PC-250B

Vital Code Following Relay

ASTS USA Part No.		
N322559-		
001	010	802
002	011	
003	015	
004	017	
005	020	
006		
007		
008		
009		

- Installation
- Operation
- Maintenance

Proprietary Notice

Important Notice

ASTS USA constantly strives to improve our products and keep our customers apprised of changes in technology. Following the recommendations contained in the attached service manual will provide our customers with optimum operational reliability. The data contained herein purports solely to describe the product, and does not create any warranties.

Within the scope of the attached manual, it is impossible to take into account every eventuality that may arise with technical equipment in service. Please consult an ASTS USA local sales representative in the event of any irregularities with our product.

ASTS USA expressly disclaims liability resulting from any improper handling or use of our equipment, even if these instructions contain no specific indication in this respect. We strongly recommend that only approved ASTS USA spare parts are used as replacements.

Revision History

Rev.	Date	Nature of Revision
0	August 1984	Initial Release
1	February 1995	Revised Table 1-1, Section 2.4.2 step b, Section 2.4.3, Section 3.2.2, Section 4.6.2 step b 2, Table 4-1, Table 5-1, and Table 5-2.

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1. GENERAL INFORMATION

1.1. Introduction

This manual provides service information for the PC-250B plug-in relay. The PC-250B relay is a biased relay designed for use as a code-following track or line relay. With no energy applied, the armature is biased to close the back (right-hand) contacts. When sufficient energy of the proper polarity is applied, the relay armature will move to close the front (left-hand) contacts. If improper polarity is applied, the back contacts will remain closed.

The design of the PC-250B relay conforms to all applicable AAR specifications.

1.2. Description

1.2.1. General

The PC-250B relay is manufactured with various combinations of low voltage (L.V.) silver platinum and high voltage (H.V.) tungsten contacts. L.V. contacts are indicated with green markings on the contact post members in the relay, while H.V. contacts are indicated by red markings.

The relay is factory calibrated to operate across a wide environmental range. All moving parts are enclosed in a sturdy, transparent, dust and moisture resistant cover. To ensure the relay is inserted in its proper mounting base, all relays have indexing pins. Relays lock securely into the plug-in position.

1.2.2. Coils

Coil resistances of PC-250B relays are (depending on part number) 18.5, 135, 225, 360 or 400 ohms. Refer to Section 1.3.1 to correlate part numbers to coil resistance values. The resistance selected depends on the system voltage and circuitry.

1.2.3. Contacts

Contacts of the PC-250B relays are low voltage (L.V.) and high voltage (H.V.). L.V. contacts are marked with green on contact posts, and are for use in circuits below 50 volts. L.V. contacts are silver platinum to silver platinum. H.V. contacts are tungsten to tungsten, and are marked with red contact posts. H.V. contacts are for use in circuits above 50 volts (to provide longer contact life); however, they cannot be employed in low voltage circuits due to the contact resistance which they develop. Refer to Figure 5-3 for a pictorial representation of the contact assembly.

1.3. Specifications

The following paragraphs provide the electrical and mechanical specifications of the PC-250B code following relays covered in this manual.

1.3.1. Electrical

Relay electrical specifications are tabulated in Table 1-1 in part number order.

Table 1-1. Electrical Specifications

Part Number N322559-	Contact Arrangement				Coil Resistance Ohms	Minimum Pick Up Amps	Maximum Full Stroke Amps	Minimum Drop Away Amps	System Voltage	Operating Amps
	1 (FB)	2 (FB)	3 (FB)	4 (FB)						
001	H. V.	H. V.	L. V.	L. V.	360	0.010	0.017	0.005	14-16	--
002	L. V.	L. V.	L. V.	L. V.	360	0.010	0.017	0.005	14-16	--
003	L. V.	L. V.	L. V.	L. V.	135	0.015	0.025	0.008	10-12	--
004	H. V.	H. V.	H. V.	H. V.	135	0.015	0.025	0.008	10-12	--
005	H. V.	H. V.	L. V.	L. V.	135	0.015	0.025	0.008	10-12	--
006	H. V.	L. V.	L. V.	L. V.	18.5	0.060	0.085	0.030	--	0.09
007	H. V.	H. V.	L. V.	L. V.	18.5	0.060	0.085	0.030	--	0.09
008	L. V.	L. V.	L. V.	L. V.	0.3 400	0.600	0.78	0.410	--	0.82
009	H. V.	L. V.	L. V.	L. V.	0.3 400	0.600	0.78	0.410	--	0.82
010	L. V.	L. V.	L. V.	L. V.	0.15 400	0.825	1.07	0.565	--	1.13
011	H. V.	L. V.	L. V.	L. V.	0.15 400	0.825	1.07	0.565	--	1.13
015	L. V.	L. V.	L. V.	L. V.	225	0.013	0.022	0.006	8-12	--
017	H. V.	L. V.	L. V.	L. V.	135	0.015	0.025	0.008	8-12	--
802	L. V.	L. V.	L. V.	L. V.	360	0.010	0.017	0.005	14-16	--
020	H. V.	H. V.	H. V.	H. V.	823	0.007	0.015	0.003	24-32	--

Contacts - Two types of contacts are available in the PC-250B Relays: L.V. and H.V. The L.V. is silver platinum to silver platinum for use in circuits below 50 volts. H.V. is tungsten to tungsten for use in circuits above 50 volts to provide longer contact life. However, the tungsten contacts cannot be employed in low voltage circuits due to the contact resistance which they develop.

1.3.2. Mechanical

The following mechanical specifications are common to all PC-250B relays covered in this manual.

Dimensions: Height 7-1/16" (17.93 cm)

Width: 4-15/16" (12.54 cm)

Depth: 8-3/8" (21.2 cm)

Temperature: -40°F (-40°C) to +185°F (85°C)

Indexing: Relay part number determines indexing plate required. (Refer to Section 2.3)

Weight: 9-3/8 Lbs.

Mounting Base: N382814 (Old Style) - 37 oz.
N438689-003 (New Style) - 18 oz.

Mounting Base Dimensions: Height: 7-15/16" (20.16 cm)
Width: 4-15/16" (12.54 cm)
Depth (Old Style Base): 2-7/16" (6.19 cm)
Depth (New Style Base): 1-25/32" (4.5 cm)

2. INSTALLATION

2.1. General

Relays plug directly into a mounting base which is secured to a rack. The only installation instructions required are for the mounting base.

2.2. Mounting Base

Secure the mounting base directly to the rack using the hardware furnished. All wiring terminates at the rear of the mounting base to solderless terminals (receptacle contact springs).

Mounting base details of the old style base and new style base are shown in Section 5.

2.3. RELAY INDELING

Relays are factory equipped with indexing pins to prevent insertion of an incorrect relay into a mounting base. Each relay is accompanied by an indexing plate which is applied to the mounting base at the time of initial installation. A typical plug-in relay with indexing pins and base with corresponding indexing plate is shown in Figure 2-1.

The following data defines the indexing that has been 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 on the mounting base.

b. The index code for each relay can be determined from the relay part number and its suffix which is marked on the name plate attached to the front of the relay. The first two digits of the index code are the last two digits of the part number, and the second two digits of the index code are the last two digits of the suffix. 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 a damaged indexing plate or for application to a new mounting base.

WARNING

Never drill new holes in a base indexing plate which will permit application of relays with different part numbers or change indexing pins on the back of a relay unless it is being converted to a new part number. Otherwise, a hazard will be created which may compromise safety circuit functions.

2.4. RECEPTACLE CONTACT SPRINGS

2.4.1. Old Style Base Only

The N382814 mounting base will normally be equipped with the required quantity of J680165 solderless receptacle contact springs, and will accommodate one or two #14 or #16 wires. It can, however, be equipped with receptacle contact springs for one or two #10 or #12 wires (J680181), or for one or two #18 or #20 wires (J680179). Make certain which type of solderless receptacle contact springs accompany the mounting base before proceeding with their installation.

2.4.2. Improved One Piece Base Only

The new one piece mounting base with hardware includes a full complement of receptacle contact springs (J680195-0001) to accommodate one or two #14 - #16 wires, mounting fasteners, and tags. It can, however, be equipped with receptacle contact springs for one or two #10 - #12 wires (J680195-0002), or for one or two #18 - #20 (J680195). Make certain which type of solderless receptacle contact springs accompany the mounting base before proceeding with their installation.

Each solderless receptacle contact spring should be inspected for physical damage before proceeding with installation.

The following is recommended when installing solderless receptacle contact springs:

a. Receptacle contact springs must be inserted into the base with the lock side down or lanced tab up (Refer to Figure 2-2).

b. Make certain that the lanced tab is slightly compressed as the receptacle contact spring is inserted along the top of the cavity. The lanced tab could have been bent during handling, and therefore would not provide the required contact pressure after the relay is inserted. If the lanced tab does not touch, pull it up slightly using 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.

