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HP X281C

HP P281C

HP K281C

Adapters

Including Options 006, 012, 013

Operating and  
Service Manual

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## Notice

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## Warranty

### Certification

*Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology (NIST, formerly NBS), to the extent allowed by the Institute's calibration facility, and to the calibration facilities of other International Standards Organization members.*

### Warranty

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Warranty service for products installed by HP and certain other products designated by HP will be performed at Buyer's facility at no charge within HP service travel areas. Outside HP service travel areas, warranty service will be performed at Buyer's facility only upon HP's prior agreement and Buyer shall pay HP's round trip travel expenses. In all other areas, products must be returned to a service facility designated by HP.

For products returned to HP for warranty service, Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country.

HP warrants that its software and firmware designated by HP for use with an instrument will execute its programming instructions when properly installed on that instrument. HP does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error free.

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## **Assistance**

Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

For assistance, call your local Hewlett-Packard Sales and Service Office (refer to “Service and Support” on page v).

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## Service and Support

Any adjustment, maintenance, or repair of this product must be performed by qualified personnel. Contact your customer engineer through your local HP Service Center. You can find a list of HP Service Centers on the web at <http://www.hp.com/go/tmdir>.

If you do not have access to the Internet, one of these HP centers can direct you to your nearest HP representative:

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<b>United States:</b>	Hewlett-Packard Company Test and Measurement Call Center PO Box 4026 Englewood, CO 80155-4026 (800) 452 4844 (toll-free in US)
<b>Canada:</b>	Hewlett-Packard Canada Ltd. 5150 Spectrum Way Mississauga, Ontario L4W 5G1 (905) 206 4725
<b>Europe:</b>	Hewlett-Packard European Marketing Centre Postbox 999 1180 AZ Amstelveen The Netherlands (31 20) 547 9900
<b>Japan:</b>	Hewlett-Packard Ltd. Measurement Assistance Center 9-1, Takakura-Cho, Hachioji-Shi Tokyo 192, Japan (81) 426 56 7832 (81) 426 56 7840 (FAX)
<b>Latin America:</b>	Hewlett-Packard Latin American Region Headquarters 5200 Blue Lagoon Drive, 9th Floor Miami, Florida 33126, U.S.A. (305) 267 4245, (305) 267-4220 (305) 267 4288 (FAX)
<b>Australia/New Zealand:</b>	Hewlett-Packard Australia Ltd. 31-41 Joseph Street Blackburn, Victoria 3130 Australia 1 800 629 485 (Australia) 0800 738 378 (New Zealand) (61 3) 9210 5489 (FAX)
<b>Asia-Pacific:</b>	Hewlett-Packard Asia Pacific Ltd. 17-21/F Shell Tower, Times Square 1 Matheson Street, Causeway Bay Hong Kong (852) 2599 7777 (852) 2506 9285 (FAX)

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## Safety and Regulatory Information

Review this product and related documentation to familiarize yourself with safety markings and instructions before you operate the instrument. This product has been designed and tested in accordance with international standards.

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### WARNING

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The **WARNING** notice denotes a hazard. It calls attention to a procedure, practice, or the like, that, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a **WARNING** notice until the indicated conditions are fully understood and met.

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### CAUTION

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The **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.

## Instrument Markings

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	When you see this symbol on your instrument, you should refer to the instrument's instruction manual for important information.
	This symbol indicates hazardous voltages.
	The laser radiation symbol is marked on products that have a laser output.
	This symbol indicates that the instrument requires alternating current (ac) input.
	The CE mark is a registered trademark of the European Community. If it is accompanied by a year, it indicates the year the design was proven.
	The CSA mark is a registered trademark of the Canadian Standards Association.
1SM1-A	This text indicates that the instrument is an Industrial Scientific and Medical Group 1 Class A product (CISPER 11, Clause 4).
	This symbol indicates that the power line switch is ON.
	This symbol indicates that the power line switch is OFF or in STANDBY position.

