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PC-250TR

Vital Code Generating Relay

US&S Part No.
N322556-001 through -022 and N322556-818

- Installation
- Operation
- Troubleshooting

SM 4569, Rev. 1.0
August 2008

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Revision History

REV.	DATE	NATURE OF REVISION
0	January 1990	Original issue
	January 1994	Reissue to provide new and corrected data.
	October 2000	Reformatted and reissues to provide new and corrected data.
1.0	August 2008	Reformatted into current Service Manual template. Revised to incorporate changes required by ECOs EE-1078 (4/99), EE-1435 (7/01), and EE-1570 (5/02),

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1. GENERAL INFORMATION

1.1. INTRODUCTION

This manual provides service information for the PC-250TR Plug-In Code Transmitter Relay. The PC-250TR relay is a code-generating relay for coded track circuits and cab signaling equipment. This relay is DC-operated at a specific frequency to open or close a circuit at the set rate, providing equal off and on times. The design of the PC-250TR relay conforms to all applicable AREMA specifications.

1.2. DESCRIPTION

1.2.1. General

The PC-250TR relay is manufactured with various combinations of low voltage (L.V.) silver platinum and high voltage (H.V.) tungsten contacts. The PC-250TR relay is available in a range of operating frequencies: 50, 75, 120, 180, 270 and 420 cycles per minute. 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. Indexing pins in the relay ensure installing in the proper base. Relays lock securely in the plug-in position.

1.2.2. Coils

Coil resistances of PC-250TR relays are (depending on part number) 40, 60 and 90 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-250TR relays are low voltage (L.V.) and high voltage (H.V.). L.V. contacts are marked with green contact posts and are for use in circuits below 50 volts. L.V. contacts are silver platinum-to-silver platinum contact posts. H.V. contacts are for use in circuits above 50 volts to provide longer contact life; however, they cannot be used in low voltage circuits due to the contact resistance that they develop.

1.3. SPECIFICATIONS

The following subsections provide the electrical and mechanical specifications of the code transmitter relays covered in this manual.

1.3.1. Electrical

Relay electrical specifications are tabulated below:

Table 1-1. Relay Electrical Specifications

US&S Part No.	Cycle/ Minute	Contact Arrangement				System Voltage	Coil Res. Ω	Arc Supr. Res. (1)
		1(F)	2(B)	3(F)	4(B)			
N322556-001	180	L.V.	L.V.	L.V.	L.V.	10-12	60	510
N322556-002	75	L.V.	L.V.	L.V.	L.V.	10-12	60	510
N322556-003	120	L.V.	L.V.	L.V.	L.V.	10-12	40	300
N322556-004	180	H.V.	H.V.	L.V.	L.V.	10-12	60	510
N322556-005	75	H.V.	H.V.	L.V.	L.V.	10-12	60	510
N322556-006	120	H.V.	H.V.	L.V.	L.V.	10-12	40	300
N322556-007	180	H.V.	H.V.	H.V.	H.V.	10-12	60	510
N322556-008	75	H.V.	H.V.	H.V.	H.V.	10-12	60	510
N322556-009	270	L.V.	L.V.	L.V.	L.V.	10-12	40	300
N322556-010	270	H.V.	H.V.	H.V.	H.V.	10-12	40	300
N322556-011	120	H.V.	H.V.	H.V.	H.V.	10-12	40	300
N322556-012	75	H.V.	H.V.	H.V.	H.V.	16	90	680
N322556-013	120	H.V.	H.V.	H.V.	H.V.	16	60	510
N322556-014	180	H.V.	H.V.	H.V.	H.V.	16	90	680
N322556-015	270	H.V.	H.V.	H.V.	H.V.	16	60	510
N322556-016	420	H.V.	H.V.	H.V.	H.V.	16	60	510
N322556-017	50	H.V.	H.V.	H.V.	H.V.	16	90	680
N322556-018	75	L.V.	L.V.	L.V.	L.V.	16	90	680
N322556-019	270	H.V.	H.V.	L.V.	L.V.	10-12	40	300
N322556-020	420	H.V.	H.V.	L.V.	L.V.	16	60	510
N322556-021	50	L.V.	L.V.	L.V.	L.V.	10-12	60	510
N322556-022	420	L.V.	L.V.	L.V.	L.V.	10-12	40	300
N322556-818	75	L.V.	L.V.	L.V.	L.V.	16	90	680

(1) Internal arc suppression resistor in series with coil.

1.3.2. Mechanical

The following mechanical specifications are common to all PC-250TR relays addressed in this manual:

Table 1-2. Relay Mechanical Specifications

Dimensions:	**Height**	7-1/16″ (17.93 cm)	
	Width	4-15/16″ (12.54 cm)	
	Depth	8-3/8″ (21.2 cm)	
Temperature:	-40^{0}F (-40^{0}C) to +185^{0}F (85^{0}C)		
Indexing:	Determined by Relay Part Number (see Subsection 2.3)		
Weight:	6-3/4 lb.		
Mounting Base:	N378609 (Old Style)		37 oz.
	N438689-003 (New Style)		18 oz.
Mounting Base Dimensions:	**Height**	7-15/16″ (20.1 cm)	
	Width:	4-15/16″ (12.54 cm)	
	Depth:	2-7/16″ (6.19 cm) (Old Style Base)	
	Depth	1-25/3″2 (4.5 cm) (New Style Base)	

1.4. SAFETY SUMMARY

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

CAUTION

and

WARNING

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 your administrative procedures.


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2. INSTALLATION

2.1. GENERAL

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

The PC-250TR relay must be mounted horizontally and separated by at least five (5) inches from the code following relays. However, PC-250TR relays can be mounted adjacent to each other.

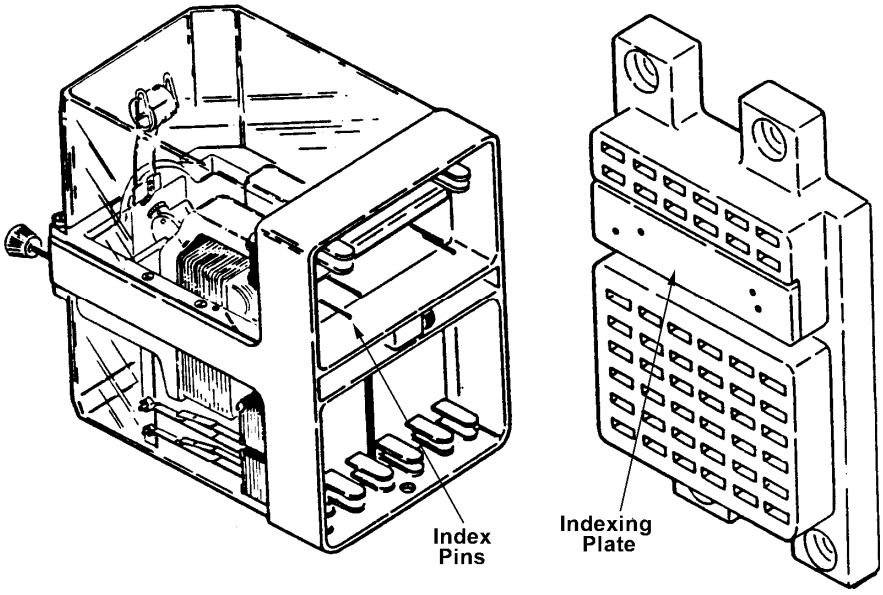

Figure 2-1. Typical Plug-(n Relay and Mounting Base

It is very important that these relays be handled carefully so that no undue stresses are applied to the contact bar hinge structure, which might throw the contacts out of adjustment or impair the life of the hinge spring.

