Preinstallation Guide

Agilent 41000 Integrated Parametric Analysis & Characterization Environment (iPACE)

Preliminary Edition

Agilent Technologies

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September 2004

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Audience

This manual is intended for customers who purchase the Agilent 41000 iPACE. Agilent application engineer (AE) may also refer to this manual during site preparation consultation.

Printing History

The printing date and publication number indicate the current edition. The printing date changes when a new edition is printed. (Minor corrections and updates, which are incorporated at reprint, do not require a date change.) The publication number is updated when extensive technical changes are incorporated.

Preliminary Edition September 2004

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Contents

1 General Information

This manual contains Agilent 41000 integrated parametric analysis & characterization environment (iPACE) preinstallation information and is the primary reference document to assist you in installation planning and site preparation.

This manual consists of the following chapters.

Chapter 1 , “General Information.” briefly describes the Agilent 41000 iPACE configuration, explains several important preinstallation considerations, and provides a brief start-to-finish system installation overview.

Chapter 2 , “Site Preparation.” describes system layout instructions, explains power and environmental considerations, and describes important safety precautions.

Chapter 3 , “Wafer Probers and Connection with Probe Card I/F.” outlines wafer prober requirements and considerations.

41000 series iPACE Configuration

Figure 1-1 shows the 41000 series iPACE overview.

Figure 1-1 41000 series iPACE overview

The 41000 series iPACE consists of the following:

System cabinet	For model 300, the system cabinet contains the 4156C semiconductor parameter analyzer, or E5270B parametric measurement solution as analyzer, and B2200A and B2210A fA leakage switch mainframe. Also, 41501B expander box for 4156C and 4284A precision LCR meter are available as optional. For model 400, the system cabinet contains the 4155C/4156C semiconductor parameter analyzer, or E5270B parametric measurement solution as analyzer, and B2201A 14ch low leakage switch mainframe. Also, 41501B expander box for 4155C/4156C and 4284A precision LCR meter are available as optional. The system cabinet is 1.6 m (5.3 ft.) high. The standard cabinet has an emergency off (EMO) unit.
probe card interface	To test devices on a wafer, the B2220A probe card interface can be mounted on an automatic or semi-automatic wafer prober.
System controller	I/CV or I/CV Lite, Windows laptop PC are available as optional.

Installation Overview

This section provides a brief start-to-finish system installation overview.

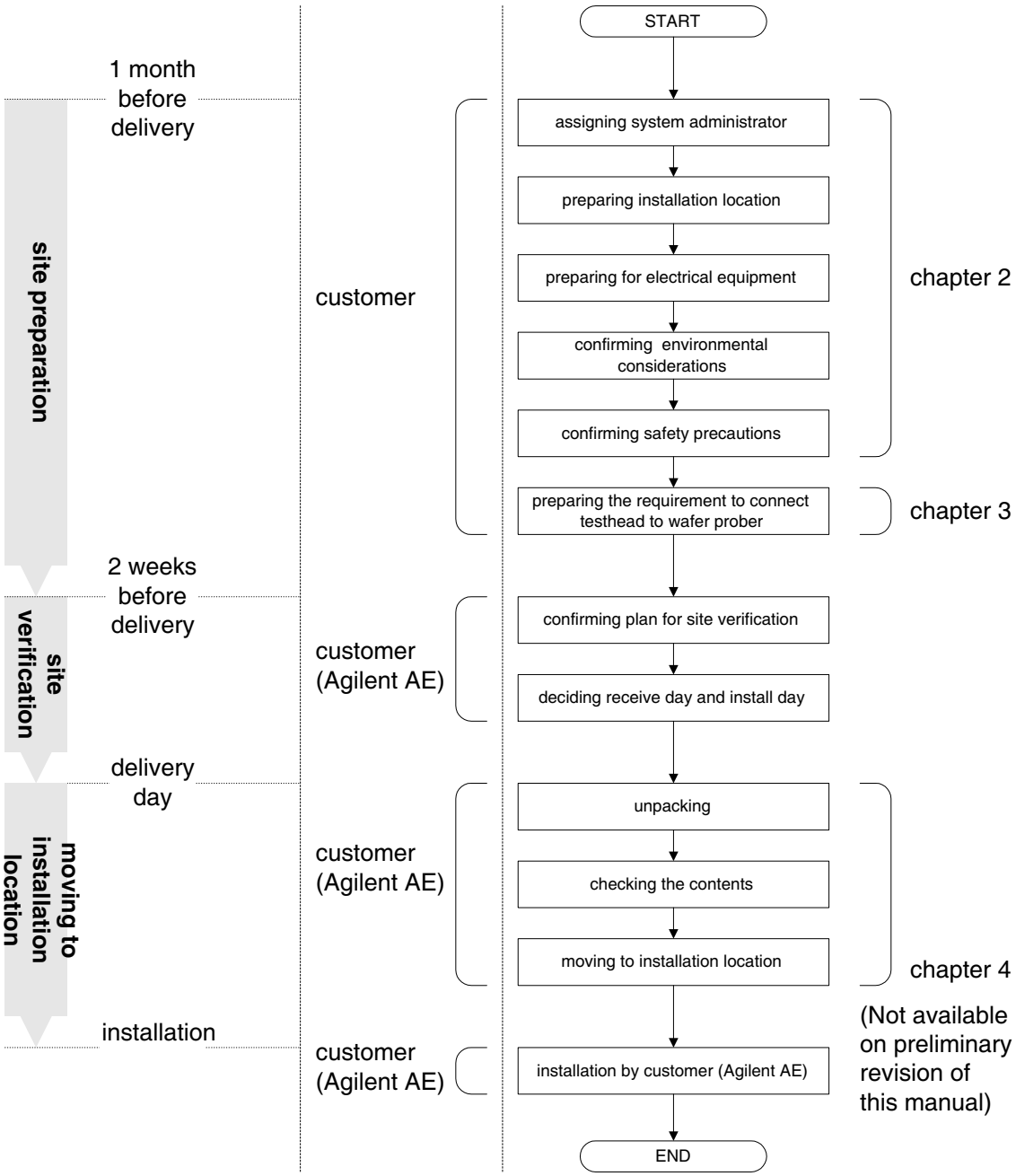
NOTE If the steps described in this document are not completed prior to the system installation date, the Agilent application engineer (AE) may not be able to install the tester.

The checklist in Chapter 2 , “Site Preparation.” is available.

NOTE Special codes and regulations covering the installation of the test system may apply in your area. It is the customer’s responsibility to ensure that all local laws, regulations, and codes for buildings, machinery, and electrical distribution systems are complied with before the system arrives.

NOTE The customer should appoint a principal operator or system manager. This person will be responsible for operating the 41000 series iPACE, performing operator maintenance when necessary, and scheduling periodic maintenance. The principal operator’s initial responsibilities are to establish and monitor site preparation schedules, and to order system supplies. The principal operator must be present for the system installation.