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## General Information

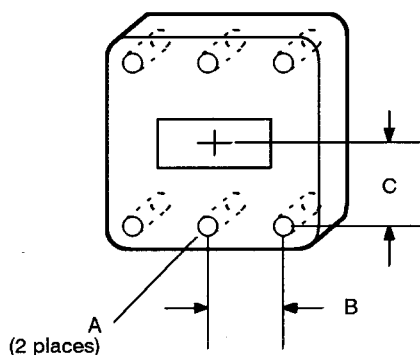
### Description

The HP X281C, P281C, and K281C adapters provide a convenient means of coupling between waveguide and coaxial systems. Power can be transmitted in either direction, and each adapter covers the full frequency range of its waveguide size. A step-like internal structure transforms the waveguide impedance to the 50  $\Omega$  impedance of the coaxial line.

**Option 006** Option 006 adds two alignment holes to the waveguide flange. The dimensions of the Option 006 alignment holes are provided in the following table.

**Table 1** *Option 006 Alignment Hole Measurement Dimensions*

Model Number	Alignment Hole Diameter "A"	Dimension "B"	Dimension "C"
X281C	3.175 mm (+ 0.014 to 0.0)	15.49 mm	16.26 mm
P281C	3.175 mm (+0.014 to 0.0)	12.62 mm	12.14 mm
K281C	2.381 mm (+0.014 to 0.0)	8.13 mm	8.51 mm



**Figure 1** *K281C Option 006 Waveguide Alignment Holes*

## General Information

**Option 012** Option 012 for the X281C and P281C offers a Type-N (m) connector to replace the standard 7-mm connector. Option 012 for the K281C replaces the APC-3.5 mm (f) connector with a APC-3.5 mm (m) connector.

**Option 013** Option 013 for the X281C and P281C offer a Type-N (f) connector to replace the standard 7-mm connector. Option 013 is not offered for the K281C.

## Instruments Covered by Manual

The adapters covered by this manual have a two part serial number. The first four digits and letter constitute the serial number prefix. The last five digits form the sequential suffix that is unique to each adapter. The contents of this manual apply to adapters prefixed at 3032A and above.

## Incoming Inspection

Inspect the shipping container for damage. Inspect the adapter for any mechanical damage incurred in transit. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness, and the adapter has been checked mechanically and electrically.

## Returning for Service

If you need to return the adapters for service, complete one of the blue repair tags located at the end of this manual and attach it to the device. If no repair tag is available, attach a tag indicating the type of service required, your return address, model number, and serial number of the adapter to be repaired.

Repackaging the adapter requires original shipping containers and materials or their equivalents. Hewlett-Packard can provide packaging materials identical to the original materials. To contact the Hewlett-Packard nearest you, refer to “Service and Support” on page v.

## Storage and Shipment Environment

Store the adapter in a clean, dry environment. The following environmental limitations apply to both storage and shipment.

Temperature	– 55 to 75 °C
Humidity	< 95% relative at + 40 °C
Altitude	< 15,000 meters (50,000 feet)



## Specifications

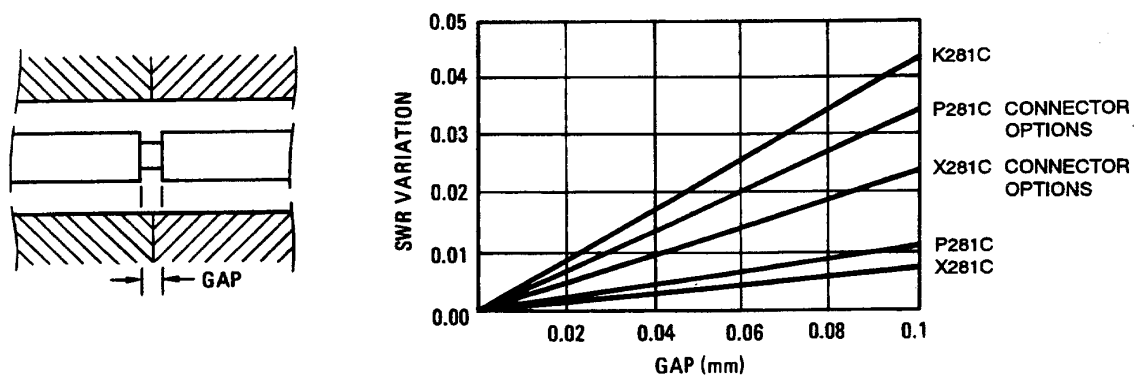
Specifications shown in Table 2 are the performance standards against which the adapter may be tested.