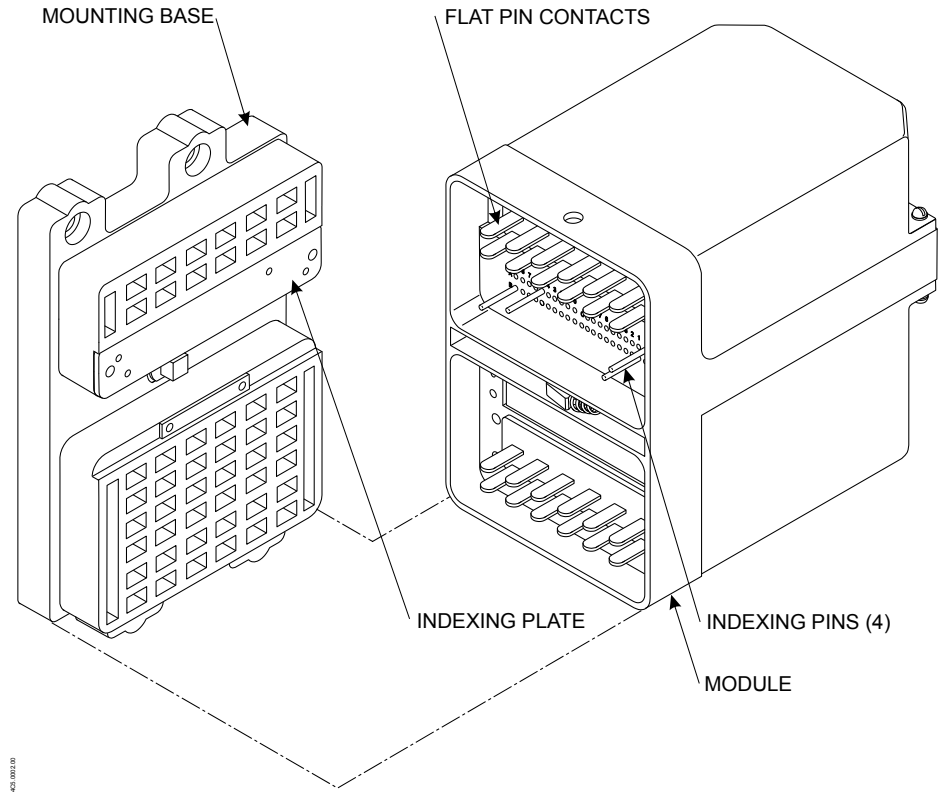


Figure 2-1. Typical Plug-In relay and Mounting Base

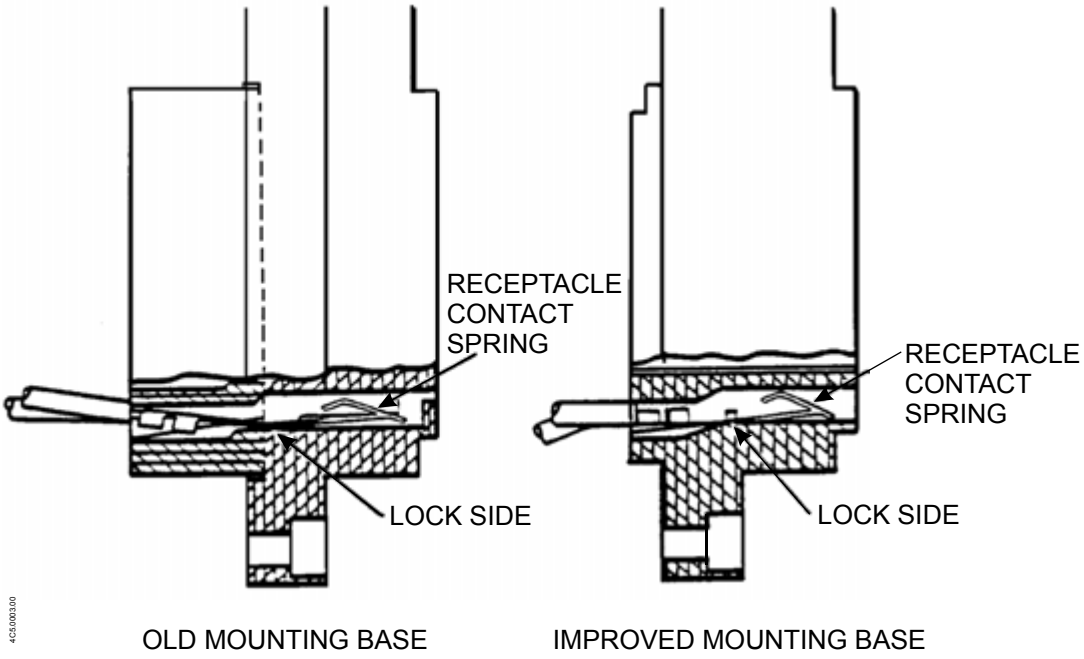


Figure 2-2. Receptacle Contact Spring Installed

2.4.3. 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. The following table identifies the correct crimping tool to be used when installing wires in receptacle contact springs.

Crimping Tool	Wire Size	Old Style Receptacle Contact Spring	Improved Base Receptacle Contact Spring
J397138	#10/#12 AWG	J680181	M451142-2703
J397139	#14/#16 AWG	J680165 (Standard)	M451142-2702
J397188	#18/#20 AWG	J680179	M451142-2701

a. Strip 3/16 in. (0.187 in. or 0.47 cm.) of insulation from the end of the wire.

b. Place the receptacle contact spring into the jaws of the proper crimping tool. When using only one terminal, of any wire size, use the shortest terminal.

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 completed and the jaws release. When using both terminals, it is more convenient to attach the first wire to the longest terminal.

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

2.5. RELAY INSERTION

Orient the relay to the mounting base with the name plate right side up; 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.

3. FILED MAINTENANCE

3.1. Introduction

This section provides the necessary periodic preventive maintenance procedures which must be performed to ensure continuous, proper, and efficient operation of the PC-250B style 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 or common laundry detergent may be used for removal of accumulated dirt, grease, etc.

3.2.2. Service Requirements

3.2.2.1. General

All vital code relays must be inspected and tested at least once every two years. The tests and inspections are to include: pick-up current, drop-away current and proper code following operation; and 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.

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 ASTS USA specifications.

3.2.2.2. In-Service Test

It is recommended that line relays in service be removed from service for shop repairs when the calibration values are not within the Field Limits given in Table 4-1, or the On-Time values are not as specified.

CAUTION

Calibration of these relays must be made either in a test stand or on a non-ferrous surface. When field testing with covers on, do not set the relays on steel tables or house floors. Relays must be supported on a non-magnetic surface.

3.2.2.3. Test Procedures

Test the operating characteristics of the PC-250B style relays as described in Section 4.6 in this manual.

4. SHOP MAINTENANCE

4.1. Introduction

This section provides the information necessary to perform shop level repairs of the PC-250B 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 and or missing contact block terminals and 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, using a lint free cloth and alcohol.

Proceed with relay contact cleaning, using the following recommended cleaning materials:

Recommended Cleaning Materials	Order Reference
Cleaning Tool	N378099
Extra sleeving for recovering three metal strips	J772330
#4/0 Metallographic paper sheet 9" x 14"	J035215
Burnishing tool	J397187
Lead pencil, soft (non-oil content)	--
Distilled Water	--

4.2.1. Cleaning Relay Contacts

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

After contacts have been dressed and/or after adjustments have been made to meet calibration requirements, the contacts should be cleaned in accordance with the procedure given in Section 4.2.1.1 and 4.2.1.2. Due to the possible unavailability of the sleeving (J772330) for the cleaning tool (N378099), an alternate contact cleaning procedure is presented in Section 4.2.2.

CAUTION

If it is desired to use an aerosol spray for cleaning relay contacts, only virgin Freon TF (available from Miller Stephenson Chemical Co. As MS-180 or MS-230 Contact Re-Nu Freon TF) is approved by ASTS USA.

4.2.1.1. General

a. Preliminary information

The cleaning tool should be used to clean no more than 12 front and 12 back contacts, after which they should be washed before re-use. The cleaning tool should be cleaned using a mild soap or detergent and water, rinsing thoroughly and allowing to dry.

b. New Sleeving

To apply new sleeving to the cleaning tool, heat seal one end by placing in a flame and pinching quickly with pliers. Stretch the sleeving over the cleaning tool and cut off excess material 1/8" beyond the end of the tool. Keeping the material stretched, heat seal the second end. Wash the tool before using if it does not appear to be perfectly clean.

4.2.1.2. Contact Cleaning Procedure

a. Apply distilled water (dispensed from a clean closed container) to a clean cleaning tool, and wash the silver/platinum (green) contact tip members while applying pressure by holding the contact mounting block. Wipe the contacts with at least six short strokes of the tool.

b. Immediately after the washing, the contacts should be wiped dry using a second clean, lint-free cleaning tool. This "dry wipe" removes or loosens any residue, such as dust, which was left from step "a". Wipe the contacts with at least six short strokes of the tool.

c. Apply more distilled water to the same tool and wipe the tungsten (red) contacts. Immediately wipe these contacts dry with the same dry cleaning tool as was previously used.

d. Immediately blow the contacts with filtered compressed air to remove any loose dust.

e. The washing and drying tools should then be washed before re-use.

f. If the contact resistance is still too high, burnish the contacts with metallographic paper cut in strips 1/2 inch wide and repeat steps "a" to "d" to remove the dust formed.

g. If the contacts are burned or pitted and the operation per step "f" does not successfully reduce the contact resistance, burnish the contacts in the direction of slide with burnishing tool J397187. Follow with metallographic paper and repeat steps "a" to "d to remove the dust formed.

4.2.2. Cleaning Relay Contacts (Alternate)

Recommended Cleaning materials

A relay contact cleaning kit, part number x451646-0901, is available that consists of the following three items, or which may be ordered individually:

Burnishing Tool, P.R. Neuses Co. No. 3-316: J397187 (pkg. of 5)

Burnishing Tool, P.K. Neuses Co. No. N313 (Heavy Duty): J397137-001 (pkg. of 5)

Paper Strip, strips cut from 67 pound white Springhill Vellum Bristol Paper J793094 (pkg. of 50)

Also recommended (commercially available)

Emery Paper, Wet or Dry, 600 Grit, cut in strips

Freon TF, Miller Stephenson MS180

NOTE

When using the paper strip, clean the silver/platinum contacts first, and then the tungsten contacts last. Discard the paper strips when dirty.