Figure 1-2 Flowchart for preinstallation



2 Site Preparation

Installation Site Requirements

This chapter describes the following:

- Space requirements
- Other requirements

Space requirements

The amount of floor space required for your Agilent 41000 series iPACE can be quickly and accurately determined by using the System Component Template and blank grid sheets provided in “Example of 41000 series iPACE layout”. The template and grid sheets are scaled so that each square on the grid sheet represents 20 cm × 20 cm = 400 cm^2 (approximately 0.43 ft^2) of floor space.

From the system component template sheet of Figure 2-2, simply cut out the components included with your system, then place the cutouts on the grid sheet of Figure 2-4 to determine the best layout for your 41000 series iPACE.

Keep the following points in mind when selecting the system location and performing the final site layout.

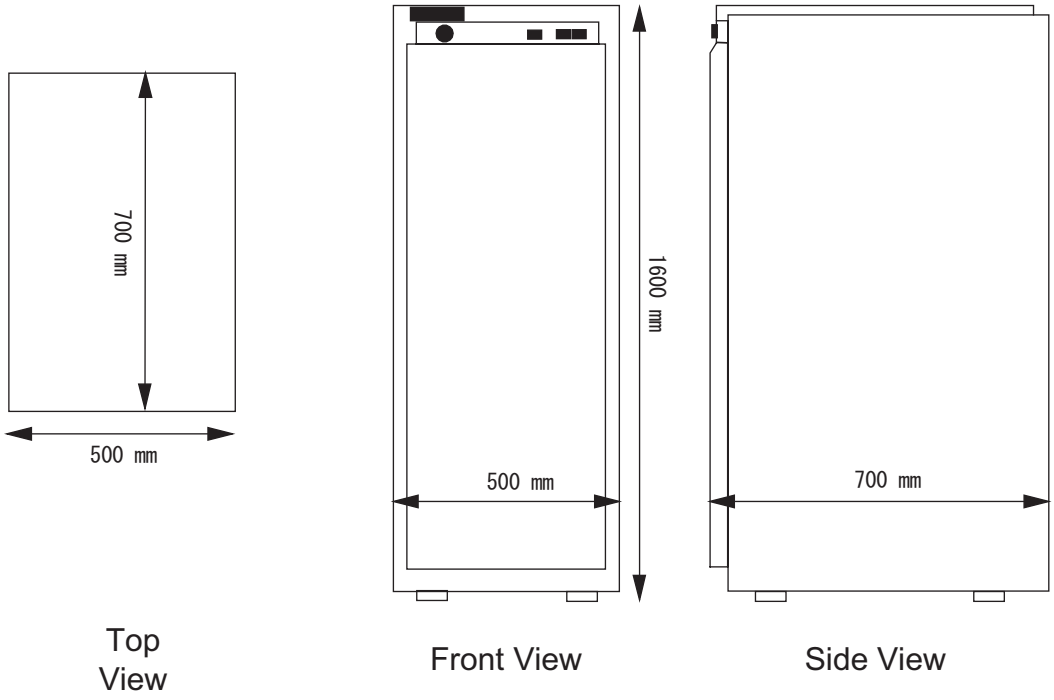
- Provide adequate space for the wafer prober. Position the wafer prober 1 meter (3.3 ft.) or less from the tester so the signal cables can be connected from the system cabinet to the testhead. Table 2-1 shows the cable lengths from the system cabinet to probe card I/F.

Table 2-1 Cable lengths from system cabinet to probe card I/F

Cable	Length from system cabinet bottom
Interlock cable (analyzer - probe card I/F)	5 m (16.4 ft.)
GNDU cable (analyzer - probe card I/F)	5 m (16.4 ft.)
Kelvin triaxial cable (B220x - probe card I/F)	4 m (13.1 ft.)

- Provide at least 0.6 meter (24 in) of clearance at the front and rear of the system cabinet to allow space for servicing. Agilent Technologies recommends 1 meter (39 in) of space for servicing.
- Make sure there is adequate workspace around the system so that operating personnel can move freely, without affecting system operation.
- To ensure adequate clearance for the system, check all doors, elevators, and passageways that the tester will use on the way to the installation site. See Figure 2-1 for the dimensions of the system cabinet.

Figure 2-1 System cabinet dimensions



Other requirements

The site requires the following environment.

Floor

Requirements for the site floor are as follows.

- Verify the load capacity of the floor at the installation site and all floors on the way to the site. All floors must have a minimum load capacity of 21 kg/cm^2 (300 lbs/in^2).
- Make sure that tile, concrete, or other industrial floors are adequate for the system site. Use a special wiring arrangement, or provide conduits or some type of protection for exposed power and signal cables.
- Use an antistatic rubber mat.

Table

Plan for a table to be placed next to the prober, to hold the probe card interface during servicing. The table must be able to bear the weight of the probe card interface (approximately 15 kg)

Lighting

Provide sufficient lighting for optimum visibility of lighted indicators, the display, and the keyboard of the system controller. Arrange lighting so that reflected light does not make it difficult to read displayed characters. Also, the system, and especially the software media, must not be exposed to direct sunlight.

Software media storage

Purchase a fireproof cabinet or locker for storing important items, such as documents and software media

Software media such as CD-ROM should be stored in an environment similar to that of the 41000 series iPACE. Extreme temperature or humidity changes, which may alter the size of a disk, must be avoided. Do not place the software media in or near magnetic fields.

Telephone

Install a telephone with an extra-long receiver cord, to allow the operator easy access to any part of the system while on the phone.

Network service

If the system controller is to be connected with a network, a network service and LAN cable are necessary. Choose a long LAN cable that can connect with the system controller. Also, prepare the IP address and hostname before the tester installation.

Label for emergency off switch

Install the 41000 series iPACE to enable easy access to the main breaker or switch and adhere conspicuous labels so that the operator will be able to cut the main power quickly in an emergency.

Example of 41000 series iPACE layout

Figure 2-2 provides a system component template sheet to make it easy for you to arrange your system and decide upon the best layout. Simply cut out, from the template sheet, the system components furnished with your Agilent 41000 series iPACE, and arrange them on the blank grid sheet provided in Figure 2-4**.**

Figure 2-3 shows an example of a 41000 series iPACE layout.

Figure 2-4 provides a blank grid sheet for use in conjunction with the system component templates provided in Figure 2-2, One square represents 20 cm by 20 cm (approximately 0.43 ft^2).