**Table 2** *Specifications*

	X281C	P281C	K281C
Frequency range (GHz)	8.2 to 12.4	12.4 to 18	18 to 26.5
SWR <sup>1</sup>	< 1.05	< 1.06	< 1.07
(Typical SWR)	(< 1.03)	(< 1.04)	(< 1.05)
Operating temperature	0 to +55 °C	0 to +55 °C	0 to +55 °C

1. Specifications in this table are measured with no gap between the full diameters of the male and female center conductors.

Figure 2 shows the variation in SWR introduced by the center conductor gap.



**Figure 2** *Typical SWR Variation Versus Center Conductor Gap*

## Specifications

Supplemental characteristics listed in Table 2 are non-warranted performance parameters that are included as additional information for the user.

**Table 3** *Supplemental Characteristics*

	HP X281C	HP P281C	HP K281C
Typical insertion loss	0.08 dB	0.10 dB	0.12 dB
Maximum peak power <sup>1</sup>	5 kW	2 kW	1 kW
Waveguide size:			
Nominal outer diameter	25.40 x 12.70 (mm)	17.83 x 9.93 (mm)	12.70 x 6.35 (mm)
	1.00 x 0.50 (in)	0.70 x 0.39 (in)	0.50 x 0.25 (in)
EIA	WR90	WR62	WR42
Equivalent flange type	UG-135/U	UG-419/U	UG-597/U
Dimensions: L x W x H	73 x 41 x 61 (mm)	52 x 33 x 55 (mm)	35 x 22 x 38 (mm)
	2.9 x 1.6 x 2.4 (in)	2.0 x 1.3 x 2.2 (in)	1.4 x 0.9 x 1.5 (in)
Net weight	210 g (7.20 oz)	110 g (4.0 oz)	40 g (1.3 oz)
Connector type:			
Standard	7-mm	7-mm	APC-3.5 mm female
Option 012	N-male	N-male	APC-3.5 mm male
Option 013	N-female	N-female	Not available

1. Determined on a theoretical basis but not tested.

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## Operation

Before connecting the adapter, note the precautions below.

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### CAUTION

- Exceeding the energy and power levels shown in Table 1 may result in damage to the adapter or associated equipment.
  - Care should be taken to protect the face of the flange from any damage that would prevent close surface-to-surface contact. Any burring, denting, or scratching may increase RF leakage and the reflection coefficient of the waveguide connection. The supplied plastic cover should be used to protect the flange when the adapter is not in use.
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### Operating Environment

Temperature	0 to 55 °C
Humidity	< 95% relative at + 40 °C
Altitude	< 4,600 meters (15,000 feet)

### Operating Procedures

When you connect an adapter to waveguide:

1. Make sure the rectangular ports are oriented the same way; that is, not “cross-guided”.
2. Align ports carefully to minimize reflections.
3. Clamp or bolt flanges securely together so that pressure is evenly distributed over the contacting surfaces. Loose waveguide connections and flange distortion may result in leakage and mismatch.

### Performance Test - SWR

The maximum SWR for the adapters are shown in Table 2 and Figure 2. When making these measurements, the test results must be less than those listed in Table 2 plus the measurement uncertainty of the measuring system. Measurement may be made using a standard reflectometer setup. To ensure satisfactory performance, make sure flanges and coaxial connectors are not damaged or worn.

### Adjustments

Adjustments should not be made unless the adapter does not meet specifications, or unless the unit has been physically damaged.

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## Service Information

### Replacing the Center Conductor Contact

Not all parts on the adapters are replaceable, but all of the adapters have a replaceable center conductor contact.

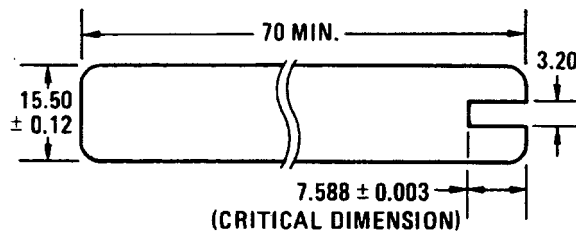
When you replace the center conductor contact, observe the following precautions:

- Before installing the new center conductor contact, apply Loctite sealant #222 to the threads of the center conductor.
- Do not use excessive force when tightening center conductor parts.

