PZ2100A Series High Channel Density Precision Source/Measure Unit Solution

PZ2100A Precision Source/Measure Unit Mainframe

PZ2110A Precision Source/Measure Unit

PZ2120A/PZ2121A Precision Source/Measure Unit

PZ2130A/PZ2131A 5-Channel Precision Source/Measure Unit

KEYSIGHT

USER'S GUIDE

Notices

Copyright Notice

Manual Part Number

PZ2100-90010

Edition

Edition 2, June 2023

Published by:

Keysight Technologies Japan K.K.
9-1, Takakura-machi, Hachioji-shi, Tokyo
192-8550 Japan

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Portions of the software are licensed by third parties, including open source terms and conditions. To get the text of the license, use the Graphical Web Interface of the instrument as described in this manual. You can also visit www.keysight.com and type the model number in the search field to get the text of the license.

Contact Keysight to obtain the source code. Keysight may charge for shipping.

Declaration of Conformity

Declarations of Conformity for this product and for other Keysight products may be downloaded from the Web. Go to http://www.keysight.com/go/conformity. You can then search by product number to find the latest Declaration of Conformity.

Latest Information

To get the latest firmware/software/electronic manuals/specifications/support information, go to www.keysight.com and type in the product number in the Search field at the top of the page.

South Korean EMC declaration

Information to the user:

This equipment has been conformity assessed for use in business environments. In a residential environment this equipment may cause radio interference.

(*) This EMC statement applies to the equipment only for use in business environment.

사용자안내문
이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다.

(*) 사용자 안내문은 “업무용 방송통신기자재”에만 적용한다.

Safety Summary

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual may impair the protections provided by the instrument. In addition, it violates safety standards of design, manufacture, and intended use of the instrument. Keysight Technologies assumes no liability for customer's failure to comply with these requirements.

Product manuals may also be available on the Web. Go to www.keysight.com and type the product model number in the Search field at the top of the page.

NOTE

Do not use this instrument in any manner not specified by the manufacturer. The protective features of this instrument may be impaired if it is used in a manner not specified in the operation instructions.

This instrument is an INDOOR USE product.

This instrument complies with OVERVOLTAGE CATEGORY II for mains input and POLLUTION DEGREE 2 defined in IEC 61010-1.

If an instrument is marked CAT I (IEC Measurement Category I), or it is not marked with a measurement category, its measurement terminals must not be connected to line-voltage mains.

Safety of any system incorporating the equipment is the responsibility of the assembler of the system.

WARNING

Hazardous voltage of up to the instrument's maximum voltage may appear at High Force, Guard, and High Sense terminals if Interlock terminal is closed. Open the Interlock terminal when the High Force, Guard, and High Sense terminals are accessible. Voltage applied to the terminals will be limited up to ±42 V.

Do not work the interlock function intentionally in order to bring the output voltage to the safe level. While the Status LED of any module is turned solid yellow, the dangerous voltage by the output voltage or the residual charge appears on the measurement terminal. For the location of the Status LED, see "PZ2100A Source/Measure Unit Modules" on page 36.

- *DANGEROUS PROCEDURE WARNINGS*

  Warnings, such as WARNING on the previous page, shall be complied. Procedures throughout in this manual prevent you from potentially hazard. Their instructions contained in the warnings must be followed.

- *BEFORE APPLYING POWER*

  Verify that all safety precautions are taken. Make all connections to the instrument before applying power. Note the instrument's external markings described under “Safety Symbols.”

- *GROUND THE INSTRUMENT*

  This is Safety Class I instrument. To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. The power terminal and the power cable must meet International Electrotechnical Commission (IEC) safety standards.

- *DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE*

  Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

- *DO NOT REMOVE COVERS*

  No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock do not remove covers.

- *IN CASE OF DAMAGE*

  Instruments that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel. Return the instrument to a Keysight Technologies sales or service office for services and repair to ensure that safety features are maintained.

- *USE ONLY THE SPECIFIC ACCESSORIES*

  Specific accessories satisfy the requirements for specific characteristics for using the instrument. Use the specific accessories, cables, adapters, and so on for safety reasons.

Safety Symbols

The general definitions of safety symbols used on equipment or in manuals are listed below.


Direct current.

Alternating current.


Earth ground terminal.


Protective conductor terminal. For protection against electrical shock in case of a fault. Used with field wiring terminals to indicate the terminal which must be connected to ground before operating equipment.


Frame or chassis terminal. A connection to the frame (chassis) of the equipment which normally includes all exposed metal structures.


Grounded terminal which indicates the earth potential.

On supply.


Off supply.


Standby supply. The equipment will be marked with this symbol is not completely disconnected from AC mains when power switch is in the standby position.

In position of a bi-stable push switch.


Out position of a bi-stable push switch.


Hazardous voltage and potential for electrical shock. Do not touch terminals that have this symbol when the equipment is on.


Hot surface. Avoid contact. Surfaces are hot and may cause personal injury if touched.


Caution, refer to accompanying documentation. The equipment will be marked with this symbol when it is necessary for the user to refer to the instruction manual.


Read operator's manual. To indicate that the operator's manual or card should be read before continuing the operation.

CAT I IEC Measurement Category I


The CE mark shows that the product complies with all applicable European Directives.


The CSA mark is a registered trademark of the Canadian Standards Association.


The UKCA mark shows that the product complies with all applicable UK regulations.

The RCM mark is a registered trademark of the Australian Communications Authority. This signifies compliance with the Australian EMC Framework Regulations under the terms of the Radio communications Act.

ICES/NMB-001

This ISM device complies with Canadian ICES-001.
Cet appareil ISM est conforme à la norme NMB-001 du Canada.

CAN ICES/NMB-001(A)

This ISM device complies with Canadian ICES-001 Class A.
Cet appareil ISM est conforme à la norme NMB-001 classe A du Canada.

This is the symbol for an Industrial, Scientific and Medical, Group 1 Class A product. (CISPR 11)

Korea's safety and EMC mark

China RoHS - Environmentally Green Product Label

China RoHS - Product with Toxic Substance 40 yr EPUP

The Chinese mark for paper-based packaging materials; Paperboard and Corrugated Fiberboard

Plastic Material Coding Identification

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

CAUTION A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, 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.

Power Supply and Measurement Safety

- Power Supply Safety

  This instrument can output high currents and voltages. Make sure that the load or device under test can safely handle the output current and voltage. Also, make sure that the connection leads can safely withstand the expected currents and are insulated for the expected voltages.

  The instrument outputs may be connected so as to float relative to earth ground. Isolation or floating voltage ratings are indicated on the instrument, near the output terminal or the Chassis ground terminal. There is the danger of electric shock by touching the floated measurement terminals. Keep in mind it to protect yourself. And it is a reason of using the recommended accessories.

- Voltage/Current Measurement Safety

  Multimeters and other instruments capable of measuring high voltages and currents are subject to specific safety concerns because of the circuits to which they may be connected. To safely use these instruments, you need to understand the markings on the instrument near the input terminals, which include the Protection Limits and the IEC Measurement Category.

- Protection Limits

  Keysight multimeters and other voltage measurement instruments provide protection circuitry to prevent damage to the instrument and to protect against the danger of electric shock, provided the Protection Limits are not exceeded. To ensure safe operation of the instrument, do not exceed the Protection Limits shown on the input terminals.

- Source/Measure Terminals

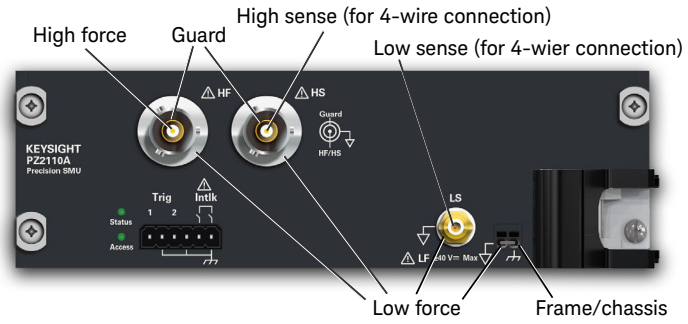
  Source/measure unit (SMU) can simultaneously perform DC voltage or current output and measurement. Typical SMU has the Force, Sense, and Guard terminals as shown below. Normally the Force, Sense, and Guard are the same potential. Voltage marked around the terminals indicates the Protection Limits.

  Force and Sense must be connected to a terminal of a device under test (DUT) for the 4-wire connection (Kelvin connection), which is effective for high current measurement and low resistance measurement. For the 2-wire connection to ease the connections, connect Force only. Do not connect Sense. It must be opened.

  Guard should be connected to the guard shield which covers the DUT high side wiring for reducing leakage current caused by the wire. Or else, the Guard must be opened.

  Frame/chassis ground should be connected to the ground shield which covers the DUT including the guard shield to minimize the affect of noise. Or else, the frame/chassis ground should be opened.

  The following figure is the source and measurement terminals of the PZ2100A series. For the PZ2100A, the High Force, High Sense, and Guard are the same potential. And the Low Force and Low Sense are the same potential.



⚠ High Voltage Shock Hazard

Keysight PZ2100A can force dangerous voltages (±210 V) at the High Force, Guard, and High Sense terminals. To prevent electric shock hazard, the following safety precautions must be observed during the use of Keysight PZ2100A.

- Use a three-conductor AC power cable to appliance coupler (inlet) and the instrument to an electric ground (safety ground).
- Prepare shielding box which covers interface to a device under test and equipped with interlock circuit that opens when the door is opened.
- Before performing measurement, connect the interlock circuit to the Interlock terminal of this instrument.
- Confirm periodically that the interlock function works normally.
- Before touching the connections of the High Force, Guard, and High Sense terminals, turn the instrument off and discharge any capacitors of the measurement path. If you do not turn the instrument off, complete “all” of the following items, regardless of any instrument’s settings.
    - Terminate source output by pressing the On/Off switch, confirm that the On/Off switch turns off.
    - Confirm that the HV (high voltage) status indicator is not lit.
    - Open the shielding box access door (open the Interlock terminal).
    - Discharge any capacitors if the capacitance is connected to this instrument.
- Warn workers in the vicinity of the instrument about hazardous conditions.

⚠ Gefahr durch Hochspannung

Von den Geräten Keysight PZ2100A können Spannungen an den Anschlüssen “High Force”, “Guard” und “High Sense” von bis zu 210 V ausgehen. Um elektrischem Schlag vorzubeugen, ist bei der Benützung der Geräte Keysight PZ2100A folgendes zu beachten.

- Verwenden Sie ein dreiphasiges AC-Stromkabel für die Gerätsteckvorrichtung (Eingang) und schließen Sie das Instrument an eine Erdung an (Sicherheitserdung).
- Bereiten Sie das Abschirmungsgehäuse vor, dass die Oberfläche eines zu testenden Geräts abdeckt und mit einem Verriegelungsstromkreis ausgestattet ist, der bei geöffneter Tür unterbrochen wird.
- Vor der Messung verbinden Sie den Verriegelungsstromkreis mit dem Interlock-Anschluss dieses Instruments.
- Prüfen Sie in regelmäßigen Abständen, dass die Verriegelungsfunktion ordnungsgemäß funktioniert.
- Bevor Sie die Verbindungen zu den Anschlüssen “High Force”, “Guard” und “High Sense” berühren, schalten Sie das Instrument aus und entladen alle Kondensatoren des Messwegs. Wenn Sie das Instrument nicht ausschalten, führen Sie, unabhängig von den Instrumenteinstellungen, alle folgenden Schritte durch.
  - Beenden Sie die Messung, indem Sie auf die Taste “On/Off” drücken. Stellen Sie sicher, dass die Statusanzeige “On/Off” nicht leuchtet.
  - Stellen Sie sicher, dass die Anzeige “HV” nicht leuchtet.
  - Öffnen Sie die Tür des Abschirmungsgehäuses (öffnen des Interlock-Anschlusses).
  - Entladen Sie alle Kondensatoren, wenn die Kapazität mit das Instrument verbunden ist.
- Warnen Sie Mitarbeiter in der Umgebung des Instruments vor den Gefahren.

⚠ Danger de choc dû à une haute tension

Une tension dangereuse (max. ± pour; 210 Vdc) émanant du dispositif Keysight PZ2100A peut être sortie aux bornes High Force, Guard et High Sense, d'appareil de protection ou de détection. Les précautions suivantes doivent être obserées contre commotion électrique accidentelle.

- Utilisez un câble d'alimentation CA à trois conducteurs vers le coupleur secteur (entrée) et branchez l'instrument sur une mise électrique à la terre (prise de terre de sécurité).
- Préparez le boîtier de protection qui couvre l'interface avec le dispositif à tester et équipez-le d'un circuit de sécurité qui s'ouvre lors de l'ouverture d'une porte.
- Avant de procéder aux mesures, connectez le circuit de sécurité à la borne Interlock de l'instrument.
- Vérifiez régulièrement le bon fonctionnement de la fonction de sécurité.
- Avant de toucher les connexions des bornes High Force, Guard et High Sense, mettez l'instrument hors tension et déchargez tout condensateur du chemin de mesure. Si vous ne mettez pas l'instrument hors tension, effectuez « toutes » les opérations ci-dessous, quels que soient les paramètres de l'instrument.
    - Terminez les mesures en appuyant sur la touche On/Off ; vérifiez que l'indicateur d'état On/Off est éteint.
    - Vérifiez que le témoin HV est éteint.
    - Ouvrez la trappe d'accès au boîtier de protection (ouvrez la borne Interlock).
    - Déchargez les éventuels condensateurs si la capacité est connectée à l'instrument.
- Informez les personnes travaillant à proximité de l'instrument des conditions.

⚠ 高電圧感電注意

Keysight PZ2100A の High Force、Guard、High Sense 端子には、危険電圧が出力されることがあります（最大 ±210 Vdc）。感電事故防止のため、必ず以下の事柄を守ってください。

- 3 極電源ケーブルを使用して本器を接地してください。
- ドアを開くことによって開放されるインターロック回路を装備し、被測定デバイスとのインタフェースを覆うことのできるシールド・ボックスを用意してください。
- 測定を開始する前にはインターロック回路を本器の Interlock 端子に接続してください。
- インターロック機能が正常であることを定期的に確認してください。
- High Force、Guard、High Sense 端子に繋がる接続部に触れる前には、本器の電源を切断してください。また、測定系のキャパシタを放電してください。電源を切らない場合は、以下の事項を全て実施してください。
  - On/Off スイッチを押して On/Off スイッチが消灯したことを確認してください。
  - 高電圧警告インジケータ（HV）が消灯していることを確認してください。
  - シールド・ボックスのドアを開けてください（Interlock 端子を開放してください）。
  - 本器にキャパシタが接続されているならば、キャパシタを放電してください。
- 周囲のほかの作業者に対しても、高電圧危険に対する注意を徹底してください。

Product Stewardship

- Waste Electrical and Electronic Equipment (WEEE)

The crossed out wheeled bin symbol indicates that separate collection for waste electric and electronic equipment (WEEE) is required, as obligated by the EU DIRECTIVE and other National legislation.

Please refer to http://keysight.com/go/takeback to understand your Trade in options with Keysight in addition to product takeback instructions.

- LCD Fluorescent Lamp

  Certain products sold by Keysight contain a liquid crystal display (LCD); backlighting for the LCD is provided by a fluorescent lamp which contains mercury, and must be managed, recycled, and/or disposed in accordance with all applicable laws, ordinances and regulations.

  For information on how to recycle or dispose of the fluorescent lamp contained in your own product, visit the following website.

  http://about.keysight.com/en/quality/env_compliance.shtml

  If you live in the U.S., also visit the following websites.

  http://www.lamprecycle.org

  http://www.eiae.org

  If you have additional questions, please visit the following website.

  http://www.keysight.com/go/contactus

- Perchlorate Information

  Perchlorate Material - special handling may apply. Visit the following website.

  http://www.dtsc.ca.gov/hazardouswaste/perchlorate/

  Equipment's real-time clock battery or coin cell battery may contain perchlorate and may require special handling when recycled or disposed of in California.

In This Manual

This manual describes the installation, front panel operation, SCPI programming, and functions of Keysight PZ2100A Series Precision Source/Measure Unit. This manual consists of the following chapters.

1. "Getting Started"

   This chapter briefly describes how to get started with the PZ2100A series.

2. "Introduction"

   This chapter describes the PZ2100A series.

3. "Installation"

   This chapter describes how to install the modules and the mainframe, and how to connect the device under test.

4. "Front Panel Operation"

   This chapter provides the quick reference information on the PZ2100A front panel keys and menus.

5. "Function Details"

   This chapter describes the functions and parameters of the PZ2100A series.

6. "Initial Settings"

   This chapter shows the initial settings of the PZ2100A series.

NOTE For the specifications of the PZ2100A series, see Data Sheet.

To get the latest information, go to www.keysight.com and type the model number in the Search box.

NOTE The information is subject to change without notice due to the future enhancement.

The actual product and screen images on the PZ2100A series may be different from the images shown in this manual.

Contents

1 Getting Started

This chapter describes the basic operation of the PZ2100A series. Before learning details of the PZ2100A series, let's try to use it briefly. The operation described in this chapter needs the PZ2100A mainframe, a PZ2100A module, and a power cord only. During the operations, open the measurement terminals.

NOTE

Before using the PZ2100A

Inspect the shipment when the PZ2100A series and accessories arrive at your site. See "Inspecting the Shipment" on page 60.

Install the module to the mainframe. See "Module Installation" on page 65.

Basic Operation

This section describes how to apply DC voltage and measure current as an example of basic operation using the front panel.

Step 1 Turning on the instrument and checking the operation

1. Make sure that the Standby switch is set to off.
2. Connect the power cord from the AC input connector (receptacle) on the PZ2100A mainframe's rear panel to a grounded outlet at your site.
3. Press the Standby switch to turn on the instrument.

   The initialization screen will appear on the PZ2100A mainframe's front panel display, and the power-on self test runs automatically.

If the PZ2100A is operating normally, the single-channel layout of Meter view will appear on the front panel display as shown below.

4. Press the **Error** key on the front panel to check errors.

   If no error is detected, "+0. No Error" is displayed.

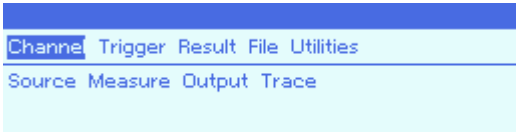
5. Press the **Meter** key to go back to the Meter view.

Figure 1-1 Keys on the Front Panel

Step 2 Setting the power line frequency, if necessary

The default setting is 50 Hz.

1. Press the **Menu** key on the front panel. The root menu of the Menu view appears.



2. Select **Utilities** > **System** > **PLC** as follows.

   a. Move the field pointer to **Utilities** using the arrow keys and press the **Select** key.

   b. Move the field pointer to **System** using the arrow keys and press the **Select** key.

   c. Move the field pointer to **PLC** using the arrow keys and press the **Select** key.

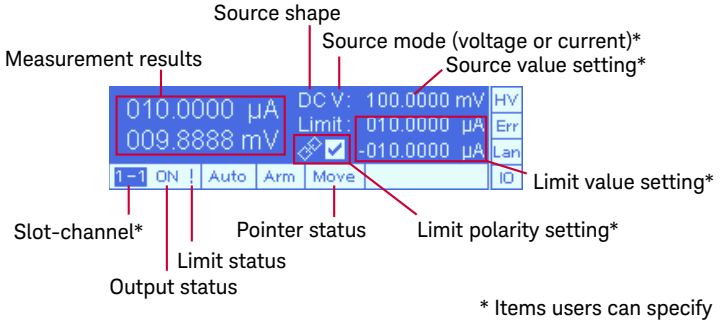
3. Select the power line frequency.
   a. Press the **Select** key.
   b. Select from 50 or 60 using the arrow keys.

      If the frequency is 50 Hz or 400 Hz, select 50; if 60 Hz, select 60. See "Setting the Power Line Frequency" on page 62.
   c. Press the **Select** key.
4. Press the **Meter** key to go back to the Meter view.

