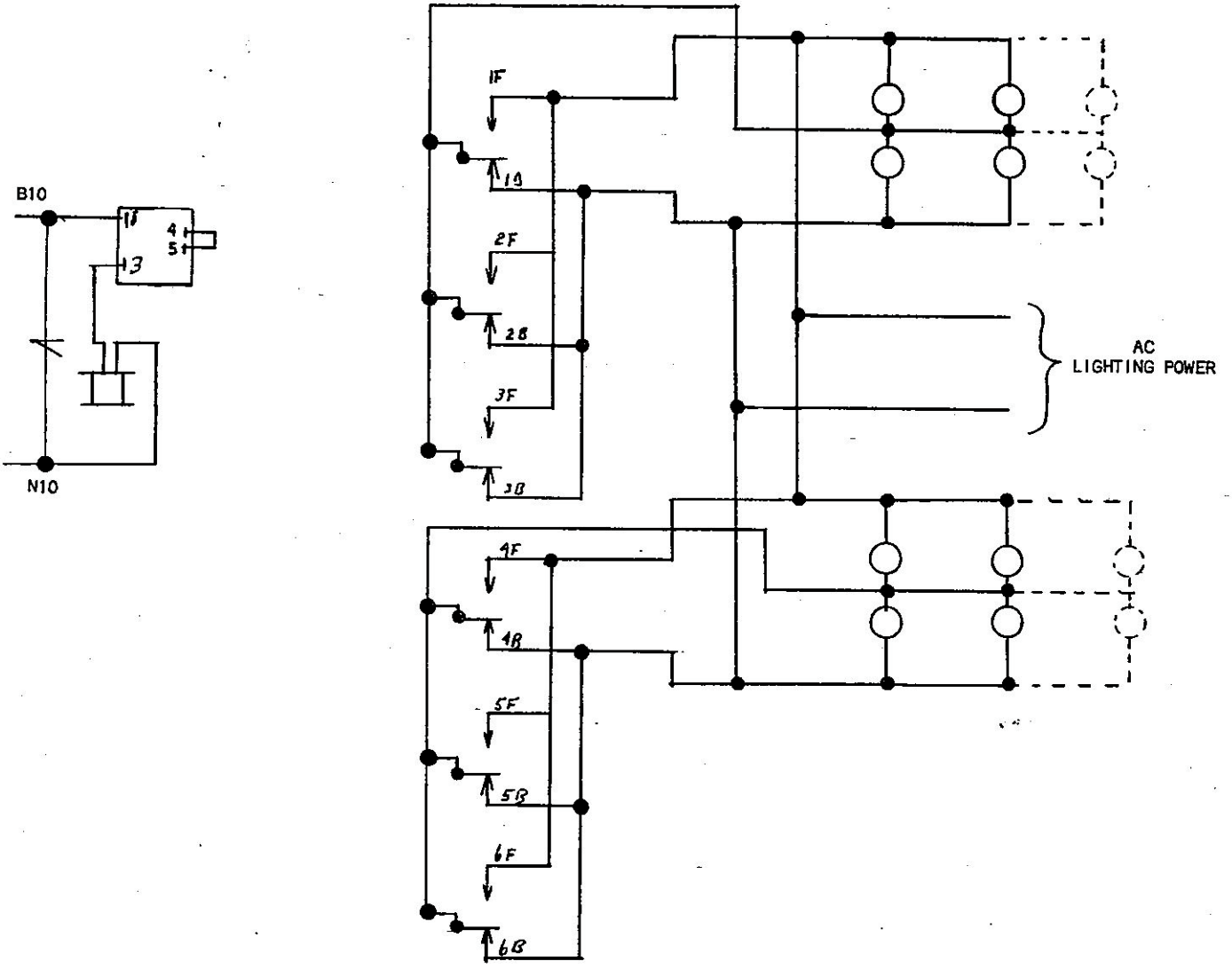


Figure 2-2. Relay Wiring

The following data defines the indexing established for relays covered by this manual.

a. The index code always consists of four figures (such as 0001, 0002, or 0101) and is used for both the relay and the indexing plate.

b. The index code for each relay can be determined from the relay part number and its suffix, which is marked on the nameplate attached to the front of the relay. The first two digits of the index code are the last two digits of the main part number, and the second two digits of the index code are the last two digits of the suffix. In this case, part number N322530-701 has an index code of 3001. The index number thus obtained should agree with the placement of the indexing pins in the numbered vertical rows on the back of the relay starting with the top pin and reading down.

c. The index code for each mounting base is determined by the placement of the holes in the numbered vertical rows of the large white nylon indexing plate which is affixed to the front of the mounting base. This indexing plate should not be removed from the mounting base unless it is damaged or the indexing is to be purposely changed to accommodate a relay of a different part number. Discard the indexing plate which comes in a bag tied to the handle of all new relays unless it is needed for replacement of damaged indexing plate or for application to a new mounting base.

CAUTION

Never drill new holes in an existing indexing plate. This would allow two or more relays of different part numbers to be inserted. The same applies to altering the position of the indexing pins in the back of the relay.

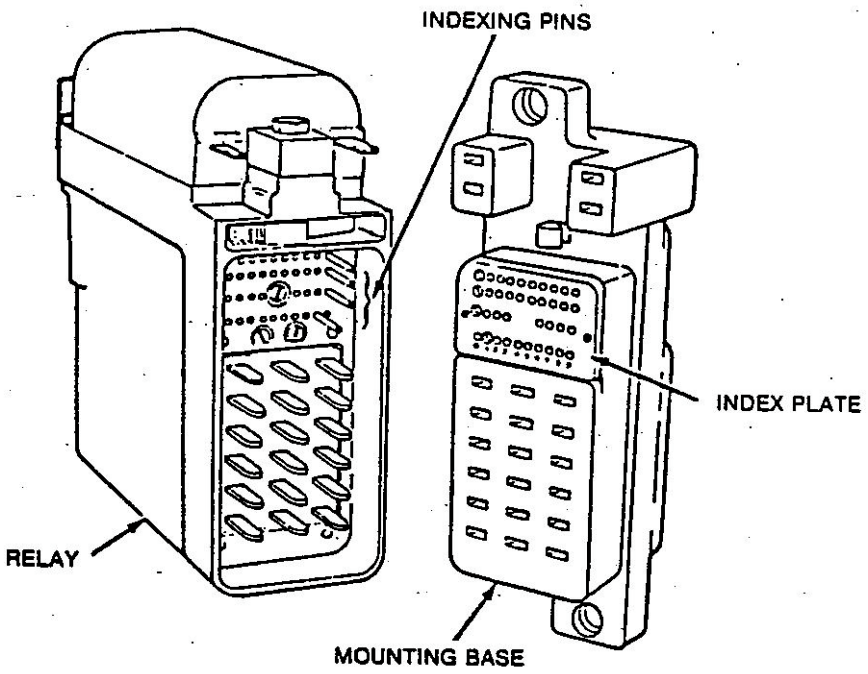


Figure 2-3. Relay Indexing Pins and Mounting Base with Index Plate

2.4 Receptacle Contact Springs

2.4.1 One Piece Mounting Base

The one piece mounting base with hardware (N451376-0305) includes a full complement of receptacle contact springs (18 – #10 for lamp contacts [M451142-2703], and 4 – #14-16 for control wiring [M451142-2702]). See Table 2-1 for other contact springs available. Make certain of the type solderless receptacle contact spring that accompanies the mounting base before proceeding with their installation.