4.2.2.1. 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 the Freon TF spray, give the contacts a degreasing/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.

4.2.2.2. Contacts with Heavy Tarnish, Slightly Rough or Pitted

Perform the procedure in Section 4.2.2.1, Steps "b" to "g".

4.2.2.3. Contacts with Surface Film or Oxidation (Not Pitted)

a. Perform the procedure in Section 4.2.2.1, Steps "f" and "g"

4.3. CHECK-OUT PROCEDURE (Performance Test)

Perform calibration, on time and dynamic test in accordance with Section 4.6.

4.4. REPAIRS AND REPLACEMENT

Since the contacts are the major wearing parts in this relay, in most cases the relay can be restored to proper operation by dressing and readjusting them.

4.4.1. Recommended Tools and Test Equipment

Magnet Tester: N245416

Magnet Charger: N249003

Gram Scale: 0-30 grams

Gap Gauge: 0.001-0.055 in.

Spacer: 0.124 in.

4.4.2. Disassembly

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

1. Remove relay cover seal.
2. Carefully remove plastic cover.
3. Remove the operating unit as required.
4. Remove contact assembly as required.
5. Remove contacts/contact springs as required.
6. Disassemble the operating unit as required.

4.4.3. Reassembly

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

4.4.3.1. Contact Spring Support

If the contact spring support has been removed, it should be checked with a straight edge that the forward and rear hinge springs are accurately in line with each other as mounted on the contact block. With the spring support reassembled, each contact spring should have an initial pressure of 13 to 15 grams against its stop, as measured at the center of the contact tip. The armature in this relay has a slight bend, and should be mounted so that the bottom of the armature is off-set toward the front contact side of the assembly.

With the permanent magnet removed, and with all front and back contact posts clear of the spring tips, the left side of the armature should stand 3/64-inch from the side of the hole at the bottom of the coil spool. The lower left-hand pole piece should be adjusted to just touch against the armature stop pin. The lower right-hand pole piece should be adjusted to just make against a 0.124 inch spacer at the right-hand armature stop pin. Securely tighten both lower pole pieces. The upper left and right pole pieces can be set to be about 3/16-inch clear of the contact spring support and armature respectively. This is a preliminary adjustment of upper pole pieces which will be established in calibrating the relay.

4.4.3.2. Permanent Magnet

The permanent magnet must be applied with its side marked "N" at the left side of the relay, otherwise the relay will not pick up when the indicated polarity is applied to its coil. If the magnet is handled carefully it should not be necessary to change its strength.

a. Permanent Magnet Strength Test

   Measure the strength of the relay permanent magnet using Magnet Tester, Part Number N245416, as follows. The required magnet strength is given in Table 4-1 of this manual under "Magnet Grams."

1. The relay permanent magnet should be applied at the front of the testing device, across the two vertical members or "backstraps" of the magnetic structure, and resting also against the small stop member near the bottom of each backstrap. The north pole of the magnet should be at the left side of the testing device. The north pole is marked "N" in red ink, and is that pole of the magnet which attracts the south seeking pole of a magnetic compass.
2. Starting with the spring at zero on the dial and the armature resting against the left-hand pole piece, the dial should be moved gradually to the right. The spring will be at the correct "grams" on the dial at the instant when the armature breaks free from the pole piece.

b. Permanent Magnet Charging

The strength of the relay magnet can be changed by using Magnet Charger, Part Number N249003. If the relay permanent magnet does not meet specification, the magnet should be replaced.

1. Connect the magnet charger as shown in Figure 4-1. Place a stop on the adjustable resistor to make sure the resistance will not be changed accidentally. (The stop will ensure that current through the meter will be limited to a safe value.) To charge the relay permanent magnet, proceed with the following steps.

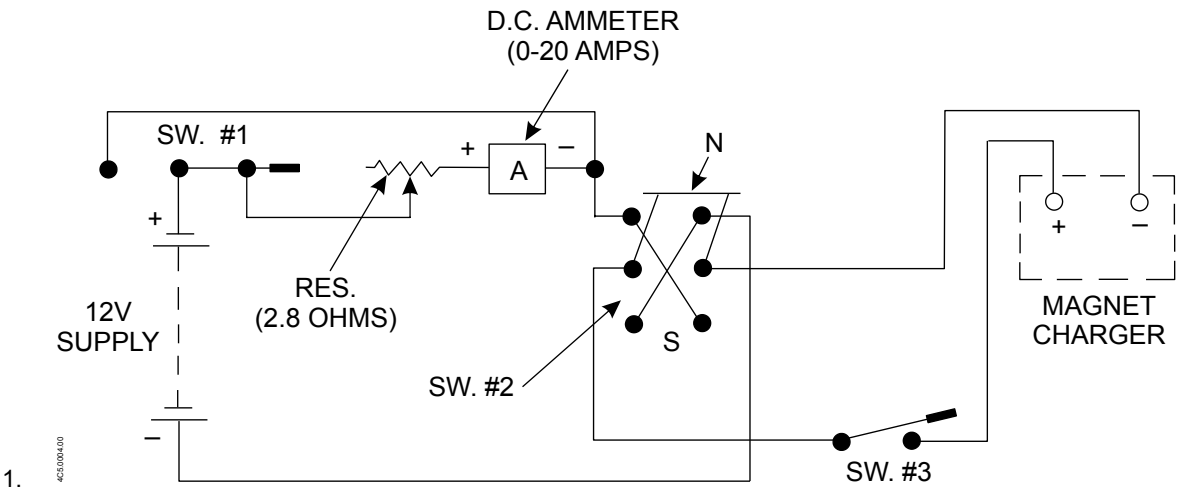


Figure 4-1. Circuit for Charging and Aging Permanent Magnets

2. Place the permanent magnet on the pole pieces so that the desired polarity of the magnet agrees with the marking on the magnet charger. Switch #2 should be in the N position and Switch #1 should be closed to the position to by-pass the meter.

3. To charge the magnet to full strength, Switch #3 should be closed for one second, and then opened for one second, and this procedure repeated until three closures of the switch have been made, always ending with the switch #3 in the open position. This procedure is called "charging the magnet to full strength".

c. Magnet Aging and Calibration

1. To "age" or calibrate the magnet to some lower value, first make sure that Switch #3 is open, then with R set at maximum resistance value, close Switch #1 to the position to include the meter. Next close Switch #2 to the S position. Now close Switch #3 only long enough to read the D.C. ammeter. This procedure is called "aging the magnet" and the ammeter reading should be used as a reference for the amount of aging.

2. The strength of the permanent magnet should now be measured by the method described in paragraph "a". If the strength is too great, the magnet should be aged at a greater value of D.C. amperes (obtained by reducing Resistor R). If strength is too low, then the magnet should again be charged to full strength and again aged at a lower value of D.C. current.

4.5. Adjustments

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

4.5.1 Contact Adjustment

With the permanent magnet in place, energize the relay to adjust the front contacts. Proceed as follows:

a. Adjust the front contact posts so that light is just visible between the contact tips with a 0.053 inch gauge at the right-hand armature stop pin. With a 0.051 inch gauge, the contacts should be closed.

b. Deenergize the relay.

c. Adjust the back contact posts using the same gauges at the left-hand armature stop pin. (With the permanent magnet removed, contacts can be adjusted by moving the bottom of the armature by hand, but in this case the gauges used should be 0.050 inch and 0.048 inch.)

4.6. Calibration

CAUTION

Calibration of these relays must be made either in a test stand or on a non-metallic surface. When field testing with covers on, do not set the relays on steel tables or house floors. Relays must be supported on a non-magnetic surface.

4.6.1. Recommended Test Equipment

NOMENCLATURE	PART/MODEL/TYPE NO.
Power Supply 0-40 VDC	HP6205 or equivalent
Digital Multimeter (Two required)	HP3435A or equivalent
DPDT Switch	--
On-Time Meter	Simpson TS-111 (ASTS USA PD-30 Code Meter)
Code Transmitter	PC-250TR (180 Code)

4.6.2. Procedure

This procedure checks Pick-Up, Minimum Drop-Away and On-Time performance of the biased code following relay.

a. Pick-Up and Drop-Away Checks.
Connect the biased relay test circuit as shown in the in Figure 4-2, and proceed as follows:

1. Set M1 (Current Monitor) to appropriate current range.
2. Set M2 (Voltage Monitor) to appropriate voltage range.
3. Set switch S1 to Normal.
4. Energize power supply, and set to appropriate output range.
5. Observe M1 and adjust DC power supply output control to obtain the charge current reading indicated in the charge column in Table 4-1. Note that relay energizes and remains energized as voltage is increased.