NOTE

Operating with the single-channel layout

Users can set some parameters and operate the instrument with the single-channel layout of the Meter view. The following figure describes the layout.



The Meter view has five layout types. To show the single-channel layout, press the **Meter** key until the single-channel layout appears.

Step 3 Selecting the slot and channel

1. Move the field pointer to the slot-channel in the single-channel layout.
2. Press the **Select** key. The Channel Selection Dialog appears.

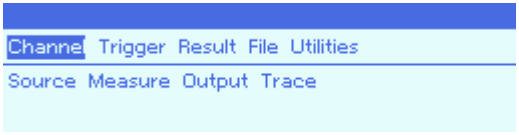
3. Select the slot number and the channel number.

   a. Move the field pointer to **Slot** using the arrow keys, then press the **Select** key.
   b. Select the slot number from the list using the arrow keys, then press the **Select** key.
   c. Move the field pointer to **Channel** using the arrow keys, then press the **Select** key.
   d. Select the channel number from the list using the arrow keys, then press the **Select** key.

4. Press the **Meter** key to go back to the Meter view.

Step 4 Setting the source shape to DC

1. Press the **Menu** key to change the front panel display to the Menu view.



2. Select **Channel** > **Source** > **Function** > **Shape** using the arrow keys and the **Select** key.
3. Press the **Select** key, and select DC from the list using the arrow keys.
4. Press the **Meter** key to go back to the Meter view.

Step 5 Setting the source mode (voltage output)

1. Move the field pointer to the source mode.
2. Press the **Select** key. The pointer status changes from Move to Edit.

3. Select the voltage source mode (V) using the arrow keys.
4. Press the **Select** key. The pointer status returns to Move.

Step 6 Setting the source value (voltage output value)

1. Move the field pointer to the source value setting.
2. Press the **Select** key. The pointer status changes from Move to Edit.
3. Specify the source value, 0.5, for example, using the numeric keys.
4. Press the **Enter** key.

   The pointer status remains Edit, which indicates the specified value is not valid yet.
5. Select the unit, V, for example, using the arrow keys.
6. Press the **Select** key.

   The pointer status returns to Move, and the value 0.5 V is set as a source value.

Step 7 Setting the Limit value

1. Move the field pointer to the check box of the Limit polarity setting.
2. If a check mark does not appear, press the **Select** key to enable the Limit polarity.

   The Limit polarity setting allows users to set the positive and negative Limit values simultaneously.
3. Move the field pointer to the positive or negative Limit value setting.
4. Press the **Select** key. The pointer status changes from Move to Edit.
5. Specify the Limit value, 10, for example, using the numeric keys.
6. Press the **Enter** key. The pointer status remains Edit.
7. Select the unit, mA, for example, using the arrow keys.
8. Press the **Select** key.

   The pointer status returns to Move, and the Limit value 10 mA is set.

If the Limit polarity setting is disabled, you can specify the positive and negative Limit values separately.

Step 8 Starting applying voltage and current measurement

1. Press the **On/Off** key.

   The PZ2100A starts applying voltage and measuring current, and the Auto indicator appears.

   The measurement results appear in the Meter view and update every measurement. The measurement results are not stored in the buffer.

NOTE **Setting the On/Off key**

If measurement results in the Meter view do not seem to be updated, check the settings as follows.

1. Press the **Menu** key to change the front panel display to the Menu view.
2. Select **Utilities** > **System** > **Key** > **On/Off** > **TargetChannels** > **Mode**, and see if **SINGLE** is selected.
3. Select **Utilities** > **System** > **Key** > **On/Off** > **AutoTrigger**, and see if the check mark appears in the check box.

Step 9 Stopping applying voltage and current measurement

1. Press the **On/Off** key.

   The PZ2100A stops applying voltage and measuring current.

SCPI Programming

The front panel operation of the PZ2100A is relatively limited. SCPI programming allows users to operate all functions of the instrument. For detailed information on programming, refer to *Programming Guide* and *SCPI Command Reference*.

- Keysight IO Libraries Suite is required.

  Go to www.keysight.com/find/iolib, download and install the software in your computer.

- GPIB, USB, and LAN are available for the PZ2100A.

  All three interfaces are enabled at the power-on sequence. Select the interface for controlling the PZ2100A and connect your computer to the appropriate interface connector on the rear panel of the PZ2100A mainframe. For more information, see "Connecting the Interfaces" on page 70.

2 Introduction

This chapter describes the basic features of Keysight PZ2100A series.

Keysight PZ2100A Series

Keysight PZ2100A series includes the products shown in Table 2-1.

Table 2-1 Keysight PZ2100A Series Mainframe and Source/Measure Unit Module

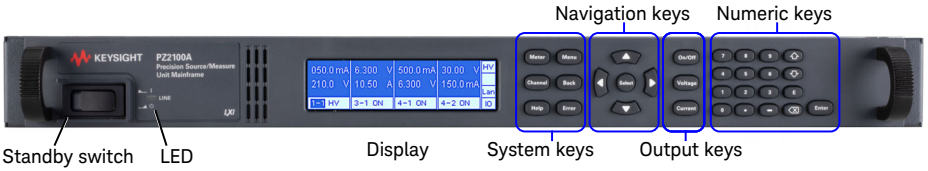
Model	Description
PZ2100A	Precision Source/Measure Unit Mainframe, 4 slots, 1U
PZ2110A	Precision Source/Measure Unit, 1.25 MSa/s, 10 fA, 210 V, 315 mA DC/pulse
PZ2120A	Precision Source/Measure Unit, 1 MSa/s, 100 fA, 60 V, 3.5 A DC/10.5 A pulse
PZ2121A	Precision Source/Measure Unit, 15 MSa/s, 100 fA, 60 V, 3.5 A DC/10.5 A pulse
PZ2130A	5-Channel Precision Source/Measure Unit, 100 pA, 30 V, 500 mA DC
PZ2131A	5-Channel Precision Source/Measure Unit, 500 kSa/s, 10 pA, 30V, 500 mA DC/pulse

WARNING The top panel of the PZ2100A mainframe may become hot during operation or immediately after turning off the instrument, which may cause burns if touched. Before touching the mainframe, take a while to allow the heat to dissipate after turning off the instrument and make sure that the top panel has cooled enough.

Front View

This section outlines the front view of the PZ2100A mainframe.

Figure 2-1 Front View



Standby switch	Turns the mainframe on or off.
LED	Shows the mainframe is turned on. See Table 2-2.
Display	Shows the settings, measurement results, and status information.
System keys	Switch between the display layouts. Display help or error messages.
Navigation keys	Move the field pointer to a menu item, select the highlighted item, and set the parameter.
Output keys	Turn the outputs on or off. Switch to the voltage or current setting menu.
Numeric keys	Enter values.

For more information on the front panel operation, see Chapter 4, “Front Panel Operation.”

Table 2-2 Front Panel LED Status

LED state	Status
Solid green	Normal operation The mainframe is turned on and in normal operation.
Solid amber	Screen saver mode The display is turned off and the LED turns amber after a certain period of inactivity if the screen saver mode is enabled. Press any key to restore the display.
Off	The mainframe is turned off.

WARNING In the screen saver mode, the display turns off. Note the high voltage indicator is not shown on the display when a Source/Measure Unit in the mainframe applies a high voltage greater than ±42 V in the screen saver mode.

Rear View

This section outlines the rear view of the PZ2100A mainframe.

Figure 2-2 Rear View

GPIB	Micro-D connector for GPIB Use a micro-D to GPIB cable to connect with a GPIB connector. For more information, see “GPIB Connector” on page 70.
USB (Type-A)	USB 2.0 Type-A host port
USB (Type-C)	USB 3.0 Type-C device port
LAN	LAN connector for 10/100/1000 Base-T The left LED indicates activity and the right LED indicates link integrity.
Digital I/O	8-pin terminal block connector
AC input	IEC60320 connector for AC input
Ground	Frame/chassis ground binding post

Slot numbers are assigned as shown in Figure 2-2.

Users can use GPIB, USB (Type-C), and LAN to control the PZ2100A remotely. For more information on the rear panel interfaces, see “Connecting the Interfaces” on page 70.

PZ2100A Source/Measure Unit Modules

This section describes the module interface including the LED indicators, measurement terminals, and trigger and interlock terminals.

Module LED Indicators

The PZ2100A Source/Measure Unit modules have two LED indicators: Access and Status. These indicators show the status of the SMU module. See Table 2-3 for the meanings. If the emergency shutdown occurs, both indicators turn red.

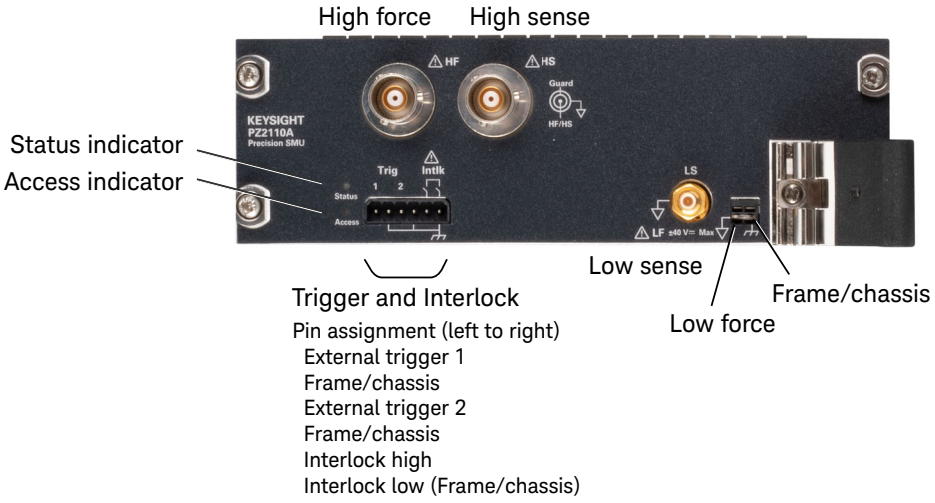
Table 2-3 LED Status

LED	LED state	Status
Access	Solid Green	The module is turned on, the initialization is completed, and the operation is ready.
	Flashing Green	The “Identify the module” feature is on.
	Solid Red	Emergency shutdown occurs.
	Off	The control session is closed.
Status	Solid Green	Output is enabled and the output voltage is within ±42 V.
	Solid Yellow	Output is enabled and the output voltage is over ±42 V.
	Solid Red	Emergency shutdown occurs.
	Off	Output is disabled.

PZ2110A Precision Source/Measure Unit

Figure 2-3 shows the PZ2110A module panel. There are two LED indicators, measurement terminals, and a 6-pin terminal block for the trigger and interlock function.

Figure 2-3 PZ2110A Module Panel



WARNING

There are potentially hazardous voltages (±210 V) present at the High force, High sense, and Guard terminals of this instrument. To prevent electrical shock, the following safety precautions must be observed during the use of the instrument.

- Use a three-conductor AC power cord to connect the cabinet (if used) and the instrument to an electrical ground (safety ground).
- If an interlock circuit is not installed in your test fixture or connection interface, you must install and connect the interlock circuit that opens the interlock terminal when the shielding box access door is opened.
- If you change the connection interface, test fixture, prober, and such, connect an interlock cable to the one actually used.
- Confirm periodically that the interlock function works normally.
- Before touching the connections on the High force, High sense, and Guard terminals, turn the instrument off and discharge any capacitors. If you do *not* turn the instrument off, complete *all* of the following items, regardless of the instrument settings.
  - Disable the output, and confirm that the Status indicator turns off.
  - Confirm that the Status indicator does not turn yellow.
  - Open the fixture cover or the shielding box access door (open interlock).
  - Discharge any capacitors connected to a channel.
- Warn persons working around the instrument about dangerous conditions.

WARNING

Une tension dangereuse (max. ± pour; 210 Vdc) émanant du dispositif l'instrument peut être sortie aux bornes High force, High sense et Guard. Les précautions suivantes doivent être obserées contre commotion électrique accidentelle.

- Utilisez un cordon d'alimentation CA à trois connecteurs pour connecter la cabine (si utilisée) et l'instrument à la mise électrique à la terre (sol de sécurité).
- Si un circuit de sécurité n'est pas installé dans votre test d'installation ou dans votre interface de connexion, vous devez installer et connecter le circuit de sécurité qui ouvre la borne d'enclenchement lorsque la porte d'accès à la protection de la boîte est ouverte.
- Si vous changez l'interface de connexion, un test d'installation, la sonde, ou toute autre élément, connectez un cordon d'enclenchement à celui utilisé actuellement.
- Vérifiez régulièrement que la fonction de verrouillage fonctionne normalement.
- Avant de toucher les connexions des bornes High force, High sense et Guard, éteignez l'instrument et déchargez tous les condensateurs. Si vous n'éteignez pas l'appareil, complétez tous les éléments suivants, indépendamment des réglages de l'appareil.
  - Désactiver la sortie, et confirmez que la LED Status est éteint.
  - Vérifiez que la LED Status ne devienne pas jaune.
  - Ouvrez le couvercle d'appareil ou la protection du boîtier de la porte d'accès (verrouillage ouvert).
  - Déchargez tous les condensateurs connectés au réseau.
- Déchargez tous les condensateurs connectés au réseau.

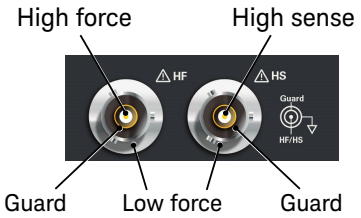
Measurement Terminals

The PZ2110A has the following measurement terminals. You can make 2-wire connection using the High force and Low force terminals or 4-wire connection (Kelvin connection) using the High force, High sense, Low force and Low sense terminals. The Kelvin connection is effective in high current measurement.

HF and HS High force, High sense, Low force, and Guard terminals (Triaxial connector)

These connectors are used to connect a device under test (DUT). If you make the 2-wire connection, use the HF connector only, and open the HS connector. The HS connector is used to make the 4-wire connection (Kelvin connection).

Each connector has three conductors: core, inner shield, and outer shield. These conductors are the measurement terminals as shown in the following figure. The outer shield of these connectors are Low force.



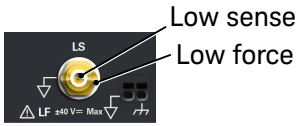
The maximum voltage which appears in High force, High sense, and Guard is expressed by the equation, ±210 V + $V_{floating}$, where $V_{floating}$ is the voltage between Low force and the frame/chassis ground. $V_{floating}$ is 0 V in the grounded measurement, and the maximum voltage of $V_{floating}$ is ±40 V in the floating measurement.

CAUTION **Never connect the Guard terminal to any output, including the frame/chassis ground or any other guard terminal. Doing so will damage the PZ2110A.**

LS Low sense terminal (SMB connector)

This connector is used for the 4-wire connection (Kelvin connection). If you make the 2-wire connection, open this connector.

The connector has two conductors: core and shield. These conductors are the measurement terminals as shown in the following figure.



LF and frame/chassis Low force terminal and frame/chassis terminal

These terminals are connected together by the short bar when the PZ2110A is shipped from the factory. The short bar must be connected to perform the grounded measurement.

If you want to perform the floating measurement, or if you want to connect another instrument's ground to the Low force, remove the short bar, and leave the terminals open. Then use the Low force terminal on the HF or HS connector to connect the other instrument.

CAUTION **For the floating measurement, do not apply voltage greater than ±40 V to the Low force terminal. $V_{floating}$, the voltage between Low force and the frame/chassis ground, must be limited to ±40 V. Failure to heed this caution may result in damage to the PZ2110A.**

CAUTION **Do not apply current or voltage to the frame/chassis terminal. Doing so will damage the PZ2110A.**

Trigger and Interlock Terminals

The PZ2110A has the following terminals for the trigger source or output and the interlock circuit status detection.

The PZ2110A has a 6-pin terminal block on the front panel. The pin assignment of the terminal block is shown in Figure 2-3. You can connect these terminals using a connector-terminal block furnished with the PZ2110A and ferrule terminal cables such as Keysight PX0101A-001/002 BNC to ferrule terminal cable.

Trig 1 and Trig 2 External trigger 1 and 2 terminals

These terminals are used to make synchronization with other modules or instruments. You can specify the direction (input/output), the polarity (positive/negative), and the pulse width of the trigger signal. The output trigger is push-pull, and the trigger level is 0 V to 3.3 V at high impedance. The input trigger must be the TTL level.

⚠ **Intlk** Interlock terminals

These terminals are used to connect an interlock circuit which is installed in your test fixture or shielding box. The interlock circuit can be created by using two mechanical switches and wire as shown in Figure 3-8. If the interlock terminals are opened or the interlock circuit is opened, the PZ2110A output voltage is limited to ±42 V or less as you specified. If you set the voltage limit to 0 V, the interlock function will be the same as inhibit control.

For more details, see "Installing an Interlock Circuit" on page 86.

CAUTION Do not connect the interlock terminals to anything other than the interlock circuit. Applying current or voltage to the terminals may damage the PZ2110A.

WARNING ⚠

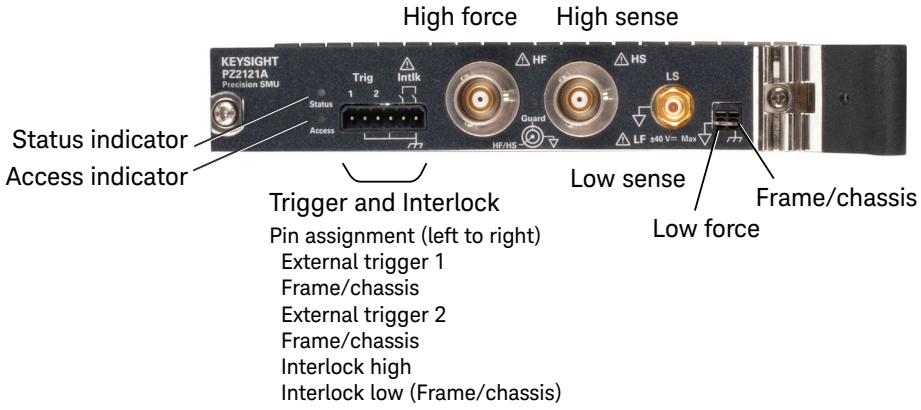
Dangerous voltage, instrument maximum output voltage may appear at the High force, High sense, and Guard terminals if the interlock terminals are closed or the interlock circuit is closed.

Une tension dangereuse, une tension de sortie maximale de l'appareil peut apparaître aux bornes High force, High sense et Guard si la borne Interlock est fermée.

PZ2120A and PZ2121A Precision Source/Measure Unit

Figure 2-4 shows the PZ2120A and PZ2121A module panel. There are two LED indicators, measurement terminals, and a 6-pin terminal block for the trigger and interlock function.

Figure 2-4 PZ2120A and PZ2121A Module Panel



WARNING

There are potentially hazardous voltages (±60.6 V) present at the High force, High sense, and Guard terminals of this instrument. To prevent electrical shock, the following safety precautions must be observed during the use of the instrument.

- Use a three-conductor AC power cord to connect the cabinet (if used) and the instrument to an electrical ground (safety ground).
- If an interlock circuit is not installed in your test fixture or connection interface, you must install and connect the interlock circuit that opens the interlock terminal when the shielding box access door is opened.
- If you change the connection interface, test fixture, prober, and such, connect an interlock cable to the one actually used.
- Confirm periodically that the interlock function works normally.
- Before touching the connections on the High force, High sense, and Guard terminals, turn the instrument off and discharge any capacitors. If you do *not* turn the instrument off, complete *all* of the following items, regardless of the instrument settings.
  - Disable the output, and confirm that the Status indicator turns off.
  - Confirm that the Status indicator does not turn yellow.
  - Open the fixture cover or the shielding box access door (open interlock).
  - Discharge any capacitors connected to a channel.
- Warn persons working around the instrument about dangerous conditions.

WARNING

Une tension dangereuse (max. ± pour; 60.6 Vdc) émanant du dispositif l'instrument peut être sortie aux bornes High force, High sense et Guard. Les précautions suivantes doivent être obserées contre commotion électrique accidentelle.