Inspect each solderless receptacle contact spring for physical damage and straightness before proceeding with installation.

2.4.2 Installing Wires in Receptacle Contact Springs

Use the following procedure to ensure a good electrical and mechanical connection between the conductor wire and the receptacle contact spring. Table 2-1 identifies the correct crimping tool to use when installing wires in receptacle contact springs.

Table 2-1. Crimping Tool Specifications

CRIMPING TOOL (AMP TYPE)	WIRE SIZE	BASE RECEPTACLE CONTACT SPRING
J397138	#10/#12 AWG	M451142-2703
J397139	#14/#16 AWG	M451142-2702
J397188	#18/#20 AWG	M451142-2701

a. Strip 3/16 in. (0.181 in. or 0.41 cm.) of insulation from the end of the wire.

b. Place the receptacle contact spring into the jaws of the proper crimping tool.

c. Partially close the crimping tool jaws against the receptacle contact spring to hold it in place. Do not crush the receptacle contact spring barrel at this time.

d. Insert the stripped end of wire all the way into the receptacle contact spring barrel. Squeeze the tool handles until crimping is complete and the jaws release. Always attach the first wire to the longest terminal. This ensures that a second lead can be attached to the receptacle contact spring later.

e. Remove the crimped receptacle contact spring from the tool and inspect the connection. Make certain the wire is flush with the crimped barrel and that there are no loose strands of wire.

2.4.3 Inserting Contact Springs

The following is recommended when installing solderless receptacle contact springs:

a. Receptacle contact springs must be inserted into the base cavity with the lock side down (See Figure 2-4).

b. Make certain that the lanced tab is slightly compressed when the receptacle contact spring is inserted along the top of the cavity. The lanced tab may have been bent during handling, and therefore might not provide the required contact pressure after the relay is inserted. If the lanced tab does not touch, pull it up slightly, using your fingers or a suitable tool.

c. After insertion, pull firmly on the wire to make certain the receptacle contact spring is locked in the cavity.

2.5 Relay Insertion

Orient the relay to the mounting base with the push rod to the left-hand side; then plug the relay into the base. The relay should be pushed firmly against the mounting base while depressing the latch rod. After the relay is completely seated in the base, release the latch rod and pull on the handle to ensure that the relay has locked in place.

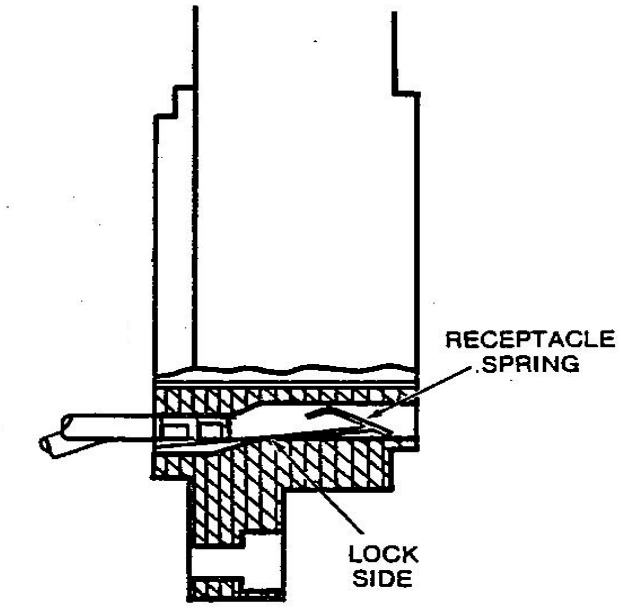


Figure 2-4. Receptacle Spring Installed

3 FIELD MAINTENANCE

3.1 Introduction

This Section provides the necessary periodic preventative maintenance procedures, which must be performed to ensure continuous, proper, and efficient operation of the PN-150F relays covered in this manual. Field maintenance covers periodic inspections and performance tests.

3.2 Periodic Performance Test

3.2.1 Cleaning

Before inspecting and testing the relay, if necessary, use a soft cloth to clean the exterior to remove any dirt or dust that may have collected. A safe cleaning solution of alcohol and water may be used for removal of accumulated dirt, grease, etc.

3.2.2 Service Requirements

3.2.2.1 General

All flasher relays must be inspected and tested at least every two years. The tests and inspections are to include: flash-rate, on-time, pick-up current, drop-away current, visual inspection of contacts for damage or misalignment, corrosion or other contamination of parts, loose parts inside of the cover, broken seal, and cracked or broken cover.

The contact surfaces will normally roughen and appear burned due to normal service. The contacts should be examined for cratering or for material transfer that could result in mechanically interlocking the contacts. Relays having contacts with severely eroded surfaces, indicating loss of more than 50% of the contact thickness should be replaced. The electronic module controls the flash rate and it is relatively independent of the relay's calibration. Therefore, it is not necessary to replace the electronics if relay is removed from service for repair.

If the flash rate is outside the requirements or is severely unbalanced, the electronic module must be replaced. Relays not passing the above stated tests and inspections must be replaced and not returned to service until the operating characteristics and conditions are in accordance with US&S specifications.

3.2.2.2 In-Service Test

It is recommended that flasher relays in service be removed from service for shop repairs when one or more of the following conditions occur. (Use the calibration values given in Table 4-7 for reference).

a. The flash rate is not within ± 5 FPM of selected flash rate. (This does not indicate a complete failure and module may be left in service, if the flash rate is not objectionable).

b. If the on-time of the lamps becomes objectionably unbalanced.

c. If the Drop-Away value (DA) falls below 67% of the value given.

d. If the Full-Drop-Away value (FDA) falls below 33% of the value given.

e. If the Full Stroke value (FS) increases to more than 110% of the value given.

3.3 Test Procedures

Test the operating characteristics of the PN-150F relays as given in Section 4.7 in this manual.

4 SHOP MAINTENANCE

4.1 Introduction

This section provides the information necessary to perform shop level repairs of the PN-150F style relays covered in this manual. In general, relays arriving at the shop for repair have been checked in the field and have been found to perform unacceptably or have been physically damaged.

4.2 Cleaning and Inspection

Before inspecting the relay and initiating repairs, use a soft cloth to clean the exterior carefully to remove any dirt or dust that may have collected. A safe cleaning solution of alcohol and water may be used for removal of accumulated dirt, grease, etc.

Inspect the relay exterior for signs of physical damage, such as cracked or broken cover, cracked or damaged housing, and damaged or missing contact block terminals or indexing pins. If severe damage is found, a careful inspection of the interior components should be made for obvious physical damage.

Remove the cover and clean the surface between the armature and the pole faces, especially the stop pin area (See Figure 4-1), using a lint free cloth and alcohol. Proceed with relay contact cleaning, using the recommended cleaning materials listed in Table 4-1.