Figure 2-2 System component template sheet

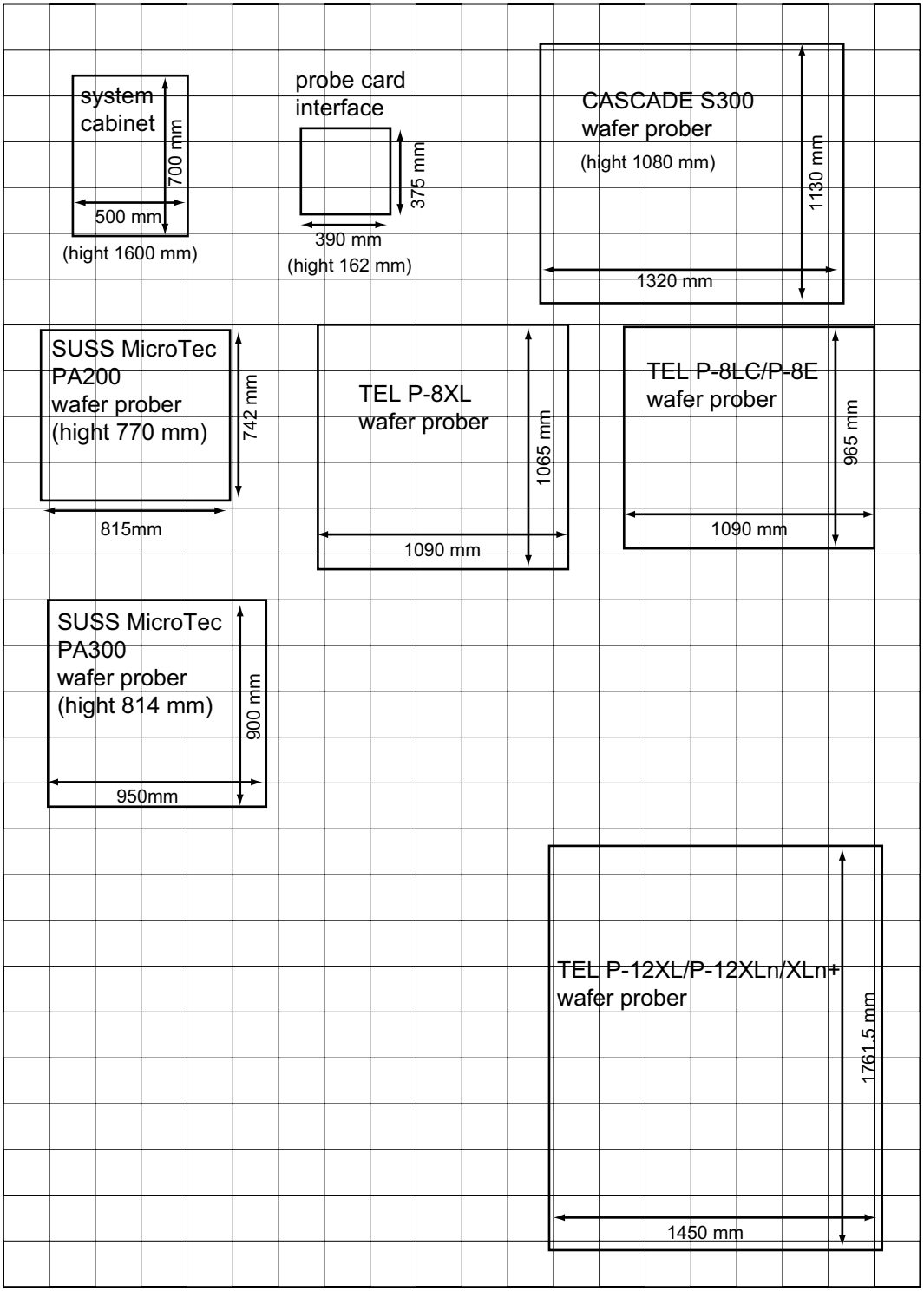


Figure 2-3 Example of 41000 series iPACE layout

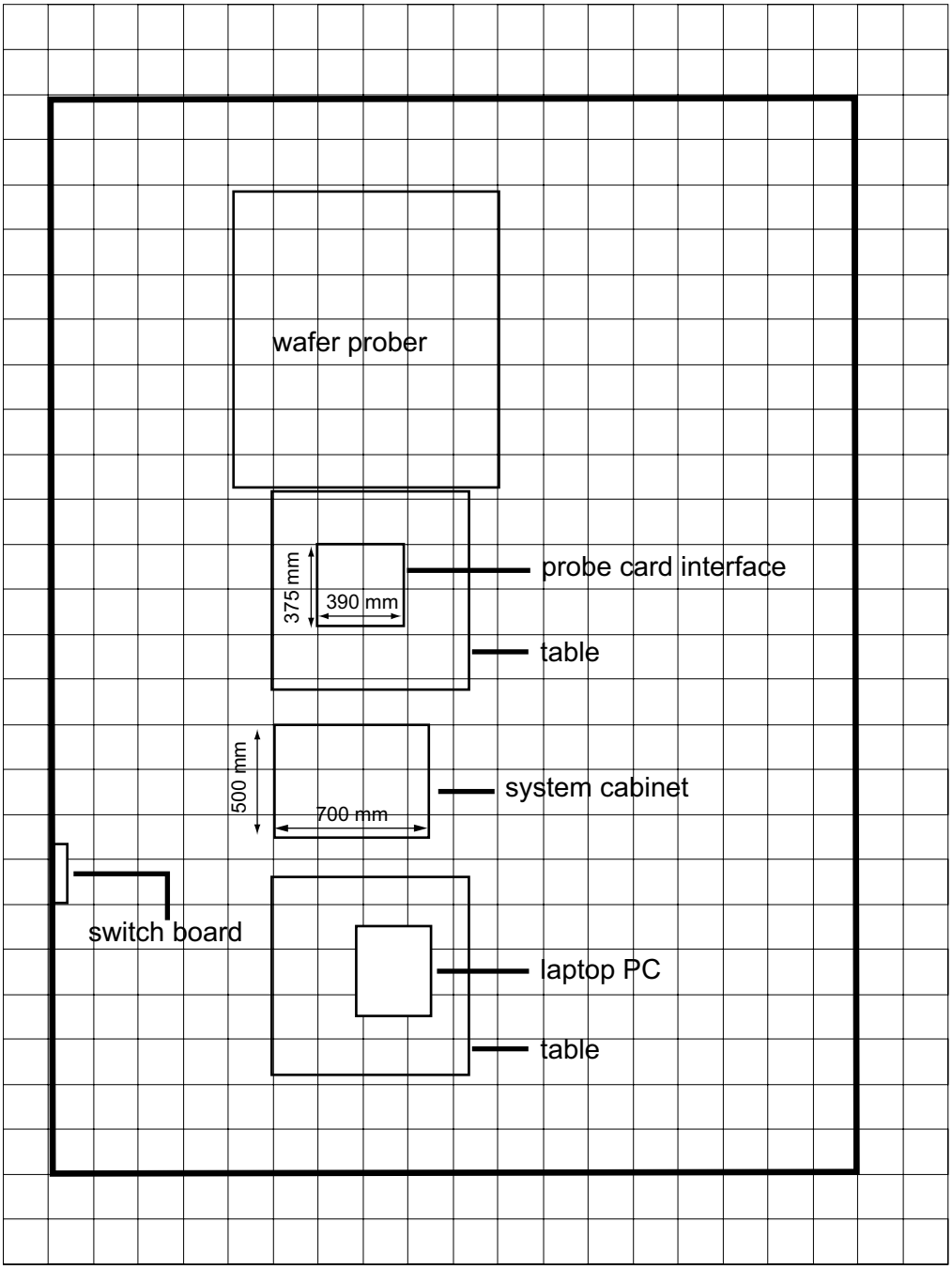
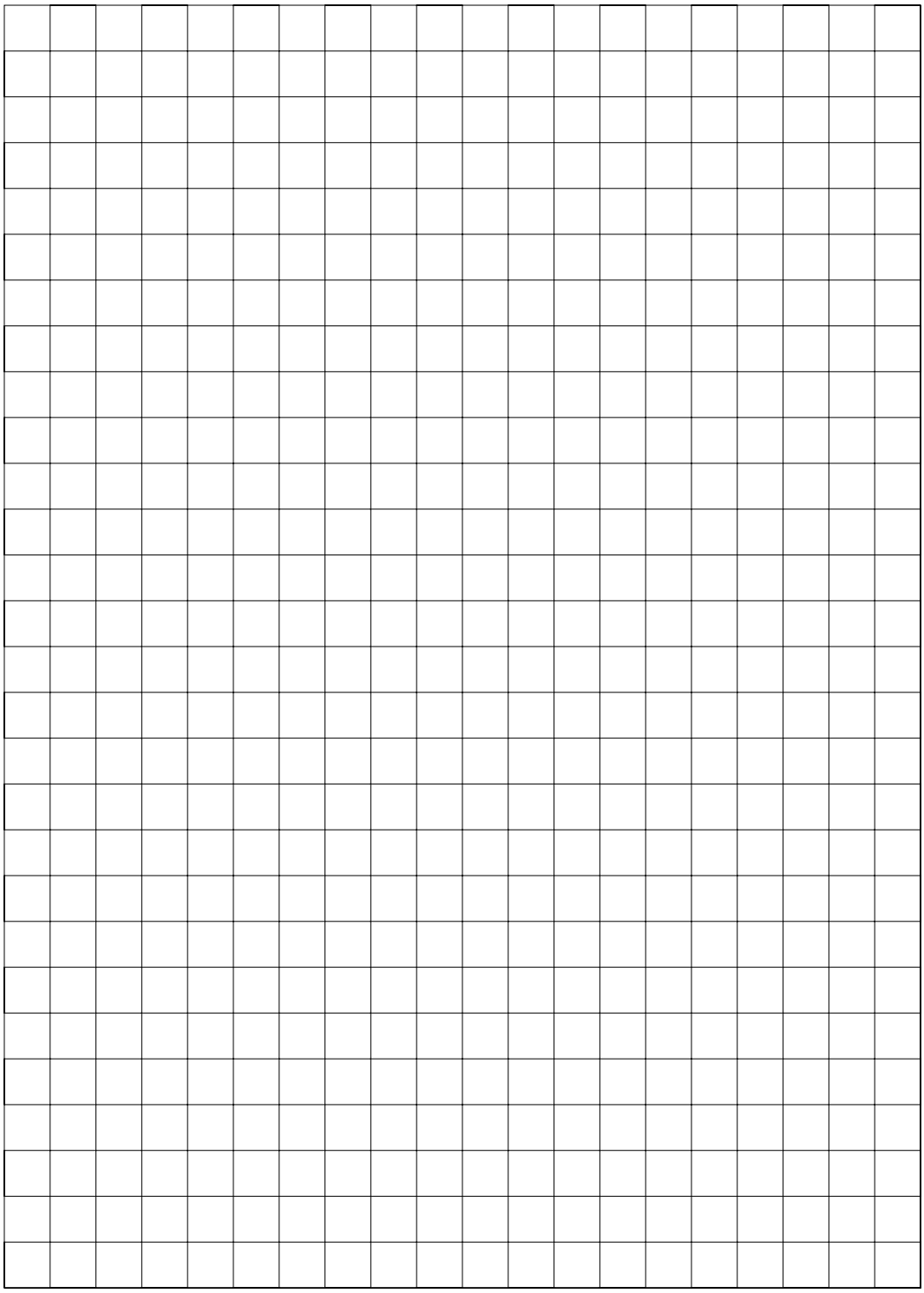