#### Model P281C Option 013 Only

To replace the center conductor contact in the HP P281C Option 013, you will need a 3/32 inch nut driver. It is also advisable to use a special alignment tool (HP part number 00281-20051) or a similar tool with dimensions as shown in Figure 3.

The alignment tool locates the center conductor pin accurately with respect to the inside end of the adapter. Otherwise the unit may not meet electrical specifications, and it may be necessary to alternately readjust and retest until specifications are met.



**CORNERS 2.0 R MINIMUM**  
**CHAMFER ALL EDGES 0.2 x 45°**  
**MATERIAL 1.0 mm TOOL STEEL**

**DIMENSIONS IN mm**

*Figure 3 HP P281C Option 013 Center Conductor Alignment Tool*

### Procedure

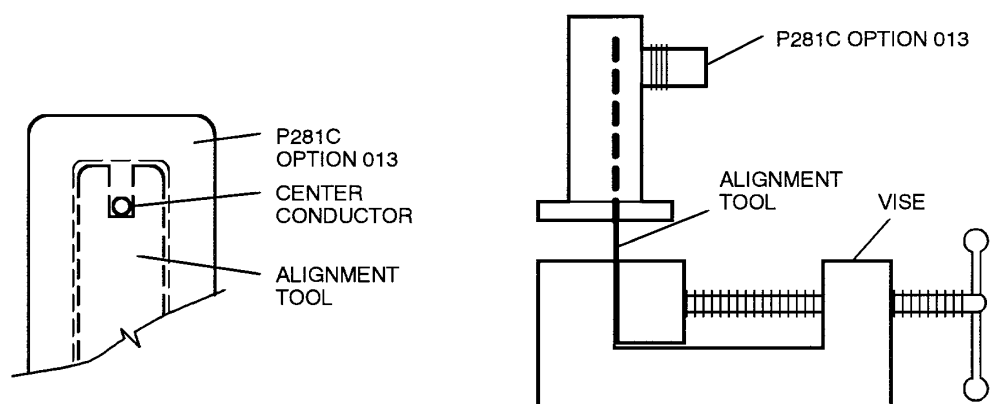
1. Place the alignment tool in a small vise, open-end up.
2. Slide the adapter over the tool with the flat side of the adapter against the tool.
3. While another person holds the adapter in place, ensure that the center conductor is against the end of the slot in the tool.
4. Tighten the center conductor nut with a 3/32 inch nut driver.

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**CAUTION**

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Do not use excessive force when tightening center conductor parts.



**Figure 4** HP P281C Option 013 Center Conductor Replacement

## Service Information

### Models K281C and K281C Option 012

To replace the center conductor, you will need a 5/64 inch hexagonal nut driver.

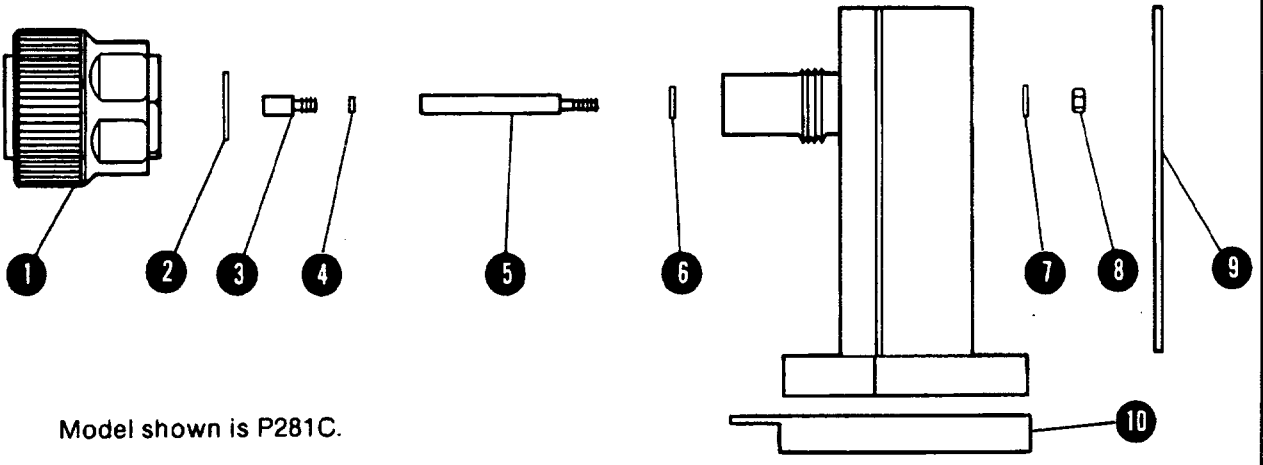
In some units, the center conductor mounting hole was made oversized to allow for a slight adjustment. When the center conductor is replaced in these units, it may be necessary to readjust and retest if the unit does not meet specifications.