4.3 Contact Cleaning and Inspection Procedure

The following procedure should be performed any time the cover is removed from the relay for inspection or any type of maintenance. Only after this procedure is performed may the cover be reinstalled on the relay. The cover should only be removed from the relay in a clean work area, i.e., an area free of any metal particles, dirt, or other material that may interfere with the proper operation of the relay.

NOTE

The use of an inspection magnifying lens is suggested for the following procedure.

1. Carefully examine the permanent magnet area (including the magnet extension) for any particles that may interfere with the proper operation of the relay, such as dirt, fibers, metal slivers, etc. Use compressed air to blow out the particles, or wipe the area to remove the particles.

CAUTION

Maintain a low pressure (10 to 50 psi.) or else damage may occur to the contact springs. Clean or filtered air should be used at all times, or else contamination may result. Care must be taken so that particles are not moved to another part of the relay.

2. Examine the stop pin counterbored hole (located on the bottom of the armature) for any particles. Use compressed air to blow out any particles. If the particle cannot be removed with compressed air. The particle should be checked to see if it is loose and has a possibility of becoming dislodged. This check can be performed by using a sharp tool (resembling an angled dental pick) to dislodge the particle.
3. Move the armature to the energized position and examine the space between the armature and the face of the magnet extension. This area must be clean and free of any particles. Pay special attention to the Teflon tape (See Note below) that is located on the bottom of the armature.

CAUTION

Particles can become embedded into the Teflon tape. Remove any such particles or they may interfere with the proper operation of the relay.

4. Move the armature to the deenergized position and examine the area between the armature and the pole faces. Use compressed air to blow out any particles. Examine the area of the hinge spring and safety stop for particles and clean when required.

NOTE

This is difficult to inspect. Backlighting the area will help considerably.

5. Use compressed air to blow out all relay surfaces.

CAUTION

Do not aim the airflow directly onto the contact springs, as they can be damaged or misaligned.

6. Use the compressed air to blow out the inside of the cover. If the air pressure does not sufficiently clean the cover, wipe the inside of the cover with a clean, lint-free cloth.

7. After cleaning is complete, perform the armature stop pin conditioning (See Section 4.3.1). The relay surfaces should be blown out with compressed air to remove any stray graphite particles following the stop pin conditioning procedure.
8. When the relay is completely cleaned and inspected, the cover may be replaced and the seal and sealing wire installed.

CAUTION

The sealing wire may be magnetic. When the wire is cut (after the seals have been applied) the cut-off pieces can be attracted to the permanent magnets of adjacent relays or can fall onto the work surface. Keep all adjacent relays covered at all times and clean up the cut-off pieces. Good housekeeping principles apply at all times. Also, care must be taken that metallic particles are not accidentally carried to the relay on hand tools that have become magnetized. If these procedures are not followed, the relay may not function properly.

9. Perform a final visual inspection once the cover and seal have been applied. Pay particular attention to the permanent magnet area and the inside of the cover.

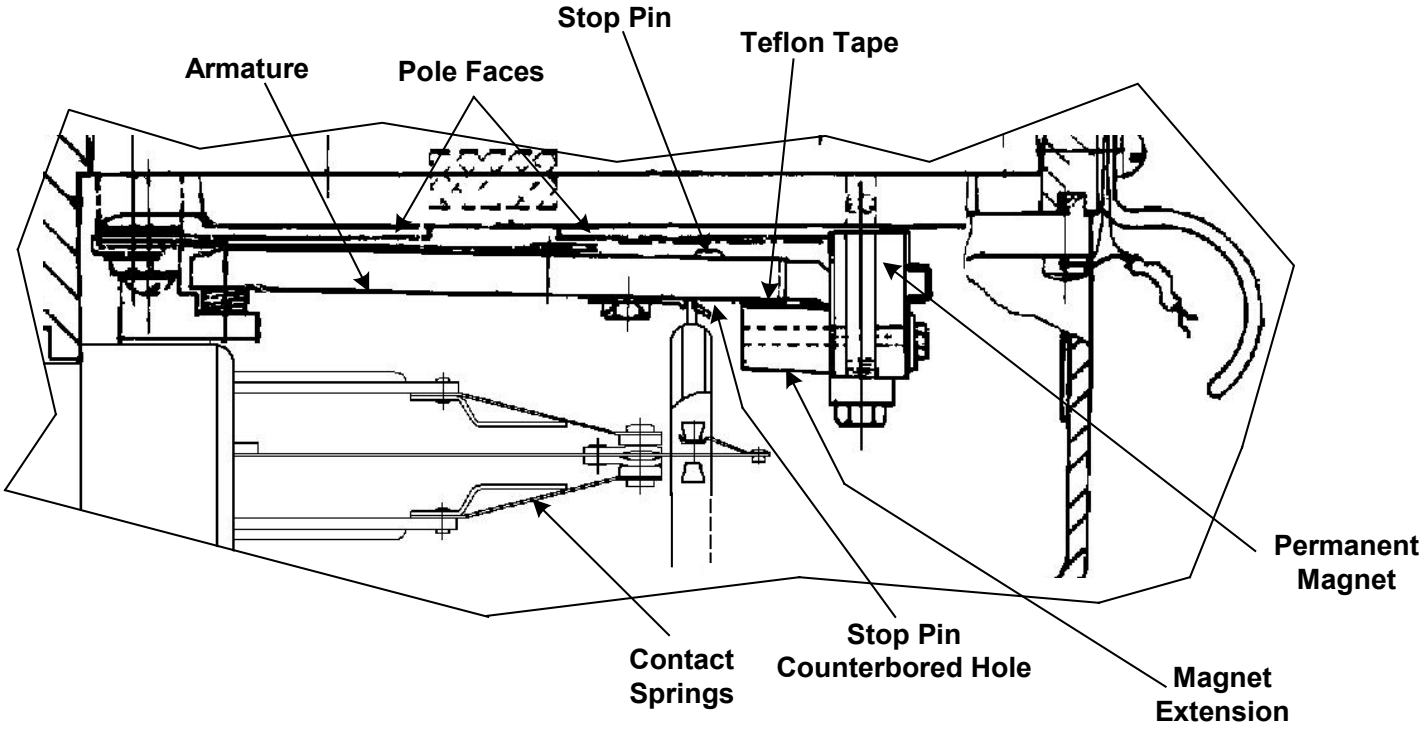


Figure 4-1. Contact Detail (typical)

4.3.1 Armature Stop Pin Conditioning

The following instructions are for conditioning the armature stop pin (See Figure 4-1). Follow this procedure whenever a relay is shopped for failure to meet its calibration specifications during scheduled field inspections and tests.

Remove the relay cover. Saturate a paper strip (J793094) with Alcohol #1 Solvent (Ethyl alcohol proprietary 190 or equivalent) and then place it between the armature and pole face. Applying moderate pressure to the armature, draw the paper out. Continue until no residue is removed from the surfaces. Dry the surfaces using a clean strip of paper.

Next, apply a dry lubricant, such as graphite, to the relay stop pin and its point of contact on the pole face.