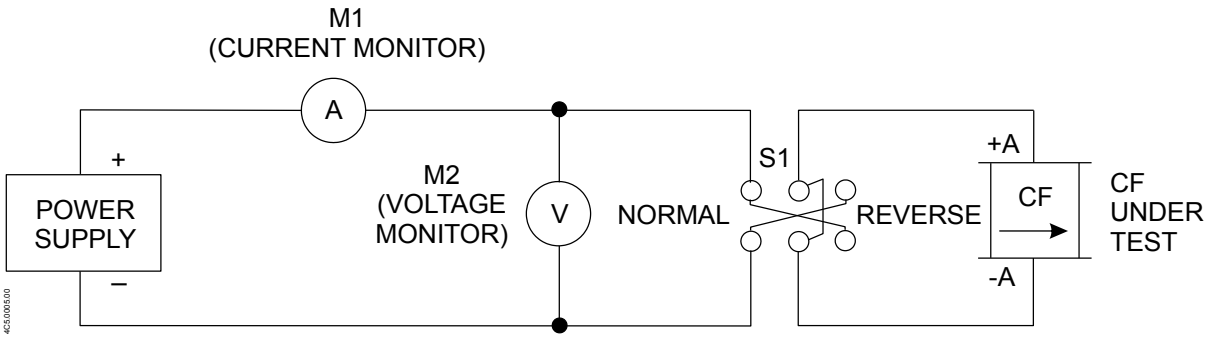


Figure 4-2. Biased Code Following Relay Test Circuit

6. Set switch S1 to Reverse. Relay should deenergize.
7. Set switch S1 to Normal. Relay should again energize.
8. Gradually adjust dc power supply output control to decrease current, and obtain the Drop-Away. This is the point at which the front contacts open and should not be less than the value specified in Table 4-1.

9. Further gradually reduce the current to obtain Full Drop-Away. This is the point at which the left-hand armature stop pin touches the pole piece and should not be less than the minimum value specified in Table 4-1.
10. Reduce the current to zero and open the coil circuit for one second.
11. Gradually adjust dc power supply output control to increase current, and obtain Pick-Up. This is the point at which the front contacts close and should not be less than value in in Table 4-1.
12. Further gradually increase the current to obtain Full Stroke. This the point at which the right-hand armature stop pin touches the pole piece and should not be less than the value in Table 4-1.

b. On-Time Test.
Connect test circuit as shown in Figure 4-3, and proceed as follows.

1. With the PD-30 connected as shown in Figure 4-3 (between the heel and front contacts of a given contact set) set the PD-30 function switch to SET 100 and adjust the ADJ% control for an indication of 100% on the meter.
2. Set the PD-30 Function switch to Slow, and observe the movement of the meter pointer. Take the reading after the pointer settles to a somewhat steady indication. The meter indication should be between 30 and 70%.
3. To check the on-time period of the back contact, repeat steps 1 and 2 with the PD-30 connected between the heel and back contacts.
4. Repeat steps 1 through 3 for all sets of contacts.

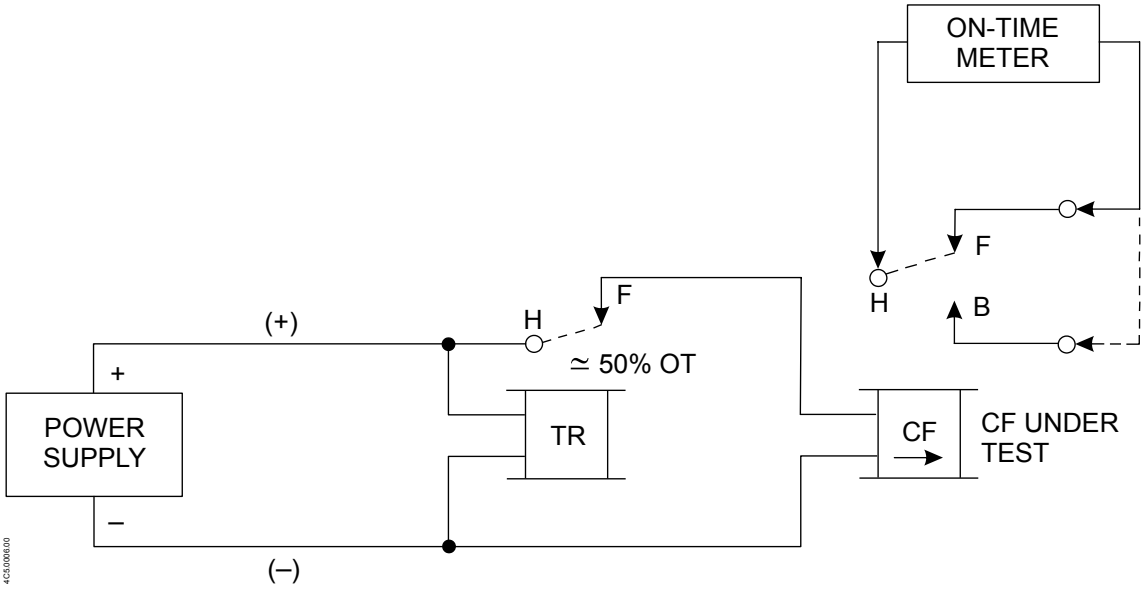


Figure 4-3. Biased Code Following Relay On-Time Test Circuit

Adjustment to meet calibration is accomplished by adjusting the upper pole pieces. The ends of these pole pieces are slightly off center, and as finally adjusted, each pole piece should be turned down just tightly enough so that there can be no vertical play of the coil in the relay. Proceed as follows:

a. Loosen pole pieces.

b. Move upper pole pieces to the left to increase calibration values or move to the right to decrease calibration values.

c. Move the upper pole piece together or apart to change the spread between Pick-Up and Drop-Away, and between Full Stroke and Full Drop-Away.

NOTE

It is generally best to move only one pole piece at a time, noting the effect on all calibration values. The lower pole pieces must not be changed from their original setting. If proper calibration cannot be obtained it might become necessary to remove the permanent magnet and change its strength.

If the relay has a double-wound coil, a check should be made that it will pick-up when energy is applied to terminals "+B", and "-B" of Figure 4-4, observing the polarity shown. For a 400 ohm second winding it will be satisfactory to apply about 10 volts.

4.6.3. Operational Test

After calibration, the relay should be tested for on-time gain or loss, to meet the values given in Table 4-1. The circuit used will be Figure 4-5, Figure 4-6, or Figure 4-7, depending upon the relay resistance. On-time gain (or loss) is the difference between the percent on-time of the code transmitter contact, and that of a front contact of the relay under test. It is permissible to readjust the upper pole pieces to obtain correct dynamic operation, but in this case the relay calibration must be rechecked to agree with the values given in Table 4-1. When the relay has tungsten contacts, it may be found necessary to clean very carefully the contact at which on-time is being measured. The method for measuring on-time is described in Section 4.6.2b of this manual.

If the resistance of the relay is below 2 ohms, it should be tested in the circuit of Figure 4-5. With steady energy applied and switch #1 closed left, adjust resistor R1 to obtain the relay current given in Table 4-1 under "Max. Loss". On 180 code, the on-time loss should not exceed the value given. With steady energy applied and switch #1 closed right, adjust R1 to the relay current given under "Max. Gain". On 180 code, the on-time gain should not exceed the value given.

If the resistance of the relay is above 2 ohms (except 18.5 ohm relays), it should be tested in the circuit of Figure 4-6. Using the value of snub resistor given in Table 4-1, it should be checked that the on-time gain and loss are within the limits given, at the test voltages specified. For this circuit it is important that there be little or no resistance in series with the battery. Voltage should be adjusted by means of a loading-down rheostat or low resistance potentiometer across the battery using only as many battery cells as required. 18.5 ohm relays should be tested in the circuit of Figure 4-7, obtaining both currents by adjustment of rheostat R2.

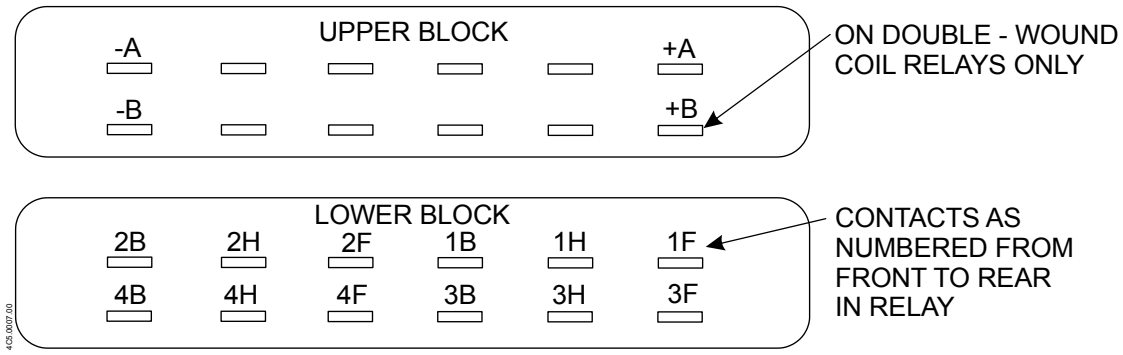


Figure 4-4. Terminal Blocks, Viewed form Rear of Relay

4.7. Calibration Requirements

4.7.1. In-Service Test

Calibration requirements will be met when the relay adjustment values are the same as those given in Table 4-1 of this manual.

After any shop adjustments are made, check the calibration values (Section 4.6) and if they are not within the values given in Table 4-1 of this manual, the relay should not be placed in service.

4.7.2. Contact Resistance

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

Type of Contacts	Ohms
Silver/Platinum	0.05 (Max.)
Tungsten	0.5 (Max.)

Contact surfaces should not be disturbed unless there is evidence of severe pitting from excessive loading or an accidental short through the contacts. When contacts must be dressed, 600 grit emery paper should be used and this should be followed by the use of the burnishing tool and paper strip.