A shipping screw, which firmly holds the armature, is applied to the relay when it leaves the factory. The screw should be removed when the relay is placed in service and retained for subsequent use in case it later becomes necessary to transport the relay from place to place.

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 (contact receptacles). Mounting base details are illustrated in Section 5.6, Relay Mounting Bases.

2.3. RELAY INDEXING

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 that 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.

WARNING

Do not drill new holes in a base indexing plate that 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. These actions create a hazard that may compromise safety circuit functions.

The following data defines the indexing that has been established for relays covered by this manual:

a. The index code always consists of four digits (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 nameplate 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 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 that 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. Never drill new holes in an existing indexing plate, for then it would accommodate two or more relays of different part numbers. The same applies to the positions

of the indexing pins in the back of the relay, unless it is being converted to another part number.

2.4. RECEPTACLE CONTACT SPRINGS

2.4.1. Old-Style Base Only

Normally, the N378609 mounting base will be equipped with the required quantity of J680165 solderless receptacle contact springs and will accommodate one or two #14 – #16 wires. However, it can be equipped with receptacle contact springs for one or two #10 – #12 wires (J680181), or for one or two #18 – #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 (M451142-2702) to accommodate one or two #14 – #16 wires, mounting fasteners, and tags. It can be equipped with receptacle contact springs for one or two #10 – #12 wires (M451142-2703), or for one or two #18 – #20 (M451142-2701) wires. Make certain which type of solderless receptacle contact springs accompany the mounting base before proceeding with 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 (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, might 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. c. After insertion, pull firmly on the wire to make certain the receptacle contact spring is locked in the cavity.

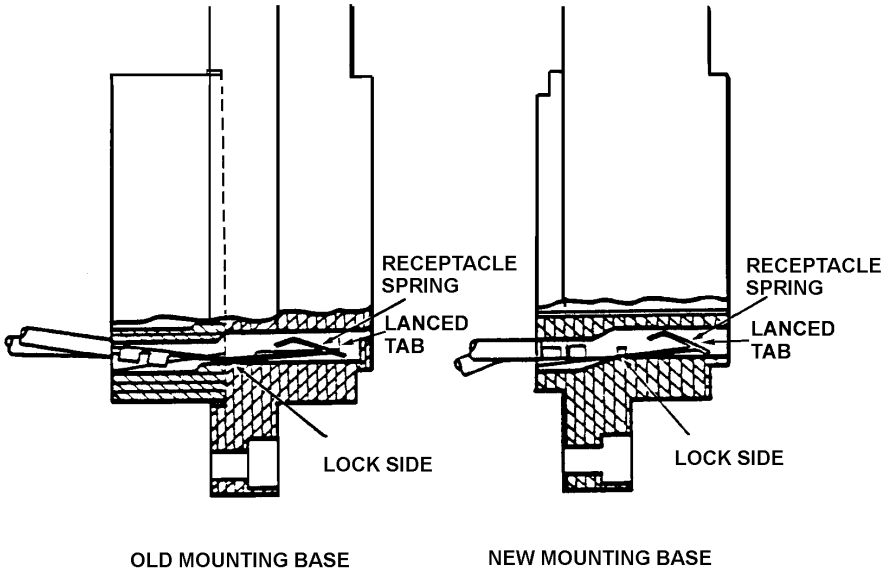

Figure 2-2. Receptacle Contact Spring Installed

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.

Table 2-1. Contact Spring Crimping Tools

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 nameplate 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.


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3. FIELD MAINTENANCE

3.1. INTRODUCTION

This section provides the necessary periodic preventive maintenance procedures that must be performed to ensure continuous, proper and efficient operation of the PC-250TR-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, 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. from the cover.

3.2.2. Service Requirements

3.2.2.1. General

All vital code relays must be inspected and tested at least once every two (2) years. The tests and inspections are to include: starting voltage; proper code and on-time operation; 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 US&S specifications.

3.2.2.2. In-Service Test

It is recommended that code relays be removed from service for shop repairs when the starting values and code rates are not within the limits given in Table 4-3, or the On-Time values are less than 38% at minimum voltage.

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. Never place the relay with its base contacts facing downward: to do so can cause damage to the relay.

3.2.2.3. Test Procedures

Procedures that test the operating characteristics of the PC-250TR-style relays as described in Sections 3 and 4 in this manual.

4. SHOP MAINTENANCE

4.1. INTRODUCTION

This section provides the information necessary to perform shop-level repairs of the PC-250TR-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.

CAUTION

A code transmitter must never be placed with its base contacts facing downward. To do so can cause damage to the relay.

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

4.2.1. Cleaning Relay Contacts

A Relay Contact Cleaning Kit (part no. X451646-0901) is available and contains the following three items, which may also be ordered individually:

Table 4-1. Contact Cleaning Materials

Cleaning Item	Part No.
Burnishing Tool, P.K. Neuses Co. No. 3-316 (pkg. of 5)	J397187
Burnishing Tool, P.K. Neuses Co. No. N318 Heavy Duty (pkg. of 5)	J397187-001
Paper Strip, strips cut from 67-pound white Springhill Vellum Bristol Paper (pkg. of 50)	J793094

US&S also recommends the following commercially available cleaning items:

- Emery paper, wet or dry, 600 grit, cut in strips

- Alcohol #1 Solvent (Ethyl Alcohol Proprietary 190) or Equivalent

Note

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

4.2.1.1. 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 steps "c" several times, if necessary.

e. Using the alcohol 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 the previous steps several times if necessary.

4.2.1.2. Contacts With Heavy Tarnish, Slightly Rough or Pitted

Perform the procedure in Subsection 4.2.2.1, steps 'b' to 'g'.

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

Perform the procedure in Subsection 4.2.2.1, steps 'f' and 'g'.

4.2.2. Shock Indicator

WARNING

Any relay displaying Shock Indicator activation requires shop service before placing relay into service. Failure to assure proper function of this relay may result in severe personal injury or death.

Relays N322556-012 and N322556-818 (only) have integral shock indicators. The shock indicator (J6801670012) displays red when the relay has been subjected to shock in excess of a safe level (i.e., dropped) during shipment or transport. This is an indication that the relay may have mechanical damage and may not meet electrical specifications. Refer to Figure 4-1 for shock indicator location on the relays.

An affected relay should be opened and visually inspected for damage (e.g., kinked springs). Mechanical settings should be checked and verified, and the relay recalibrated and tested according to specifications by a qualified individual.

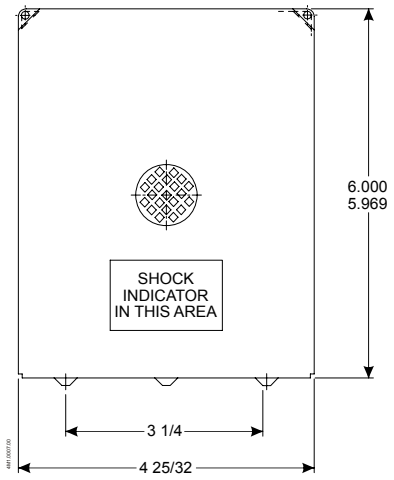

Figure 4-1. Shock Indicator Location

4.3. 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.

4.3.1. Disassembly

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

a. Remove relay cover seal.

b. Carefully remove plastic cover.

c. Remove the operating unit as required

d. Remove contact assembly as required.

e. Remove contacts/contact springs as required.

f. Disassemble the operating unit as required.

4.3.2. Reassembly

Reassembly is accomplished generally in the reverse order of disassembly. The following subsections provide additional instructions to be followed during reassembly of this relay. When reassembling the code transmitter relay, do not over-tighten screws or nuts, and do not apply force that may cause damage to parts.