Insert the Stop Pin Conditioning Graphite Stick (N451151-3203) between the armature stop pin and its point of contact on the pole face with the graphite against the stop pin. While applying moderate pressure on the stick, pull it back-and-forth in a circular motion over the stop pin, continuing for several seconds to ensure a sufficient amount of graphite transfer.

It is not necessary to observe a significant deposit of graphite since only a microscopic amount is necessary.

Recheck relay calibration and prepare the relay for return to service.

4.3.2 Cleaning Relay Contacts

This section covers recommended methods for the preparation and cleaning of relay contacts.

After contacts are dressed or after adjustments are made, to meet calibration requirements, the contacts should be cleaned in accordance with the following procedures.

Table 4-1. Recommended Contact Cleaning Materials

MATERIAL	PART NUMBER
Relay Contact Cleaning Kit (contains the following three items)	X451646-0901
Burnishing Tool, P.K. Neuses Co. No. 3-316	J397187 (Pkg. of 5)
Burnishing Tool, P.K. Neuses Co. No. N-318 (Heavy Duty)	J397187-001 (Pkg. of 5)
Paper Strip, 50 strips cut from 67# white Springhill Vellum Bristol Paper (or equivalent)	J793094 (Pkg. of 50)
Emery Paper, Wet or Dry, 600 grit, cut in strips	(Commercially Available)
Denatured Alcohol	(Commercially Available)
Stop Pin Conditioning Graphite Stick	N451151-3203

NOTE

When using the paper strip, clean the back contacts first, and the front contacts last. Discard the paper strips when dirty.

4.3.2.1 Contacts That Are Severely Burned

a. Using a 600-grit emery paper strip folded with the grit side out so that both contacts can be burnished simultaneously, stroke the contacts in the direction of contact wipe.

b. Using the burnishing tool, stroke the contacts several times in the direction of contact wipe.

c. Place the paper strip between the open contacts, then close the contacts and withdraw the paper strip.

d. Repeat step 'c' several times if necessary.

e. Using alcohol, give the contacts a degrease/wash.

f. Place the paper strip between the open contacts, then close the contacts and withdraw the paper strip.

g. Repeat step 'f ' several times if necessary.

4.3.2.2 Contacts With Heavy Tarnish, Slightly Rough or Pitted

Perform the procedure in Section 4.3.2.1, Steps 'b' to 'g.'

4.3.2.3 Contacts With Surface Film or Oxidation (Not Pitted)

Perform the procedure in Section 4.3.2.1, Steps 'f ' and 'g.'

4.4 Check-Out Procedure (Performance Test)

Perform calibration in accordance with Section 4.7.

4.5 Repairs and Replacement

Since the contacts are the only wearing parts in this relay, in most cases the relay can be restored to proper operation by dressing (Section 4.3) and readjusting them (Section 4.6.3 or 4.6.4 as applicable).

4.5.1 Disassembly

Dismantle the relay only to the degree necessary to complete repairs. Refer to the parts list (See Section 5) for part information and location of parts. In general, to dismantle the plug-in relay, proceed with the following sequence:

a. Remove the relay cover seal.

b. Carefully remove plastic cover.

c. Remove/disassemble relay components as required.

d. Remove contacts/contact block as required.

e. Remove permanent magnet as required.

NOTE

These magnets are of a special alloy that permits retention of proper strength indefinitely if not abused. When not in place on relays, magnet assemblies should be kept separated from other magnetic objects and the screws, which hold the extension to the magnet must be kept tight. Should a magnet become weakened, it should be returned to the factory for recharging where special equipment fully charges the magnet, and then ages it to its best working strength.

4.5.2 Reassembly

Reassembly is accomplished generally in the reverse order of disassembly. The following sections provide additional instructions to be followed during reassembly of this relay.

4.5.3 General Parts Replacement

Do not over-tighten or force parts when reassembling a relay. Upon completion of reassembly, calibrate the relay as directed in Section 4.7.

4.5.4 Replacing Contact Block

If the contact block is to be replaced by another, remove the old block, and then use a small punch to remove the small dowel pins. Attach the new block with the four screws. Run a #42 drill (0.0935 dia.) through the dowel pin holes into the epoxy contact block for a total depth of 9/16" (+ 1/32" – 0").

NOTE

Replacement contact blocks MUST be of the same general design.

Carefully install the dowel pins, tapping them in until they are flush with the aluminum surface. If it is necessary to install a used contact block from another relay, remove only one of the dowel pins from the aluminum frame. Carefully press the block on the remaining pin and fasten in place with the screws. One dowel pin will adequately hold the block in place.

Do not over-tighten or force parts when reassembling a relay. Upon completion of reassembly, calibrate the relay as directed in Section 4.7.

4.5.5 Permanent Magnet

The polarity of the magnet should be such that the top end farthest from the two notched holes will attract the end of a compass needle that points toward geographic South. The permanent magnet assembly should be applied to the relay making sure that the shunt between the magnet and the magnet extension is touching the pole piece. Tighten the two long screws holding the magnet assembly to the pole piece sufficiently to straighten the curved strap against the magnet. Bend the nut locks securely up against the sides of the screw heads.

4.6 Adjustments

All adjusting and testing must be done with the relay in its normal upright position.

4.6.1 Recommended Tools and Test Equipment

Table 4-2. Recommended Equipment

TOOL/TEST EQUIPMENT	DESCRIPTION	PART NUMBER
Thickness Gauges	0.001 in. to 0.200 in.	
Gram Gauge	250 Grams	
Screw Driver	Torque Measuring	
Contact Driver Removal Tool		N451151-2801

4.6.2 Magnet and Magnet Extension

Insert a 0.130 inch spacer between the stop-pin and the pole-face and adjust the permanent magnet extension so that it touches the Teflon back stop tape or the back stop pins, whichever is present on the bottom of the armature.

After adjustment, the magnet and magnet extension should be centered on each other and on the armature. On relays without back-stop pins the bottom of the armature should fit flush on the surface of the magnet extension, with no air gaps. On relays with back-stop pins, the air gap should be of uniform width across the surface of the magnet extension.

4.6.3 Contact Adjustments

This section covers relays with one-piece molded driver and new contact blocks applied by customers.

The contact block or blocks should be installed in the relay frame with screws tightened by means of a torque measuring tool to 10 ± 2 inch pounds. The dowel pin hole or holes in the relay frame must be so located that the completed relay will fit freely into its proper mounting base (without receptacle contact springs).

a. Adjust all contact stops open.

b. With a 0.053" spacer under the core pin, set all front contacts closed. All front contacts should open on a 0.058" spacer.

c. With a 0.077" spacer under the core pin, set all back contacts closed. With a 0.072" spacer, all back contacts should be open.

d. Using Tool N451151-2801, remove the driver and adjust the heel springs so that they are neither touching the front and back contacts.

e. Reinstall the driver and recheck the settings per steps 'b' and 'a' above.

f. With a 0.042" spacer under the core pin, adjust the contact stops so that all front contacts are closed. With a 0.047" spacer, all fronts should be open.

g. With a 0.088" spacer under the core pin, adjust the back-stops so that all backs are closed. With a 0.083 spacer, all backs should be open.

h. Check that at Full Stroke Pick-Up and Release, that all stops are open. This opening should be approximately 0.008 inches.

i. The relays should now be baked for 45 hours at 212°C.

j. After baking, recheck contacts per steps 'f ' and 'g ' above.

k. With the armature held in the midpoint position, with neither fronts or backs making contact, check to see that the free play between the heel spring and the driver is 0.010" or less. If the free play is excessive, adjust the height of the clip as shown in Figure 4-2.