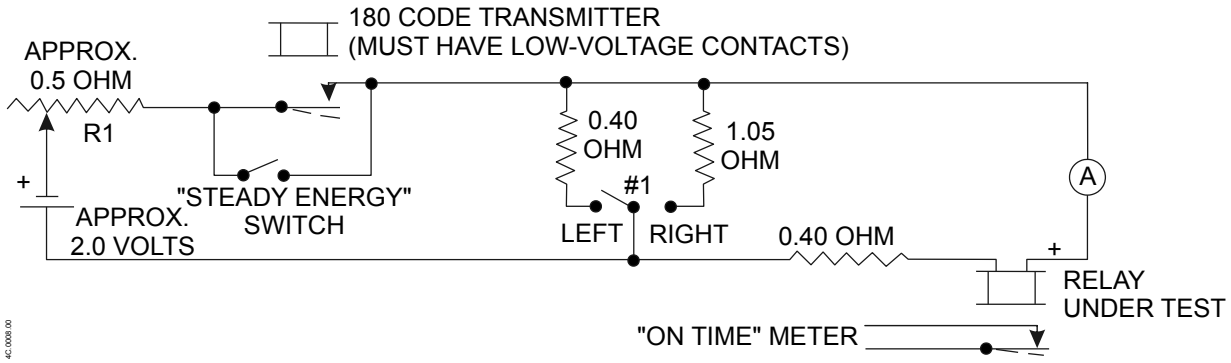


Figure 4-5. Test Circuit for Relay with Less Than 2 Ohms

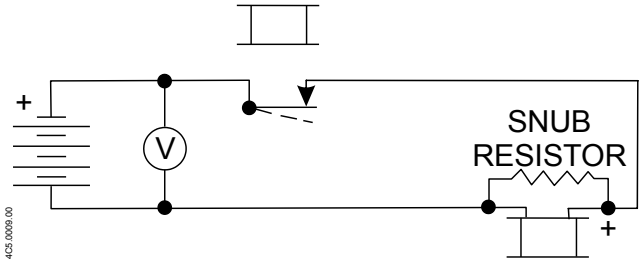


Figure 4-6. Test Circuit for Relay with Resistance Above 2 Ohms

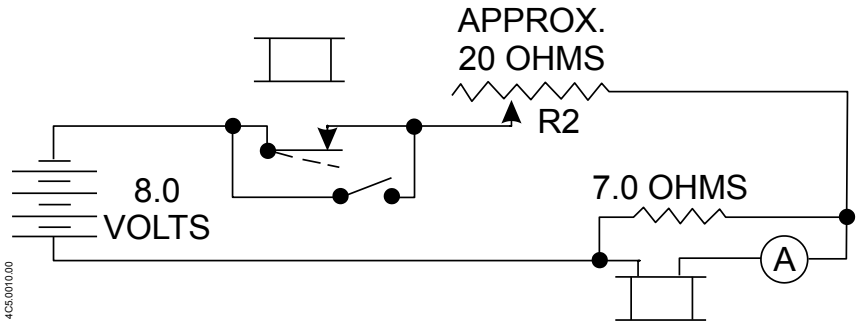


Figure 4-7. Test Circuit for 18.5 Ohm Relay Resistance

Table 4-1. Electrical Adjustments and Calibration

Relay Ohms	Recommended Working	Magnet Grams +/- 10	Shop Adjustment Limits - Amps					On-Time Gain or Loss					Filed limits - Amps		
			Charge	Minimum Pick Up	Maximum Full Stroke	Minimum Drop Away	Minimum Full Drop Away	Snub Ohms	Maximum Loss		Maximum Gain		Pick Up		Minimum Drop Away
									At	%	At	%	Minimum	Maximum	
*0.15/400	1.13. Amps	90	3.44	0.825	1.07	0.565	0.40	None	1.13 Amps	6	1.70 Amps	2	0.750	1.07	0.395
*0.30/400	0.82 Amps	75	2.50	0.60	0.78	0.410	0.29	None	0.82 Amps	6	1.24 Amps	2	0.550	0.78	0.285
18.5	0.09 Amps	65	0.25	0.060	0.085	0.030	0.020	None	0.092 Amps	6	0.016 Amps	8	0.054	0.085	0.021
135	8/12 Volts	85	0.060	0.015	0.025	0.008	0.006	510	8.0 Volts	1	13.0 Volts	3	0.012	0.030	0.005
360	14/16 Volts	75	0.045	0.010	0.017	0.005	0.004	1200	13.0 Volts	1	21.0 Volts	2	0.008	0.021	0.003
225	8/12 Volts	85	0.060	0.013	0.022	0.006	0.005	750	10.0 Volts	1	16.0 Volts	2	0.010	0.026	0.0036
823	24/32 Volts	90	0.048	0.007	0.015	0.003	0.0025	3000	24.0 Volts	4	38.0 Volts	2	0.007	0.015	0.003

* Double-Wound Coil

5. PARTS LIST

The Reference column letters in Table 5-1 are keyed to the main assembly parts list given in Table 5-2

Table 5-1. Parts List References for PC-250B Code Following Vital Relay

Reference	Relay Part Number	Number of Contacts	Coil - Ohms
A	N322559-001	2F & 2B H. V. #1 & #2 2F & 2B L. V. #3 & #4	360
B	N322559-002	4F & 4B L. V.	360
C	N322559-003	4F & 4B L. V.	135
D	N322559-004	4F & 4B H. V.	135
E	N322559-005	2F & 2B H. V. #1 & #2 2F & 2B L. V. #3 & #4	135
F	N322559-006	1F & 1B H. V. #1 3F & 3B L. V. #2, #3 & #4	18.5
G	N322559-007	2F & 2B H. V. #1 & #2 2F & 2B L. V. #3 & #4	18.5
H	N322559-008	4F & 4B L. V.	0.3/400
J	N322559-009	1F & 1B H. V. #1 3F & 3B L. V. #2, #3 & #4	0.3/400
K	N322559-010	4F & 4B L. V.	0.15/400
L	N322559-011	1F & 1B H. V. #1 3F & 3B L. V. #2, #3 & #4	0.15/400
M	N322559-015	4F & 4B L. V.	225
N	N322559-017	1F & 1B H. V. #1 3F & 3B L. V. #2, #3 & #4	135
P	N322559-802	4F & 4B L. V.	360
Q	N322559-020	4F & 4B H. V.	823

Table 5-2. PC-250B Code Following Vital Relay Main Assembly Parts List (see Figure 5-1)

Item No.	Part Number	Description	Used on Relay Reference
1	M382791	Frame	All
2	J487090	Pin, Roll, 3/32 Diameter x 1-1/8” Long	All
3	M349392	Rod, Latch, 1/8 Stainless Steel	All
4	M395496	Nut, 1/8, Heavy	All
5	J770536	Knob, Round, Knurled, 6-32, 5/8" Diameter	All
6	M321728	Latch, Machined	All
7	J048716	Pin, Roll, Stainless Steel	All
8	M321861	Spring, Plated	All
9	PM382797	Contact Block	A, B, C, D, E, F, G, M, N, P, Q
	PM385148	Contact Block	H, J, K, L
10	J5001320108	Screw, Stainless Steel, 8-32 x 1/2, Round Head	All
11	N382792	Operating Unit, 360 Ohms	A
	N382793	Operating Unit, 360 Ohms	B
	N384854	Operating Unit, 135 Ohms	C
	N384855	Operating Unit, 135 Ohms	D
	N384856	Operating Unit, 135 Ohms	E
	N384857	Operating Unit, 18.5 Ohms	F
	N384858	Operating Unit, 18.5 Ohms	G
	N384859	Operating Unit, 0.3/400 Ohms	H
	N384860	Operating Unit, 0.3/400 Ohms	J
	N384861	Operating Unit, 0.15/400 Ohms	K
	N384862	Operating Unit, 0.15/400 Ohms	L
	N433303	Operating Unit, 225 Ohms	M
	N37019	Operating Unit, 135 Ohms	N
	PN382793	Operating Unit, 360 Ohms	P
	N384855001	Operating Unit, 823 Ohms	Q
	Operating Unit Sub Assembly (Item No. 12) Detailed On Figure 5-2 Itemized On Separate Parts Listing		
12	J522153	Screw, 10-32 x 3/4, Fillister Head, Nylok (for reference only)	All
13	J047081	Gasket, Rubber	All
14	M436923	Cover	A, B, F, G, J, K, L, M
	J776598	Cover, Molded Relay	C, D, E, H, N, P, Q
15	J5072950119	Screw, 8-32 x 7/16 " Long, Fillister Head	All
16	A043013	Wire Seal, #22 AWG, 2 Ply	All
17	J079351	Security Seal, Gray	All
18	S003665	Tag	All