Figure 2-4 Grid sheet



Electrical Requirements

This section describes electrical requirements for the 41000 series iPACE instruments, system controller, and peripherals.

Power configurations and requirements

The 41000 series iPACE requires single phase power configuration with protective earth. Its line voltage is 100, 120, 220, or 240 V_{AC}, and line frequency is 50 or 60 Hz. The line voltage and frequency are selected by specifying options.

The system cabinet for the 41000 series iPACE is equipped with a power distribution unit (PDU) for each line voltage. Actually, selectable PDU are 100/120 V or 220/240 V. The rated current of the PDU is 15 A for 100 V_{AC}, 20 A for 100/120 V_{AC}, and 10 A for 220/240 V_{AC}.

The site installation location must satisfy the power requirements described in table 2-2. If the line voltage is too low or too high, sporadic failures or complete system shutdown may occur. For example, if you install the 41000 series iPACE with a line voltage of 200 V_{AC} and a line frequency of 60 Hz, the electric power must satisfy the line voltage range of 180 to 220 V_{AC}, at least 10 A, and a line frequency range of 48 to 63 Hz.

Table 2-2 Power requirements for 41000 series iPACE

Normal line voltage[a]	Allowable voltage range	Rated current
AC 100 V	AC 100 ± 10%	15 A
AC 100/120 V	AC 100/120 ± 10%	20 A
AC 200/220 V	AC 220/240 ± 10%	10 A

a. Line frequency must be 48 to 63 Hz.

NOTE Agilent Technologies recommends that the following line voltage conditions be satisfied for measuring low-current and low-voltage with the 41000 series iPACE:

Burst Noise: ≤ 1 kV (for earth, line, and neutral)

Surge Noise: ≤ 1 kV (for common and normal modes)

Agilent Technologies recommends that if the conditions above cannot be met, the tester should use the noise cut trans.

This line voltage environment conforms to EN61326-1.

Grounding

The system cabinet, and all computer peripherals are grounded through the three-wire power cable grounding wire. Earth grounding protects the operator against shock hazards and protects the system components against catastrophic events, such as lightning.

Also, all system components must have a common ground reference that is electrically isolated from any non-system equipment owing to the interfaces between the system controller, system instruments, and computer peripherals. Otherwise, signals generated by non-system equipment could cause system errors.

WARNING **To protect operators from electric shock injury due to current leakage, a grounding connection is essential before connecting the power supply. When you connect the system to the power supply, connect the grounding wire before connecting other power wires.**

Power line transients

Heavy electrical loads from nearby machinery or equipment, for example, elevators or electric welders, can cause intermittent system errors, even if that equipment is on a different circuit breaker. To prevent this, you must provide a separate, completely independent circuit with isolated ground and circuit breaker coming directly from the main power source of the building.

NOTE Agilent Technologies does not recommend installing printers or plotters close to the 41000 series iPACE. When the electrical motors in these peripherals begin operating and their electric consumption increases, noise from the print head or pen movement may cause system errors.

Power consumption of 41000 series iPACE instruments

Now under testing. This will be updated in the official revision of preinstallation guide.

Table 2-3 Power consumption of iPACE system instruments (TBD in next revision.)

Component	Line voltage			
	AC 100 V	AC 120 V	AC 220 V	AC 240 V
4155C				
4156C				
E5270B				
B2200A				
B2201A				
B2220A				
41501B				
4284A				

Additional power outlets

To provide power for PC Controller, test/maintenance equipment and other equipment not included in the system, install additional power outlets (two power outlets, 15 A) at the site. Show the locations of all additional power outlets on your site layout drawing and include their potential load in your calculation for total site power. Additional power outlets must be supplied with grounding circuits intact and must be used when connecting additional equipment.