- Utilisez un cordon d'alimentation CA à trois connecteurs pour connecter la cabine (si utilisée) et l'instrument à la mise électrique à la terre (sol de sécurité).
- Si un circuit de sécurité n'est pas installé dans votre test d'installation ou dans votre interface de connexion, vous devez installer et connecter le circuit de sécurité qui ouvre la borne d'enclenchement lorsque la porte d'accès à la protection de la boîte est ouverte.
- Si vous changez l'interface de connexion, un test d'installation, la sonde, ou toute autre élément, connectez un cordon d'enclenchement à celui utilisé actuellement.
- Vérifiez régulièrement que la fonction de verrouillage fonctionne normalement.
- Avant de toucher les connexions des bornes High force, High sense et Guard, éteignez l'instrument et déchargez tous les condensateurs. Si vous n'éteignez pas l'appareil, complétez tous les éléments suivants, indépendamment des réglages de l'appareil.
  - Désactiver la sortie, et confirmez que la LED Status est éteint.
  - Vérifiez que la LED Status ne devienne pas jaune.
  - Ouvrez le couvercle d'appareil ou la protection du boîtier de la porte d'accès (verrouillage ouvert).
  - Déchargez tous les condensateurs connectés au réseau.
- Déchargez tous les condensateurs connectés au réseau.

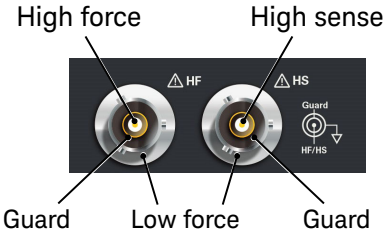
Measurement Terminals

The PZ2120A/PZ2121A has the following measurement terminals. You can make 2-wire connection using the High force and Low force terminals or 4-wire connection (Kelvin connection) using the High force, Low force, High sense and Low sense terminals. The Kelvin connection is effective in high current measurement.

⚠ **HF and HS** High force, High sense, Low force, and Guard terminals (Triaxial connector)

These connectors are used to connect a device under test (DUT). If you make the 2-wire connection, use the HF connector only, and open the HS connector. The HS connector is used to make the 4-wire connection (Kelvin connection).

Each connector has three conductors: core, inner shield, and outer shield. These conductors are the measurement terminals as shown in the following figure. The outer shields of these connectors are Low force.

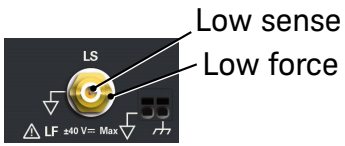


The maximum voltage which appears in High force, High sense, and Guard is expressed by the equation, ±60.6 V + $V_{floating}$, where $V_{floating}$ is the voltage between Low force and the frame/chassis ground. $V_{floating}$ is 0 V in the grounded measurement, and the maximum voltage of $V_{floating}$ is ±40 V in the floating measurement.

CAUTION **Never connect the Guard terminal to any output, including the frame/chassis ground or any other guard terminal. Doing so will damage the PZ2120A/ PZ2121A.**

LS Low sense terminal (SMB connector)

This connector is used for the 4-wire connection (Kelvin connection). If you make the 2-wire connection, open this connector.



The connector has two conductors: core and shield. These conductors are the measurement terminals as shown in the following figure.

LF and frame/chassis Low force terminal and frame/chassis terminal

These terminals are connected together by the short bar when the PZ2120A/PZ2121A is shipped from the factory. The short bar must be connected to perform the grounded measurement.

If you want to perform the floating measurement, or if you want to connect another instrument's ground to the Low force, remove the short bar, and leave the terminals open. Then use the Low force terminal on the HF or HS connector to connect the other instruments.

CAUTION **For the floating measurement, do not apply voltage greater than ±40 V to the Low force terminal. $V_{floating}$, the voltage between Low force and the frame/chassis ground, must be limited to ±40 V. Failure to heed this caution may result in damage to the PZ2120A/PZ2121A.**

CAUTION **Do not apply current or voltage to the frame/chassis terminal. Doing so will damage the PZ2120A/PZ2121A.**

Trigger and Interlock Terminals

The PZ2120A/PZ2121A has the following terminals for the trigger source or output and the interlock circuit status detection.

The PZ2120A/PZ2121A has a 6-pin terminal block on the front panel. The pin assignment of the terminal block is shown in Figure 2-4. You can connect these terminals using a connector-terminal block furnished with the PZ2120A/PZ2121A and ferrule terminal cables such as Keysight PX0101A-001 or PX0101A-002 BNC to ferrule terminal cable.

Trig 1 and Trig 2 External trigger 1 and 2 terminals

These terminals are used to make synchronization with other modules or instruments. You can specify the direction (input/output), the polarity (positive/negative), and the pulse width of the trigger signal. The output trigger is push-pull, and the trigger level is 0 V to 3.3 V at high impedance. The input trigger should be the TTL level.

Intlk Interlock terminals

These terminals are used to connect an interlock circuit which is installed in your test fixture or shielding box. The interlock circuit can be created by using two mechanical switches and wire as shown in Figure 3-8. If the interlock terminals are opened or the interlock circuit is opened, the PZ2120A/PZ2121A output voltage is limited to ±42 V or less as you specified. If you set the voltage limit to 0 V, the interlock function will be the same as inhibit control.

For more details, see "Installing an Interlock Circuit" on page 86.

CAUTION Do not connect the interlock terminals to anything other than the interlock circuit. Applying current or voltage to the terminals may damage the PZ2120A/PZ2121A.

WARNING Dangerous voltage, instrument maximum output voltage may appear at the High force, High sense, and Guard terminals if the interlock terminals are closed or the interlock circuit is closed.

Une tension dangereuse, une tension de sortie maximale de l'appareil peut apparaître aux bornes High force, High sense et Guard si la borne Interlock est fermée.

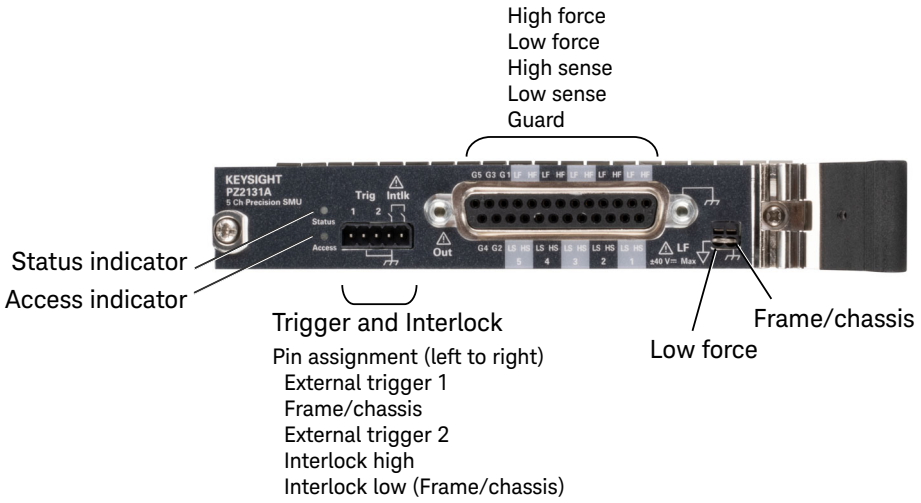
WARNING **When you remove the PZ2120A or PZ2121A module from the mainframe**

Immediately after powering down, the PZ2120A/PZ2121A module side panels may be hot to cause a burn. Before removing the module from the mainframe, take a time for dissipating the heat, and make sure that the side panels are cool enough to touch.

PZ2130A and PZ2131A 5-Channel Precision Source/Measure Unit

Figure 2-5 shows the PZ2130A and PZ2131A module panel. There are two LED indicators, measurement terminals, and a 5-pin terminal block for the trigger and interlock function.

Figure 2-5 PZ2130A and PZ2131A Module Panel



WARNING Use a three-conductor AC power cord to connect the cabinet (if used) and the instrument to an electrical ground (safety ground).

Utilisez un cordon d'alimentation CA à trois connecteurs pour connecter la cabine (si utilisée) et l'instrument à la mise électrique à la terre (sol de sécurité).

Measurement Terminals

The PZ2130A/PZ2131A has the following measurement terminals. You can make 2-wire connection using the High force and Low force terminals or 4-wire connection (Kelvin connection) using the High force, Low force, High sense and Low sense terminals. The Kelvin connection is effective in high current measurement.

HF, LF, HS, LS High force (HF), Low force (LF), High sense (HS), and Low sense (LS) terminals (D-sub connector)

These terminals are used to connect a device under test (DUT). If you make the 2-wire connection, use only the HF and LF terminals, and open the HS and LS terminals. The HS and LS terminals are used to make the 4-wire connection (Kelvin connection).

The D-sub connector has 25 positions and consists of five-channel interfaces as shown in the following figure and table. Each channel has five terminals: HF, LF, HS, LS, and Guard. Although LF is shared by all channels, it is recommended to use each HF terminal with the LF terminal of the same channel.

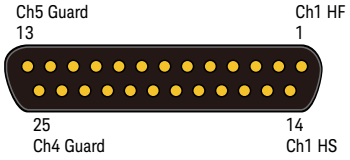


Table 2-4 Pin Assignment of the D-sub Connector

No.	Name	Description
1	Ch1, HF	High force for channel 1
2	Ch1, LF	Low force for channel 1
3	Ch2, HF	High force for channel 2
4	Ch2, LF	Low force for channel 2
5	Ch3, HF	High force for channel 3
6	Ch3, LF	Low force for channel 3
7	Ch4, HF	High force for channel 4
8	Ch4, LF	Low force for channel 4
9	Ch5, HF	High force for channel 5
10	Ch5, LF	Low force for channel 5
11	Ch1, Guard	Guard for channel 1
12	Ch3, Guard	Guard for channel 3
13	Ch5, Guard	Guard for channel 5

No.	Name	Description
14	Ch1, HS	High sense for channel 1
15	Ch1, LS	Low sense for channel 1
16	Ch2, HS	High sense for channel 2
17	Ch2, LS	Low sense for channel 2
18	Ch3, HS	High sense for channel 3
19	Ch3, LS	Low sense for channel 3
20	Ch4, HS	High sense for channel 4
21	Ch4, LS	Low sense for channel 4
22	Ch5, HS	High sense for channel 5
23	Ch5, LS	Low sense for channel 5
24	Ch2, Guard	Guard for channel 2
25	Ch4, Guard	Guard for channel 4

The maximum voltage which appears in HF, HS, and Guard is expressed by the equation, ±30.5 V + $V_{floating}$, where $V_{floating}$ is the voltage between Low force and the frame/chassis ground. $V_{floating}$ is 0 V in the grounded measurement, and the maximum voltage of $V_{floating}$ is ±40 V in the floating measurement.

CAUTION **Never connect the Guard terminal to any output, including the frame/chassis ground or any other guard terminal. Doing so will damage the PZ2130A/PZ2131A.**

LF and frame/chassis

Low force terminal and frame/chassis terminal

These terminals are connected together by the short bar when the PZ2130A/PZ2131A is shipped from the factory. The short bar must be connected to perform the grounded measurement.

If you want to perform the floating measurement, or if you want to connect another instrument's ground to the Low force, remove the short bar, and leave the terminals open. Then use the Low force terminals on the D-sub connector to connect the other instruments.

CAUTION **For the floating measurement, do not apply voltage greater than ±40 V to the Low force terminal. $V_{floating}$, the voltage between Low force and the frame/chassis ground, must be limited to ±40 V. Failure to heed this caution may result in damage to the PZ2130A/PZ2131A.**

CAUTION **Do not apply current or voltage to the frame/chassis terminal. Doing so will damage the PZ2130A/PZ2131A.**

Trigger and Interlock Terminals

The PZ2130A/PZ2131A has the following terminals for the trigger source or output and the interlock circuit status detection.

The PZ2130A/PZ2131A has a 5-pin terminal block on the front panel. The pin assignment of the terminal block is shown in Figure 2-5. You can connect these terminals using a connector-terminal block furnished with the PZ2130A/PZ2131A and ferrule terminal cables such as Keysight PX0101A-001 or PX0101A-002 BNC to ferrule terminal cable.

Trig 1 and Trig 2 External trigger 1 and 2 terminals

These terminals are used to make synchronization with other modules or instruments. You can specify the direction (input/output), the polarity (positive/negative), and the pulse width of the trigger signal. The output trigger is push-pull, and the trigger level is 0 V to 3.3 V at high impedance. The input trigger should be the TTL level.

⚠ **Intlk** Interlock terminals

These terminals are used to connect an interlock circuit which is installed in your test fixture or shielding box. The interlock circuit can be created by using two mechanical switches and wire as shown in Figure 3-8. If the interlock terminals are opened or the interlock circuit is opened, the output voltage is limited to ±42 V or less as you specified.

The interlock circuit is not necessary for the PZ2130A/PZ2131A because the maximum output voltage is ±30 V, but can be used to limit the output voltage to the specified value. If you set the limit to 0 V, the interlock function will be the same as inhibit control.

For more details, see "Installing an Interlock Circuit" on page 86.

CAUTION **Do not connect the interlock terminals to anything other than the interlock circuit. Applying current or voltage to the terminals may damage the PZ2130A/PZ2131A.**

Accessories

Furnished Accessories

The following items are furnished with the PZ2100A mainframe.

- Quick Startup Poster, 1 ea.
- Quick Reference, 1 ea.
- Connector-terminal block, 1 ea.
- Filler panels, installed in the PZ2100A, 4 ea.
- Slot blockers, installed in slots 2 and 4 of the PZ2100A, 2 ea.
- Power cord, 1 ea.

The following items are furnished with the PZ2110A, PZ2120A, PZ2121A, PZ2130A, or PZ2131A module.

- Quick Startup Poster, 1 ea.
- Quick Reference, 1 ea.
- Connector-terminal block, 1 ea.
- Short bar, installed on the module panel, 1 ea.

Available Accessories

Keysight provides accessories such as the Micro-D to GPIB cable, the rack mount kit, and BNC-ferrule terminal cables. For the complete list of accessories, refer to the data sheet.

To get the latest information, go to www.keysight.com and search by the product model number.

D-sub to SMB Adapter

The following D-sub to SMB adapter is available for PZ2130A and PZ2131A.

- PX0106A Dsub25 to 5 SMB Adapter

The adapter is attached to the D-sub connector on the front panel of the PZ2130A/PZ2131A module and has five SMB connectors for outputs as shown below.

Low Noise Filter Adapter

The following external filter is available for PZ2130A and PZ2131A to apply low-noise and clean output signal.

- PX0107A Low Noise Filter Adapter

For using the low noise filter adapter, see "Low Noise Filter Adapter (PZ2130A and PZ2131A)" on page 141.

WARNING The bodies of the D-sub to SMB adapter and the low noise filter adapter are electrically at the same potential as the Low force. To prevent electrical shock, do not touch any of measurement circuit at any time while a floating measurement in progress. Also use accessories that comply with IEC 61010-031. All terminals and the extended conductors must be isolated by using insulation caps, sleeves, etc.

Options

Table 2-5 lists the options for the PZ2100A modules.

Table 2-5 Options

Option	Description
1A7	Calibration, uncertainties, and guardbanding (not accredited)
A6J	ANSI Z540-1-1994 calibration
UK6	Commercial calibration certificate with test data

3 Installation

This chapter describes how to install Keysight PZ2100A series.

WARNING To avoid electrical shock and instrument damage, turn the instrument off before connecting or disconnecting measurement cable.

WARNING There are potentially hazardous voltages (±210 V) present at the High Force, High Sense, and Guard terminals of this instrument. To prevent electrical shock, the following safety precautions must be observed during the use of the instrument.

- Use a three-conductor AC power cord to connect the cabinet (if used) and the instrument to an electrical ground (safety ground).
- If an interlock circuit is not installed in your test fixture or connection interface, you must install and connect the interlock circuit that opens the interlock terminal when the shielding box access door is opened.
- If you change the connection interface, test fixture, prober, and such, connect an interlock cable to the one actually used.
- Confirm periodically that the interlock function works normally.
- Before touching the connections on the High Force, High Sense, and Guard terminals, turn the instrument off and discharge any capacitors. If you do *not* turn the instrument off, complete *all* of the following items, regardless of the instrument settings.
  - Press the standby switch and confirm that the LED on the right side turns off.
  - Confirm that the Status LED of any module is not turned solid yellow. For the location of the Status LED, see "PZ2100A Source/Measure Unit Modules" on page 36.
  - Open the fixture cover or the shielding box access door (open interlock).
  - Discharge any capacitors connected to a channel.
- Warn persons working around the instrument about dangerous conditions.

WARNING

Une tension dangereuse (max. ± pour; 210 Vdc) émanant du dispositif l'instrument peut être sortie aux bornes High Force, High Sense et Guard. Les précautions suivantes doivent être obserées contre commotion électrique accidentelle.

- Utilisez un cordon d'alimentation CA à trois connecteurs pour connecter la cabine (si utilisée) et l'instrument à la mise électrique à la terre (sol de sécurité).
- Si un circuit de sécurité n'est pas installé dans votre test d'installation ou dans votre interface de connexion, vous devez installer et connecter le circuit de sécurité qui ouvre la borne d'enclenchement lorsque la porte d'accès à la protection de la boîte est ouverte.
- Si vous changez l'interface de connexion, un test d'installation, la sonde, ou toute autre élément, connectez un cordon d'enclenchement à celui utilisé actuellement.
- Vérifiez régulièrement que la fonction de verrouillage fonctionne normalement.
- Avant de toucher les connexions des bornes High Force, High Sense et Guard, éteignez l'instrument et déchargez tous les condensateurs. Si vous n'éteignez pas l'appareil, complétez tous les éléments suivants, indépendamment des réglages de l'appareil.
  - Appuyez sur l'interrupteur de veille et confirmez que la LED sur le côté droit s'éteint.
  - Confirmez que la LED "Status" de n'importe quel module n'est pas allumée en jaune fixe. Pour connaître l'emplacement de la LED "Status", voir “PZ2100A Source/Measure Unit Modules” on page 36.
  - Ouvrez le couvercle d'appareil ou la protection du boîtier de la porte d'accès (verrouillage ouvert).
  - Déchargez tous les condensateurs connectés au réseau.
- Informez les personnes se trouvant à proximité de l'appareil à propos des conditions dangereuses.

Inspecting the Shipment

Perform the following inspections when Keysight PZ2100A series and accessories arrive at your site.

1. Before unpacking any component, inspect all boxes for any signs of damage that might have occurred during shipment, such as:
   - dents
   - scratches
   - cuts
   - water marks

   If you suspect any damage, contact your nearest Keysight Sales and Support Office.
2. When you open the boxes that contain Keysight PZ2100A series and accessories, check the components against the contents lists attached to the boxes.

   If anything is missing, contact your nearest Keysight Sales and Support Office.

Checking the Operation of the PZ2100A

Perform the following operation after installing the modules. For the module installation, see "Module Installation" on page 65.

1. Make sure that the Standby switch is set to off.
2. Connect the power cord from the AC input connector (receptacle) on the PZ2100A mainframe's rear panel to a grounded outlet at your site.
3. Press the Standby switch to turn on the instrument.

   The initialization screen will appear on the PZ2100A mainframe's front panel display, and the power-on self test runs automatically.

If the PZ2100A is operating normally, the single-channel layout will be shown on the front panel display. For more information on the single-channel layout, see "Single-Channel Layout" on page 100.

Press the **Error** key on the front panel to check errors. If no error is detected, "0, No Error" is displayed.

You can also check errors by the following procedure.

1. Press the **Menu** key.
2. Select **Utilities** > **System** > **Error** > **Log** to display the error information.

   If no error is detected, "0, No Error" is displayed.
3. Press the **Menu** key to switch to the Meter view.

If any problem occurs, contact your nearest Keysight Sales and Support Office.

Installing the PZ2100A

This section describes information on installing the mainframe and modules.