4.6.4 Contact Adjustment, Old Blocks

For original factory installed blocks, adjust the contacts per steps 'f ' and 'g ' above and check stop opening per step 'h.' If the 0.008" opening cannot be maintained, then complete contact adjustment must be performed.

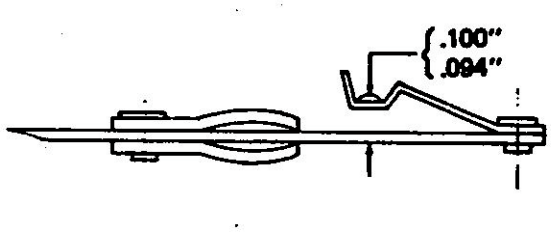


Figure 4-2. Heel Contact Springs

4.6.5 Hold-Down Force

With the relay in the normal upright position and de-energized, a force of at least 190 grams (Refer to Table 4-6) should be required to move the armature away from the permanent magnet assembly. This upward force should be measured with a gram gauge at the bottom end of the centermost contact driver.

The hold-down force can be increased, if necessary, by bending the shunting strip (fastened to its forward face) away from the permanent magnet. If one, or both, of the two vertical screws which fasten the permanent magnet assembly to the relay frame is steel, a further increase in hold-down force can be obtained by changing to bronze screws. The steel screw J463078, has dull (tin) plating and a 3/32 inch thick head. The bronze screw, M327179, has brighter (nickel) plating and a 1/8 inch thick head.

Any change in the hold-down force will affect the relay calibration, as discussed in Sections 4.7 and 4.8.

4.7 Calibration (Relay Only, without Flasher Module)

4.7.1 Recommended Test Equipment

Table 4-3. Recommended Test Equipment (Relay Only)

NOMENCLATURE	PART/MODEL/TYPE NO
Power Supply, 0-40 VDC	HP6205B or equivalent
Digital Multimeter (two required)	HP3435A or equivalent
DPDT (double pole, double throw-S1)	
SPST Switch (S2)	

4.7.2 Procedure

Connect the circuit as shown in Figure 4-3, and proceed as follows:

a. Set ammeter to appropriate current range.

b. Set voltmeter to appropriate voltage range.

c. Set DC power supply to appropriate output range.

d. Set switch S1 to Normal.

e. Turn DC power supply on, and close S2.

f. Observe ammeter and adjust DC power supply output control to obtain the charge current reading indicated in the "Charge Amp" column in Table 4-7. Note that relay energizes and remains energized as voltage is increased.

g. Set switch S1 to Reverse. Relay should de-energize.

h. Set switch S1 to Normal. Relay should again energize.

i. Adjust DC power supply output control to reduce the current at a rate so as not to overshoot the actual value, and measure the "Drop-Away." This is the value at which the front contacts open. Refer to Table 4-7 for the acceptable value.

j. Further reduce the DC power supply output control setting at a rate so as not to overshoot the actual value and check Minimum Drop-Away with Full Back Contact Compression. Refer to Table 4-7 for the acceptable value.

k. Reduce current to zero then open the circuit momentarily using switch S2.

l. Adjust DC power supply output control to increase current at a rate so as not to overshoot the actual value, and obtain Pick-Up. This is the value at which the front contacts make contact. Refer to Table 4-7 for the acceptable values.

m. Further increase the DC power supply output control at a rate so as not to overshoot the actual value to obtain the relay Full-Stroke value. This is the value at which the armature is tight up against its stop pins. Frequently, Pick-Up and Full-Stroke will be the same value.

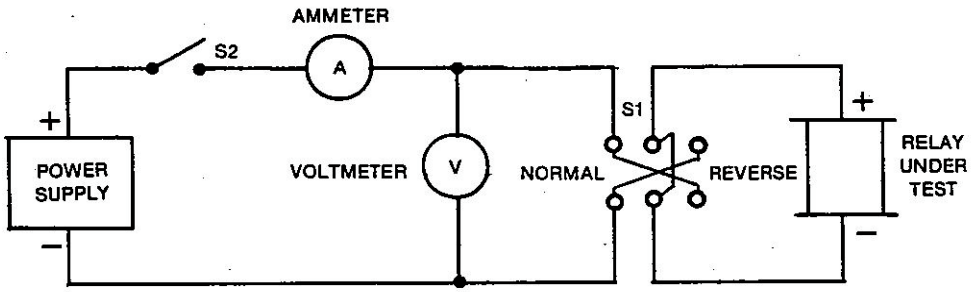


Figure 4-3. PN-150 Relay Test Circuit

4.7.3 Flash Rate Test (Relay With Flasher Module)

4.7.3.1 Recommended Test Equipment

Table 4-4. Recommended Test Equipment (Relay with Flasher)

NOMENCLATURE	PART/MODEL/TYPE NO
Power Supply, 0-40 VDC	HP6205B or equivalent
Digital Multimeter	HP3435A or equivalent
SPST Switch (S1)	
Counter	Redington Counter R9-3206
Stopwatch	Accurate within 0.1 sec.
On-Time Meter	PD-30 (Simpson TS-111)

4.7.3.2 Procedure

Connect the flasher relay test circuit as shown in Figure 4-4, jumper terminals 4 and 5 and proceed as follows:

a. Set M1 to appropriate DC voltage range.

b. Turn DC power supply on and adjust for 10 ± 1 VDC output.

c. Set switch S1 to the ON position and simultaneously begin to time a period of three minutes.

d. At the end of precisely three minutes, set switch S1 to OFF, and note the reading at the counter.

e. Divide the counter reading by three. The resultant rate should be 45 ± 5 counts per minute.

f. Reset the counter to zero and remove the jumper from terminals 4 and 5.

g. Repeat steps 'd' and 'e.' Divide the counter reading by three. The resulting rate should be 60 ± 5 counts per minute.

h. With switch S1 set to OFF and the relay operating at 10 volts, connect leads of the On-Time meter across the heel and front contacts. Then connect the leads across the heel and back contacts. Front and back contact on-time readings should be between 45 and 55%.