If the mounting hole appears to be oversized, mount the center conductor toward one end of the adapter as far as it will go. If the adapter fails the performance test, move the center conductor toward the opposite end and then retest.

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## Replaceable Parts

Replaceable parts for HP P281C adapter are shown below. Refer to Table 4, Table 5, and Table 6 for identification of parts and corresponding part numbers for all models. For ordering information, contact the nearest Hewlett-Packard listed in "Service and Support" on page v.



Model shown is P281C.

**Figure 5** *Replaceable Parts*

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**NOTE**

Table 1 on page 1 gives dimensional tolerances for Option 006 that can be expected to yield satisfactory results. It may be necessary to try various combinations of spacers and shims to obtain proper dimensions. The use of at least one shim is recommended because of electro-chemical differences between the connector body and the adapter body. Refer to the appropriate table of replaceable parts for the thickness of shims and spacers.

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**CAUTION**

Take care to avoid damaging parts. Burring, scratching, denting or deforming parts may impair operating characteristics.

## Replaceable Parts

**Table 4 HP X281C Replaceable Parts**

Item No.	Description	HP Part Number
1	Connector body	1250-1466
2	Spacer	00281-20027 (0.05 mm)
	or	00281-20028 (0.075 mm)
	or	00281-20049 (0.025 mm)
3	Center conductor contact	
	G-slotted	85050-20001
	Collet holder	85130-20002
4	Shim	5020-8540 (0.013 mm)
	or	5020-8541 (0.025 mm)
5	Center conductor	Not replaceable
6	Spacer	Not replaceable
7	Washer	Not replaceable
8	Nut	Not replaceable
9	Blank label	Not replaceable
10	Flange cap	5040-0354
<b>HP X281C Option 012</b>		
1	Connector body	
	Male	1250-0916
	Nut	1250-0918
	Ring	1250-0016
2	Spacer	00281-20027 (0.05 mm)
	or	00281-20028 (0.075 mm)
	or	00281-20049 (0.025 mm)
3	Center conductor contact	5180-0988
4	Shim	5020-8540 (0.013 mm)
	or	5020-8541 (0.025 mm)
5	Center conductor	Not replaceable
6	Spacer	Not replaceable
7	Washer	Not replaceable
8	Nut	Not replaceable
9	Blank label	Not replaceable
10	Flange cap	5040-0354



**Table 4 HP X281C Replaceable Parts (Continued)**

Item No.	Description	HP Part Number
<b>HP X281C Option 013</b>		
1	Connector body	1250-0914
2	Spacer	00281-20027 (0.05 mm)
	or	00281-20028 (0.075 mm)
	or	00281-20049 (0.025 mm)
3	Center conductor contact	5180-0854
4	Shim	5020-8540 (0.013 mm)
	or	5020-8541 (0.025 mm)
5	Center conductor	Not replaceable
6	Spacer	Not replaceable
7	Washer	Not replaceable
8	Nut	Not replaceable
9	Blank label	Not replaceable
10	Flange cap	5040-0354

**Table 5 HP P281C Replaceable Parts**

Item No.	Description	HP Part Number
1	Connector body	1250-1466
2	Spacer	00281-20027 (0.05 mm)
	or	00281-20028 (0.075 mm)
	or	00281-20049 (0.025 mm)
3	Center conductor contact	
	G-slotted	85050-20001
	Collet holder	85130-20002
4	Shim	5020-8540 (0.013 mm)
	or	5020-8541 (0.025 mm)
5	Center conductor	Not replaceable
6	Spacer	Not replaceable
7	Washer	Not replaceable
8	Nut	Not replaceable
9	Blank label	Not replaceable
10	Flange cap	5040-0358