Item No.	Part Number	Description	Used on Relay Reference
19	N438370	Cover	A, B, F, G, J, K, L, M
	J7763040001	Cover, Molded Relay	C, D, E, H, N, P, Q
20	J790257	Seal, Adhesive Vent	A through N, Q
21	J776402	Block, Molded Component	Al
22	J631083	Name Plate, Aluminum	All
23	J525024	Screw, 4-40 x 3/16, Pan Head, Stainless Steel	All
24	J561111	Handle, Pull, Aluminum	All
25	J4751210125	Washer, #10, Stainless Steel, Shakeproof	All
26	J5072960129	Screw, 10-32 x 3/8, Phillips Head	All
27	N3497115901	Parts Bag with Indexing Plate	A
	N3497115902	Parts Bag with Indexing Plate	B, P
	N3497115903	Parts Bag with Indexing Plate	C
	N3497115904	Parts Bag with Indexing Plate	D
	N3497115905	Parts Bag with Indexing Plate	E
	N3497115906	Parts Bag with Indexing Plate	F
	N3497115907	Parts Bag with Indexing Plate	G
	N3497115908	Parts Bag with Indexing Plate	H
	N3497115909	Parts Bag with Indexing Plate	J
	N3497115910	Parts Bag with Indexing Plate	K
	N3497115911	Parts Bag with Indexing Plate	L
	N3497115915	Parts Bag with Indexing Plate	M
	N3497115917	Parts Bag with Indexing Plate	N
	N3497115920	Parts Bag with Indexing Plate	Q
	NOTE: Item 31 consists of the following: (2) Machine Screw, 6-32 x 1-1/4" Round Head. J525099 (1) Nomenclature Tag J075828 (2) Type "F" Self -Tapping Screw, 4-40 x 3/16" Round. Head. J525024 (1) Inst. Tag S003863		
28	J522149	Screw, 18-32 x 1/2, Fillister Head, Nylok (for reference only)	All
29	J522042	Screw, 8-32 x 7/16, Fillister Head, Stainless Steel	All
30	J047714	Washer, #8, Shakeproof, Lock, Stainless Steel	All

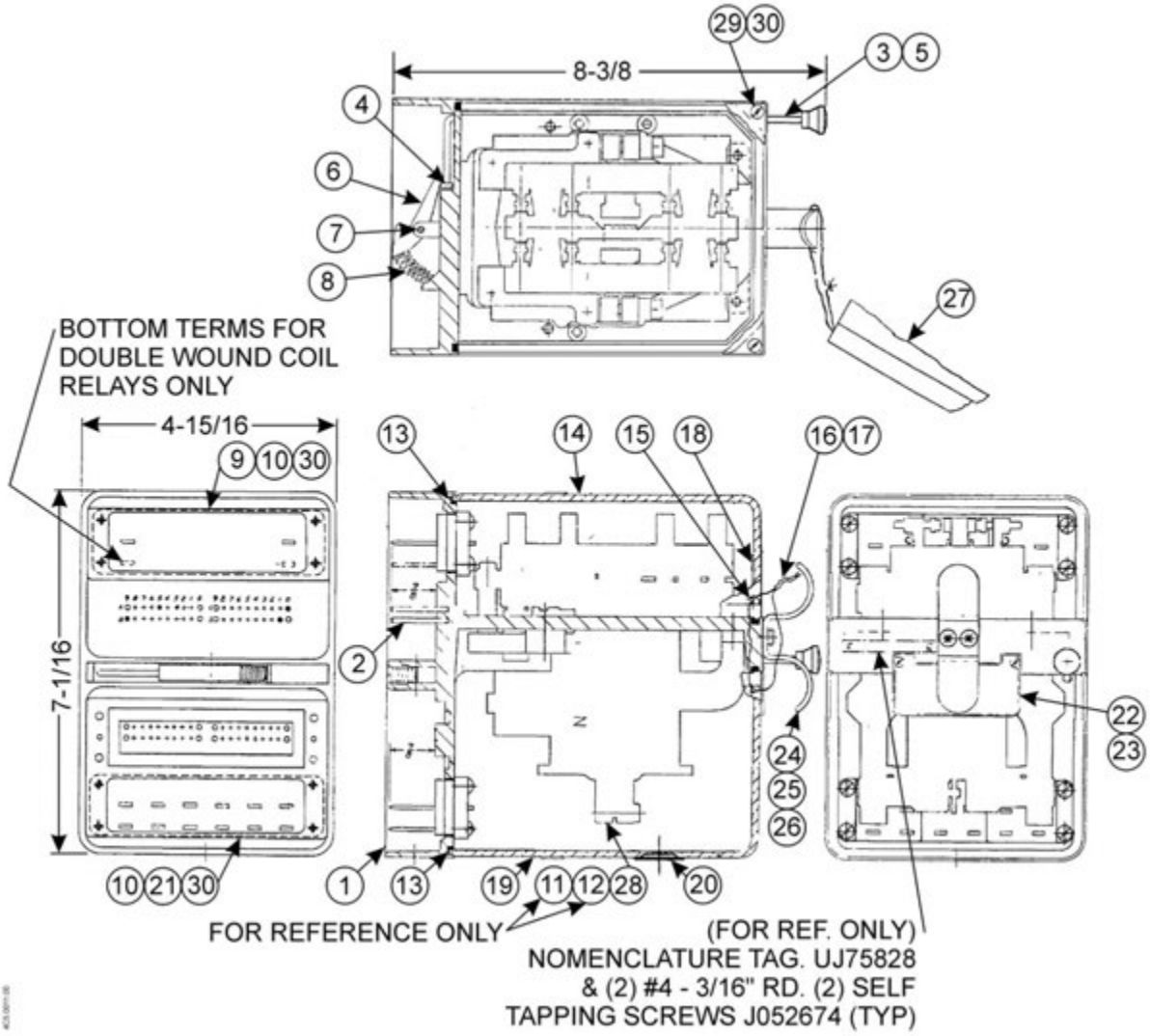


Figure 5-1. PC-250B Relay Main Assembly Parts Location

Table 5-3. Parts List for Operating Unit (Item 11) Used on PC-250B Code Following Vital Relay (see Figure 5-2)

Reference	Operating Unit Part Number	Reference	Operating Unit Part Number
A	N382792	J	N384860
B	N382793	K	N384861
C	N384854	L	N384862
D	N384855	M	N433303
E	N384856	N	N437019
F	N384857	P	PN382793
G	N384858	Q	N384855001
H	N384859		

Item No.	Part Number	Description	Used on Operating Unit Reference
1	M288999	Strap, Back	All
2	M382789	Rear Mounting Bracket	All
3	M382790	Front Mounting Bracket	All
4	J463088	Bolt,10-32x1-1/4-Hex-Hd	All
5	J4751210125	Washer, Stainless Steel, #10 Shakeproof	All
6	J048172	Nut,10-32 Hex Steel	All
7	M288990	Pole Piece	All
8	M289302	Bolt, .312 Brass, Hex Head	All
9	M289005	Pin	All
10	N301579	Coil, Complete	A, B, P
	N291576	Coil, 135 Ohm, Complete	C, D, E, N
	N304655	Coil, Complete	F, G
	N386143	Coil, Complete	H, J
	N386144	Coil, Complete	K, L
	N289053	Coil, Complete	M
	N291576001	Coil, 823 Ohm, Complete	Q
11	M187875	Pole Piece	All
12	PN384785	Contact Assembly	A, E, G
	PN289040	Contact Assembly	B, C, H, K, M, P
	N289042	Contact Assembly	D, Q
	N384786	Contact Assembly	F, J, L, N
	Contact Assembly sub-assembly Item No. 12 detailed on Figure 5-3. Itemized in Table 5-5.		
13	J047708	Washer, #6 Phos. Bronze Shakeproof	All
14	M001505	Nut, .250 Brass Hex	All
15	J047709	Washer, Internal Lock, #8, Phos. Bronze Shakeproof	A, B, F, G, J, K, L, M
16	M197182	Magnet, Permanent	All
17	M288991	Clamp, Magnet	All
18	J051260	Screw, 8-32 x 2-1/2 Fillister Head	All
19	M382791	Relay Frame	All
20	J522153	Screw,10-32 x 3/4 Fillister Head	All
21	J522149	Screw, 8-32 x 1/2 Fillister head., Steel	All