Safety Considerations

Refer to the Safety Summary page at the beginning of this manual for general safety information. Before installation or operation, check the PZ2100A and review this manual for safety warnings and instructions. Safety warnings for specific procedures are located at appropriate places throughout this manual.

Environment

WARNING **Do not operate the instrument in dusty environment, or in the presence of flammable gases, corrosive gases, or fumes.**

Ne pas utiliser l'appareil dans un endroit poussiéreux, ou en présence de gaz inflammables, corrosifs ou de fumée.

Keysight PZ2100A series is designed for use in indoor facilities. For details of environmental conditions, refer to the data sheet.

Fans cool the instrument by drawing air through the sides and exhausting it out the back. The instrument must be installed in a location that allows sufficient space at the sides and back of the instrument for adequate air circulation.

Setting the Power Line Frequency

The power line frequency must be set properly for the AC power at your site. Press the **Menu** key on the front panel, select **Utilities** > **System** > **PLC**, and select from 50 or 60. If the line frequency is 50 Hz or 400 Hz, select 50; if 60 Hz, select 60.

When using 400 Hz, users should set the line frequency option of the PZ2100A to 50, and parameters, such as power line cycle, are internally calculated the same as for 50 Hz.

For SCPI programming, use the :SYSTem:LFRequency command.

Connecting the Power Cord

WARNING FIRE HAZARD: Use only the power cord supplied with your instrument. Using other types of power cord may cause overheating of the power cord, resulting in fire.

SHOCK HAZARD: The power cord provides the chassis ground through a third conductor. Be sure to connect to a three-conductor type power outlet with the correct pin grounded.

RISQUE D'INCENDIE : utilisez uniquement le câble d'alimentation fourni avec votre appareil. L'utilisation d'autres types de câble d'alimentation peut provoquer une surchauffe du câble d'alimentation et provoquer un incendie.

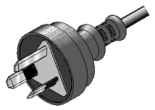
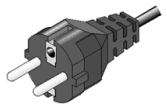
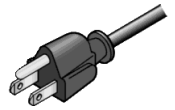
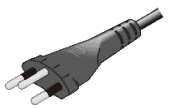
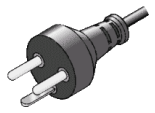
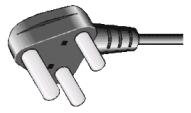
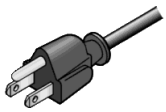
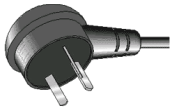
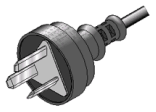
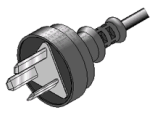
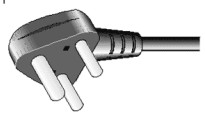
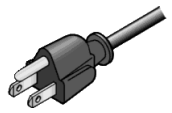
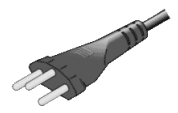
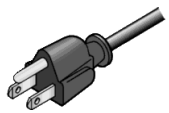
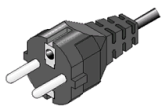
RISQUE DE CHOC ÉLECTRIQUE: le câble d'alimentation fournit la masse du châssis par le biais d'un troisième conducteur. Assurez-vous de connecter la prise d'alimentation de type trois conducteurs avec la broche correcte mise à la terre.

NOTE The detachable power cord may be used as an emergency disconnecting device. Removing the power cord will disconnect the AC input power to the instrument.

Connect the power cord to the IEC 60320 connector on the rear of the mainframe. If the wrong power cord was shipped with your instrument, contact Keysight Technologies.

The AC input on the rear panel of your mainframe is a universal AC input. It accepts nominal line voltages in the range of 100 to 240 VAC for 50 Hz and 60 Hz, or 100 to 120 VAC for 400 Hz.

Table 3-1 Power Cord Options

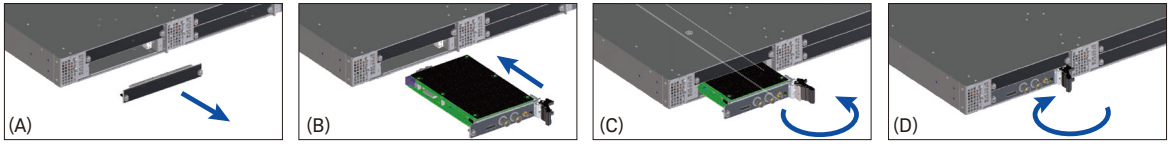
Option 900  • Plug: BS 1363/A, 250 V, 10 A • PN: 8120-4420	Option 901  • Plug: AS/NZS 3112, 250 V, 10 A • PN: 8120-4419	Option 902  • Plug: IEC 60277-1, 250 V, 10 A • PN: 8121-1226	Option 903  • Plug: NEMA 5-15P, 125 V, 10 A • PN: 8121-3446
Option 904  • Plug: NEMA 6-15P, 250 V, 10 A • PN: 8120-3996	Option 906  • Plug: SEV 1011, 250 V, 10 A • PN: 8120-4416	Option 912  • Plug: SB 107-2-D1, 250 V, 10 A • PN: 8121-1655	Option 917  • Plug: IS 1293 and IS 6538, 250 V, 10 A • PN: 8121-1690
Option 918  • Plug: JIS C 8303, 125 V, 12 A • PN: 8121-0743	Option 919  • Plug: Israel SI 32, 250 V, 10 A • PN: 8121-0724	Option 920  • Plug: IRAM 2073, 250 V, 10 A • PN: 8121-0725	Option 921  • Plug: CEI 23-16, 250 V, 10 A • PN: 8121-0722
Option 922  • Plug: GB 1002 figure 3, 250 V, 10 A • PN: 8120-8376	Option 923  • Plug: SANS 164-1, 250 V, 10 A • PN: 8121-0564	Option 927  • Plug: NEMA WD-6, 250 V, 10 A • PN: 8120-0674	Option 930  • Plug: NBR 14136, 250 V, 10 A • PN: 8121-1809
Option 931  • Plug: CNS 10917-2, 125 V, 10 A • PN: 8121-1635	Option 932  • Plug: CS 0017, 250 V, 10 A • PN: 8121-1638		

Module Installation

NOTE The information in this section applies if you have a PZ2100A mainframe without the modules installed, or if you are adding a module to the mainframe.

CAUTION **Turn off the mainframe before installing or removing modules. Observe all standard electrostatic discharge precautions before handling electronic components.**

Figure 3-1 Module Installation



Procedure

1. Make sure that the mainframe standby switch is off position.
2. Connect the power cord to a grounded outlet to establish earth ground and to prevent ESD.
3. Remove the filler panel and slot blocker on the slot where you will install the module as shown in Figure 3-1(A).

   The PZ2100A mainframe is shipped from the factory with filler panels in all slots and slot blockers in slots 2 and 4.
4. Remove the thread protectors from the left and right mounting screws of the module.
5. Hold the module by the injector/ejector handle and slide it into the slot.

   a. Place the module card edges into the module guides on the left and right of the slot as shown in Figure 3-1(B).

   b. Slide the module to the front of the mainframe and assure that the injector/ejector handle is pushed right to set the unlatched position as shown in Figure 3-1(C).

   c. When you feel resistance during installation, start pulling the injector/ejector handle to the left and completely insert the module into the mainframe.

6. Latch the module by pulling the injector/ejector handle to the left and secure the module panel to the mainframe using the mounting screws on the module panel as shown in Figure 3-1(D).
7. Tighten the screws on the module panel. Performance may suffer if the screws are not securely tightened.

CAUTION **Installing filler panels and slot blockers**

Ensure that filler panels are installed in all empty slots. Missing filler panels will impact cooling and may cause radio frequency interference (RFI) with other devices.

Ensure that slot blockers are installed correctly. If either slot 1 or 2 is empty, or either slot 3 or 4 is empty, you must install a slot blocker in the empty slot. Missing slot blockers will impact cooling.

For example, when you install only a PZ2120A module in slot 1 of the mainframe, you must install a slot blocker and filler panel in slot 2 and install filler panels in slots 3 and 4.

WARNING **When you remove the PZ2120A or PZ2121A module from the mainframe**

Immediately after powering down, the PZ2120A/PZ2121A module side panels may be hot to cause a burn. Before removing the module from the mainframe, take a time for dissipating the heat, and make sure that the side panels are cool enough to touch.

Bench Installation

Do not block the air intake and exhaust at the sides, or the exhaust at the rear of the mainframe. Minimum clearances for bench operation are 50 mm along the sides and 100 mm along the back.

WARNING The top panel of the PZ2100A mainframe may become hot during operation or immediately after turning off the instrument, which may cause burns if touched. Before touching the mainframe, take a while to allow the heat to dissipate after turning off the instrument and make sure that the top panel has cooled enough.

Rack Installation

CAUTION **You can not use support rails for rack mounting your instrument. Support rails would block the airflow needed for cooling.**

Use the rack mount kit for the PZ2100A series to install your mainframe into a rack.

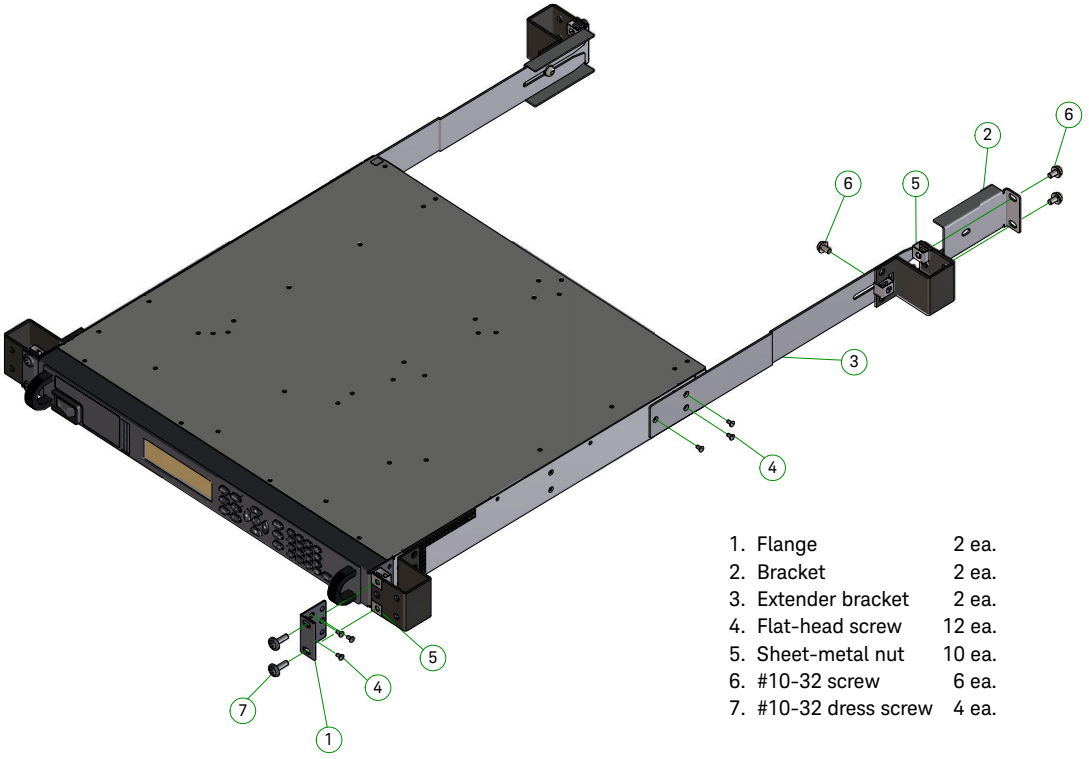
NOTE Do not block the emergency disconnecting device.

The detachable power cord may be used as an emergency disconnecting device. Removing the power cord will disconnect the AC input power to the instrument when the mainframe is used by itself. However, when the mainframe is installed in a rack, the disconnecting device may be impaired and must be considered in the installation.

The PZ2100A mainframe can be mounted in a 19-inch EIA rack cabinet. The mainframe is designed to fit in one rack-unit (1U) of space. Do not block the air intake and exhaust at the sides and the exhaust at the rear of the mainframe. Other instruments can be mounted directly above or below the PZ2100A into the rack.

Figure 3-2 shows the items for rack installation and where to install them, followed by the step-by-step procedure.

Figure 3-2 Rack Installation



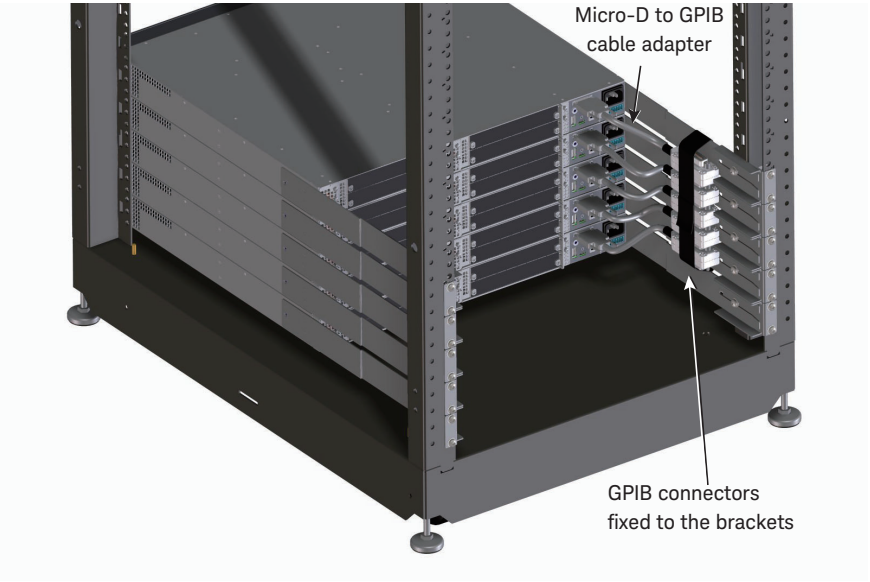
1.	Flange	2 ea.
2.	Bracket	2 ea.
3.	Extender bracket	2 ea.
4.	Flat-head screw	12 ea.
5.	Sheet-metal nut	10 ea.
6.	#10-32 screw	6 ea.
7.	#10-32 dress screw	4 ea.

Procedure

1. Install ten sheet-metal nuts (item 5) on the rack frame where you will install the instrument. Two nuts will be on each right and left side of the front frame and three nuts on each side of the rear frame.
2. Install two flanges (item 1) and two extender brackets (item 3) on the instrument with 12 flat-head screws (item 4), as shown in Figure 3-2.
3. Install two brackets (item 2) on the rear frame of the rack with four screws (item 6).
4. Slide the instrument into the rack, making the rear extender brackets aligned inside the brackets on the rear frame of the rack.
5. Attach the flanges on the instrument to the front frame of the rack with four dress screws (item 7).
6. Attach the extender brackets to the brackets and the rear frame of the rack with two screws (item 6).

When installing multiple PZ2100A mainframes in a 19-inch rack, it is recommended to fix GPIB connectors to the extender brackets with a band to avoid stress on the Micro-D connectors. Figure 3-3 shows an example.

Figure 3-3 Installing Multiple Instruments in a Rack



Connecting the Interfaces

This section describes the communication interfaces on the PZ2100A mainframe and how to connect them. The GPIB, USB, and LAN interfaces are available. The mainframe also has a Digital I/O connector as shown in Figure 2-2 on page 35.

NOTE The Keysight IO Libraries Suite is required. You can download it on www.keysight.com/find/iolib.

GPIB Connections

GPIB Connector

The PZ2100A mainframe has a micro-D connector on the rear panel for GPIB connection. The following figure and Table 3-2 show the pin assignment.

Users need a micro-D to GPIB cable for connecting with a GPIB connector.

NOTE A micro-D to GPIB cable is not supplied with the PZ2100A mainframe. It is available from Keysight as an accessory with the part number PX0110A or PX0114A.

Other micro-D to GPIB cables may not be compatible with the PZ2100A. Interoperability cannot be guaranteed with other similar GPIB cables because there is no industry standard for a micro-D connector for GPIB.

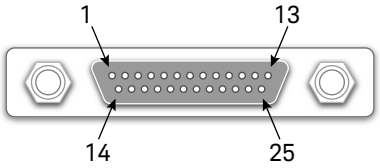


Table 3-2 Pin Assignment of the Micro-D Connector for GPIB

No.	Signal	Description	No.	Signal	Description
1	DIO1#	GPIB data 1	14	DIO6#	GPIB data 6
2	DIO2#	GPIB data 2	15	DIO7#	GPIB data 7
3	DIO3#	GPIB data 3	16	DIO8#	GPIB data 8
4	DIO4#	GPIB data 4	17	REN	Remote enable
5	EOI	End or identify	18	GND	Signal ground
6	DAV	Data valid	19	GND	Signal ground
7	NRFD	Not ready for data	20	GND	Signal ground
8	NDAC	Not data accepted	21	GND	Signal ground
9	IFC	Interface clear	22	GND	Signal ground
10	SRQ	Service request	23	GND	Signal ground
11	ATN	Attention	24	GND	Signal ground
12	Shield	Chassis ground	25	GND	Signal ground
13	DIO5#	GPIB data 5			

Connecting GPIB

The GPIB interface is enabled at power-on.

1. If you do not have a GPIB interface card installed on your computer, turn off your computer and install the GPIB interface card.
2. Connect your instrument to the GPIB interface card using a GPIB interface cable and a micro-D adapter.
3. Use the Connection Expert utility of Keysight IO Libraries Suite to configure the GPIB card's parameters.
4. Use the front panel menu, **Utilities > I/O > GPIB**, if you need to change the GPIB address.

   You can also sets the GPIB address by the SCPI command. The PZ2100A is shipped with the GPIB address set to 26.

You can now use Interactive IO within the Connection Expert to communicate with your instrument, or you can control your instrument using the various programming environments.

USB Connections

The USB interface is enabled at power-on.

1. Connect your instrument to the USB port on your computer using a USB cable. Then connect the cable to the Type-C connector on the rear panel of the instrument.

With the Connection Expert utility of Keysight IO Libraries Suite running, the computer will automatically recognize the instrument. This may take several seconds. When the instrument is recognized, the VISA alias, IDN string, and VISA address will be displayed. This information is located in the USB folder. You can also view the instrument's USB connect string using the front panel menu.

You can now use Interactive IO within the Connection Expert to communicate with your instrument, or you can control your instrument using the various programming environments.

LAN Connections

LAN connections have a site LAN and a private LAN.

A site LAN is a local area network in which LAN-enabled instruments and computers are connected to the network through routers, hubs, and switches. They are typically large, centrally-managed networks with services such as DHCP and DNS servers.

1. Connect your instrument to the site LAN or to your computer using a LAN cable.

   When the instrument is shipped from the factory, the LAN settings are configured to automatically obtain an IP address from the network using a DHCP server. The DHCP server will register the instrument's hostname with the dynamic DNS server. The hostname as well as the IP address can then be used to communicate with the instrument.

   The Lan indicator on the front panel display will appear when the LAN port configuration finishes.

2. Use the Connection Expert utility of Keysight IO Libraries Suite to add the instrument and verify a connection.

To add the instrument, you can request the Connection Expert to discover the instrument. If the instrument cannot be found, add the instrument using its hostname and IP address.

A private LAN is a network in which LAN-enabled instruments and computers are directly connected, and not connected to a site LAN. They are typically small, with no centrally-managed resources.

1. Connect your instrument to the computer using a LAN crossover cable. Alternatively, connect the computer and the instrument to a standalone hub or switch using regular LAN cables.

   When the instrument is shipped from the factory, the LAN settings are configured to automatically obtain an IP address from a site LAN using a DHCP server. You can leave these settings as they are. Most Keysight products and most computers will automatically choose an IP address using auto-IP if a DHCP server is not present. Each assigns itself an IP address from the block 169.254.*m*.*n*, where *m* and *n* are the numbers from 0 to 255. Note that this may take up to one minute.

   The Lan indicator on the front panel display will appear when the LAN port configuration finishes.