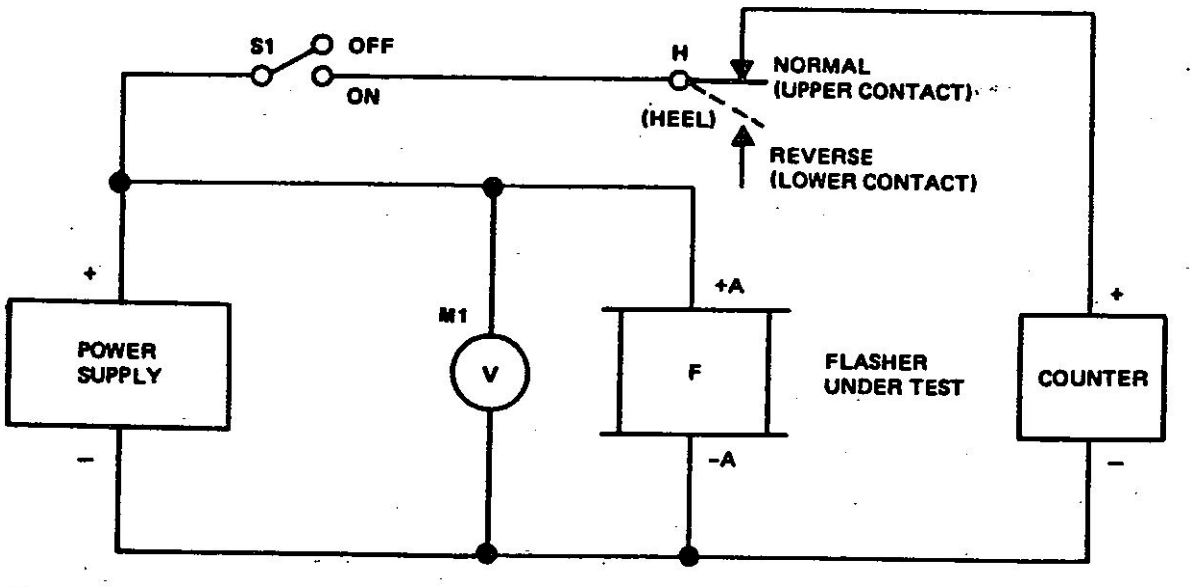


Figure 4-4. Flasher Relay Test Circuit

4.8 Calibration Requirements

4.8.1 In-Service Test

Calibration requirements will be met when the relay adjustment values are the same as those given in Table 4-7 of this manual.

After any shop adjustments are made check the calibration values (See Section 4.7). If they are not within the values given in Table 4-7 of this manual, the relay should not be placed in service.

4.8.2 Contact Resistance

Resistance of front contacts should be measured with the armature in its full stroke position, and the resistance of the back contacts should be measured with the armature fully released. Cleaned contact resistances should not exceed the values listed in Table 4-5.

Table 4-5. Contact Specifications

TYPE OF CONTACT	OHMS
Silver Alloy-to-Silver Alloy	0.03

Contact surfaces should not be disturbed unless there is evidence of severe pitting from excessive loading or from an accidental short through the contacts. When contacts must be dressed, refer to Section 4.3or 4.3.2.

Table 4-6. Mechanical Adjustments and Hold-Down Torque

RELAY	ARM. AIR GAP (IN.)	ARM. STROKE (IN.)	MIN HOLD-DOWN (GRAMS)	ADJUSTING SPACERS			
				FRONT CONTACTS		REAR CONTACTS	
				CLOSED (IN.)	OPEN (IN.)	CLOSED (IN.)	OPEN (IN.)
PN-150F	0.026	0.130	190	0.042	0.047	0.083	0.088

Table 4-7. Calibration Values – Single Coil Relays

RELAY STYLE	OHMS	CHARGE (AMP)	MIN. DROP-AWAY (AMP)	MIN FULL DROP-AWAY (AMP)	MAX PICK-UP & FULL STROKE (AMP)
150F	60	0.188	0.024	0.009	0.065

4.9 RAIL Team and Technical Support

The Rapid Action Information Link (RAIL) team was created in 1996 to serve the technical needs of current and potential US&S customers. Convenient 24-hour access and a rapid resolution to customer problems are the trademarks of this organization. The RAIL team, which is staffed primarily by US&S product and application engineers, is ready to assist and resolve any technical issues concerning this or any US&S product.

Any questions regarding the contents of this service manual should be directed to the RAIL team by telephone at 1-800-652-7276 or through Internet e-mail at railteam@switch.com.

5 PARTS LISTS

5.1 PN-150F Flasher (Complete)

Table 5-1. Parts List for X-451018-3001

ITEM NUMBER	PART NUMBER	DESCRIPTION
1	N322530-701	Relay, PN-150F
2	J726274	Flasher Module
3	M451563-6401	Bracket, Module Mtg.
4	J525040	Screw, 10-32-x 1-1/4" Rd. Hd.
5	J048172	Nut, 10-32, Hex
6	J047710	Washer, #10 Phos. Bz. Shprf.
7	J475077	Washer #10 Flt.
8	J525031	Screw, 6-32-x 3/8", Rd. Hd.
9	J047996	Washer, 16 Flt.
10	J047708	Washer, 16 Phos. Bz. Shprf.
11	J525128	Screw, 8-32 x 3/8", Rd. Hd.
12	N451458-5601	Jumper
13	N451458-5602	Jumper
14	J735547	Varistor, 26 VDC, V33ZA5

5.2 PN-150F Relay with One Piece Molded Driver

Table 5-2. Parts List for PN-150F Relay with One Piece Molded Driver

Part Number (N322530-701) – See Figure 5-1.

ITEM NUMBER	PART NUMBER	DESCRIPTION
1	M433355	Frame
2	M388888	Latch Rod
3	J487087	Roll Pin
4	M275388	Lock, Bolt
5	M321728	Latch
6	J048716	Dowel Pin
7	M321861	Spring
8	N438599	Armature Assembly
9	N438908	Arm, Molded Operating
10		(Deleted)
11	N438954	Contact Block
12	J522168	Screws #6-32 x 3/4" Phil. Fil. Hd. Mach. (T.P.)
13.	M433358	Armature Shim
14	J26105-0401	Hinge Block
15	J792919	Bolt Lock
16	J500076	Screw, #8-32-x 5/8" Hex. Hd. St. (Tin Pl.)
17	N435191-001	Permanent Magnet Assembly
18	M321853	Strap
19	J475199	Plate Washer
20	J790257	Seal, Vent
21	M561111	Handle
22	J047710	Lock Washer, #10 Int. Tooth Ph. Bz (N. Pl.)
23	J525277	Screw, #10-32 x 3/8" Phil. Pan Hd. St. (Cad. Pl.)
24	N433498-004	Coil, Complete 60-Ohm
25	M434091	Shim
26	M434092	Shim
27	J050016	Screw, 1/4-20 x 3/4" Hex. Cap. St. (Tin Pl.)
28	M349785	Spring, Operating Arm
29	J630871	Name Plate
30	J487090	Indexing Pin
31	J047081	Gasket
32	J776596	Cover

33		(Deleted)
34		(Deleted)
35	J522042-001	Screw
36	A043013	Seal Wire
37	J079351	Seal
38	M433411	Armature Spring
39	5003665	Calibration Tag
39	J791665	Adhesive Film (for applying Ref. 39)
40	J047713	Washer, SH FRF. LK 116
41	N330681-0001	Parts Bag
42		(Deleted)
43	J463075	Screw, #6-32 x 1/4" Hex. Stl.
44	J463078	Screw, #8-32-x 1-1/4" Hex. Hd. St. (Tin Pl.)
45	M327179	Bolt, Hex. Hd. Bz.
46	J075828	Tag, Nomenclature