4.3.2.1. Contact Replacement

Shop repairs should consist of replacing badly worn or burned contacts and correcting any condition that might contribute to improper relay operation. Each contact spring and contact post is separate and, with care, can be replaced without affecting the other contacts. Proper care should be exercised when contacts are replaced to make certain that the hinge spring supports are not forced out of line sufficiently to cause a set, which would throw the other contacts out of line or render the hinges susceptible to breakage.

Contacts that are not to be replaced may be dressed, if necessary, by following the procedures in Section 4.2.1.

4.4. ADJUSTMENTS

4.4.1. Recommended Tools

The tools recommended for relay adjustment are:

- Gram Scale - 0-10 grams
- Gap Gauge - 0.001″ - 0.80″

4.4.2. Starting Air Gap

In making all mechanical and contact adjustments, the relay must be mounted in a level position. The armature position with respect to the pole pieces, when viewed from the front of the relay, should be adjusted to the limits shown in Figure 4-2 by shifting the pole pieces slightly or rearranging the tuning weights on the armature; or on 180 coders, the pendulum arm may be bent slightly if necessary.

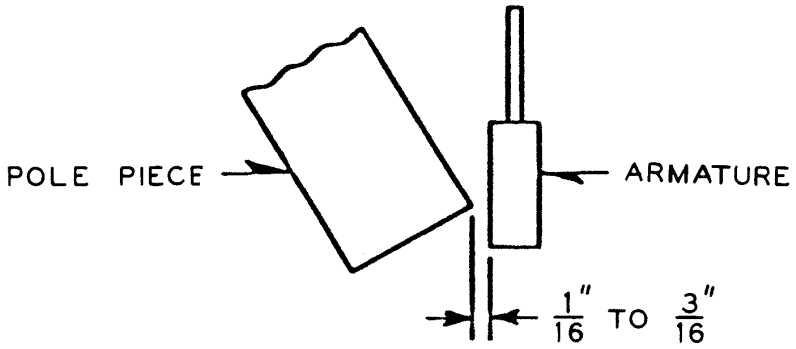

Figure 4-2. Position of Armature to Pole Piece

4.4.3. Side Air Gaps

The armature should be centered between the pole pieces with a minimum clearance of 1/16″± 1/64″ from either pole piece when moved to a position between the poles (refer to Figure 4-3).

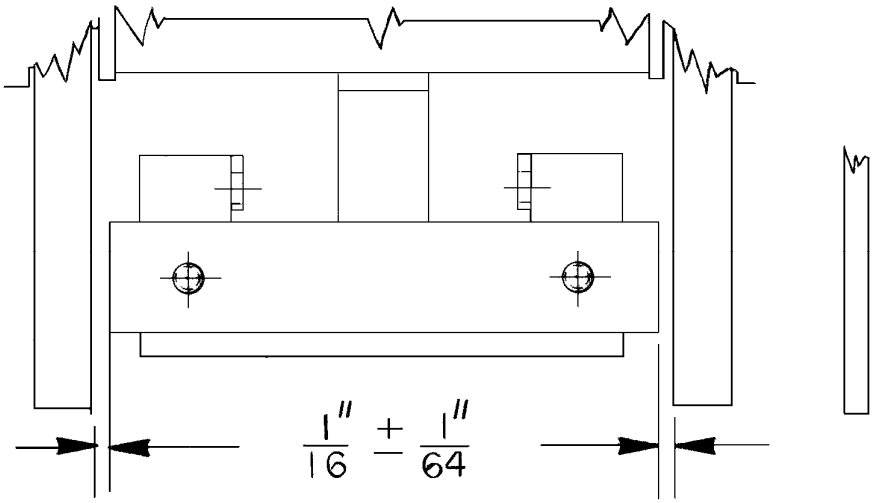

Figure 4-3. Side Air Gap

When the armature is pulled back to approximately the full-stroke position and then released, the pendulum should continue to oscillate with appreciable amplitude for a minimum of ten complete cycles.

4.4.4. Contacts

With the relay in a level position and with the pendulum free to operate, adjust the contacts as follows:

a. At the start of the adjustment, all contacts should be moved out of engagement. The pendulum must hang free and be practically vertical. Pendulum position should be checked any time that tuning weights are added or arranged.

b. Adjust initial pressure of all contacts against their stops from 4 to 6 grams measured at the contact tips.

c. When the relay is viewed from the top with the handle toward the observer, the contacts are as shown in Figure 4-4.

d. With all contacts open, set power contacts to 0.010″ opening. With front power contacts open 0.036″ ± 0.003″, set drive contact on same side to just make. With back power contacts open 0.036″ ± 0.003″, set drive contact on same side to just make.

4.4.5. Contact Resistance

The resistance of each set of contacts should he measured with the pendulum held in such a position that the contact compression is approximately 0.010″. Resistance should not exceed 0.05 ohm for silver-platinum contacts, 0.5 ohm for tungsten.

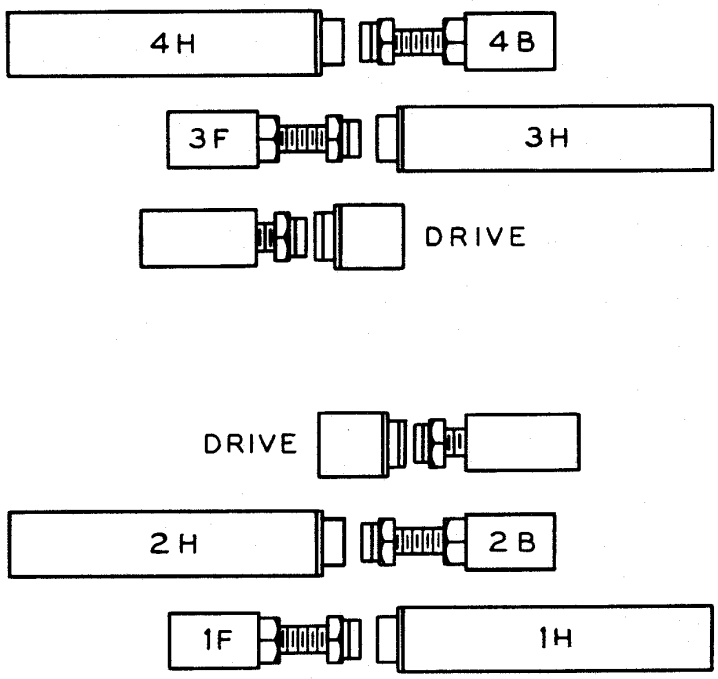

Figure 4-4. Front of Relay – Top View

4.5. CALIBRATION

CAUTION

Calibration of these relays must be made either in a test stand or on a nonmetallic 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.

4.5.1. Recommended Equipment

The following table specifies the equipment recommended for use to calibrate the relays:

Table 4-2. Calibration Equipment

Equipment Item	Description
Power Supply, 0 - 40 Vdc	HP6205B or equivalent
Digital Multimeter	Fluke 87 Multimeter or equivalent
SPST (single pole, single throw) switch	Commercially available
Cycle Counter	Redington Counter R9-3206 or equivalent
Stopwatch	Accurate within 0.1 sec.
On-Time Meter	PD-30 (J620754) or equivalent

4.5.2. Procedures

A rear view of the relay base or mounting base showing the terminal arrangement is shown in Figure 4-5.

a. Starting Voltage Check

1. Connect the code transmitter into the test circuit as shown in Figure 4-6.

2. With the contacts adjusted, pole pieces set, and the pendulum at rest, slowly increase the power supply output until the pendulum begins to oscillate. The voltage at this point should not exceed the “maximum starting” voltage given in Table 4-3.

b. Code Rate Check

1. Connect the code transmitter test circuit, as shown in Figure 4-6.

2. Ensure that the code transmitter is operated at the rated voltages given in Table 4-3.

3. Set the power supply at nominal rated voltage, and allow relay to operate for approximately one minute before continuing with the next step.