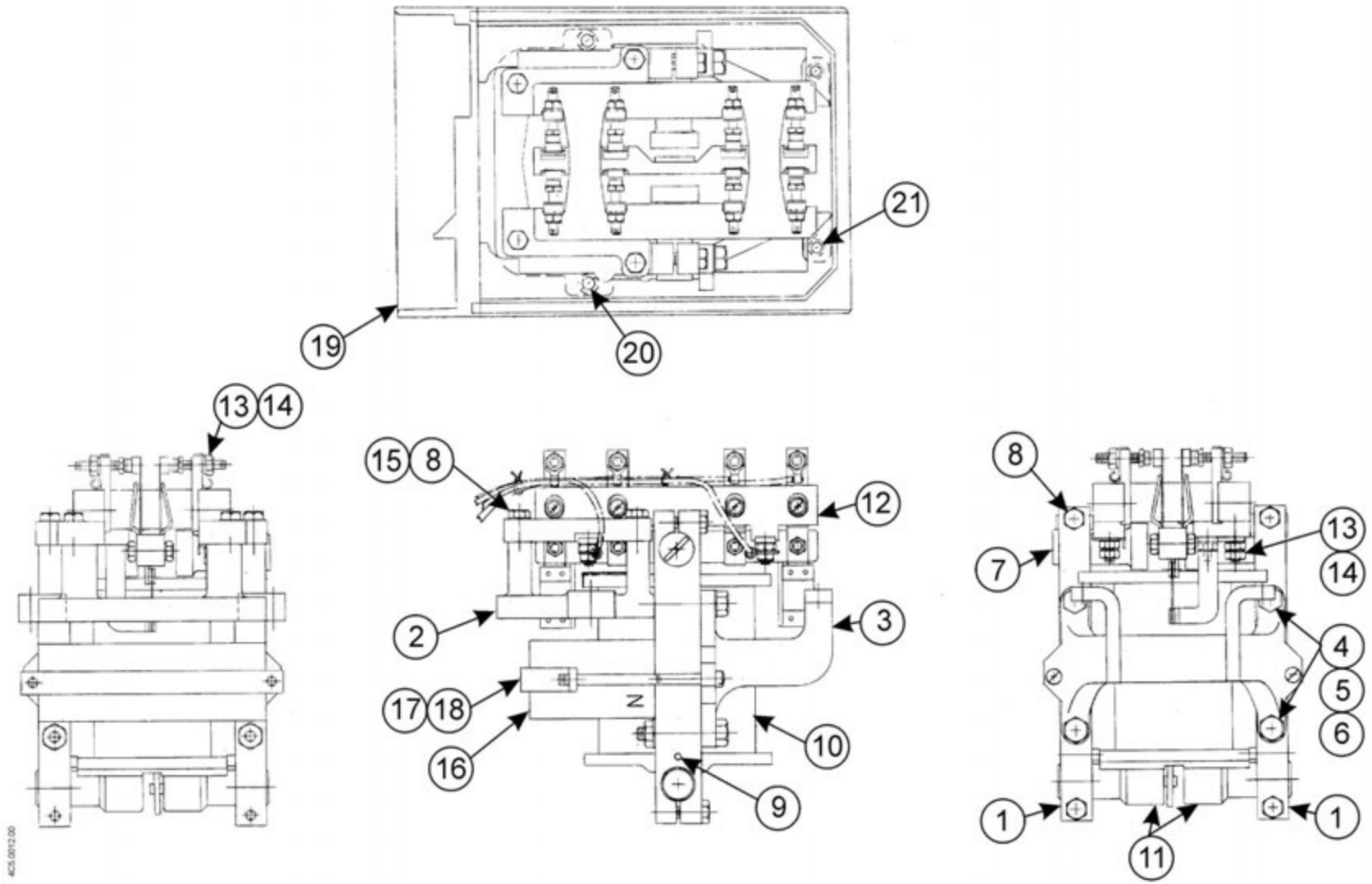


Figure 5-2. Operating Unit Main Assembly (Item 11) Parts Location

Table 5-4. Parts List for Contact Assembly Used on PC-250B Code Following Vital Relay (see Figure 5-1)

Reference	Contact Assembly Part Number	Used on Operating Unit With Reference Letter
W	PN384785	A, E, G
X	PN289040	B, C, H, K, M, P
Y	N289042	D, Q
Z	N384786	F, J, L, N

Item No.	Part Number	Description	Used on Relay Reference
1	M288987	Block, Contact Mounting	All
2	M288983	Support, Contact Spring	All
3	N289010	Hinge, Front	All
4	J051384	Screw, 6-40 x 7/16 Fillister Head	All
5	J047708	Washer, 6 Phos Bronze Shakeproof	All
6	M288994	Screw, 1/4 Bronze, Round	All
7	N288995	Connector, Flexible	All
8	N289011	Hinge, Rear	All
9	M001505	Nut, .250 Brass, Hex	All
10	M107722	Guide, #14 x 3/8 Brass	All
11	M102525	Spring, Stop	All
12	M221049	Guide, 1/8 x 3/8, Brass	All
13	N289003	Armature	All
14	N288998	Front Contact Post, Silver Plated	See Figure 5-3 and Table 5-5.
15	N289038	Front Contact Post, Tungsten	
16	N102515	Front Contact Spring Component, Silver Plated	
17	N102516	Front Contact Spring, Tungsten	
18	N102515	Back Contact Spring Component, Silver Plated	
19	N102516	Back Contact Spring, Tungsten	
20	N288998	Back Contact Post, Silver Plated	
21	N289038	back Contact Post, Tungsten	

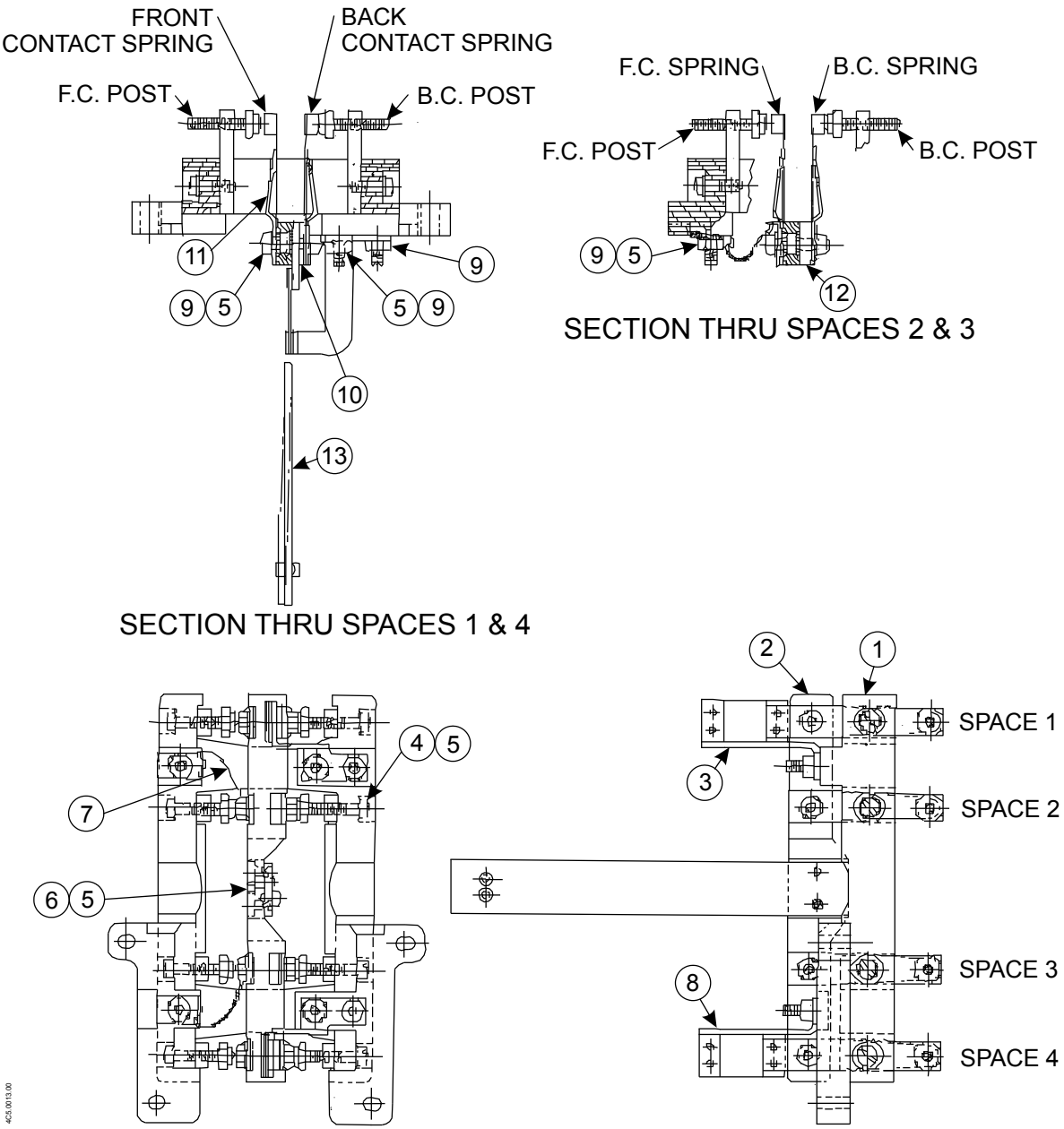


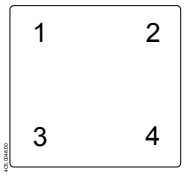
Figure 5-3. Contact Assembly Parts Location

Table 5-5. Contact Assembly Section Parts List

Contact Assembly	Contact Section in Space			
	1*	2*	3*	4*
W	15 17 19 21	15 17 19 21	14 16 18 20	14 16 18 20
X	14 16 18 20	14 16 18 20	14 16 18 20	14 16 18 20
Y	15 17 19 21	15 17 19 21	15 17 19 21	15 17 19 21
Z	15 17 19 21	14 16 18 20	14 16 18 20	14 16 18 20

* Numbers in each square are item unmbers for applicable part numbers shown in Table 5-4.

KEY TO SEQUENCE



Position 1 = Front Contact Post
Position 2 = Front Contact Spring
Position 3 = Back Contact Spring
Position 4 = Back Contact Post

Table 5-6. Old Style Mounting Base for PC-250B Relays Parts List

Item No.	Part Number	Description
1	N382814	Mounting Base Complete (see Note)
2	N382814-099	Mounting Base Only
3	J075828	Tag
4	J680181	Contact Receptacle Solderless #10 to #12 Wire
	J680165	Contact Receptacle Solderless #14 to #16 Wire
	J680179	Contact Receptacle Solderless #18 to #20 Wire
5	M322965	Meter Test Plug
6	J077931	Insulated Test Plug (for opening any coil or contact circuit and for removing receptacle springs)
NOTE	When Mounting Base complete (Item 1) is ordered, a muslin bag of parts 4-1/8" x 5-1/2" is included in the inner carton with the mounting base and instruction prints.	

Bag Contains	(2) Tags
	(4) #4-40 x 3/16" Round Head Screws
	(4) 1/4" Steel Plate Washers
	*(4) 1/4" - 20 x 1-1/4" Round Head Steel Screw
	*(4) Washers
	*(4) 1/4" Steel Lock Washers
	*(4) 1/4" - 20 Steel Hex Nuts
	(Required Quantity) Contact receptacles (solderless) J680165 for #14 to #16 wire. If other wire size is used request the proper part number as shown in Item No. 4 when ordering base complete. (i.e., N382814 except using contact receptacles, solderless J680181)
	Asterisk (*) Items are for attaching the mounting base to the rack.