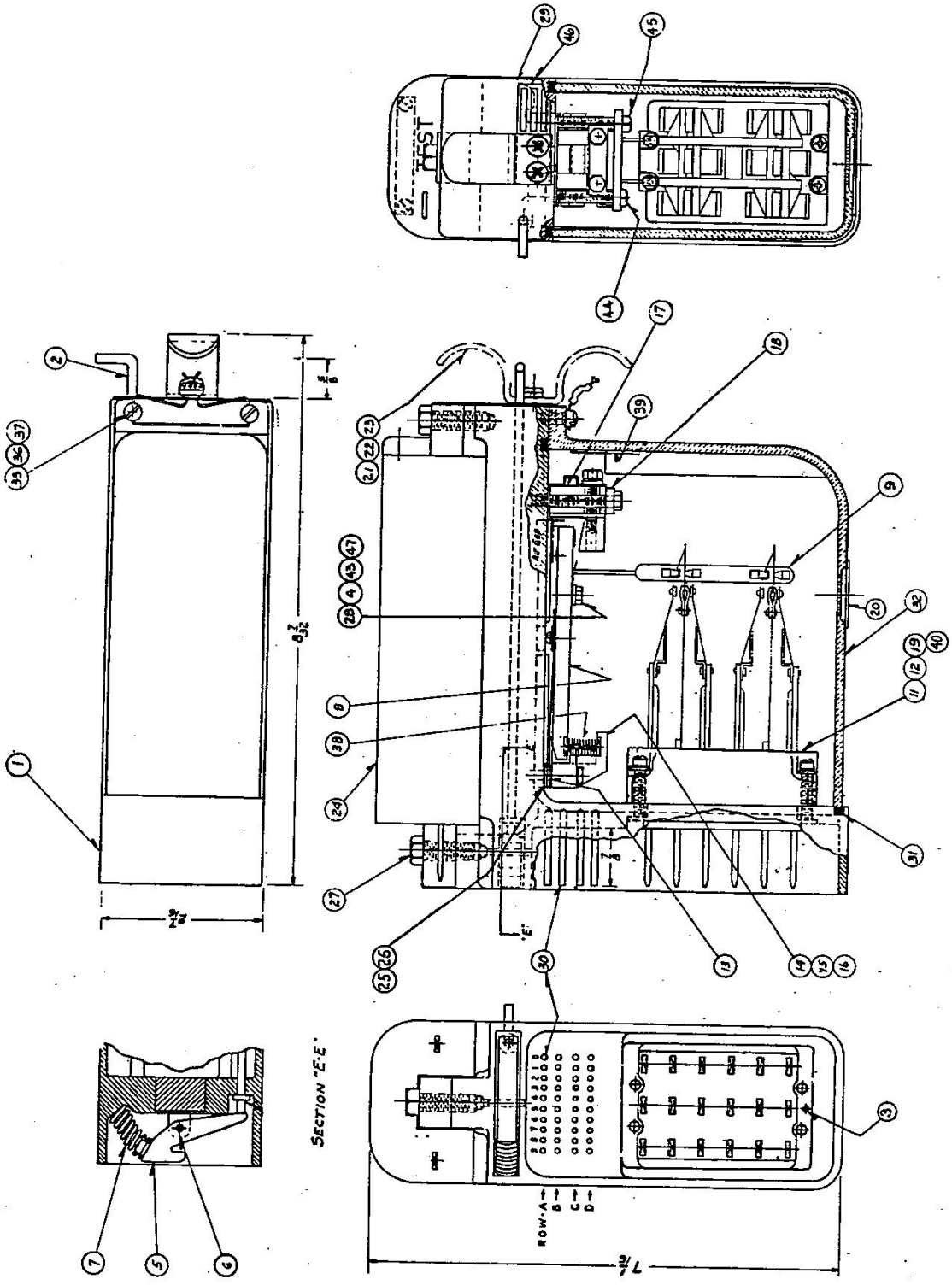


Figure 5-1. PN-150F Relays with One Piece Molded Contact Driver

5.3 Mounting Base PN-150F Relays

Table 5-3. Parts List for Mounting Base PN-150F Relays

(See Figure 5-2)

ITEM NUMBER	PART NUMBER	DESCRIPTION
1a	N451376-0305	Base Complete for Wayside Relays (Note "A")
1b	N451376-0301	Base Only
2	J780055	Base-Mounting Molded
3	J792848	Strike-Relay
4	J480280	Nut-Speed Push-On
*5	M451142-2702	Spring-Cont. Recept.
6	J052667	Screw, 1/4–20 x 1-1/4" Rd.
7	J047775	Washer, 1/4" Stl. Lk. Med.
8	J047501	Washer, 1/4" Stl. Plate
9	J048002	Nut, 1/4-20 UNC-2B Hvy.
10	J075951	Tag, Relay Indentification
	S000008	Sheet, Instr. Form #8
	J078399	Bag, Plastic

NOTE "A": When Mounting Base complete is ordered, a plastic bag of parts is included in the inner carton with the mounting base and instruction prints.

Bag Contains: Tags (Item 10), Screws (Item 6), Items 6, 7, 8 and 9 which are for attaching the mounting base to rack.

*Included receptacle contact springs are normally (M451142-2702) for #14 and #16 wire, unless otherwise specified. If other wire size is used the proper part number (M451142-2701 for #18-20, M451142-2703-for #10-12) should be specified when ordering the complete base (N451376-0305 except using receptacle contact springs, solderless M451142-2703).