4. Set switch S1 to OFF, and ensure that the counter is reset to zero.

5. Using a stopwatch to make the time measurement, simultaneously set switch S1 to ON, and start the stopwatch.

6. Set switch S1 to OFF when the stopwatch indicates that exactly three minutes have elapsed.

7. Divide the reading on the counter by three and observe that the result is within the appropriate code rate indicated in Table 4-3.

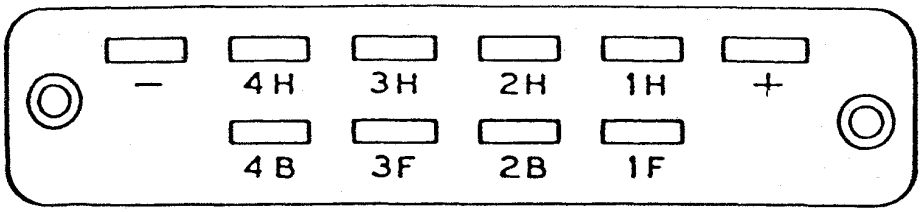

Figure 4-5. Mounting Base Terminals

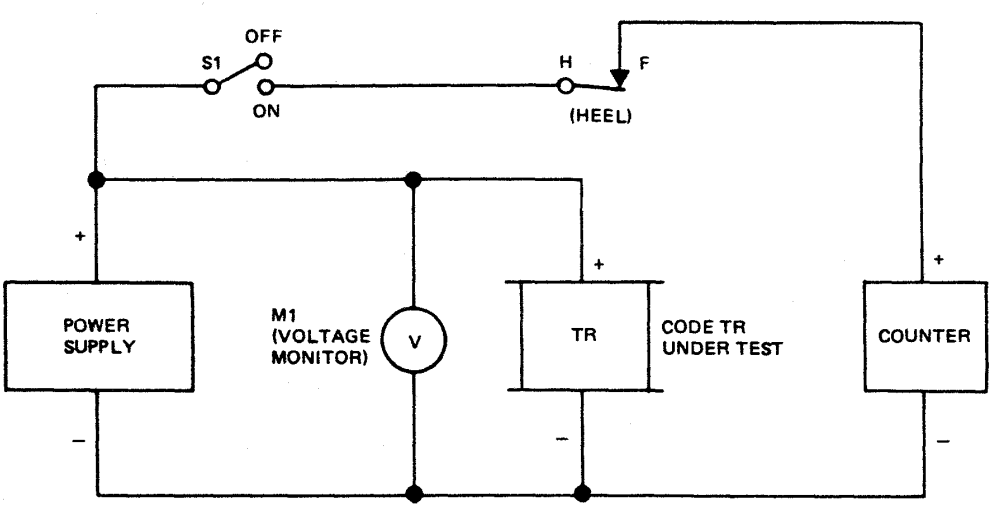

Figure 4-6. Code Transmitter Code Rate Test Circuit

Note

The code speed is adjusted to the value given in Table 4-3 by varying the number and size of tuning weights as required. To increase code frequency on 50 and 75 coders, add weight to the pendulum. To increase code frequency on the 120, 180, 270 and 420 coders, remove weight from the pendulum.

8. Repeat Steps 4 through 7 at the rated maximum and minimum voltages. The code rates should be within the limits specified in Table 4-3.

Note

The amplitude of the pendulum should be checked at the rated maximum voltage given in Table 4-3. The amplitude should not be so great that the pendulum strikes any fixed part of the transmitter.

c. On-Time Check

Connect the code transmitter test circuit, shown in Figure 4-7, and proceed as follows:

1. With PD-30 connected between a set of heel and front contacts, 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. After final tuning, the on-time must be 42% minimum to 48% maximum (46 - 52% for 50 code only) for both front and back contacts at both minimum and maximum voltages.

3. To check the on-time period of the back contact of the CT, 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 coding contacts.

Note

In the event that on-time of any contact at rated minimum voltage is below 42% (46% for 50 code only), the contact adjustment shall be carefully checked and changed as necessary, observing the limits specified. At rated maximum voltage, the on-time of both left and right contacts should be approximately the same.

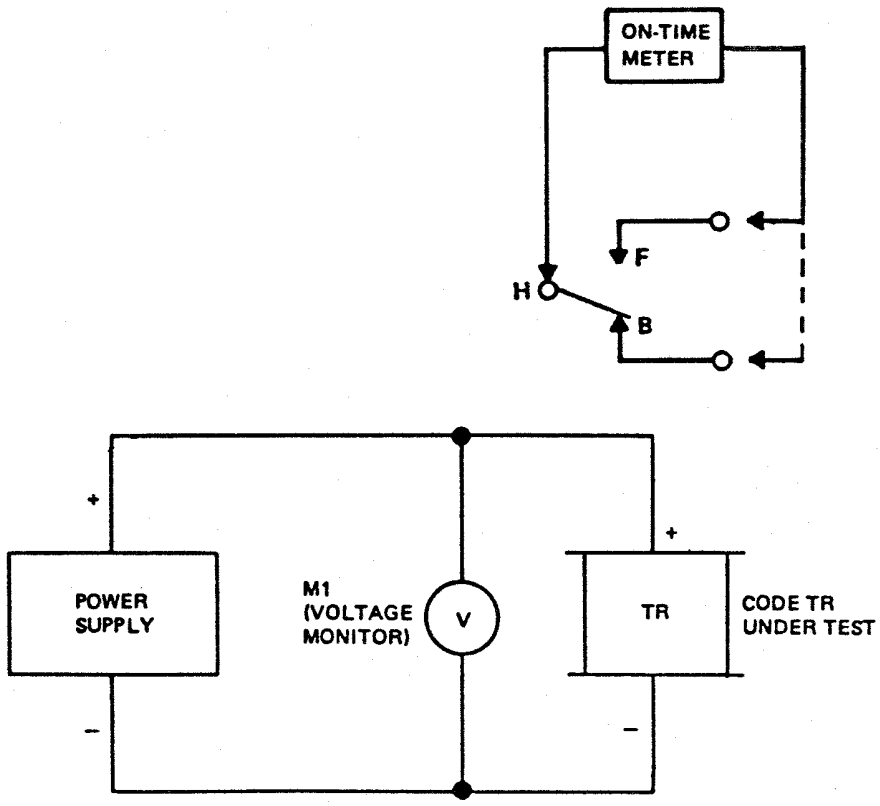

Figure 4-7. Code Transmitter On-Time test Circuit

4.6. CALIBRATION REQUIREMENTS

4.6.1. In-Service Test

Calibration requirements will be met when the relay adjustment values are the same as those given in Table 4-3 of this manual.

After any shop adjustments are made, repeat the calibration procedures in Section 4.5.2. If the values are not within the tolerance given in Table 4-3, the relay should not be placed in service.

4.6.2. 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.

- Silver/Platinum contacts – 0.05Ω maximum
- Tungsten contacts – 0.5 Ω maximum

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 should be followed by the use of the burnishing tool and paper strip.

Table 4-3. PC-250TR Calibration Values

Rated Code Speed	Coil Res. Ω	Voltages				Code Frequency Cycles per Minute		
		Rated Nominal	Rated Min.	Rated Max.	Max. Starting	At Rated Voltage	At Min. Voltage	At Max. Voltage
75	60	10/12	8	14	7	72 ± 0.5	74	70
120	40	10/12	8	14	7.5	123 ± 0.5	125	121
180	60	10/12	8	14	6	184 ± 1	187	181
270	40	10/12	8	14	6	276 ± 0.5	280	272
420	40	10/12	8	14	8.33	420 ± 0.5	424	416
75	90	16	11	18	6.7	72 ± 0.5	74	70
120	60	16	11	18	10	123 ± 0.5	125	121
180	90	16	11	18	8	184 ± 1	187	181
270	60	16	11	18	8	276 ± 0.5	280	272
420	60	16	11	18	10	420 ± 0.5	424	416
50	90	16	11	18	7.0	48 ± 0.5	46	50
50	60	10/12	8	14	5.6	48 ± 0.5	46	50

5. PARTS LISTS

5.1. PC-250TR Relay Main Assembly

Common parts for all PC-250TR Code Generating Relays are in the following table. Refer to Figure 5-1.