2. Use the Connection Expert utility of Keysight IO Libraries Suite to add the instrument and verify a connection.

   To add the instrument, you can request the Connection Expert to discover the instrument. If the instrument cannot be found, add the instrument using its hostname and IP address.

You can now use Interactive IO within the Connection Expert to communicate with your instrument, or you can control your instrument using the various programming environment.

Users can see the present LAN settings of the PZ2100A with the front panel operation.

1. Press the **Menu** key on the front panel to switch the display to the Menu view.
2. Select **Utilities> I/O > LAN** using the arrow keys and the **Select** key on the front panel.

   It lists the DHCP state, mDNS state, auto DNS state, DNS server name, domain name, default gateway, hostname, IP address, MAC address, subnet mask, and VISA connection strings.

For the front panel operation, see “Menu View and Operation” on page 107.

Users can also see the present LAN settings and change them with the graphical web interface. For more details, see "Using Graphical Web Interface" on page 78.

Digital I/O Connections

The PZ2100A mainframe has an 8-pin terminal block on the rear panel. Figure 3-4 and Table 3-3 show the pin assignment and the possible pin configuration for the digital I/O connector. The level of the output signal is TTL or 5 V CMOS. The input signal should be TTL or 3.3 V CMOS level.

You can connect these digital I/O terminals using a connector-terminal block furnished with the PZ2100A mainframe.

Figure 3-4 Pin Assignment for Digital I/O Connector on the Rear Panel

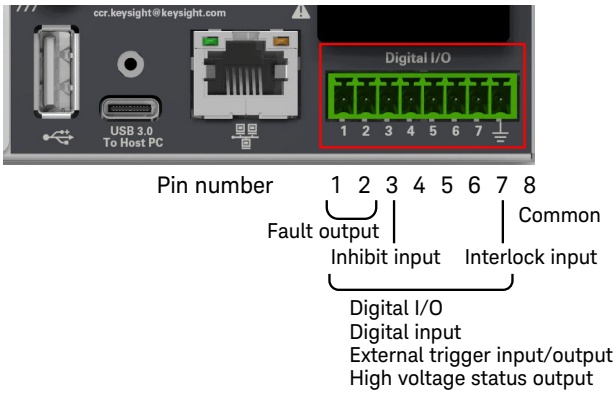


Table 3-3 Pin Configuration for Digital I/O Connector on the Rear Panel

Pin function	Available configurable pins
Digital I/O and Digital Input	Pins 1 through 7
External Trigger Input or Output	Pins 1 through 7
Fault Output	Pins 1 and 2 Pin 2 is the isolated common for Pin 1.
Inhibit Input	Pin 3
Interlock Input	Pin 7

Pin function	Available configurable pins
High Voltage Status Output	Pins 1 through 7
Common	Pin 8

Digital I/O

Each of the seven pins can be configured as general purpose bi-directional digital inputs and outputs. The polarity of the pins can also be configured. Pin 8 is the signal common for the digital I/O pins. Data is programmed according to the following bit assignments.

Pins	7	6	5	4	3	2	1
Bit weight	6 (msb)	5	4	3	2	1	0 (lsb)

Digital Input

Each of the seven pins can be configured as digital inputs. The polarity of the pins can also be configured. Pin 8 is the signal common for the digital inputs.

The pin status reflects the true condition of the external signal that is applied to the pin. When the pin is configured as a digital input, the digital output data is ignored.

External Trigger Input or Output

Each of the seven pins can be configured as trigger inputs or trigger outputs. The polarity of the pins can also be configured. When you program the trigger polarity, POSitive means a rising edge and NEGative means a falling edge. Pin 8 is the signal common for the trigger signals.

When configured as a trigger input, you can apply either a negative-going or positive-going pulse to the designated trigger input pin. The trigger latency is 5 microseconds. The minimum pulse width is 4 microseconds for positive-going signals, and 10 microseconds for negative-going signals. The pin's polarity setting determines which edge generates a trigger event.

When configured as a trigger output, the designated trigger pin will generate a 10 microsecond-wide pulse when a Trigger Output occurs. Depending on the polarity setting, it can be either positive-going (rising edge) or negative-going (falling edge) when referenced to the signal common.

Fault Output

Pins 1 and 2 can be configured as a fault-output pair. The fault output function enables a fault condition on any channel to generate a protection fault signal on the digital I/O terminal.

Both pins 1 and 2 are dedicated to this function. Pin 1 is the fault output; Pin 2 is the signal common for pin 1. This provides an optically isolated output. The polarity of pin 1 can also be configured. Note that the fault output signal remains latched until the fault condition is removed and the protection sate is cleared explicitly.

When pin 1 is configured as a fault output, the function that is selected for pin 2 is ignored. Pin 2 should be connected to the ground of the external circuit.

Inhibit Input

Pin 3 can be configured as an inhibit input. The inhibit input function lets an external input signal control the output state of all the output channels in the mainframe. When the inhibit input is active, the outputs of all modules in the mainframe will turn off, and the mainframe will be in the protection state. For more details, see "Fault and Inhibit System Protection" on page 191.

The polarity of pin 3 can also be configured. The input is level triggered. The signal latency is 5 microseconds. Pin 8 is the signal common for pin 3.

Interlock Input

The interlock input is the default setting of pin 7. Only pin 7 can be configured as an interlock input. The polarity configured for pin 7 is ignored when pin 7 is configured as the interlock input.

This pin is used to connect an interlock circuit for the mainframe. See "Installing an Interlock Circuit" on page 86. Pin 8 is the signal common for pin 4.

When the mainframe interlock function is enabled and pin 7 is not set to the interlock input, the interlock circuit is treated as open, and you cannot apply a voltage greater than the threshold.

High Voltage Status

Output	Each of the seven pins can be configured as high voltage status outputs. The high voltage status output is active when the output of any channel is on and set or held at an output voltage greater than ±42 V.
Common	The frame/chassis ground

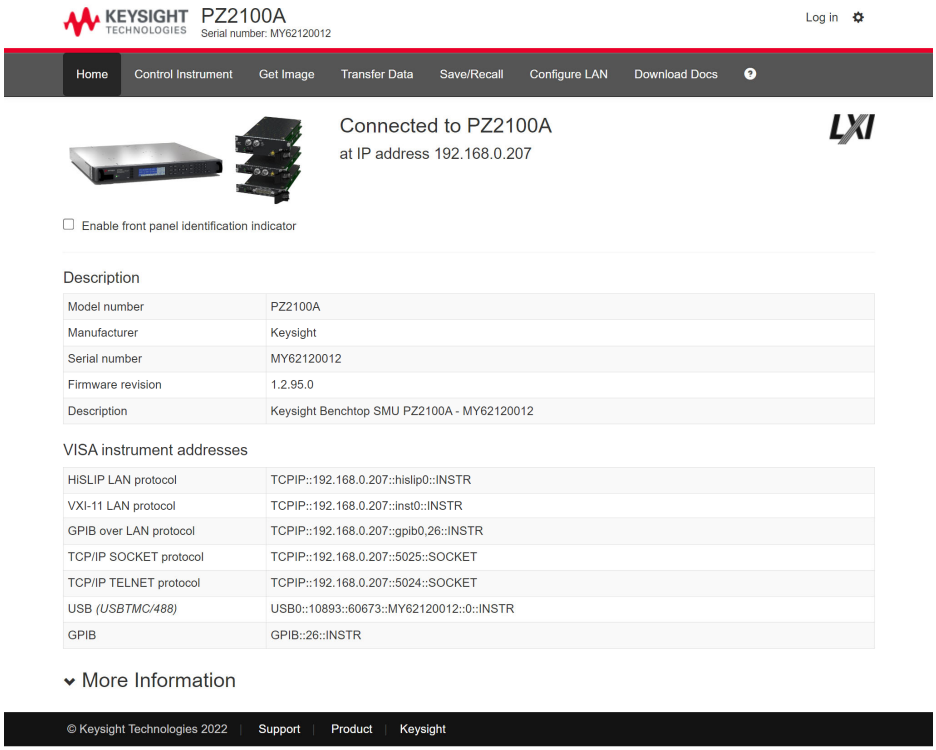
Using Graphical Web Interface

The PZ2100A has a built-in web interface that enables users to control the instrument directly and graphically from a W3C-compliant web browser.

To launch the web interface, follow the procedures below.

1. Open a web browser on your computer that is connected to the instrument using LAN.
2. Enter the instrument's hostname or IP address into the address bar on the web browser.

   The following home page will appear.

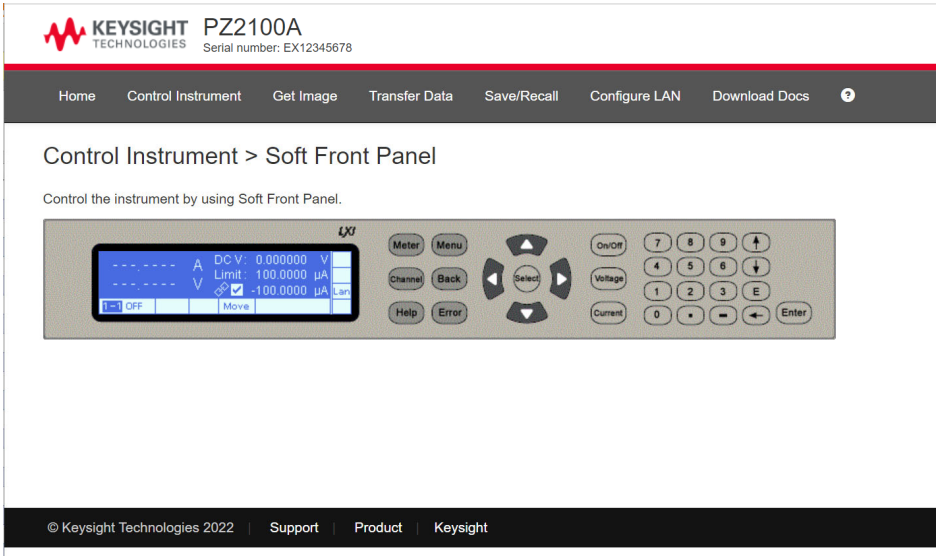


Home	Displays the home page.	
Control Instrument	Provides the Soft Front Panel.	
Get Image	Captures the image of the front panel display.	
Transfer Data	Gets the data.	
	Get...	Gets the data from the instrument to your computer.
Save/Recall	Saves or restores the instrument state.	
	Save	Saves the present configuration to your computer. The same operation as the front panel menu, **File > Save > Config**
	Recall...	Restores the instrument configuration to the previously saved one. If the hardware configuration is different from that of the saved file, an error occurs. The same operation as the front panel menu, **File > Load > Config**
Configure LAN	Displays the overview of the present LAN settings. Users can change the LAN settings in this page.	
Download Docs	Downloads the instrument SCPI Command Reference and Third Party License list.	
? (Question mark)	Opens the help page.	
Log in	Allows users to log in with a password. This item appears when the password is enabled. After the user logs in, **Log out** appears instead. The default setting is that the password is enabled. The default password is Keysight. Users can see the default password in the help page. To enable or disable the password, click the gear icon on the top-right of the page. Users can also change the password.	

Soft Front Panel on Web Interface

Soft Front Panel on the web interface allows users to control the instrument in the same way as the front panel operation. For detailed information on the front panel operation, see Chapter 4, “Front Panel Operation.”

To launch the Soft Front Panel, select **Control Instrument** from the menu and click the **Soft Front Panel** button.



Connecting a DUT

This section describes how to connect a device under test (DUT) to the PZ2100A module.

WARNING

To avoid touching the end of the extension cable or the terminal area with the DUT, cover over the conductors with insulator. Also it is important to protect the terminal area by using the grounded shield cover and such.

To prevent electrical shock and DUT damage, do not connect or disconnect the DUT while the instrument is applying voltage or current.

When you touch the DUT after the measurement, devise a countermeasure of residual charge and heat to prevent electrical shock and burn. Use gloves and any tool. Also have enough time for discharge and radiation.

Afin d'éviter de toucher l'extrémité du câble d'allongement ou l'aire de la borne avec l'appareil mis sous tension (MST), couvrez les conducteurs avec l'isolant. En outre, il est important de protéger la zone de la borne en utilisant le couvercle d'écran à la mise à terre, ou tout autre élément.

Afin d'éviter toute décharge électrique et dommage MST, ne branchez ou déconnectez pas la sortie MST alors que la source de sortie est appliquée.

Lorsque vous touchez le MST après la mesure, élaborez une contre-mesure de la charge résiduelle et du chauffage afin d'éviter tout choc électrique et toute brûlure. Utilisez des gants et des outils. Prévoyez également du temps pour la décharge et la radiation.

NOTE Set the instrument output off when changing the connections. If not, the DUT may be damaged.

NOTE **Connecting the interlock circuit**

Keysight PZ2100A series provides an interlock function to prevent the user from receiving an electrical shock from high voltages over the limit.

The limit is programmable within ±42 V. If the interlock terminals are open, the PZ2100A module *cannot* apply a high voltage.

For high voltage measurement, connect the interlock terminals to the interlock circuit as described in "Installing an Interlock Circuit" on page 86.

NOTE Generally, environmental conditions, such as electromagnetic environment, have a negative impact on the performance of the instrument. Use coaxial cables and shielding technique to minimize the impact.

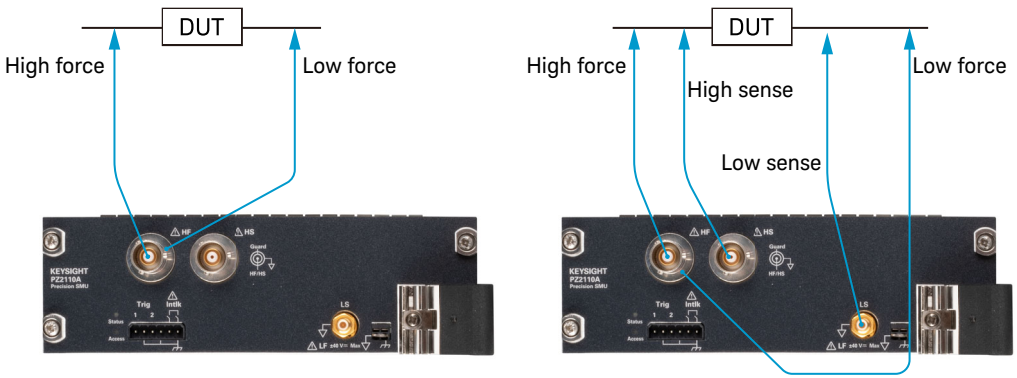
2-Wire Connection or 4-Wire Connection

When connecting a device under test (DUT), you can choose the connection type either the 2-wire connection or the 4-wire connection.

If you want to simplify the connections, use the 2-wire connection by connecting the force terminals only, while the sense terminals will remain open.

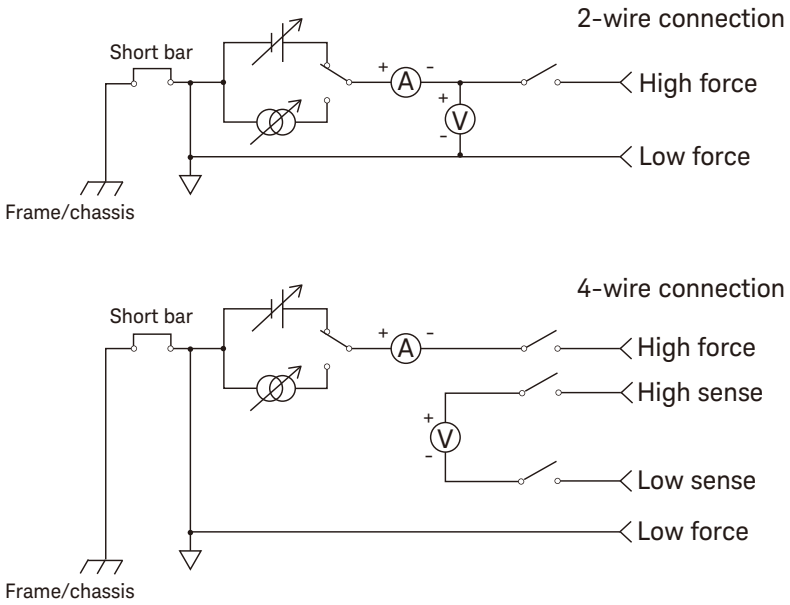
To make the 4-wire connection, well known as Kelvin connection, use both force and sense terminals. Connecting the force and sense lines together at the terminal of the DUT minimizes the measurement error by the residual resistance of the test leads or cables. This connection is effective in measuring low resistance or high current.

Figure 3-5 2-Wire Connection and 4-Wire Connection



2-wire connection 4-wire connection

Figure 3-6 Simplified SMU Circuit Diagram



Floating

When the PZ2100A module is shipped from the factory, the Low force terminal is connected to the frame/chassis terminal by a short bar. The short bar must be connected to perform the grounded measurement.

If you want to perform the floating measurement or if you want to connect another instrument's ground to the Low force, remove the short bar, and leave the terminals open. Then use the Low force terminal on the HF or HS connector to connect the other instrument.

CAUTION For the floating measurement, do not apply voltage greater than ±40 V to the Low force terminal. $V_{floating}$, the voltage between Low force and the frame/chassis ground, must be limited to ±40 V. Failure to heed this caution may result in damage to the PZ2100A module.

CAUTION Do not apply current or voltage to the frame/chassis terminal. Doing so will damage the PZ2100A module.

WARNING

To prevent electrical shock, do not touch any of measurement circuit at any time while a floating measurement is in progress. Also use accessories that comply with IEC 61010-031. All terminals and the extended conductors must be isolated by using insulation caps, sleeves, etc.

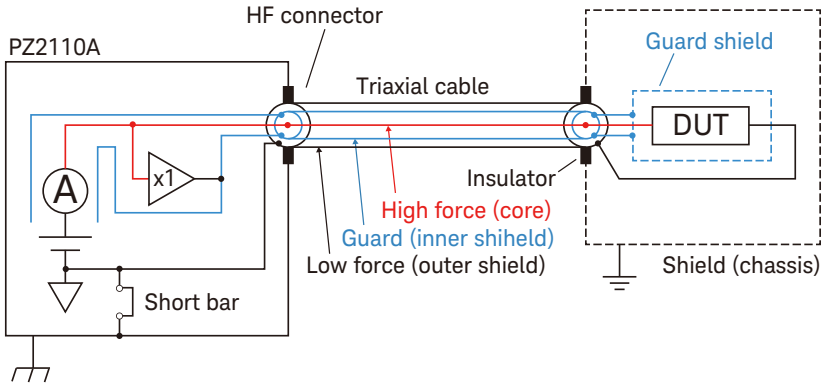
Afin d'éviter toute décharge électrique, ne touchez aucune mesure de circuit à tout moment lorsque la mesure de flotte est en cours. Utiliser également des accessoires qui sont conformes à la norme IEC 61010-031. Toutes les bornes et les conducteurs prolongés doivent être isolés en utilisant des bouchons d'isolation, des manchons, etc.

Guarding

Guarding reduces the leakage current between the instrument and a DUT. This is important when you perform low current measurements.

The overview of the guard technique for the grounded measurement is shown in Figure 3-7. The guard shield is necessary to prevent the leakage current in the measurement environment including extension cables, test fixtures, shielding boxes. So it is important to use a triaxial cable such as Keysight PX0102A-001 Low noise triaxial cable (1.5 m). The buffer amplifier keeps the potential of the Guard (inner shield of triaxial cable) at the same potential as the High force (core), so that the current does not flow between the core and the inner shield. Therefore ideally, the current measured by the instrument is the same as the current at the DUT terminal because there is no leakage current.

Figure 3-7 Example of Guard Technique for Grounded Measurement



NOTE Low force signal comes from the outer shield of the HF connector. In the grounded measurement, the outer shield of the triaxial connector must be electrically isolated from the shield of your test fixture or shielding box. Do not connect the outer shield to anything other than the low terminal of DUT.