## Replaceable Parts

Item No.	Description	HP Part Number
<b>HP P281C Option 012</b>		
1	Connector body	
	Male	1250-0916
	Nut	1250-0918
	Ring	1250-0016
2	Spacer	00281-20027 (0.05 mm)
	or	00281-20028 (0.075 mm)
	or	00281-20049 (0.025 mm)
3	Center conductor contact	5180-0988
4	Shim	5020-8540 (0.013 mm)
	or	5020-8541 (0.025 mm)
5	Center conductor	Not replaceable
6	Spacer	Not replaceable
7	Washer	Not replaceable
8	Nut	Not replaceable
9	Blank label	Not replaceable
10	Flange cap	5040-0358
<b>HP P281C Option 013</b>		
1	Connector body	1250-0914
2	Spacer	00281-20027 (0.050 mm)
	or	00281-20028 (0.075 mm)
	or	00281-20049 (0.025 mm)
3	Center conductor contact	00281-20050
6	Spacer	00281-20029
7	Washer	3050-0965
8	Nut	0608-0001
9	Blank label	Not replaceable
10	Flange cap	5040-0358
<b>Needed But Not Supplied</b>		
	Alignment tool	00281-20051
	3/32 inch nut driver	

**Table 6 HP K281C Replaceable Parts**

<b>Item No.</b>	<b>Description</b>	<b>HP Part Number</b>
1	Connector body	1250-1507
2	Spacer	5021-9679 (0.013 mm)
	or	5021-9680 (0.025 mm)
	or	5021-9681 (0.051 mm)
3	Center conductor contact	00281-20043
6	Spacer	000281-20045
7	Washer	3050-0261
8	Nut	0608-0003
9	Blank label	Not replaceable
10	Flange cap	5040-0357
<b>Needed But Not Supplied</b>		
5/64 inch hexagonal nut driver		
<b>HP K218C Option 012</b>		
1	Connector body	1250-1509
2	Spacer	5021-9679 (0.013 mm)
	or	5021-9680 (0.025 mm)
	or	5021-9681 (0.051 mm)
3	Center conductor contact	00281-20044
6	Spacer	000281-20045
7	Washer	3050-0261
8	Nut	0608-0003
9	Blank label	Not replaceable
10	Flange cap	5040-0357
<b>Needed But Not Supplied</b>		
5/64 inch hexagonal nut driver		
<b>Miscellaneous Items</b>		
	Loctite #222	0470-0573
	Operating and Service Manual	00281-90043

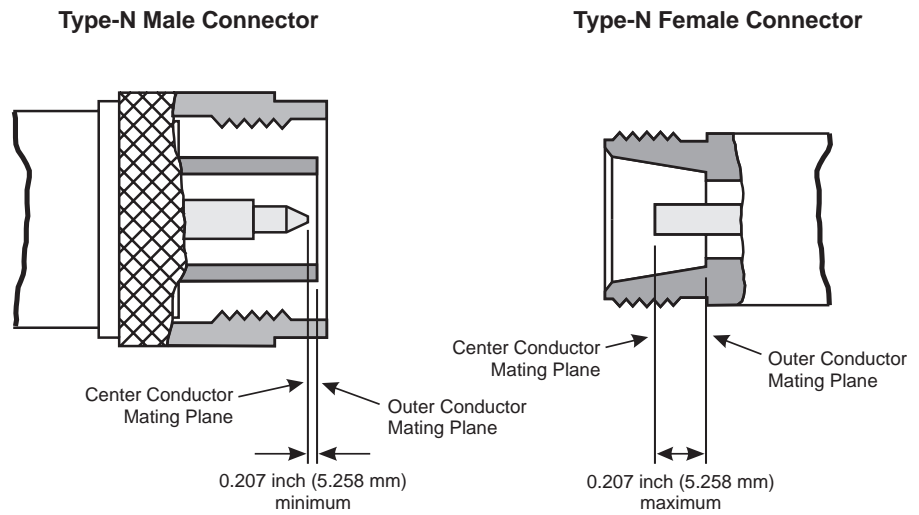
## Connector Types

Pin depth is the distance that the center conductor mating plane differs from being flush with the outer conductor mating plane. The pin depth of a connector can be in one of two states, protruding or recessed.