Table 5-1. PC-250TR Relay Generic Components

Item	Part Number	Description	Quantity
1	M398472	FRAME	1 EA
3	J487090	PIN,ROLL-3/32DX1-1/8	4 EA
4	M349392	ROD,LATCH 1/8 SS	1 EA
5	M395496	NUT,1/8 HVY	1 EA
6	J770536	KNOB KNURLED TH.NUT	1 EA
7	M321728	LATCH,MACHINED	1 EA
8	J048716	PIN,ROLL SST	1 EA
9	M321861	SPRING,PLATED	1 EA
10	PM377128	CONTACT BLOCK	1 EA
11	J5001320108	SCR-SST 8-32X1/2 RD	4 EA
12	Refer to Table 5-2	***OPERATING UNIT	1 EA
13	J522151	SCREW, 10-32 X 9/16 FIL NYLOK	4 EA
14	J047081	GASKET,RUBBER	2 EA
15	J776598	COVER,MOLDED RELAY	1 EA
16	J5072950119	SCREW,8-32 X 7/16″L,FIL HEAD	2 EA
17	A043013	WIRE-SEAL #22 AWG, 2 PLY	0.50 FT
18	J079351	SEAL-SECURITY, GRAY	1 EA
19	S000110	TAG	1 EA
20	J790257	SEAL,ADHESIVE VENTIL	1 EA
23	J7763040001	COVER,MOLDED RELAY	1 EA
25	M437864	PLATE,NAME	1 EA
26	J525024	SCREW,4-40 X 3/16,PAN HD,SS	2 EA
27	J561111	HANDLE,PULL ALUMINUM	1 EA
28	J4751210125	WSHR-SST #10 SHAK PF	2 EA
29	J5072960129	SCR-SST 10-32X3/8 PH	2 EA
31	Refer to Table 5-2	BAG PARTS	1 EA
32	R377664	LOCK,SHIPPING	1 EA
34	Refer to Table 5-2	RES,510R,2W,5%,CC/MG,AXIAL,THT	1 EA
35	S000807	TAG	1 EA
36	J522042	SCREW,8-32X7/16 FIL HD SS	2 EA
37	J047714	WASHER-8 SHPRF LK SS	6 EA

Item	Part Number	Description	Quantity
(a)	N385127	LEAD	1 EA
(a)	N385119	LEAD	1 EA
(a)	N385120	LEAD	1 EA
(a)	N385121	LEAD	1 EA
(a)	N385122	LEAD	1 EA
(a)	N385123	LEAD	1 EA
(a)	N385124	LEAD	1 EA
(a)	N385125	LEAD	1 EA
(a)	N385126	LEAD	1 EA
(a)	N385128	LEAD	1 EA
(b)	J6801670012	CLIP-MNT ON VITAL RELAYS	1 EA

(a) Not illustrated
(b) Shock Indicator on N322556012 and N322556818 only.

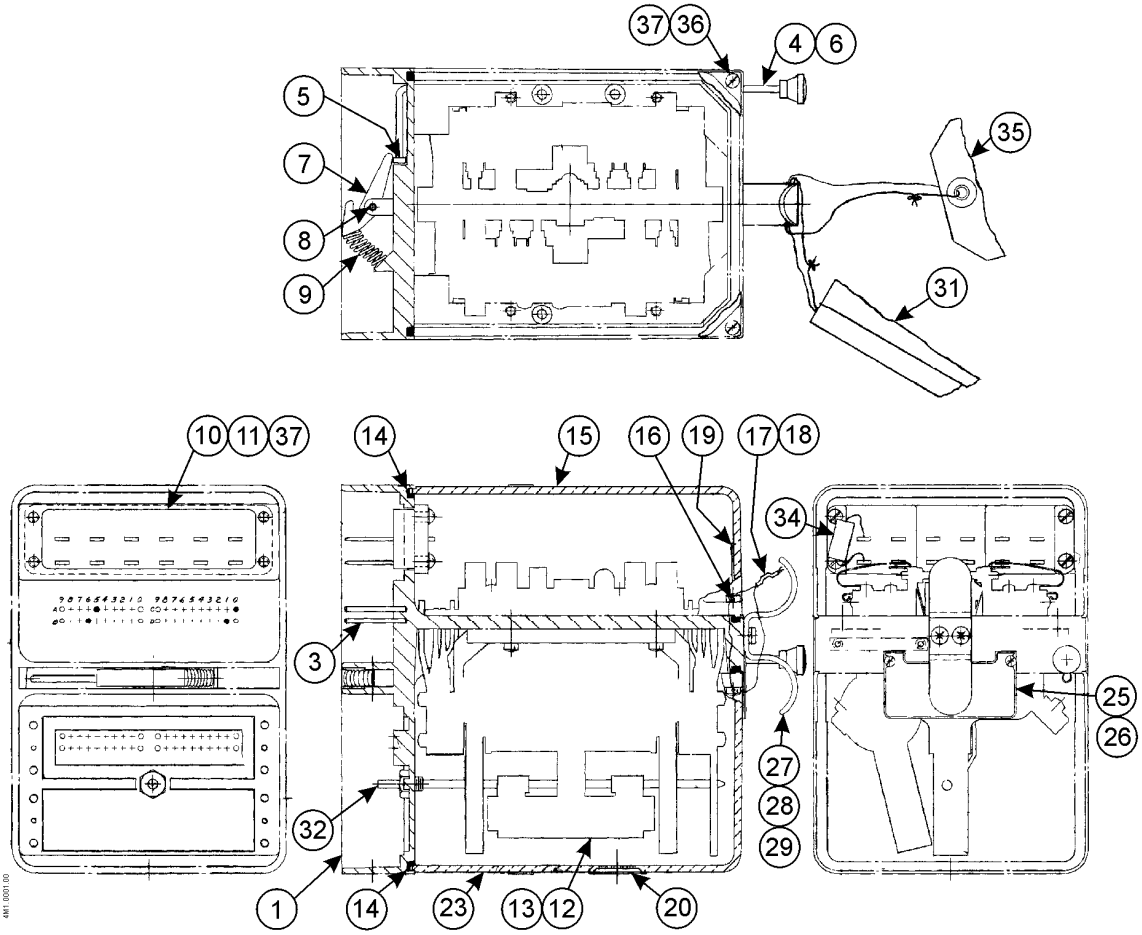

Figure 5-1. PC-250TR Relay Main Assembly

5.2. PC-250TR Relay Specific Parts

The following table tabulates the components that are specific to different PC-250TR Relay part numbers.

Table 5-2. PC-250TR Relay Specific Components

Relay N322556	Operating Unit (Item 12)	Parts Bag (Item 31) N349711	Resistor (Item 34)	Ohms Ω
-001	N378386	-5601	J721169	510
-002	N378387	-5602	J721169	510
-003	N378388	-5603	J720863	300
-004	N380644	-5604	J721169	510
-005	N380645	-5605	J721169	510
-006	N380646	-5606	J721863	300
-007	N383779	-5607	J721169	510
-008	N383780	-5608	J721169	510
-009	N386409	-5609	J720863	300
-010	N395164	-5610	J720863	300
-011	N395431	-5611	J720863	300
-012	N433750	-5612	J720815	680
-013	N433751	-5313	J271169	510
-014	N433752	-5614	J720815	680
-015	N433753	-5615	J721169	510
-016	N433755	-5616	J721169	610
-017	N435702	-5617	J720815	680
-018	N437107	-5618	J720815	680
-818	N437107	-5618	J720815	680
-019	N437792	-5619	J720863	300
-020	N433755-001	-5620	J721169	510
-021	N435702-001	-5621	J721169	510
-022	N433755-002	-5622	J720863	300

For components specific to each Operating Unit (Item 12), refer to Table 5-3 and Table 5-4.