NOTE You need additional power outlets for PC Controller, or power cable for PDU outlet.

Environmental Considerations

To ensure optimum 41000 series iPACE accuracy and performance, be sure to comply with the following environmental conditions.

Temperature and humidity

The measurement accuracy is specified at the following temperature and humidity:

Temperature: 23 °C ± 5 °C (73 °F ± 9 °F)

Humidity: ≤ 60% RH

NOTE

In addition to the above temperature and humidity conditions, Agilent Technologies recommends that the following conditions be satisfied for measuring low-current and low-voltage with the 41000 series iPACE:

Temperature change:	Within ± 1 °C after the calibration
Temperature change period:	≥ 10 minutes
Humidity:	≤ 50%

Floor vibration

In addition to the conditions described in “Temperature and humidity”, Agilent Technologies recommends that the following vibration conditions should be satisfied for measuring low-current and low-voltage with the 41000 series iPACE:

Floor vibration: ≤ 1 mG

Floor vibration transmission frequency: ≥ 10 Hz

Air cleanliness

Your 41000 series iPACE must be located in an area where the air purity meets or exceeds class 100,000 standards. Also, to ensure trouble-free disk and disk drive operation, system controller peripherals should be located in an environment of similar air purity.

NOTE Agilent Technologies recommends that the following air cleanliness condition should be satisfied for measuring low-current and low-voltage with the 41000 series iPACE:

Air cleanliness: < class 10,000

Safety Precautions

To maintain safe operating conditions for the 41000 series iPACE, observe the following earthquake, fire, electrical, and chemical safety precautions.

Fire

General cleanliness of the work area and system equipment is essential for preventing electrical fires. Only keep paper materials that are required for efficient operation in your operating area. Store extra paper in an adjacent area. Do not allow wastepaper to accumulate, and use metal wastebaskets. Store cleaning fluids, especially those in aerosol cans, in a separate area when not in use.

All printed-circuit boards in the 41000 series iPACE are manufactured from flame-retardant materials that are self-extinguishing and represent a minimal fire hazard. Be sure, however, to observe normal fire precautions within the operating area.

Chemicals

Normally, cleaning solvents or compounds used for repair are the only chemicals at a system site that require careful handling. Provide adequate ventilation to prevent accumulation of fumes if the particular chemical being used can produce harmful vapors under any conditions.

Volatile liquids, such as insulating varnish, lacquer, and turpentine are dangerous when used near energized electrical or electronic equipment because of the danger of igniting the fumes. Do not stock alcohol or carbon tetrachloride as cleaning agents.

Emergency Off (EMO) System

The system cabinet is equipped with an emergency off (EMO) unit. When you press the EMO switch, the main contactor and emergency breaker in the power distribution unit (PDU) of the system cabinet opens and stops supplying electrical power to the system components.

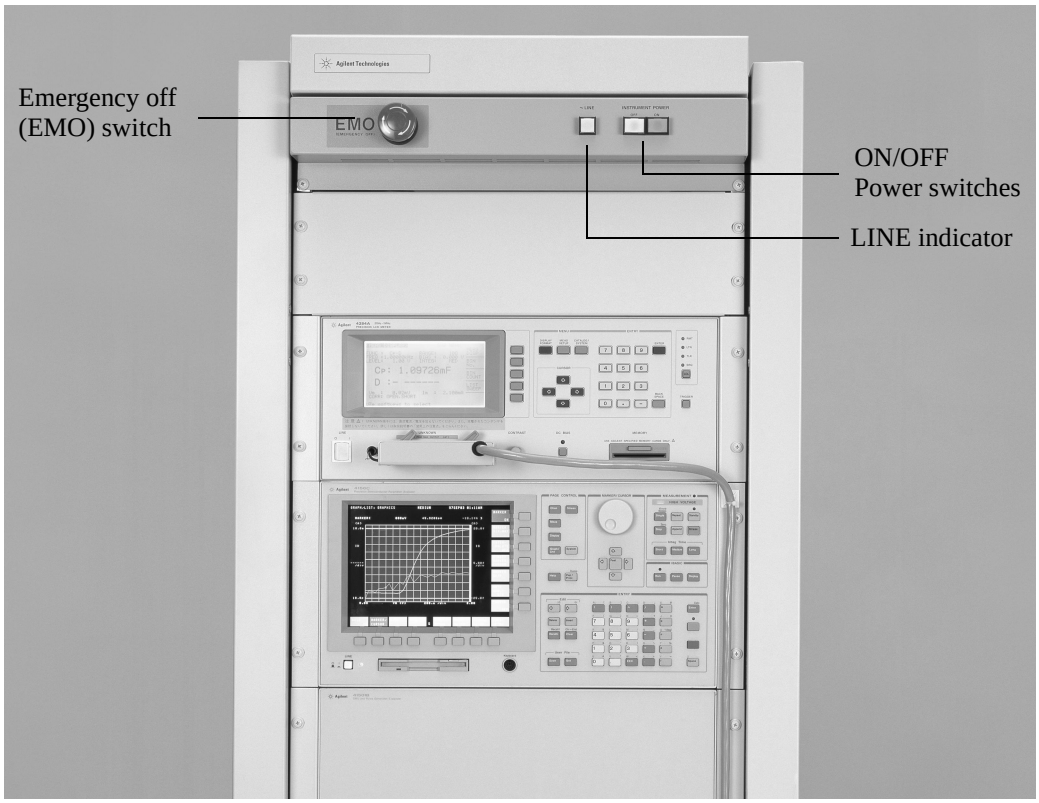
The EMO unit can also receive an emergency signal from another instrument or system, and can stop supplying electric power to the system components. In addition, it can transfer an emergency signal to any other instruments or systems.

If you configure the EMO system with a 41000 series iPACE, you must understand the EMO unit before connecting it to other systems. Included are:

- Circuit diagram and its operation for the EMO switch and power distribution unit.
- I/O interface (external in/out terminals) specifications for the PDU.
- Example design for an external emergency lamp.

The 41000 series iPACE with a system cabinet has an emergency off (EMO) switch at the top of the cabinet, as shown in Figure 2-5. The emergency off switch is a red, circular push-switch labeled “EMO.” Pushing the EMO switch stops the power to the system instruments. After the EMO switch is pushed, the switch is locked in the pushed condition. To release the locked EMO switch, turn the switch clockwise.

Figure 2-5 Emergency off (EMO) switch on system cabinet



Switch and EMO Operation

- **Turning on system**

  Switching on the main breaker, the emergency breaker, and the main switch turns on the LINE indicator. When the system switch closes, power is supplied to the PC controller. When the EMO panel ON switch closes, the main contactor switch closes. The ON indicator (green) also turns on. Power is then supplied to the system instruments.

- **Turning off system instrument**

  Pressing the EMO panel OFF switch stops the power for system instruments. But power is supplied to the PC controller.

- **EMO switch**

  When the EMO switch is pressed, the power to both the system instruments and PC controller stops.