CAUTION **Never connect the guard shield to any output, including the frame/chassis ground or any other guard terminal. Doing so will damage the PZ2100A module.**

Connecting Multiple Modules to a DUT

Users can connect multiple PZ2100A modules of different models to a DUT at the same time to perform measurements. Each PZ2100A module model has a maximum voltage and current. Do not apply a voltage or current exceeding the maximum value to the terminals of modules. For the maximum voltage and current, refer to the data sheets.

CAUTION **Do not apply a voltage or current exceeding the maximum value to the terminals of the PZ2100A modules. Doing so will damage the PZ2100A module.**

When you use multiple PZ2100A modules of different models in a measurement, a voltage or current exceeding the maximum value may be applied to the terminals of modules due to a failure such as a DUT short.

Adopting protection circuits can reduce voltage or current levels in such failures. For example, a current-limiting resistor can be inserted into the module output with the higher maximum voltage or a Zener diode can be placed at the module input with the lower maximum voltage to keep the applied voltage or current below the acceptable level. For detailed information on protection circuits, contact Keysight.

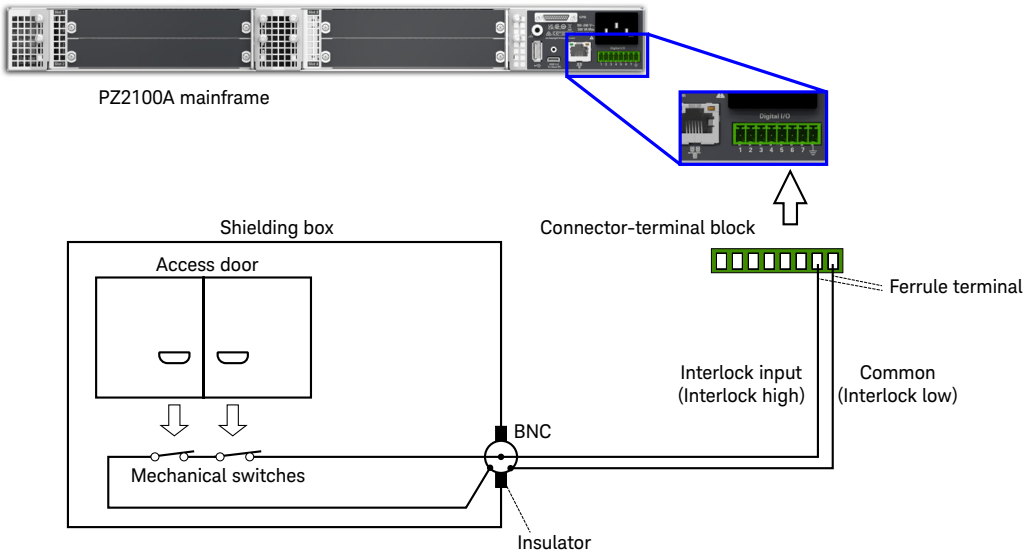
Installing an Interlock Circuit

The interlock circuit is a simple electric circuit as shown in Figure 3-8. The circuit electrically opens when the access door is open, and closes when the door is closed.

To perform high voltage measurements, the interlock terminals must be connected to the interlock circuit installed in the measurement environment such as the shielding box. The interlock circuit is important and necessary to prevent electrical shock when the user touches the measurement terminals.

The PZ2100A series has the mainframe interlock input and the module interlock terminals. Users can specify which interlock function is used for the mainframe.

Figure 3-8 Interlock Circuit Example for Mainframe Interlock



Mainframe Interlock

The PZ2100A mainframe has an interlock input on the rear panel as described in "Digital I/O Connections" on page 74.

When the interlock input is open, all Source/Measure Unit modules in the mainframe cannot apply a high voltage greater than the threshold level. If the interlock input opens when a high voltage greater than the threshold level is applied, the outputs of all modules in the mainframe will be set 0 V and turned off.

When the interlock input is connected to the signal common, the interlock circuit is closed, and Source/Measure Unit modules in the mainframe can apply high voltages greater than the threshold level.

Module Interlock

The PZ2100A module has the interlock terminals on the panel as described in "PZ2100A Source/Measure Unit Modules" on page 36.

When you select the module interlock function for your mainframe, you must connect the interlock terminals of all Source/Measure Unit modules in the mainframe to the interlock circuits.

The PZ2100A module cannot apply a high voltage greater than the threshold level when the interlock terminals are open. It can apply a high voltage greater than the threshold level when the interlock terminals are closed.

Interlock Threshold Voltage Level

The threshold level, or the interlock threshold voltage level, is programmable within ±42 V. If you set the threshold level to 0 V, the interlock function will be the same as inhibit control.

To specify the threshold level, press the **Menu** key on the front panel, select **Utilities** > **System** > **Interlock** > **Level**, and specifies the threshold level. For information on setting the threshold level by programming, refer to *SCPI Command Reference*.

To Install an Interlock Circuit

This section describes how to install the interlock circuit for the mainframe interlock terminals.

WARNING

Hazardous voltage, instrument maximum output voltage may appear at the High force, High sense, and Guard terminals if the interlock terminal is closed. To prevent electrical shock, do *not* expose these lines.

Une tension dangereuse, une tension de sortie maximale de l'appareil peut apparaître aux bornes High force, High sense et Guard si le couvercle de l'équipement est fermé. Afin d'éviter toute décharge électrique, n'exposez pas ces lignes.

CAUTION

Do not connect the interlock terminals to anything other than the interlock circuit. Applying current or voltage to the terminals may damage the PZ2100A.

Requirements

- Mechanical switch (Keysight N1254A-402 or equivalent), 2 ea.
- Connector-terminal block 2.5 mm 6-terminal, 1 ea.
- BNC to ferrule terminal cable, 1ea.

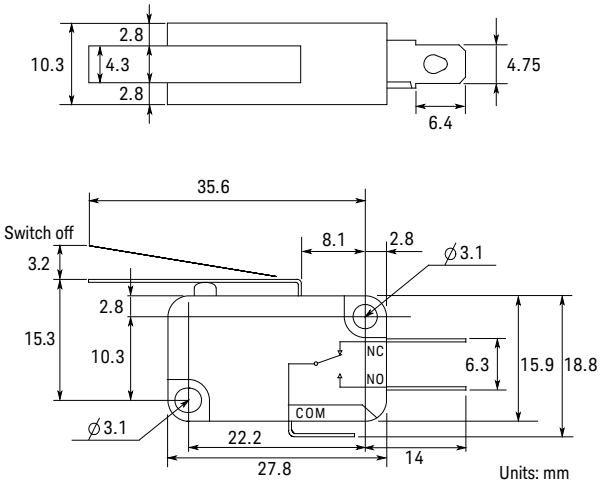
  Users can also use Keysight PX0101A-001 (1.5 m) or PX0101A-002 (3.0 m).
- BNC connector (jack to soldering terminals), 1 ea.
- Connection wires

Procedure

1. Mount two mechanical switches onto your shielding box, so that the switches close when the access door is closed, and open when the access door is open. See Figure 3-9 for the switch dimensions.
2. Mount a BNC connector onto your shielding box. Be sure that the outer shield of the BNC connector is electrically isolated from the shielding box.
3. Use a wire, and connect the two switches in series between the soldering terminals of the BNC connector as shown in Figure 3-8.
4. Connect the connector-terminal block to the PZ2100A mainframe.
5. Connect the BNC to ferrule terminal cable to the interlock terminals of the PZ2100A mainframe.
6. Connect the BNC to ferrule terminal cable to the BNC connector on the shielding box.

You can also connect the mechanical switches directly to the connector-terminal block by connection wires and ferrule terminals.

Figure 3-9 Dimension of the Interlock Switch (Keysight N1254A-402)



Updating the Firmware

Users can update the firmware with the front panel operation using a USB flash drive.

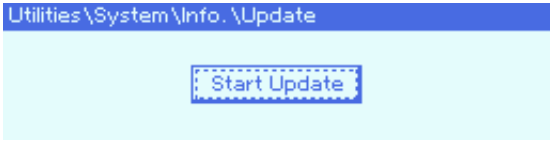
1. Place the binary file for updating the firmware in the root directory of a USB flash drive. The name must be `PZ2100A.update`.

   For example,

   ```
   D:\PZ2100A.update
   ```

2. Insert the USB flash drive into the USB port on the mainframe's rear panel.
3. Press the **Menu** key on the front panel to switch the display to the Menu view.
4. Select **Utilities** > **System** > **Info.** > **Update** using the arrow keys and the **Select** key on the front panel.

   The Start Update button appears.

5. Press the **Select** key on the front panel. Then the firmware update starts.

   It takes a few or more minutes to update the firmware. Do not turn off the instrument while updating.

   When the update finishes, the manufacturer's logo will appear.

6. Turn off and on the instrument to restart.

For the front panel operation, see "Menu View and Operation" on page 107.

Maintenance

This section provides general information on maintenance.

Cleaning

To prevent electrical shock, disconnect the mainframe from the mains before cleaning.

Use a dry soft cloth or a soft cloth slightly dampened with water a mild soap and water solution to clean the external surfaces of the mainframe, modules, and accessories. Do not use detergents or chemical solvents.

Do not attempt to clean the inside.

To clean the connectors, use alcohol in a well-ventilated area. Allow all residual alcohol moisture to evaporate, and the fumes to dissipate prior to energizing the instrument.

WARNING **SHOCK HAZARD**

To avoid any risk of electric shock, unplug the mainframe before cleaning.

Self Test

The PZ2100A provides the self test function to check the operation. It is recommended to perform the self test for the following conditions or purposes.

- If an emergency shutdown occurs

  In this condition, both Access and Status indicators of the module turn red. The shutdown condition will be solved after passing the self test.
- If you feel that the instrument may be defective
- For preventive maintenance

NOTE Before performing the self test, turn the instrument output off and disconnect cables from the measurement terminals.

Users can perform the self test using the front panel menu, **Utilities> System > Cal/Test > Self-Test**. For more information about the front panel operation, see Chapter 4, "Front Panel Operation."

The PZ2100A also provides the SCPI command, *TST?, to perform the self test.

Users can export the self-test results to a file in a USB flash drive with the front panel operation. See "Exporting the Self-Test Errors, Channel Settings, and System Information" on page 108.

Self Calibration

The PZ2100A provides the self calibration function to maintain the measurement performance.

NOTE Before performing the self calibration, turn the instrument output off and disconnect cables from the measurement terminals.

Users can perform the self calibration using the front panel menu, **Utilities > System > Cal/Test > Self-Cal**. For more information about the front panel operation, see Chapter 4, "Front Panel Operation."

The PZ2100A also provides the SCPI command, *CAL?, to perform the self calibration.

Calibration

Calibration and adjustments must be performed periodically so that the instruments satisfy the specifications and keep a good condition. It is recommended to perform the calibration once a year at least.

For the calibration and adjustments, contact your nearest Keysight Sales and Support Office. Trained service personnel will perform the calibration and adjustments.

4 Front Panel Operation

This chapter describes the front panel operation.

Front Panel Display

The PZ2100A mainframe has an LCD display with the size of 256 × 64 pixels and keys on the mainframe front panel.

Figure 4-1 Display and Keys on the Front Panel

Meter Displays the Meter view and toggles layouts. For the Meter view, see "Meter View and Operation" on page 99.

Menu Switches between the Meter view and Menu view. For the Menu view, see "Menu View and Operation" on page 107.

Channel In the Meter view, switches to the channel setting menu.

In the Menu view, toggles channels for the channel setting menu.

For the channel setting menu, see "Channel Setting" on page 112.

Back Returns to the previous item. Note that the detailed operation of this key depends on the previous operation.

Help Displays help messages for information about the displayed view.

Error Displays error messages.

Arrow keys Move the field pointer.

Select Selects the item which the field pointer indicates.

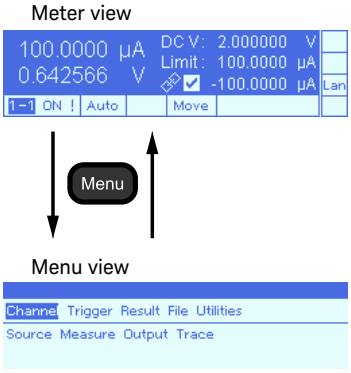
On/Off Turns on or off the outputs of channels. Users can set the key operation with the front panel menu. See "Utilities Setting" on page 124.

Voltage	Displays the voltage setting menu: **Config** > **Measure** > **Voltage** for the current source mode or **Config** > **Source** > **Voltage** for the voltage source mode. For the voltage setting menu, see "Channel Setting" on page 112.
Current	Displays the current setting menu: **Config** > **Measure** > **Current** for the voltage source mode or **Config** > **Source** > **Current** for the current source mode. For the current setting menu, see "Channel Setting" on page 112.
Numeric keys	Specify a value in the edit mode, where the **E** key sets an exponent.
Enter	Makes the value specified with the numeric keys effective.

Meter View and Menu View

The PZ2100A provides Meter view and Menu view. Press the **Menu** key to switch between these views.

Figure 4-2 Switching Meter View and Menu View



Meter view displays output settings, measurement results, and the status of modules and the mainframe. For more information, see "Meter View and Operation" on page 99.

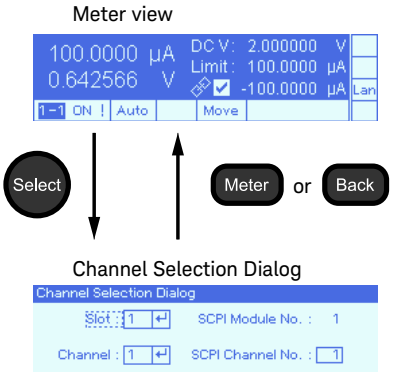
Menu view allows users to see and set parameters and options for each channel or for the mainframe. For more information, see "Menu View and Operation" on page 107. All menus are listed in "Front Panel Menu Reference" on page 112.

Channel Selection

To set the channel to be displayed, move the field pointer using the arrow keys to the slot-channel in the Meter view, and press the **Select** key. Then the display turns to the Channel Selection Dialog.

To go back to the Meter view, press the **Meter** or **Back** key.

Figure 4-3 Switching Meter View and Channel Selection Dialog



The PZ2100A has two expressions for indicating a channel. One is the slot-channel for the front panel operation, and the other is the channel number for the SCPI programming. You can specify the slot and channel numbers or the channel number for the SCPI programming in the Channel Selection Dialog.

If you specify the slot and channel in the Channel Selection Dialog, the channel number for the SCPI programming will be set automatically. If you specify the channel number for the SCPI programming, the slot and channel will be set automatically.

Help and Error Messages

The PZ2100A front panel display also provides help messages and error messages. Press the **Help** key to display the help message, or press the **Error** key to display the error message.

Users can also check errors with the front panel menu, **Utilities**> **System** > **Error** > **Log**.

Pop-up Message Window

Pop-up message windows provide information on errors or the instrument lock. They also display the messages set by users. A pop-up message window will disappear when a user presses any key on the front panel.

An error message window appears on the front panel display when an error occurs, for example, a GUI error or an emergency. It informs users that something users do not expect on the instrument. The following figure shows an example.

The PZ2100A has the communication interfaces: GPIB, USB, and LAN. These interfaces can lock the instrument by the :SYSTem:LOCK:REQuest? command. When an interface locks the instrument, only the interface can control the instrument remotely, and a pop-up message window like the following will appear.

The instrument lock is cleared by the :SYSTem:LOCK:RELease command.

Users can set the message of the pop-up message window using the SCPI commands, :DISPlay:WINDow:TEXT:DATA and :DISPlay:WINDow:TEXT:STATus. The following figure shows an example.

Remote Display Mode

The PZ2100A has the remote display mode, which means whether the front panel display turns on or off while the instrument is controlled remotely.

If the remote display mode is disabled, the front panel display turns off, and only the mainframe indicators appear while in the remote operation, as shown in the following figure. Events except an emergency do not update the front panel display.

Users can enable or disable the remote display mode with the front panel menu, **Utilities** > **Display** > **Remote**.

You can also enable or disable the remote display mode using the SCPI command, :DISPlay:ENABle.

When you execute :DISPlay:ENABle OFF, the remote display mode will be disabled, and the display will turn off. When you execute :DISPlay:ENABle ON, the remote display mode will be enabled, and the display will turn on.

If you press the **Back** key during the remote operation, the instrument will turn into the front panel operation, or the local operation, and the display will turn on. Note that pressing the **Back** key will be ignored if any communication interface locks the instrument.

The setting of the remote display mode is stored in the nonvolatile memory. The default setting is that the remote display mode is disabled.

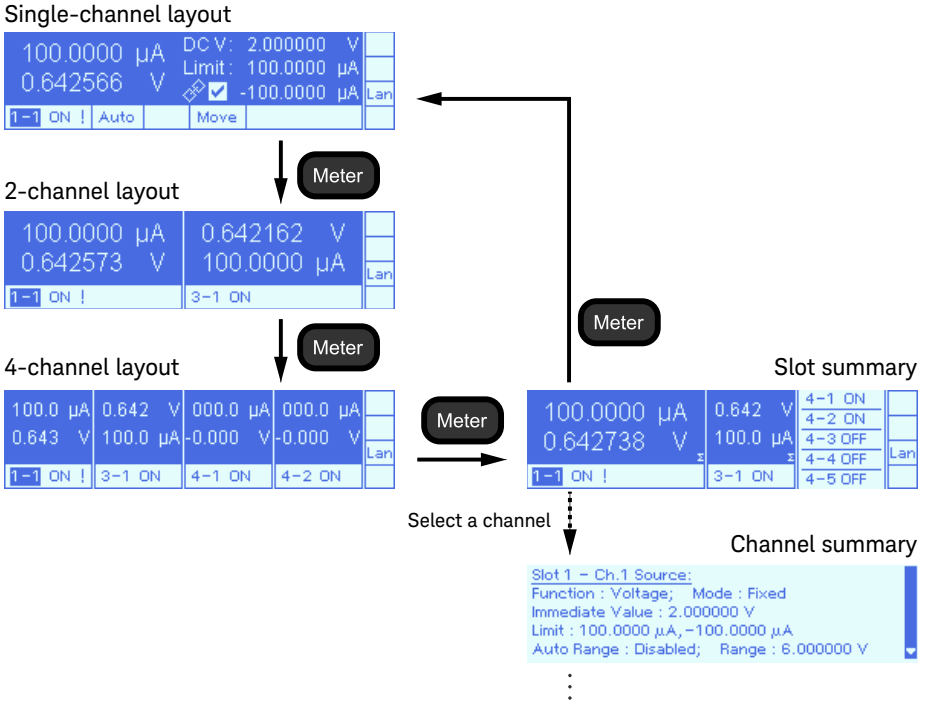
Meter View and Operation

Meter view displays output settings, measurement results, and the status of the modules and mainframe.

Meter view has five layout types: single-channel layout, 2-channel layout, 4-channel layout, slot summary, and channel summary. The 2-channel layout is available when the mainframe has multiple channels. The 4-channel layout is available when the mainframe has three or more channels.

Pressing the **Meter** key toggles these layouts except the channel summary as shown in Figure 4-4. To switch to the channel summary, select the channel in the slot summary.

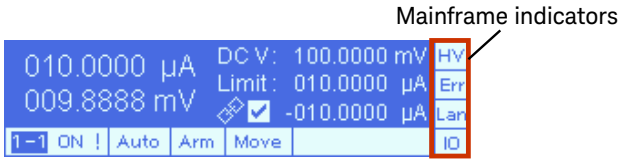
Figure 4-4 Meter View



Mainframe Indicators

Mainframe indicators appear on the right border of all the Meter view layouts except the channel summary as shown in Figure 4-5 to inform users of the mainframe status.

Figure 4-5 Mainframe Indicators Example



Each indicator appears when the mainframe is in the following status.

HV High voltage status

The output of any channel in the mainframe is on and set or held at an output voltage greater than ±42 V.

Err Error status

At least one error is detected.

Lan LXI LAN status

The LAN interface is successfully configured.

If the device identification turns on when this indicator appears, this indicator will be flashing.

IO Remote control status

The communication interface is active and the mainframe is controlled remotely.