5.3. PC-250TR Relay Operating Units

Common parts for all PC-250TR Code Generating Relay Operating Units are tabulated in the following table. Refer to Figure 5-2 and Figure 5-3.

Table 5-3. PC-250TR Relay Operating Unit Generic Components

Item	Part Number	Description	Quantity
1	M376660	MTG.BRACKET	1 EA
2	M376702	MTG.BLOCK	2 EA
3	J522147	SCREW,6-40X1 FIL HD STEEL	6 EA
4	M376820	VERTICAL STOP	2 EA
5	M376823	END,STOP	1 EA
6	J522150	SCREW,8-32X5/8 FIL HD STEEL	6 EA
7	Refer to Table 5-4	***SUPPORT	1 EA
8	M376836	STOP,FRONT	1 EA
9	M377119	MAG.CORE	1 EA
10	Refer to Table 5-4	***POLE,PIECE	2 EA
11	J475181	WSHR-SPRING, PH BZ	2 EA
12	Refer to Table 5-4	COIL	1 EA
13	M376852	SPACER,#14X1/2 BRASS	4 EA
14	M376851	SPACER,1/4X1/2 BRASS	4 EA
16	J522090	SCREW,6-32X5/8 FIL HD STEEL	4 EA
17	J4751210107	WASHER,SST LOCK NO 6	4 EA
18	M377114	SUPPORT,CONT.POST	6 EA
19	J4751210128	WSHR-SST .144 ID FLT	6 EA
20	J071963	L.V. POST TERMINAL	Refer to Table 5-4
21	M001505	NUT,.250 BRASS HEX	6 EA
22	J047708	WSHR-6PHOS BZ SHPRF	6 EA
23	N376712	BEARING,ARM	4 EA
24	M382730	SPACER	4 EA
25	J522148	SCR-8-32X7/16″ FILLISTERSS	4 EA
26	J522146	SCREW-6-32X1″FIL.HD.ST	6 EA
27	J047745	WASHER-#8 PL FLAT STL	2 EA
28	J500030	SCREW 8-32X1/2 IN	2 EA
30	M378492	RELAY FRAME	1 EA
31	J522151	SCREW,10-32X9/16 FIL HD	4 EA
32	J071962	H.V. POST-TERM TUNG CONT	Refer to Table 5-4

5.4. PC-250TR Relay Operating Unit Specific Parts

The following table tabulates the components that are specific to different PC-250TR Relay Operating Unit part numbers.

Table 5-4. PC-250TR Relay Operating Unit Specific Components

Operating Unit	Pendulum & Contact Spring Item 7	Pole Piece Item 10	Coil Item 12	Ohms	Post Item 32	Contact Posts* Items 20 and/or 32				Code Rate
						1F	2B	3F	4B	
N378386	N377464	M377127	N378745	60	N/A	A	A	A	A	180
N378387	N377465	M377127	N378745	60	N/A	A	A	A	A	75
N378388	N377466	M377127	N378746	40	N/A	A	A	A	A	120
N380644	N380641	M377127	N378745	60	2	B	B	A	A	180
N380645	N380642	M377127	N378745	60	2	B	B	A	A	75
N380646	N380643	M377127	N378746	40	2	B	B	A	A	120
N383779	N383777	M377127	N378745	60	4	B	B	B	B	180
N383780	N383778	M377127	N378745	60	4	B	B	B	B	75
N386409	N386408	M386425	N378746	40	N/A	A	A	A	A	270
N395164	N395177	M386425	N378746	40	4	B	B	B	B	270
N395431	N395430	M377127	N378746	40	4	B	B	B	B	120
N433750	N383778	M377127	N433749	90	4	B	B	B	B	75
N433751	N395430	M377127	N378745	60	4	B	B	B	B	120
N433752	N383777	M377127	N433749	90	4	B	B	B	B	180
N433753	N395177	M386425	N378745	60	4	B	B	B	B	270
N433755	N433768	M386425	N378745	60	4	B	B	B	B	420
N435702	N435703	M377127	N433749	90	4	B	B	B	B	50
N437107	N377465	M377127	N433749	90	N/A	A	A	A	A	75
N437792	N437793	M386425	N378746	40	2	B	B	A	A	270
N433755-001	N433768-001	M386425	N378745	60	2	B	B	A	A	420
N435702-001	N435703-001	M377127	N378745	60	N/A	A	A	A	A	50
N433755-002	N433768-002	M386425	N378746	40	N/A	A	A	A	A	420

*Note: A = low voltage Silver/Platinum contacts
B = high voltage Tungsten contacts