  At the same time, the Ext alarm 1, which is normally in the closed state, is opened, and the Ext alarm 2, which is normally in the open state, is closed.

  Opening the Ext control terminal is the same as pressing the EMO switch. This also stops power to the system controller.

  Table 2-4 describes conditions for normal operation.

Table 2-4 Conditions for normal operation

<table>
<tr><th rowspan="2">Operation</th><th colspan="4">Results</th></tr>
<tr><th>Power for PC controller</th><th>Power for system instruments</th><th>Ext. alarm 1 (NC) [a]</th><th>Ext. alarm 2 (NO) [b]</th></tr>
<tr><td>Disconnect device is ON</td><td>not supply</td><td rowspan="2">not supply</td><td>Open</td><td>Close</td></tr>
<tr><td>Pressing system switch</td><td rowspan="4">supply</td><td rowspan="3">Close</td><td rowspan="3">Open</td></tr>
<tr><td>Pressing ON switch</td><td>supply</td></tr>
<tr><td>pressing OFF switch</td><td rowspan="2">Stop</td></tr>
<tr><td>Opening Remote Ctrl</td></tr>
<tr><td>Pressing EMO switch or opening Ext. control</td><td>Stop</td><td>Open</td><td>Close</td></tr>
</table>

a. NC (“Normally Closed”) indicates that the terminals are closed when the tester operates properly.
b. NO (“Normally Open”) indicates that the terminals are open when the tester operates properly.

I/O specifications

There are five I/O interface points in the power distribution unit (PDU). The I/O specifications for these interfaces are as follows:

Power outlets for 100/120 V PDU	Total current: 10A x 2 system + 5A outlet x 3 for PC
Power outlets for 220/240 V PDU	Total current: 10 A x 1 system + 5A outlet x 3 for PC
Power outlets for 100V PDU	Total current: 7.5 A x 2 system + 5A outlet x 3 for PC
Remote control	Steady current: 8 mA at 24 V_{DC}
Ext alarm 1 and 2	Maximum current: 0.8 A at 24 V_{DC}

Example design of external emergency lamp

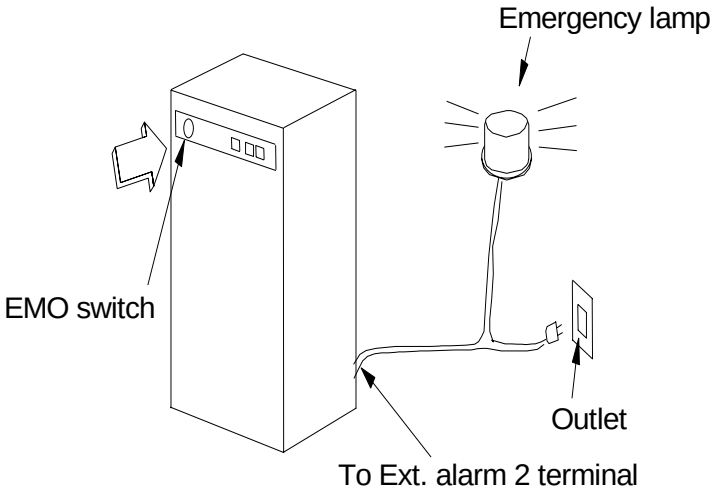
The procedure below describes how to implement an external lamp (using the External alarm terminals on the PDU) that turns on when the EMO switch is pressed.

Refer to Figure 2-6 and connect the Ext alarm 2 terminals (normally open) to an emergency lamp as follows:

1. Connect the NEUTRAL (or LINE) side of the power line outlet to a terminal of the emergency lamp.
2. Connect the LINE side of the power outlet to one terminal of the Ext alarm 2.
3. Connect the other terminal of the Ext alarm 2 to the other terminal of the emergency lamp.

Note that you must not use a power line outlet from the system cabinet because power to these outlets stops when the EMO switch is pressed.

Figure 2-6 Example design of external emergency lamp



Site Preparation Checklist

Table 2-5 provides a site preparation checklist. Check each planning item off as it is completed. If an item is not applicable to your situation, mark the item “N/A”.

Table 2-5 Site preparation checklist

Check	Item
Floor plan	
	Did you complete the layout for 41000 iPACE, prober, controller, table, and so on?
	Is the site suitably ventilated?
	Is the floor at the site suitably prepared?
	Did you provide a table for service and maintenance?
	Is the site suitably lit?
	Did you provide a place for storing software media?
	Did you install a telephone near the tester?
	Did you provide network port, network cable, IP address, and host name?
	Did you provide a lock for locking the main switch?
Electrical power	
	Did you confirm that voltage, frequency, and noise meet requirements? If not, have you initiated their preparation?
	Did you provide a main power cable from the switchboard to the main power supply?
	Did you prepare a power line for maintenance service?
Environmental considerations	
	Did you check the installation area for temperatures with relative humidities?
	Did you check the installation area for the floor vibration ≤ 1 mG and floor vibration transmission frequency ≥ 10 Hz? If some of the following apply to your site, Agilent Technologies recommends that you measure floor vibration. • The floor type is the access floor. • The floor is not durable enough for the 4070, prober, and other equipment installed at the installation site. • Something causing vibration is installed near the installation site.

Table 2-5 Site preparation checklist

Check	Item
	Did you check the installation area to ensure class 10,000 or better air cleanliness? If some of the following apply to your site, Agilent Technologies recommend that you check the air cleanliness using a particle counter. • Temperature, humidity, and cleanliness are not controlled. • The flooring material is carpet. • Outdoor air flows directly into the installation site. • You do not change clothes and shoes. • Items near the installation site are covered with dust.
	Did you provide proper air flow?
Upgrade	
	Did you prepare the proper power supply?
	Did you provide the required floor to upgrade?
Safety precautions	
	Did you prepare suitable metal fittings to attach the system cabinet?
	Did you keep general cleanliness of the work area and system equipment for preventing electrical fires?
	Did you check that volatile liquids, such as insulating varnish, lacquer, and turpentine have not been placed near the tester? (Those are dangerous when used near powered-up electrical and electronic equipment.)

3 Wafer Probers and Connection with Probe Card I/F

Wafer Probers

The Agilent 41000 series iPACE is typically used with a wafer prober as most of the devices under test (DUTs) are on a wafer. You can use automatic and semi-automatic wafer probers and manual wafer probers with the 41000 series iPACE.