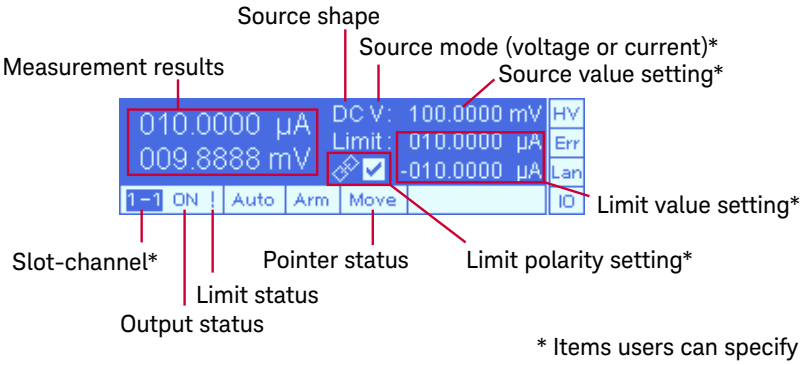
To switch to the front panel operation, or the local operation, press the **Back** key.

Single-Channel Layout

Single-channel layout displays the measurement results, output settings, Limit values, and other status indicators of a specified channel as shown in Figure 4-6.

With this single-channel layout, users can set the parameters and operate the instrument as a DC source.

Figure 4-6 Example of Single-Channel Layout



Measurement results Measurement voltage and current results

Source shape Source output shape

The icons are listed below.

DC	DC
	Pulse
	Linear single sweep
	Linear single pulse sweep
	Linear double sweep
	Linear double pulse sweep
	List sweep
	List pulse sweep

Source mode Source mode: voltage (V) or current (A)

Users can select the source mode on the front panel. Press the arrow keys to move the field pointer to the source mode icon and press the **Select** key. Then press up- or down-arrow keys to select V for the voltage source mode or A for the current source mode.

Source value setting Source output voltage or current value

Users can set the DC source output value on the front panel. Move the field pointer to the source value setting, and press the **Select** key. First, set the value using the numeric keys, and press the **Enter** key. Second, set the unit using up- or down-arrow keys, and press the **Enter** key.

Limit value setting

Limit value

Users can set the Limit value on the front panel in the same way as the DC source output value.

Limit polarity setting

Polarity setting for the Limit value

The polarity setting enables users to set the positive and negative Limit values simultaneously; users should specify only one of the Limit values. If the polarity setting is disabled, users should specify both the positive and negative Limit values.

To enable the Limit polarity setting, move the field pointer to the check box of the Limit polarity setting, and press the **Select** key.

Slot-channel

Slot number and channel number

For example, 2-1 means that the information about channel 1 of the module in slot 2 is displayed.

For setting the slot number and channel number using the front panel display, see "Channel Selection" on page 96.

Output status

Output status indicator

OFF	Output off
ON	Output on
HV	High voltage status The output of the displayed channel is on and set or held at an output voltage greater than ±42 V.
INTL	Interlock open The output of the displayed channel is off because the interlock circuit opens when the channel is in the high voltage status.
OV	Over voltage Over voltage emergency is detected and the output is disabled.

OC	Over current Over current emergency is detected and the output is disabled.
OT	Over temperature Over temperature emergency is detected and the output is disabled.
PF	Power failure Power failure emergency is detected and the output is disabled.

Limit status Limit status

When the measurement value reaches the Limit value, an exclamation point (!) appears.

Auto Auto appears when the channel output is on and the repeat measurement is running.

Users can enable or disable the repeat measurement using the front panel menu. The repeat measurement starts when the channel output is turned on by the **On/Off** key.

The repeat measurement is performed with a DC source and the internally predefined trigger. The trigger parameters set by users are ignored. The measurement results appear in the Meter view except the channel summary layout and are not stored in the buffer.

When the instrument is controlled remotely, the repeat measurement is automatically disabled.

Arm Arm appears when the trigger system is running. ARM disappears when the trigger system turns to the idle status.

Pointer status Status of the field pointer

Move	Users can move the pointer from a field to another field using the arrow keys.
Edit	Users can specify the highlighted parameter using the arrow keys and numeric keys.

2-Channel and 4-Channel Layout

The 2-channel and 4-channel layouts display the measurement results, the slot and channel number, an output status indicator, and the Limit status of the specified channels as shown in Figures 4-7 and 4-8. For more information on each indicators, see "Measurement results," "Slot-channel," "Output status," and "Limit status."

The 2-channel layout is available for the mainframe containing multiple channels, and the 4-channel layout is available for the mainframe containing three or more channels.

Figure 4-7 Example of 2-Channel Layout

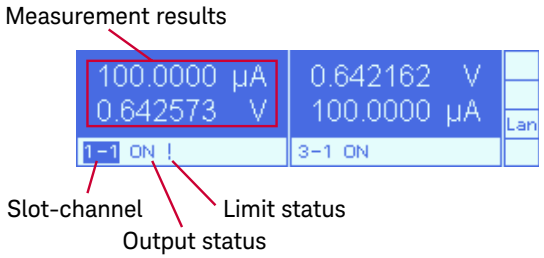
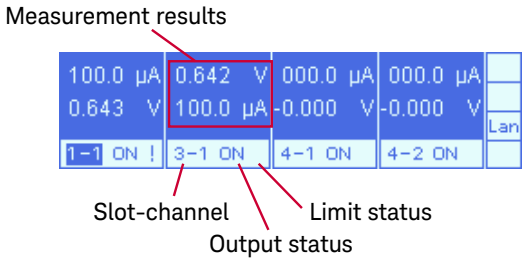


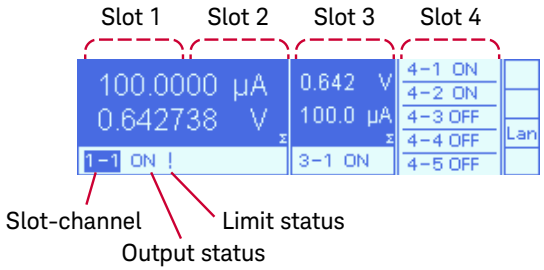
Figure 4-8 Example of 4-Channel Layout



Slot Summary

The slot summary shows the output status of each channel of four slots. Figure 4-9 shows an example that the mainframe has a PZ2110A module in slot 1 and 2, a PZ2120A or PZ2121A module in slot 3, and a PZ2130A or PZ2131A module in slot 4.

Figure 4-9 **Example of Slot Summary**



The PZ2110A module occupies two slots, and the module information is displayed on half of the LCD in the same way as the 2-channel layout. A Σ mark on the right-bottom corner means that it is a component of the slot summary, not the 2-channel layout.

The PZ2120A or PZ2121A has only one channel, and the module information is displayed in the same way as the 4-channel layout. A Σ mark on the right-bottom corner means that it is a component of the slot summary, not the 4-channel layout.

The PZ2130A or PZ2131A has five channels, and the summarized information of all channels is listed.

If the mainframe has an empty slot, the slot information will be blank in the slot summary.

Channel Summary

The channel summary shows the parameters and settings of the specified channel as shown in Figure 4-10. The summary contains the same parameters as those of the exported file of channel parameter settings. See Table 4-1 in "Exporting the Self-Test Errors, Channel Settings, and System Information" on page 108.

To display the channel summary, move the filed pointer to the slot-channel field in the slot summary using the arrow keys, and press the **Select** key.

To scroll the channel summary, use the arrow keys; the up- and down-arrow keys scroll each line, and the right- and left-arrow keys scroll each page.

To go back to the slot summary, press the **Back** key.

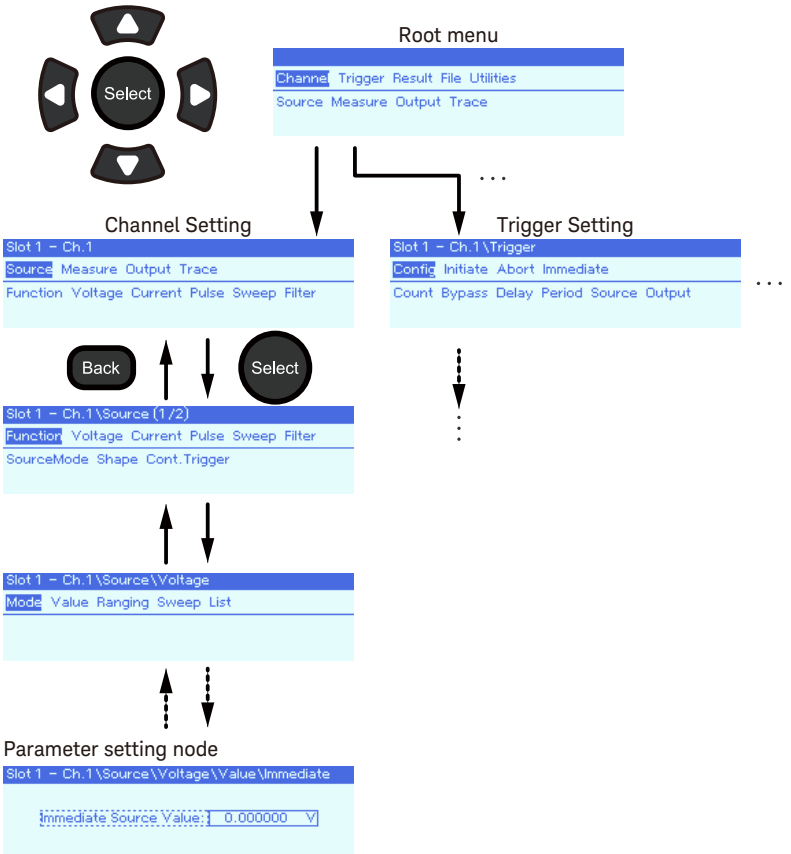
Figure 4-10 Example of Channel Summary

Menu View and Operation

Menu view allows users to see the settings and to set the parameters and options for each channel or the mainframe.

Press the **Menu** key to switch the display to the Menu view.

Figure 4-11 Menu View Operation



The PZ2100A front panel menu has a hierarchical structure. Users can select from Channel, Trigger, Result, File, or Utilities in the root menu using the arrow keys and the **Select** key. When you select an option, the subsequent level menu will appear, as shown in Figure 4-11. To go back to the previous menu, press the **Back** key.

When users reach the parameter setting node, they can set the parameter using the arrow keys, the numeric keys, and the **Select** key.

All menus are listed in "Front Panel Menu Reference" on page 112.

Exporting the Self-Test Errors, Channel Settings, and System Information

Users can export the data to three files in a USB flash drive using the front panel menu. Each file contains the self-test errors, the summary of channel parameter settings, or the system information of the instrument.

1. Insert a USB flash drive into the USB port on the mainframe's rear panel.
2. Press the **Menu** key on the front panel to switch the display to the Menu view.
3. Select **Utilities** > **System** > **Info.** > **Export** using the arrow keys and the **Select** key on the front panel.

   The Export Info. Data button appears.

4. Press the **Select** key on the front panel. Then exporting the data starts.

   The self-test errors are stored in Dump.txt, the summary of channel parameter settings is stored in ChannelSummary.txt, and the system information of the instrument is stored in SystemInfo.txt.

   The files will be placed in the root directory of the USB flash drive.

The summary of channel parameter settings includes the parameters shown in Table 4-1 for all channels in the mainframe.

The system information of the instrument includes the items shown in Table 4-2.

Table 4-1 Channel Parameters in the Exported Data

	Setting item
Source	Function
	Mode
	Immediate value
	Limit
	Auto range
	Range
Measure	Speed
	Range
Arm and trigger settings for Acquire device action Arm and trigger settings for Transient device action	Source
	Count
	Delay
	Period
	Trigger output
	Bypass
Pulse	State
	Base
	Peak
	Delay
	Width

	Setting item
Sweep	State
List sweep	Operation mode
	Start (Not available for List sweep)
	Stop (Not available for List sweep)
	Points
	Step (Not available for List sweep)
	Values (Available for only List sweep)
Module	Model name
	Model description
	Serial number
	Slot number

Table 4-2 System Information in the Exported Data

	Setting item
Instrument information	Manufacturer
	Model number
	Serial number
	Firmware version
Mainframe information	Carrier board revision
	Carrier board FPGA revision
	Backplane board revision
	Backplane board FPGA revision
Slot information	Module model number
	Module bus FPGA revision
	Module float FPGA revision

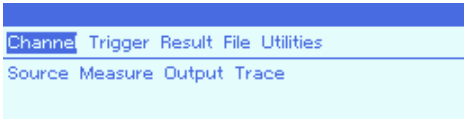
The following shows an example of SystemInfo.txt that contains the system information of the instrument.

```
Firmware: Keysight Technologies,PZ2100A,EX12345678,0.16.29.0
Mainframe: 1, 2.52, 3, 2.37
Slot1: PZ2110A, 1.64, 2.32
Slot2: (empty)
Slot3: PZ2121A, 2.57, 2.78
Slot4: PZ2131A, 2.33, 4.60
```

Front Panel Menu Reference

The PZ2100A's front panel menu has a hierarchical structure. The root menu consists of Channel, Trigger, Result, File, and Utilities, as shown in Figure 4-12. This section provides an overview of all front panel menus in tables of root menu options.

Figure 4-12 Root menu



Channel Setting

The following table shows the channel setting menu in a hierarchical structure.

Table 4-3 Channel Setting Menu

Menu			Description and SCPI commands
Source	Function	SourceMode	Selects the source output mode from Voltage or Current. [:SOURce]:FUNCtion:MODE
		Shape	Selects the source output shape from DC or Pulse. [:SOURce]:FUNCtion[:SHAPe]
		Cont.Trigger	Enables or disables the continuous trigger output. [:SOURce]:FUNCtion:TRIGgered:CONTinuous
	Voltage	Mode	Selects the source mode from Sweep, List, or Fixed. [:SOURce]:VOLTage:MODE

Menu				Description and SCPI commands
(Source)	(Voltage)	Value	Immediate	Changes the output value immediately. [:SOURce]:VOLTage[:LEVel][:IMMediate][:AMPlitude]
			Triggered	Changes the output level when a trigger from the trigger source is detected and the trigger delay time for the Transient elapses. [:SOURce]:VOLTage[:LEVel]:TRIGgered[:AMPlitude]
		Ranging	Auto	Specifies the automatic output ranging operation. [:SOURce]:VOLTage:RANGe:AUTO [:SOURce]:VOLTage:RANGe:AUTO:LLIMit
			Fixed	Specifies the output range (source range). [:SOURce]:VOLTage:RANGe
		Sweep	Start/Stop	Specifies the start and stop values and the number of sweep steps for the sweep output. [:SOURce]:VOLTage:STARt [:SOURce]:VOLTage:STOP [:SOURce]:VOLTage:POINts
			Base	Selects the level and type of pulse base. [:SOURce]:VOLTage:BASE:LEVel [:SOURce]:VOLTage:BASE[:TYPE]
			Post	Specifies the output value after the sweep. [:SOURce]:VOLTage:POST:LEVel [:SOURce]:VOLTage:POST:TYPE [:SOURce]:VOLTage:POST[:STATe]
		List	ValueTable	Displays the list sweep values.

Menu				Description and SCPI commands
(Source)	(Voltage)	(List)	Trig.OutputTable	Displays the values of trigger output table.
	Current	Mode		Selects the source mode from Sweep, List, or Fixed. [:SOURce]:CURRent:MODE
		Value	Immediate	Changes the output value immediately. [:SOURce]:CURRent[:LEVel][:IMMediate][:AMPlitude]
			Triggered	Changes the output level when a trigger from the trigger source is detected and the trigger delay time for the Transient elapses. [:SOURce]:CURRent[:LEVel]:TRIGgered[:AMPlitude]
		Ranging	Auto	Specifies the automatic output ranging operation. [:SOURce]:CURRent:RANGe:AUTO [:SOURce]:CURRent:RANGe:AUTO:LLIMit
			Fixed	Specifies the output range (source range) of the specified source channel. [:SOURce]:CURRent:RANGe
		Sweep	Start/Stop	Specifies the start and stop values and the number of sweep steps for the sweep output. [:SOURce]:CURRent:STARt [:SOURce]:CURRent:STOP [:SOURce]:CURRent:POINts
			Base	Selects the level and type of pulse base. [:SOURce]:CURRent:BASE:LEVel [:SOURce]:CURRent:BASE[:TYPE]

Menu				Description and SCPI commands
(Source)	(Current)	(Sweep)	Post	Specifies the output value after the sweep. [:SOURce]:CURRent:POST:LEVel [:SOURce]:CURRent:POST:TYPE [:SOURce]:CURRent:POST[:STATe]
		List	ValueTable	Displays the list sweep values.
			Trig.OutputTable	Displays the values of trigger output table.
	Pulse	Delay		Sets the pulse delay time. [:SOURce]:PULSe:DELay
		Width		Sets the pulse width. [:SOURce]:PULSe:WIDTh
		RangePriority		Selects the pulse range priority. Available for PZ2120A and PZ2121A. [:SOURce]:PULSe:RPRiority
	Sweep	Spacing		Selects the scale of the sweep output from linear or logarithmic. [:SOURce]:SWEep:SPACing
		Stair		Selects the sweep mode from Single or Double. [:SOURce]:SWEep:STAir
		Ranging		Selects the output ranging mode of the sweep output from Best, Fixed, or Auto. [:SOURce]:SWEep:RANGing
		Direction		Selects the sweep direction. [:SOURce]:SWEep:DIRection
	Filter	State		Enables or disables the output filter. :OUTPut:FILTer[:LPASs][:STATe]

Menu				Description and SCPI commands
(Source)	(Filter)	Auto		Enables or disables the automatic filter. :OUTPut:FILTer[:LPASs]:AUTO
		TimeConstant		Sets the time constant of the output filter. :OUTPut:FILTer[:LPASs]:TCONstant
	Wait			Sets the parameters for calculating the source wait time. [:SOURce]:WAIT:AUTO [:SOURce]:WAIT:GAIN [:SOURce]:WAIT:OFFSet [:SOURce]:WAIT[:STATe]
Measure	Speed			Sets the integration time for one measurement point. :SENSe:<VOLTage|CURRent>[:DC]:APERture :SENSe:<VOLTage|CURRent>[:DC]:APERture:AUTO
	Digitizer	State		Enables or disables the digitizer mode. :SENSe:FUNCtion:MODE
		Point/Time		Sets the parameters for the digitizer mode. :SENSe:SAMPling:POINts :SENSe:SAMPling:TIME
	Voltage	Limit	Level	Sets the Limit value. :SENSe:VOLTage:PROTection[:LEVel]:NEGative :SENSe:VOLTage:PROTection[:LEVel]:POSitive :SENSe:VOLTage:PROTection[:LEVel][:BOTH]

Menu				Description and SCPI commands
(Measure)	(Voltage)	(Limit)	Range	Sets the measurement range for the specified Limit value. :SENSe:VOLTage:PROTection:RANGe :SENSe:VOLTage:PROTection:RANGe:AUTO
		Ranging	Fixed	Sets the measurement range for the specified value. :SENSe:VOLTage[:DC]:RANGe[:UPPer]
			Auto	Sets the automatic ranging. :SENSe:VOLTage[:DC]:RANGe:AUTO :SENSe:VOLTage[:DC]:RANGe:AUTO:LLIMit
	Current	Limit	Level	Sets the Limit value. :SENSe:Current[:DC]:PROTection[:LEVel]:NEGative :SENSe:Current[:DC]:PROTection[:LEVel]:POSitive :SENSe:Current[:DC]:PROTection[:LEVel][:BOTH]
			Range	Sets the measurement range for the specified Limit value. :SENSe:Current[:DC]:PROTection:RANGe :SENSe:Current[:DC]:PROTection:RANGe:AUTO
		Ranging	Fixed	Sets the measurement range for the specified value. :SENSe:Current[:DC]:RANGe[:UPPer]
			Auto	Sets the automatic ranging. :SENSe:Current[:DC]:RANGe:AUTO :SENSe:Current[:DC]:RANGe:AUTO:LLIMit

Menu				Description and SCPI commands
(Measure)	(Current)	(Ranging)	Seamless	Enables or disables the seamless current measurement ranging. Available for PZ2120A, PZ2121A, PZ2130A, and PZ2131A. :SENSe:CURRent[:DC]:RANGe:SLESs[:STATe] Sets the lower limit for the seamless current measurement ranging. Available for PZ2130A and PZ2131A. :SENSe:CURRent[:DC]:RANGe:SLESs:LLIMit
	RemoteTransient			Enables or disables the remote transient voltage measurement. Available for PZ2120A and PZ2121A. :SENSe:RTVoltage[:DC][:STATe]
	Wait			Sets the parameters for calculating the measurement wait time. :SENSe:WAIT:GAIN :SENSe:WAIT:OFFSet :SENSe:WAIT:STATe
Output	AutoOff			Enables or disables the automatic output off function. :OUTPut:OFF:AUTO
	AutoOn			Enables or disables the automatic output on function. :OUTPut:ON:AUTO

Menu				Description and SCPI commands
(Output)	Mode			Selects the output operation mode from NORMAL, PSUPPLY, HCAPACITANCE, and LDIODE. PSUPPLY is available for PZ2110A, PZ2120A, PZ2121A, PZ2130A, and PZ2131A. HCAPACITANCE and LDIODE are available for PZ2120A and PZ2121A. :OUTPut:MODE
	OffState			Selects the source condition after the output is off. The options are Zero, Hiz, and Normal. :OUTPut:OFF:MODE
	Resistance	State		Enables or disables the output resistance. :OUTPut:RESistance:[STATe]
		Series		Sets the value of output series resistance from –2 MΩ to +2 MΩ. This value is valid when the source function is Voltage. :OUTPut:RESistance:SERies[:LEVel]
		Shunt		Sets the value of output shunt resistance from 0.2 Ω to 2 GΩ. This value is valid when the source function is Current. :OUTPut:RESistance:SHUNt[:LEVel]
		Filter	State	Enables or disables the output resistance filter. :OUTPut:RESistance:FILTer[:LPASs]:STATe
			Auto	Enables or disables the function to automatically set the output resistance filter. :OUTPut:RESistance:FILTer[:LPASs]:AUTO:STATe

Menu				Description and SCPI commands
(Output)	(Resistance)	(Filter)	TimeConstant	Sets the time constant of the output resistance filter. This setting is ignored if the function to automatically set the output resistance filter is enabled. :OUTPut:RESistance:FILTer[:LPASs]:TCONstant
Trace	BufferControl			Selects the trace buffer control. :TRACe:FEED:CONTrol
	BufferSize			Sets the size of the trace buffer. This command is valid when the trace buffer control mode is set to Never. :TRACe:POINts

Trigger Setting

The following table shows the trigger setting menu in a hierarchical structure.