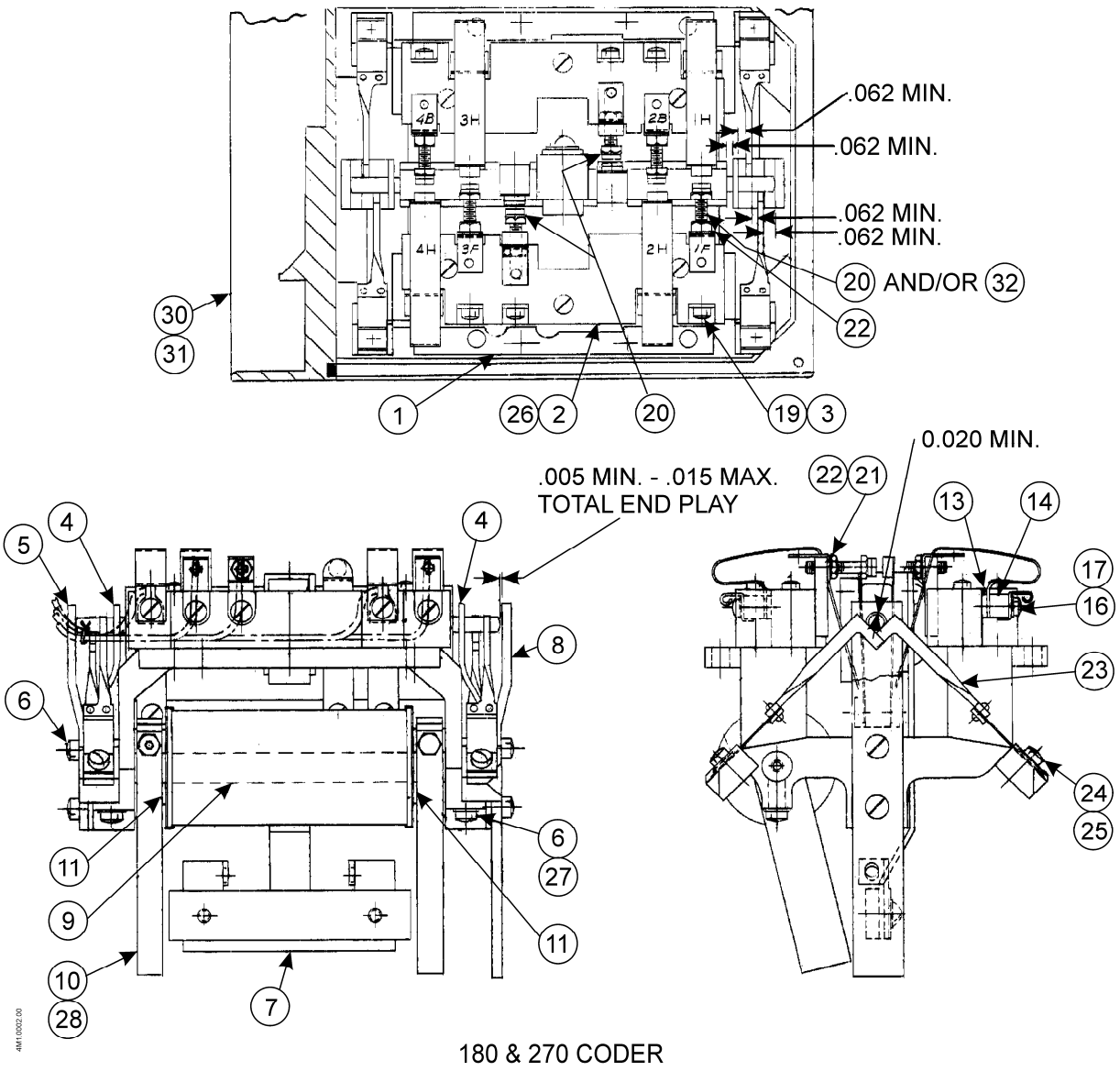

Figure 5-2. PC-250TR Relay Operating Unit Assembly, Sheet 1

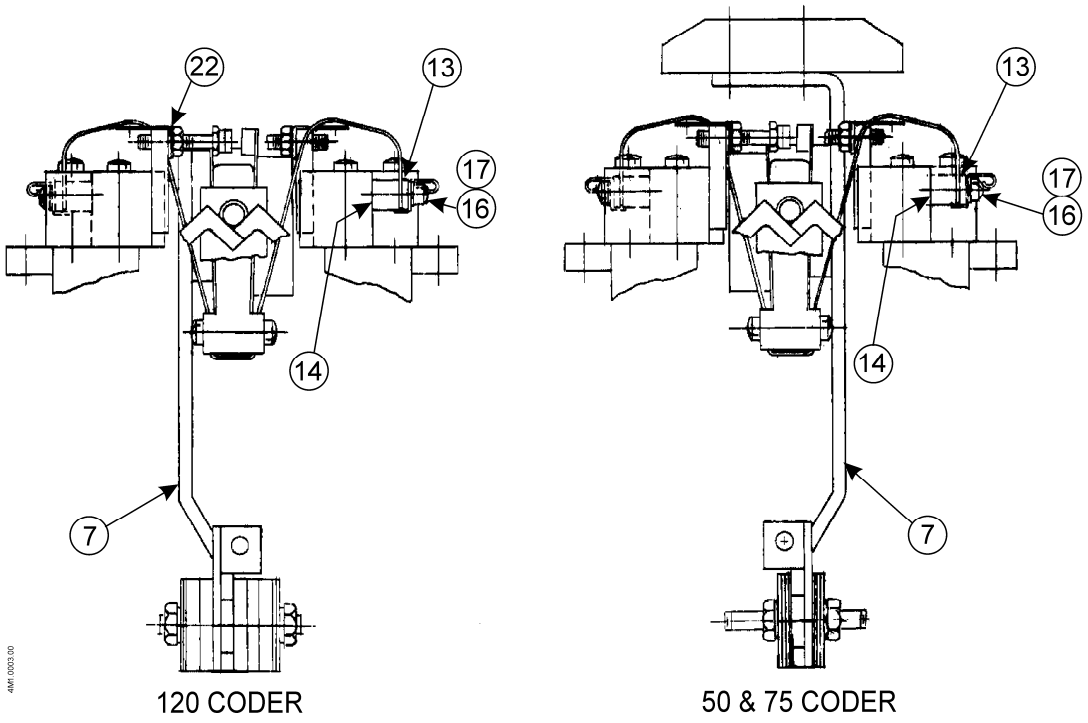

Figure 5-3. PC-250TR Relay Operating Unit Assembly, Sheet 2

5.5. Relay Operating Unit Pendulum and Contact Spring Support

The following table correlates the contact spring material and illustration views for the Pendulum and Contact Spring Support assemblies associated with the PC-250TR Relay Operating Units.

Table 5-5. Pendulum and Contact Spring Supports

Part No.	Code	Contact Spiting*			
		1H	2H	3H	4H
N377464	180	L.V	L.V.	L.V.	L.V.
N377465	75	L.V	L.V.	L.V.	L.V.
N377466	120	L.V	L.V.	L.V.	L.V.
N380641	180	H.V.	H.V.	L.V.	L.V.
N380642	75	H.V.	H.V.	L.V.	L.V.
N380643	120	H.V.	H.V.	L.V.	L.V.
N383777	180	L.V	L.V.	L.V.	L.V.
N383778	75	H.V.	H.V.	H.V.	H.V.
N386408	270	L.V	L.V.	L.V.	L.V.
N395177	270	L.V	L.V.	L.V.	L.V.
N395430	120	L.V	L.V.	L.V.	L.V.
N435768	420	L.V	L.V.	L.V.	L.V.
N435703	50	L.V	L.V.	L.V.	L.V.
N437793	270	H.V.	H.V.	L.V.	L.V.
N43768-001	420	H.V.	H.V.	L.V.	L.V.
N435703-001	50	L.V	L.V.	L.V.	L.V.
N433768-02	420	L.V	L.V.	L.V.	L.V.

*Note: L.V. = low voltage Silver/Platinum contacts
Contact Spring Part No. R377144

H.V. = high voltage Tungsten contacts
Contact Spring Part No. R380690

5.6. Relay Mounting Bases

5.6.1. Solderless Type (Old Style)

Refer to Figure 5-4.

Table 5-6. Relay Mounting Base (Old Style)

Item	Part No.	Description	Quantity
5	J776306	BASE-MOLDED RELAY	1 EA
11	J776318	CLAMPING,BLOCK MOLDED	1 EA
15	J525061	SCREW,6-32X5/8 RD HD STEEL	2 EA
20	M321745	STRIKE	1 EA
25	M267499	NUT,.312 BRASS HEX	1 EA
30	S000007	SHEET,INSTR.FORM7	1 EA
35	J075828	TAG VINYLITE	2 EA
40	J052674	SCREW,4X3/16 RD HD	4 EA
45	J078399	BAG-PLASTIC,#60F-0406	2 EA
50	J052667	SCREW,1/4-20X1-1/4 RD	4 EA
61	J680165	SPR CONTACT RCPT	10 EA
75	J047775	WASHER,1/4 STEEL LOCK MED	4 EA
80	J047501	WASHER,1/4 STEEL PLATE	4 EA
85	J048002	NUT,1/4-20 UNC 2B HVY	4 EA

Plastic Bags, item 34, are thermosealed, shipped with the mounting base, and contain the following:

- Required quantity of contact receptacles (J680165)
- 2 – Tags)J075828)
- 2 – #4 x 3/16″ round head “Z” type self-tapping screws (J052674)
- 4 - ¼-20 X ¼ round head steel machine screws (J052667)
- 4 – ¼ steel lock washers(J047775)
- 4 – ¼ steel plate washers (J047501)
- 4 – ¼-30 steel hex nuts (J048002)
- Instruction sheet US7 – Sh. 1184-10939