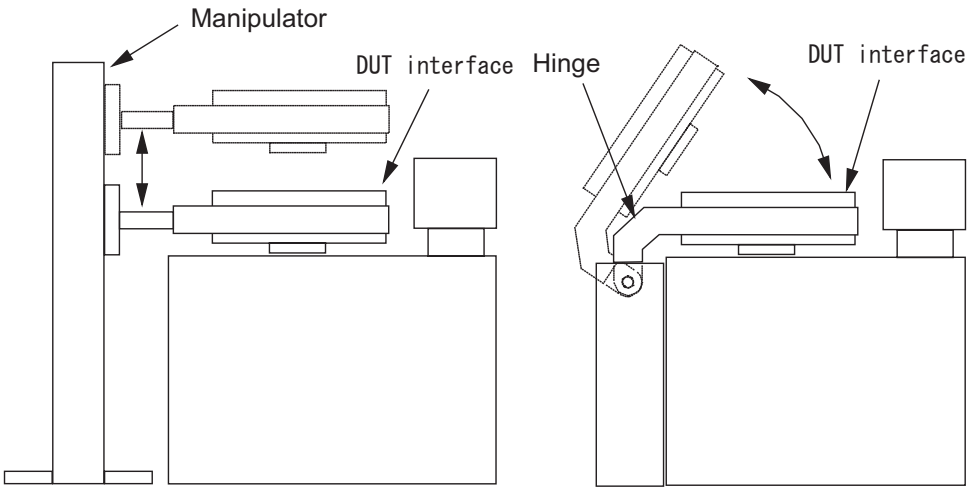
NOTE The wafer prober used with the 41000 series iPACE must be the low noise prober for the capacitance measurement. For the details, contact the wafer prober manufacturer.

Mounting probe card I/F on wafer prober

Most automatic or semi-automatic wafer probers have a mechanism to mount a probe card I/F using mounting hardware, such as a manipulator or hinges (clam shell type). Figure 3-1 shows an example of a wafer prober with the probe card I/F mounted using a manipulator.

Mounting mechanism

Figure 3-1 Mounting mechanism



For a manipulator-type mounting mechanism, the probe card I/F is attached to the arm of the manipulator. You just push the probe card I/F down on the wafer prober, and then fit it to the interface using the clamping mechanism.

For a hinge-type mounting mechanism, the probe card I/F is fixed to a hinge arm. You just rotate the hinge arm to put the probe card I/F on the wafer prober (this movement is similar to the clam shell), and then fit the probe card I/F to the interface using the clamping mechanism.

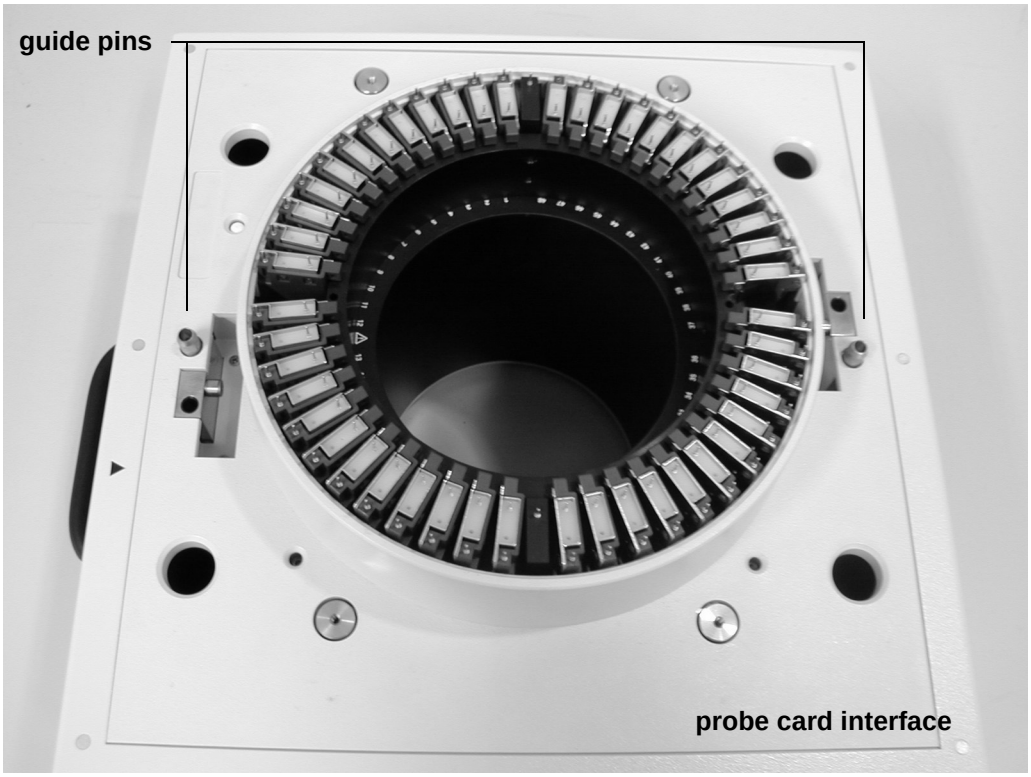
There are two guide pins on the probe card I/F, as shown in Figure 3-2. These pins are used to position the probe card I/F on the wafer prober correctly.

To assist you in mounting your probe card I/F on a wafer prober, Figure 3-3 shows the probe card I/F dimensions

for the 41000 series iPACE.

For details on how to mount a probe card I/F, contact the wafer prober manufacturer.

Figure 3-2 Guide pins on probe card I/F



Wafer prober sense switch

The 41000 series iPACE uses the wafer prober sense switch located on the bottom panel of the probe card I/F to ensure that the probe card I/F sets on the wafer prober properly.

The probe card I/F mounting hardware must be designed so that a part of the mounting hardware, such as a pin, pushes the wafer prober sense switch when the probe card I/F is set on the wafer prober.

See Figure 3-4 for the location of the wafer prober sense switch. The wafer prober sense switch is labeled “WAFER PROBER SENSE”.

Figure 3-3 Probe card interface (24 pin) dimensions (1 of 2)