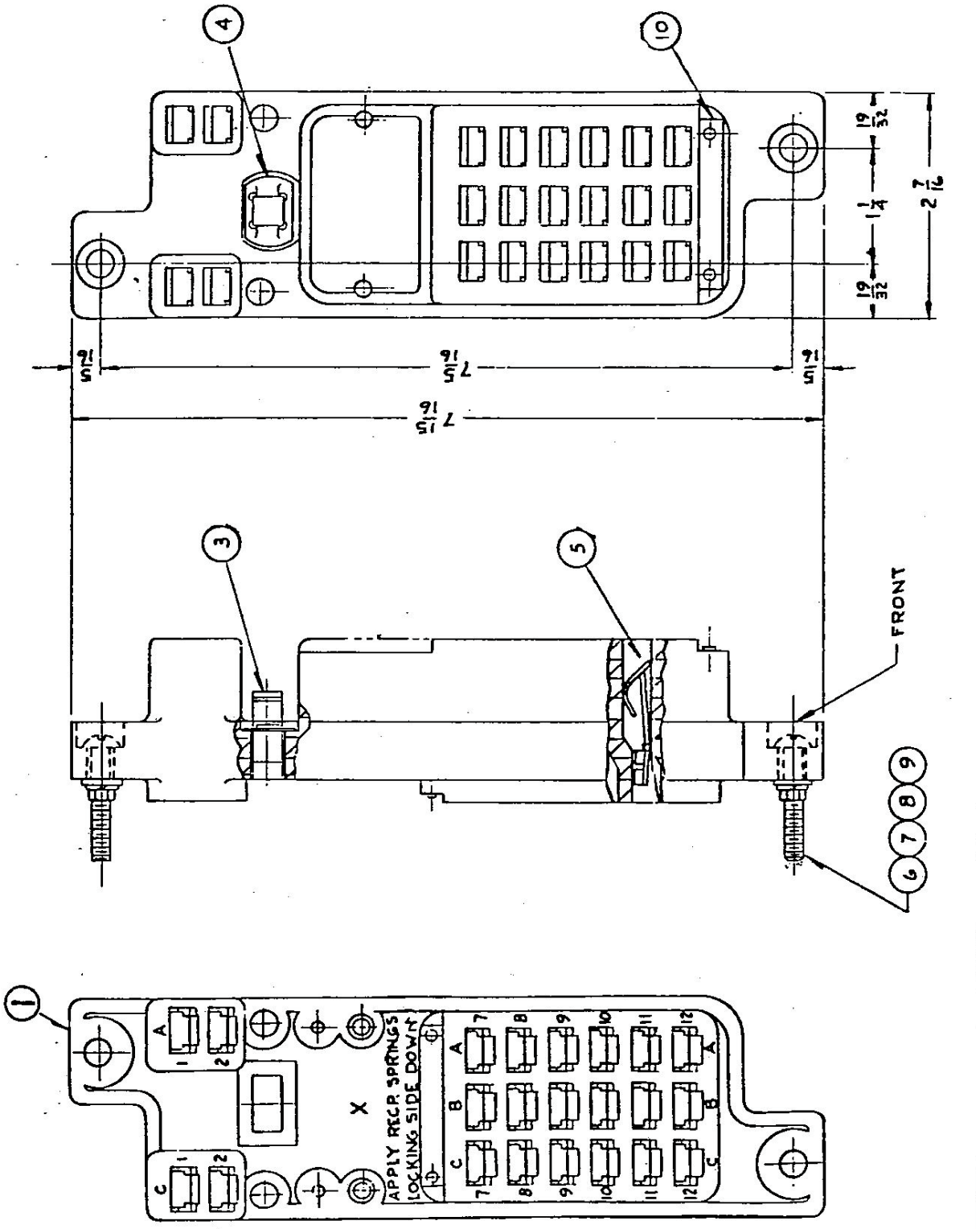


Figure 5-2. Mounting Base for PN-150F Relays

5.4 Installation Kit X-Bill for N322530-701

Table 5-4. Parts List for X-451018-3003

(See Figure 5-3)

ITEM NUMBER	PART NUMBER	DESCRIPTION
	N322530-701	RELAY,PN 150F
10	J726274	FLASHER-RELAY
15	M4515636401	BRKT.,MODULE MTG
20	J525040	SCR-10-32X1-1/4 RD HD
25	J048172	NUT,10-32 HEX STEEL
30	J4751210125	WSHR-SST #10 SHAK PF
35	J475077	WSHR-10FLT STL COML
40	J525031	SCR-6-32X3/8 RDH S/ST
45	J047996	WASHER,#6 FL STEEL
50	J047708	WSHR-6PHOS BZ SHPRF
55	J525128	SCREW,8-32X3/8 RD HD STEEL
60	N4514585601	JUMPER
65	N4514585602	JUMPER
70	J735547	VARIS-26 VDC V33ZA5
75	J047714	WASHER-8 SHPRF LK SS
	N4513760305	BASE, PN-150F MTG.

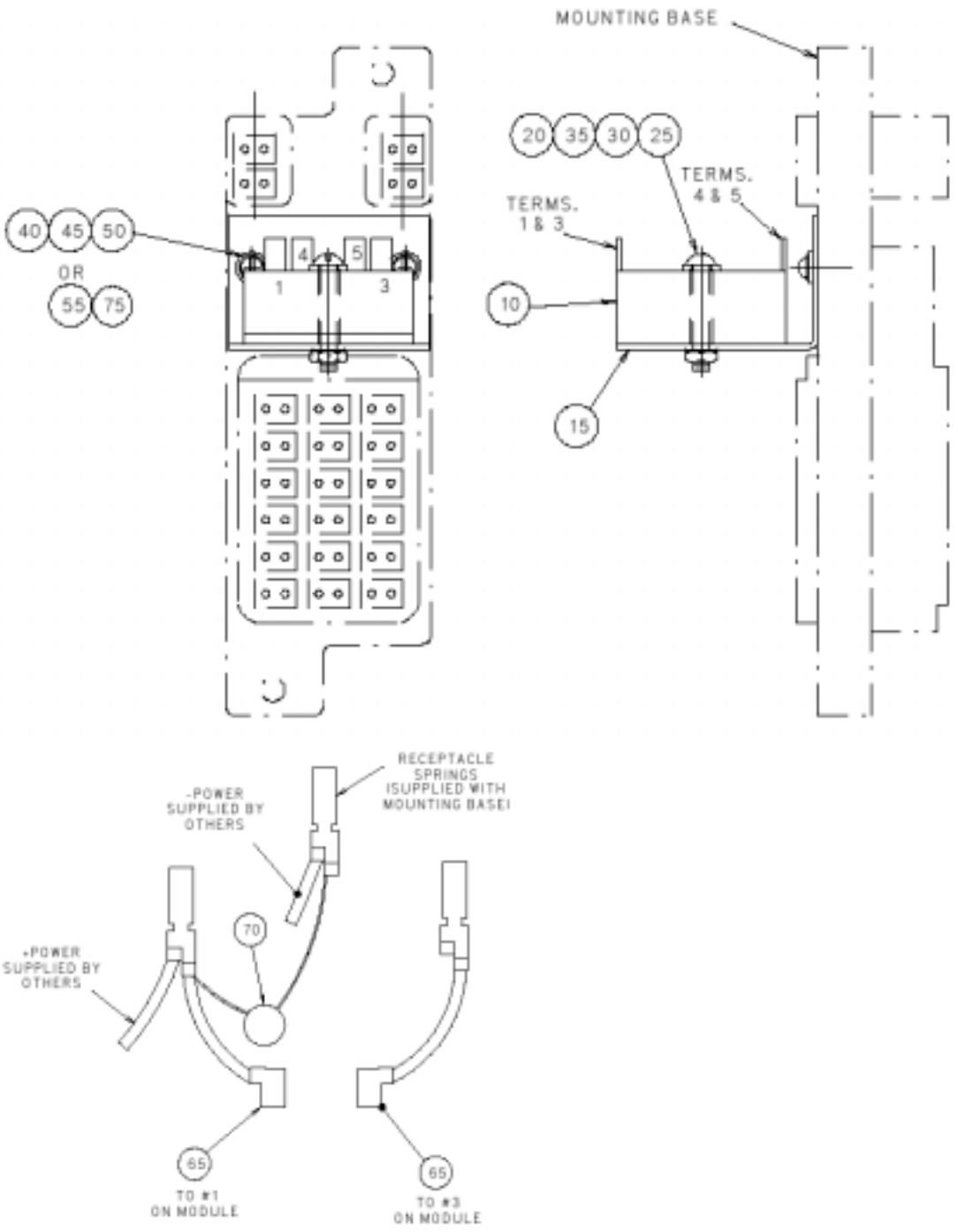


Figure 5-3. New Installation Kit for N322530-701

End of Manual