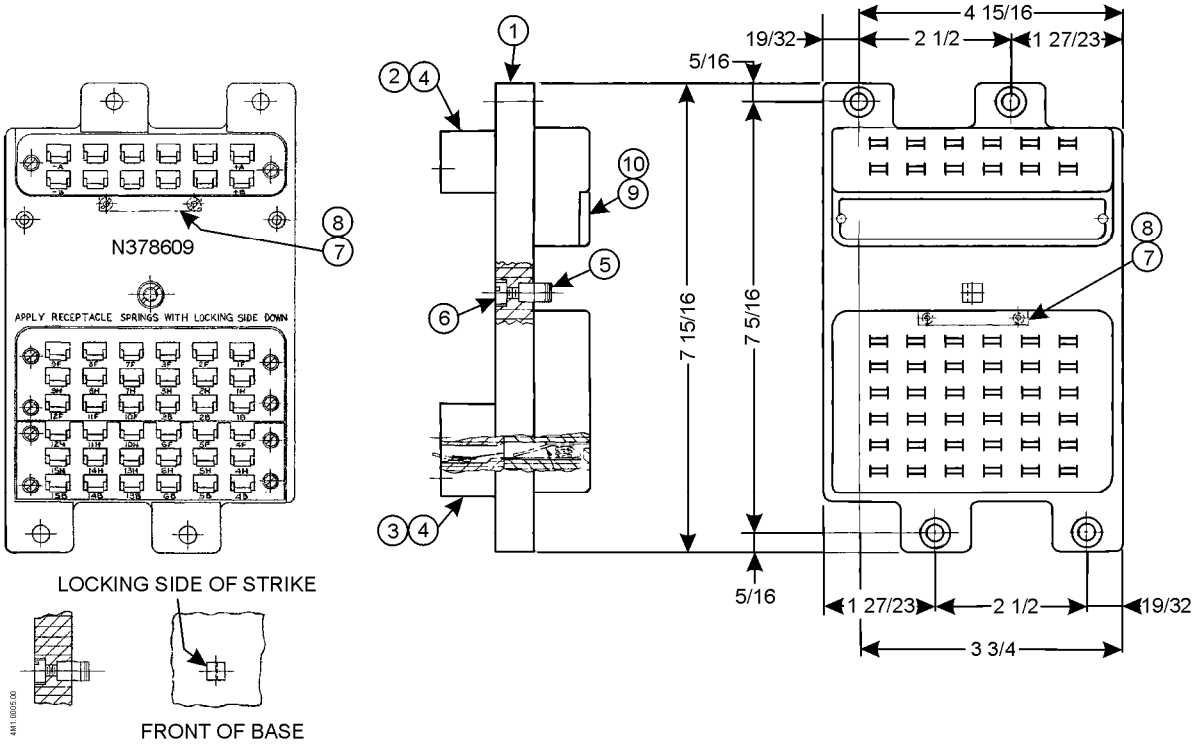

Figure 5-4. Relay Mounting Base (Old Style)

5.6.2. Solderless Type (New Style)

Table 5-7. Relay Mounting Base (New Style)

Item	Part No.	Description	Quantity
1	J780054	BASE,MOUNTING MOLDED 250	1 EA
2	J792848	STRIKE RELAY	1 EA
3	J480280	NUT,SPEED PUSH ON	1 EA
4	M4511422702	CONTACT,SPRING	40 EA
5	J075951	TAG-RELAY IDENT	2 EA
6	J5001360120	SCR-SST 1/4-20X1-1/4	4 EA
7	J4751210111	WASHER,SST LOCK NO1/4	4 EA
8	J4751200112	WASHER,SST PLATE NO1/4	4 EA
9	J4802110108	NUT,1/4-20 SST HEX	4 EA
10	S000008	SHEET,INSTR.FORM #8	1 EA
11	J078399	BAG-PLASTIC,#60F-0406	2 EA
15	J052674	SCREW,4X3/16 RD HD	4 EA

Plastic Bags, item 11, are thermosealed, shipped with the mounting base, and contain the following:

- Required quantity of contact receptacles (J680195 for #18 - #20 wire; J6801950002 for #10 - #12 wire)
- Contact springs (item 4)
- Tags (item 5), screws, lock washers, plate washers, and nuts (items 6, 7, 8, and 9)

The following items are also supplied: mounting base instructions sheet (item 10), coil connection diagram, and conversion chart.

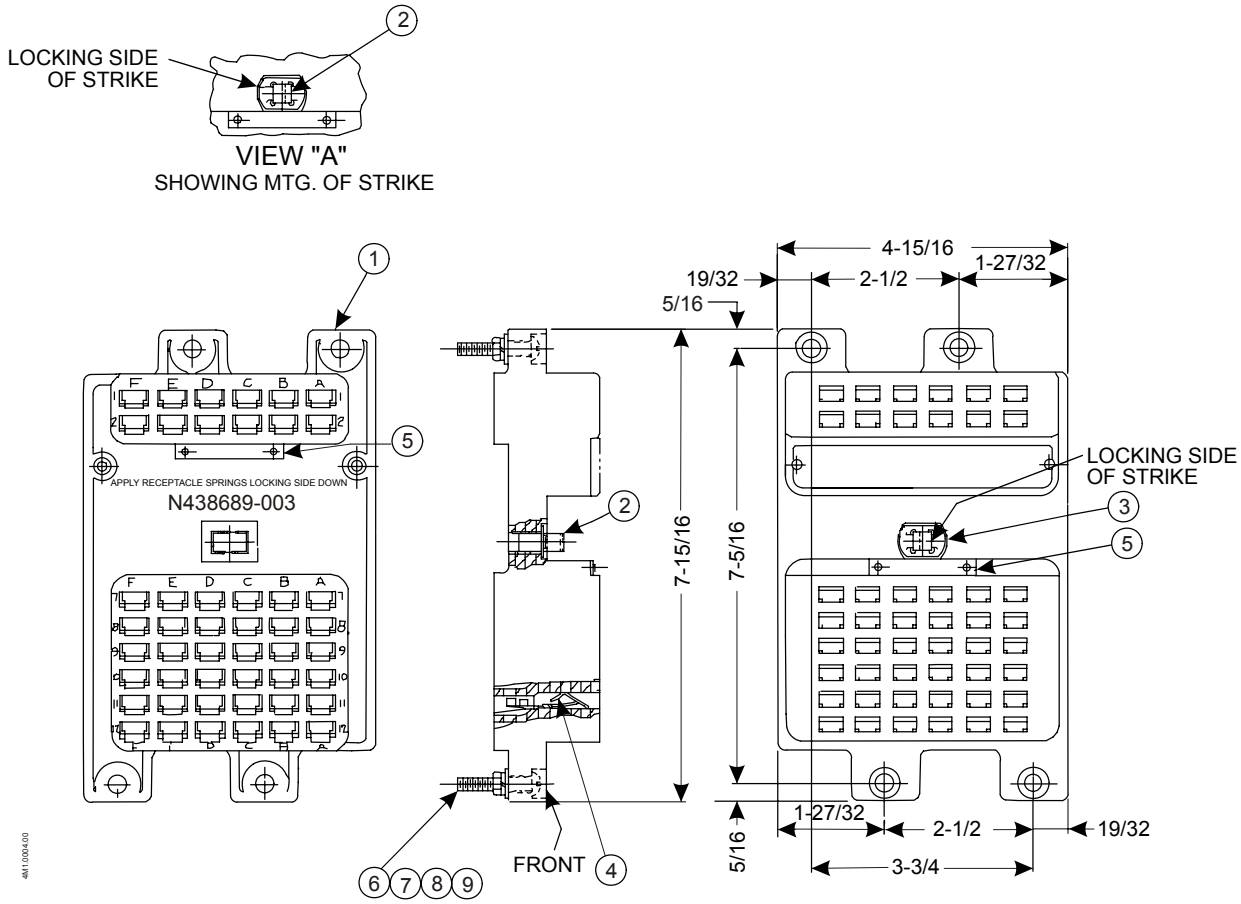

Figure 5-5. Relay Mounting Base (New Style)

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@switch.com.

End of Manual