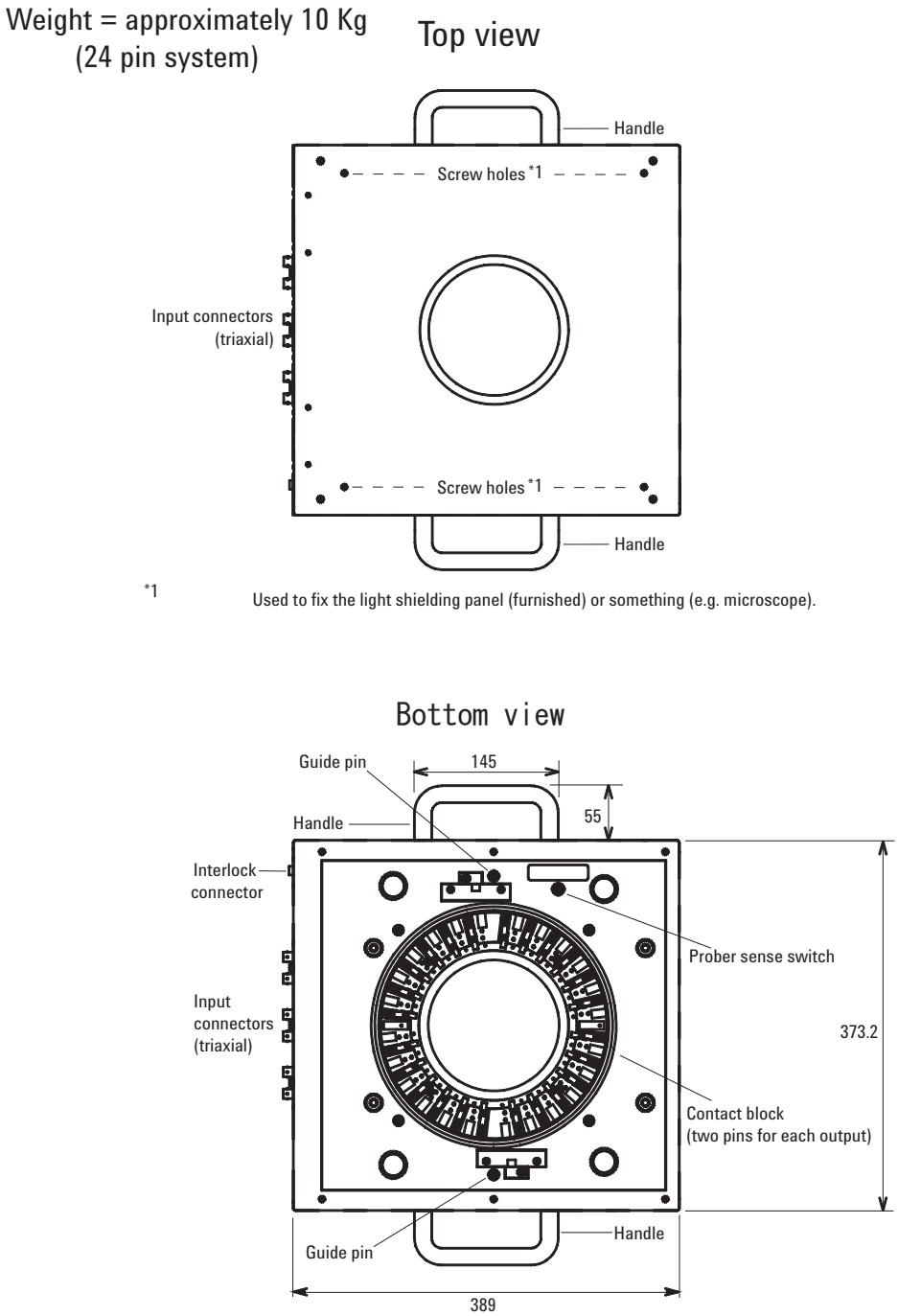
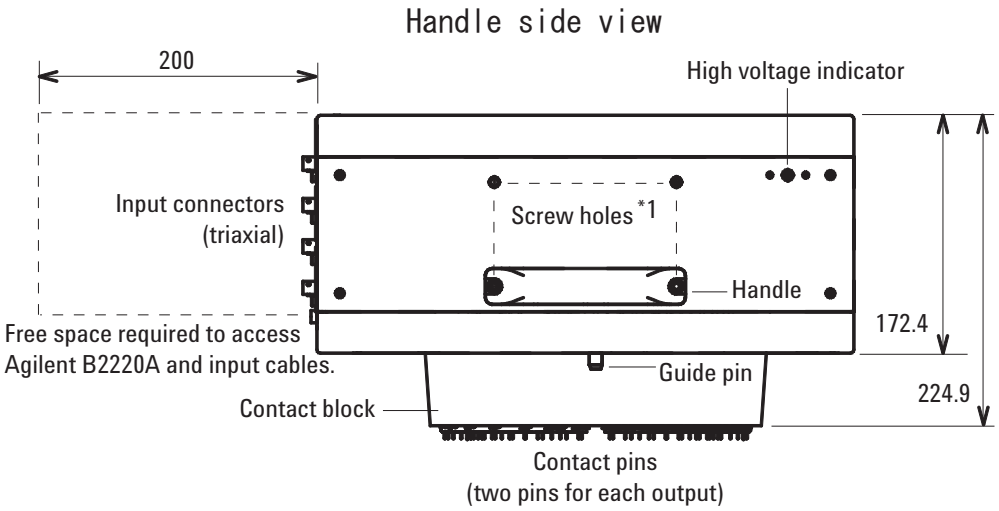
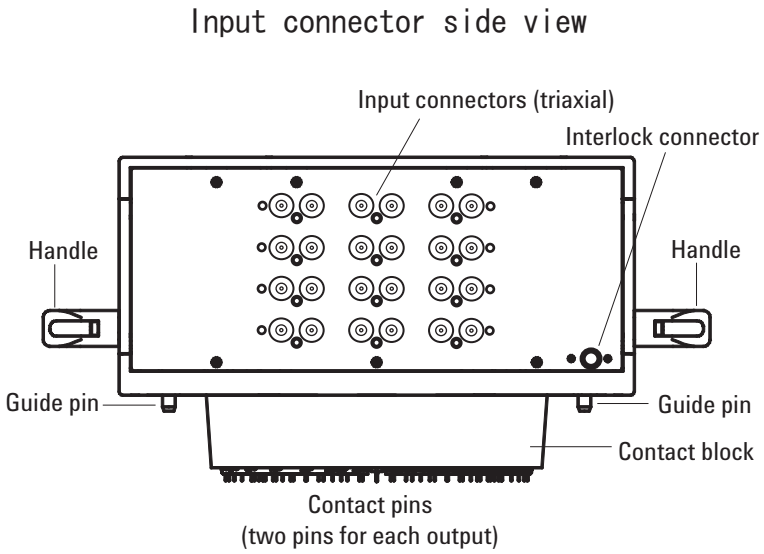


Figure 3-4 Probe card interface (24 pin) dimensions (2 of 2)



*1 Used to fix something (e.g. hinge) used to mount the B2220A on the prober.



Connecting with probe card I/F

There are two types of interfacing techniques used between the probe card I/F and the wafer prober:

- Mounting the probe card I/F on the Wafer Prober

  Mounting the probe card I/F on the wafer prober. A probe card direct docking, or a personality board and probe card are normally used to interface between the measurement pins of the probe card i/f and probe needles.

- Placing the Probe Card I/f beside a Manual Wafer Prober

  Placing the probe card i/f beside the wafer prober. An *Extension cable fixture*, *connector plate* and so on are used to interface between the measurement pins of the probe card i/f and probe needles.

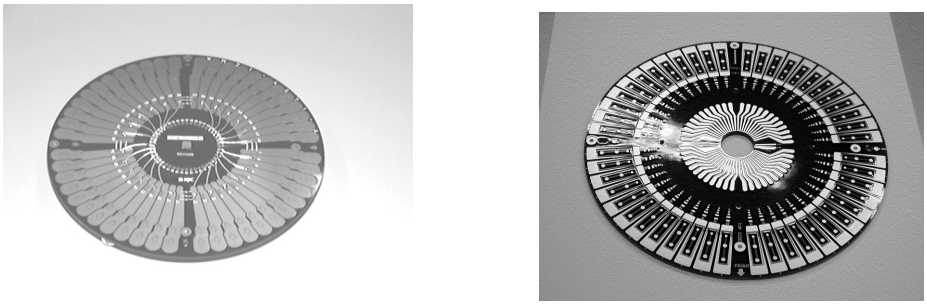
Probe card for direct docking

To improve low-leakage performance, you can use a probe card designed for direct docking. Direct docking means that the measurement pins of the probe card i/f directly contact the probe card, which reduces the leakage current.

NOTE Agilent Technologies recommends the use of the direct docking probe card.

The 41000 iPACE may not fully perform if a personality board or extension cable fixture is used.

Figure 3-5 Probe card for direct docking



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