Figure 6, Figure 7, and Figure 8 show a visual representation of proper pin depth for connector types for standard and option models.

**Table 7** *Connector Types for Standard and Options*

	HP X281C	HP P281C	HP K281C
Standard	7-mm	7-mm	APC-3.5 mm female
Option 012	N-male	N-male	APC-3.5 mm male
Option 013	N-female	N-female	Not available



**Figure 6** *Type-N Connectors*

3.5-mm Male Connector

3.5-mm Female Connector

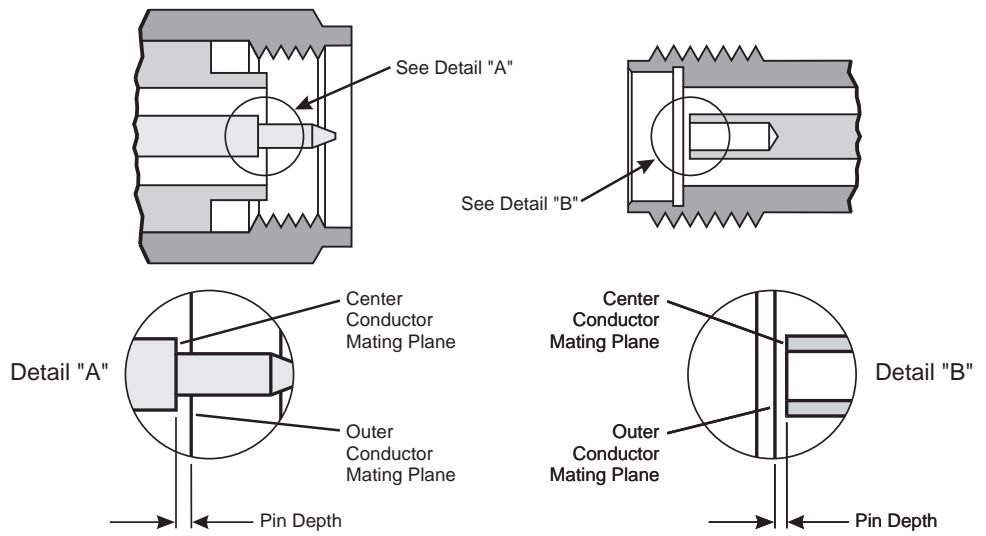


Figure 7 3.5-mm Connectors

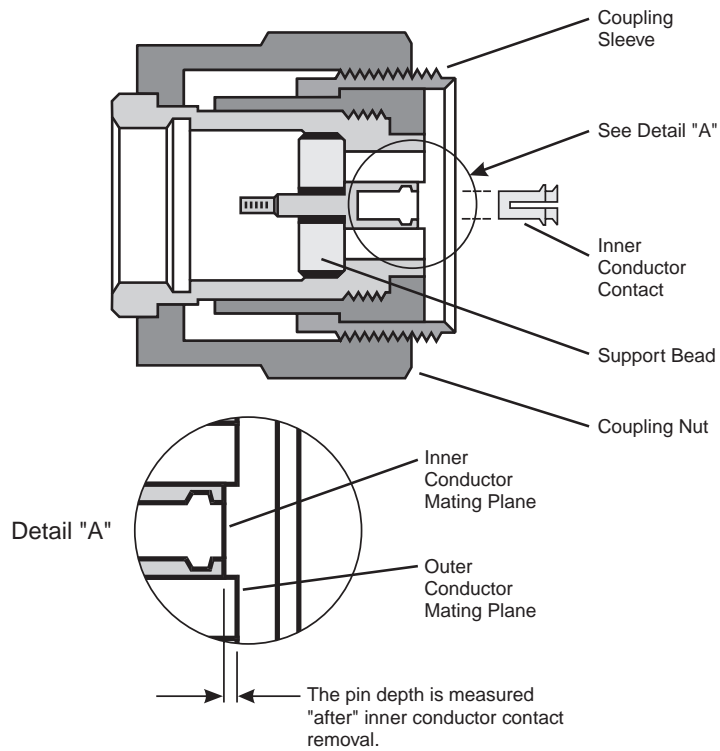


Figure 8 7-mm Connector

## Connector Types