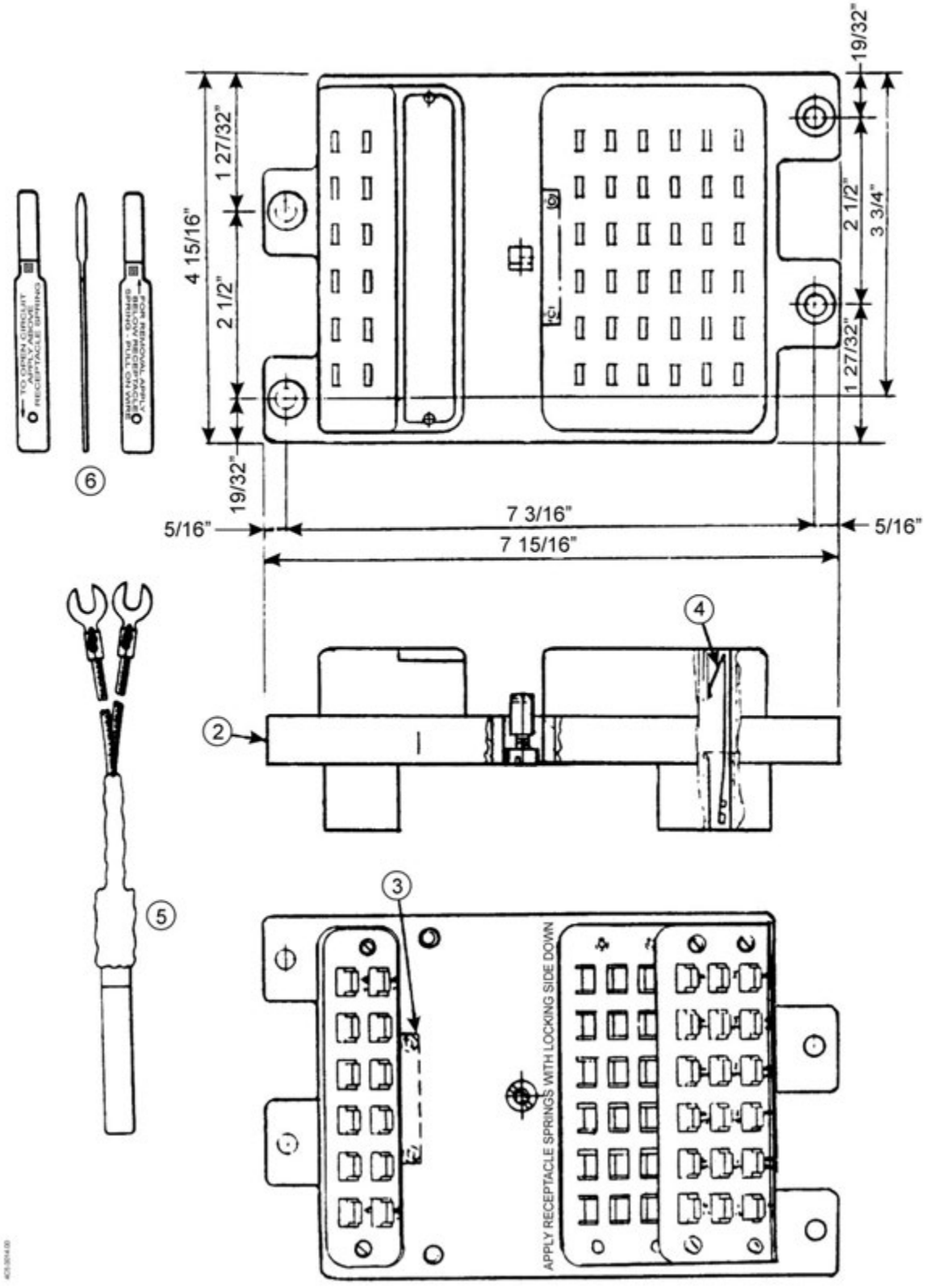


Figure 5-4. Old Style Mounting Base for PC-250B Relay

Table 5-7. Improved Mounting Base (N438689-003) for PC-250B Relays Parts List

Item No.	Part Number	Description
1	J780054	Base Only
2	6792848	Strike
3	J480280	Nut
4	M451142-2702	Receptacle Contact Spring, Solderless for #14 to #16 Wire
	M451142-2701	Receptacle Contact Spring, Solderless for #18 to #20 Wire
	M451142-2703	Receptacle Contact Spring, Solderless for #10 to #12 Wire
5	J075951	Tag
6	J052667	Screw, 1/4-20 x 1-1/4, Round Head
7	J047775	Lock Washer, 1/4 Steel
8	J047501	Plate Washer, 1/4 Steel
9	J048002	Nut, 1/4-20, Hex. Steel
NOTE	When Mounting Base complete is ordered, a bag of parts is included that contains the following:	
	(2) Tags (Item 5)	
	*(4) Screws (Item 6)	
	*(4) Lock Washers (Item 7)	
	*(4) Plate Washers (Item 8)	
	*(4) Nuts (Item 9)	
	(Required quantity) - Receptacle contact springs (M451142-2702) for #14 to #16 wire. If other wire size is needed, request the proper part number as shown in Item 4 when ordering base complete (i.e. N438689-001, except using receptacle contact springs, solderless, M451142-2703)	
	(*) These Items are for attaching the mounting base to the rack.	

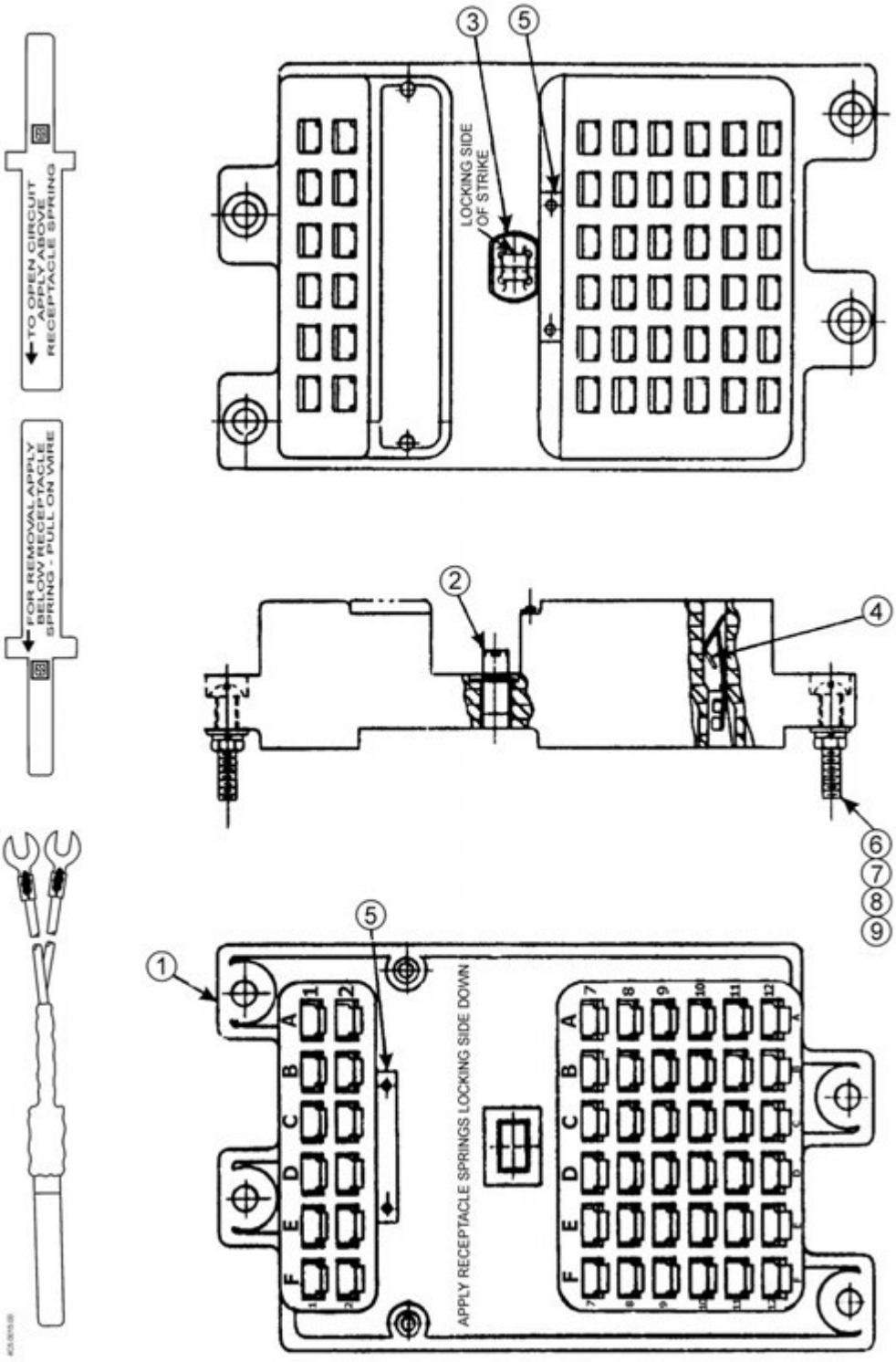


Figure 5-5. Improved Mounting Base for PC-250B Relays

6. RAIL TEAM AND TECHNICAL SUPPORT

The Rapid Action Information Link Team (RAIL Team) is a group of experienced product and application engineers ready to assist you to resolve any technical issues concerning this product. Contact the RAIL Team in the United States at 1-800-652-7276 or by e-mail at railteam@ansaldo-sts.us.

End of Manual