Table 4-4 Trigger Setting Menu

Menu		Description and SCPI commands
Config	Count	Sets the arm and trigger count. :ARM:ACQuire[:LAYer]:COUNt, :ARM:TRANsient[:LAYer]:COUNt :TRIGger:ACQuire:COUNt :TRIGger:TRANsient:COUNt

Menu			Description and SCPI commands
(Config)	Bypass		Sets the function to bypass the event detector for the first time in the arm or trigger loop of the specified device action. :ARM:ACQuire[:LAYer]:BYPass :ARM:TRANsient[:LAYer]:BYPass :TRIGger:ACQuire:BYPass :TRIGger:TRANsient:BYPass
	Delay		Sets the arm and trigger delay. :ARM:ACQuire[:LAYer]:DELay :ARM:TRANsient[:LAYer]:DELay :TRIGger:ACQuire:DELay :TRIGger:TRANsient:DELay
	Period		Sets the interval of the TIMER trigger source. :ARM:ACQuire[:LAYer]:TIMer :ARM:TRANsient[:LAYer]:TIMer :TRIGger:ACQuire:TIMer :TRIGger:TRANsient:TIMer
	Source		Selects the trigger source. :ARM:ACQuire[:LAYer]:SOURce[:SIGNal] :ARM:TRANsient[:LAYer]:SOURce[:SIGNal] :TRIGger:ACQuire:SOURce[:SIGNal] :TRIGger:TRANsient:SOURce[:SIGNal]
	Output	State	Enables or disables the trigger output. :ARM:ACQuire[:LAYer]:TOUTput[:STATe] :ARM:TRANsient[:LAYer]:TOUTput[:STATe] :TRIGger:ACQuire:TOUTput[:STATe] :TRIGger:TRANsient:TOUTput[:STATe] [:SOURce]:TOUTput[:STATe] :SENSe:TOUTput[:STATe]

Menu			Description and SCPI commands
(Config)	(Output)	Signal	Selects the trigger source or the trigger output port. :ARM:ACQuire[:LAYer]:TOUTput:SIGNal :ARM:TRANsient[:LAYer]:TOUTput:SIGNal :TRIGger:ACQuire:TOUTput:SIGNal :TRIGger:TRANsient:TOUTput:SIGNal [:SOURce]:TOUTput:SIGNal :SENSe:TOUTput:SIGNal
Initiate			Initiates the device action. The trigger status will be changed from idle to initiated. :INITiate[:IMMediate][:ALL] :INITiate[:IMMediate]:ACQuire :INITiate[:IMMediate]:TRANsient
Abort			Aborts the device action. The trigger status is changed to idle. :ABORt[:ALL] :ABORt:ACQuire :ABORt:TRANsient
Immediate	Arm		Sends an immediate arm trigger. :ARM[:ALL][:LAYer][:IMMediate] :ARM:ACQuire[:LAYer][:IMMediate] :ARM:TRANsient[:LAYer][:IMMediate]
	Trigger		Sends an immediate trigger. :TRIGger[:ALL][:IMMediate] :TRIGger:ACQuire[:IMMediate] :TRIGger:TRANsient[:IMMediate]

Result Setting

The following table shows the result setting menu in a hierarchical structure.

Table 4-5 Result Setting Menu

Menu	Description
Measure	Displays the measurement result data.
Trace	Displays the values in the trace buffer.

File Setting

The following table shows the file setting menu in a hierarchical structure.

Table 4-6 File Setting Menu

Menu		Description
Load	Config	Loads the configuration data.
	Program	Loads the program memory data.
Save	Config	Saves the configuration data.
	Program	Saves the program memory data.
	Measurement	Saves the measurement result data.
	Trace	Saves the trace buffer data.

Utilities Setting

The following table shows the utilities menu in a hierarchical structure.

Table 4-7 Utilities Setting Menu

Menu			Description and SCPI commands
Program	Catalog		Displays the defined program catalog. :PROGram:CATalog?
	Select		Selects the program. :PROGram[:SELected]:NAME
	Control		Sets the execution status of the program. :PROGram[:SELected]:STATe
	View		Displays the selected program.
Group	Assign	Setting	Defines the channels in the groups. :SYSTem:GROup[:DEFine]
		List	Displays the channels in the groups.
	Reset		Restores the channel group setting to the default.The channel grouping is enabled and all channels are assigned to the channel group 1. :SYSTem:GROup:PRESet
	State		Enables or disables the channel grouping. :SYSTem:GROup:STATe

Menu				Description and SCPI commands
I/O	Format	Measure		Specifies the elements included in the measurement result data. :FORMat:ELEMent:SENSe
		DataType		Sets the data output format. :FORMat[:DATA]
		DataSwap		Sets the byte order of binary output data. :FORMat:BORDer
	DIO	Function		Selects the function for the specified digital I/O terminal. [:SOURce]:DIGital:EXTernal[:FUNCtion]
		Level		Selects the signal level of the specified digital I/O terminal. [:SOURce]:DIGital:EXTernal:LEVel
		Polarity		Selects the polarity of the specified digital I/O terminal. [:SOURce]:DIGital:EXTernal:POLarity
		Routing	State	Enables or disables the connection between the specified digital I/O terminal and the internal trigger lines. [:SOURce]:DIGital:EXTernal:ROUTe:STATe
			Destination	Connects the internal trigger line to the specified digital I/O terminal. [:SOURce]:DIGital:EXTernal:ROUTe

Menu				Description and SCPI commands
(I/O)	LAN	Config	DHCP	Enables or disables the use of the Dynamic Host Configuration Protocol (DHCP). :SYSTem:COMMunicate:LAN:DHCP
			DNS	Sets the IP address of the DNS server. :SYSTem:COMMunicate:LAN:DNS[1|2]
			mDNS	Enables or disables multicast DNS (mDNS) function. :LXI:MDNS:ENABle
			IPAddress	Sets the static LAN (IP) address of the instrument. :SYSTem:COMMunicate:LAN:ADDRess
			Subnet	Sets the static subnet mask. :SYSTem:COMMunicate:LAN:SMASk
			Gateway	Sets the IP address of the default gateway. :SYSTem:COMMunicate:LAN:<GATE|GATeway>
			Hostname	Sets the hostname of the instrument. :SYSTem:COMMunicate:LAN:HOSTname
			Update	Updates the LAN settings. :SYSTem:COMMunicate:LAN:UPDate
		Status		Displays the present LAN settings.
		Reset		Resets the LAN configuration. :LXI:LAN:RESet
	GPIB			Sets the GPIB address. :SYSTem:COMMunicate:GPIB[:SELF]:ADDRess
	USB			Displays the USB VISA string.

Menu			Description and SCPI commands
Display	Digits		Sets the display resolution of the data on the front panel display. :DISPlay:DIGits
	Remote		Selects enabling or disabling the display while controlling the instrument remotely. :DISPlay:ENABle
	Screen Saver		Specifies the settings of the screen saver mode. :DISPlay:SSAVer[:STATe] :DISPlay:SSAVer:WAKE[:IO] :DISPlay:SSAVer:DELay
System	Error	Log	Displays the error log.
		Clear	Clears the error log.
	Reset		Performs an instrument reset. *RST
	Cal/Test	SelfTest	Performs the self test. *TST?
		SelfCal	Performs the self calibration. *CAL?
	Interlock	Level	Specifies the interlock threshold voltage level of all channels in the mainframe. :SYSTem:INTerlock:VOLTage[:LEVel]
		Mode	Selects the mainframe interlock or the module interlock for your mainframe. :SYSTem:INTerlock:MODE
	OutputProt.	Coupling	Enables or disables the protection coupling. :OUTPut:PROTection:COUPling

Menu					Description and SCPI commands
(System)	(Output Protection)	Clear			Clears the protection state of the mainframe. :OUTPut:PROTection:CLEar
	PLC				Selects the power line frequency. :SYSTem:LFRequency
	Timestamp	Clear			Resets the timer count immediately. :SYSTem:TIME:TIMer:COUNt:RESet[:IMMediate]
		AutoCLR			Enables or disables the function to reset the timer automatically. If this function is enabled, the timer count is reset when the trigger system is initiated. :SYSTem:TIME:TIMer:COUNt:RESet:AUTO
	Key	On/Off	Target Channels	Mode	Selects the channel mode of the On/Off key operation. Options are Single Channel, Group, List, and All. Single Channel: The On/Off key controls the channel highlighted in the front panel display. Group: The On/Off key controls all channels in the same group as the highlighted channel. List: The On/Off key controls the channels in the list specified by users. All: The On/Off button controls all channels.
				ListSetting	Set the list of channels controlled by the On/Off key.
				ListTable	Displays the list of channels controlled by the On/Off key.
			Auto Trigger		Enables or disables the repeat measurement with the internally predefined trigger. the default setting is enabled.
	Module	Module 1/2/3/4	Reset		Resets the volatile memory of the module to the initial setting. :SYSTem:MODule:RESet
			Status		Displays the module status and information.

Menu						Description and SCPI commands
(System)	(Module)	(Module 1/2/3/4)	Ext.Filter			Enables or disables the low noise filter adapter. Available for P2130A and PZ2131A. :SYSTem:MODule:FILTer:EXTernal[:STATe]
			Trigger	Internal	Function	Selects the function for the specified internal trigger terminal. :SYSTem:MODule:INTernal[:FUNCtion]
					Level	Selects the signal level of the specified internal trigger terminal. :SYSTem:MODule:INTernal:LEVel
					Polarity	Selects the polarity of the specified internal trigger terminal. :SYSTem:MODule:INTernal:POLarity
					Output > Type	Selects the trigger output type of the specified internal trigger terminal. :SYSTem:MODule:INTernal:TOUTput:TYPE
					Output > Timing	Selects the trigger output edge position of the specified internal trigger terminal. :SYSTem:MODule:INTernal:TOUTput[:EDGE]:POSition
					Output > Width	Sets the trigger output edge width of the specified internal trigger terminal. :SYSTem:MODule:INTernal:TOUTput[:EDGE]:WIDth
				External	Function	Selects the function of the specified external trigger terminal on the module panel. :SYSTem:MODule:EXTernal:FUNCtion
					Level	Selects the signal level of the specified external trigger terminal. :SYSTem:MODule:EXTernal:LEVel
					Polarity	Selects the polarity of the specified external trigger terminal. :SYSTem:MODule:EXTernal:POLarity

Menu						Description and SCPI commands
(System)	(Module)	(Module 1/2/3/4)	(Trigger)	(External)	Output > Type	Selects the trigger output type of the specified external trigger terminal. :SYSTem:MODule:EXTernal:TOUTput:TYPE
					Output > Timing	Selects the trigger output edge position of the specified external trigger terminal. :SYSTem:MODule:EXTernal:TOUTput:POSition
					Output > Width	Sets the trigger output edge width of the specified external trigger terminal. :SYSTem:MODule:EXTernal:TOUTput:WIDTh
			NVRAM	Store		Stores the cached settings to the specified module. :SYSTem:MODule:NVOLatile:STORe
				Clear		Clears or discards any changes to cached values and resets cached values to the present nonvolatile settings of the specified module. :SYSTem:MODule:NVOLatile:CLEar
				Cal.Info	Due	Displays the module calibration due date for the specified module. :SYSTem:MODule:NVOLatile:CALibration:DUE[:MODule]?
					Interval	Sets the module calibration interval in days for the specified module. :SYSTem:MODule:NVOLatile:CALibration:INTerval[:MODule]
					Periodic	Enables or disables the periodic calibration. :SYSTem:MODule:NVOLatile:CALibration:PERiodic
					Reminder	Sets the calibration reminder in days for the specified module. :SYSTem:MODule:NVOLatile:CALibration:REMinder

Menu						Description and SCPI commands
(System)	(Module)	(Module 1/2/3/4)	(NVRAM)	(Cal.Info)	Warning	Enables or disables the module calibration checks and warnings. :SYSTem:MODule:NVOLatile:CWARnings[:MODule][:STATe]
				Passphrase		Sets the passphrase to protect various values in the nonvolatile memory of the specified module. :SYSTem:MODule:NVOLatile:PASSphrase
				AssetNo.		Sets the asset number of the specified module. :SYSTem:MODule:NVOLatile:ANUMber
				SystemID		Sets the identification string of the specified module. :SYSTem:MODule:NVOLatile:SID
	StartUp	PowerOn Program State				Sets and enables or disables the power-on program. :PROGram:PON:COPY :PROGram:PON:RUN
		PowerOn State				Selects the power-on state. :SYSTem:PON
	Sound					Enables or disables the key press sound. :SYSTem:BEEPer[:STATe]
	Info.	Date/Time				Sets the date and time of the internal clock. :SYSTem:DATE :SYSTem:TIME
		Revision				Displays the firmware revision of the mainframe and the model number, serial number, firmware revision, FPGA revisions, and license of the module.
		Update				Updates the firmware.
		Export				Exports the firmware data.
	Factory					Resets the instrument to the factory setting.

Front Panel Operation Summary

This section summarizes front panel operations on the PZ2100A.

Table 4-8 Setting Up the PZ2100A and System Operation

Task	Relevant front panel menu or key
To set the line frequency	Utilities > System > PLC
To initialize the PZ2100A	Utilities > System > Reset
To set the key press	Utilities > System > Sound
To perform the self-test	Utilities > System > Cat/Test > Self-Test
To perform the self-calibration	Utilities > System > Cat/Test > Self-Cal
To display error messages	Utilities > System > Error > Log
To clear the error log	Utilities > System > Error > Clear
To display the firmware revision	Utilities > System > Info. > Revision
To display the module information	Utilities > System > Module > Module*n* > Status
To set the GPIB address	Utilities > System > I/O > GPIB
To set the remote display mode	Utilities > Display > Remote
To return to the front panel (or local) operation from the remote operation.	Back key
To return the factory shipment condition	Utilities > System > Factory
To set the date and time	Utilities > System > Info. > Date/Time
To set the operation at power-on	Utilities > System > StartUp > PoweronProgramState Utilities > System > StartUp > PoweronState
To clear the timestamp	Utilities > System > Timestamp > Clear
To set the automatic clear of the timer	Utilities > System > Timestamp > AutoCLR

Task	Relevant front panel menu or key
To save the configuration data	File > Save > Config
To recall the configuration data	File > Load > Config
To specify the interlock threshold voltage level	Utilities > System > Interlock > Level
To select the module interlock or the mainframe interlock	Utilities > System > Interlock > Mode
To enable or disable the protection coupling	Utilities > System > OutputProtection > Coupling
To clear the protection state of the mainframe	Utilities > System > OutputProtection > Clear

Table 4-9 Setting Source Output

Task	Relevant front panel menu
To select the operation mode	Channel > Output > Mode
To select the source mode	Channel > Source > Function > Mode
To set the Limit value	Channel > Measure > Voltage > Limit > Level Channel > Measure > Current > Limit > Level
To set the output range	Channel > Source > Voltage > Ranging > Channel > Source > Current > Ranging >
To select the source shape from DC or pulse	Channel > Source > Function > Shape
To set the pulse parameters	Channel > Source > Pulse >
To set the sweep parameters	Channel > Source > Voltage > Sweep > Channel > Source > Current > Sweep > Channel > Source > Sweep >
To display the list sweep values	Channel > Source > Voltage > List > ValueTable Channel > Source > Current > List > ValueTable
To set the trigger parameters	Trigger > Config >
To set the source wait time	Channel > Source > Wait >
To set the output filter	Channel > Source > Filter >

Task	Relevant front panel menu
To specify the output off mode	Channel > Output > OffState
To enable or disable the automatic output on function	Channel > Output > AutoOn
To enable or disable the automatic output off function	Channel > Output > AutoOff

Table 4-10 Setting Measurement

Task	Relevant front panel menu
To set the aperture time	Channel > Measure > Speed
To set the measurement range	Channel > Measure > Voltage > Ranging > Channel > Measure > Current > Ranging >
To set the measurement trigger parameters	Trigger > Config>
To set the measurement wait time	Channel > Measure > Wait >

Table 4-11 Trace Buffer Operation

Task	Relevant front panel menu
To set the trace buffer	Channel > Trace >
To display the values in the trace buffer	Result > Trace

Table 4-12 Program Memory Operation

Task	Relevant front panel menu
To select a program	Utilities > Program > Select
To select program operation	Utilities > Program > Control

5 Function Details

This chapter describes the functions of the PZ2100A series.

Limit (Compliance)

Limit or Compliance is the output limiter for preventing damage to a device under test (DUT) due to overcurrent or overvoltage. The voltage Limit is for the current source, and the current Limit is for the voltage source.

When a channel output value reaches the Limit, the channel acts as a constant voltage source or a constant current source; The channel keeps the output value constant.

The following should be considered for the Limit setting.

- The minimum value of voltage Limit is 1% of the range for PZ2120A/PZ2121A and PZ2130A/PZ2131A.

  For PZ2110A, the minimum value of voltage Limit is 1% of the range for 6 V range to 200 V range, or 50 mV for 500 mV range and 2 V range.
- The minimum value of current Limit is 1% of the range for PZ2120A/PZ2121A and PZ2130A/PZ2131A.

  For PZ2110A, the minimum value of current Limit is 1% of the range for 100 nA range to 300 mA range, or 1 nA for 1 nA range and 10 nA range.
- Limit can be set with the same resolution and accuracy as output current or output voltage.
- If the current Limit value is too low, the SMU may require a long settling time.
- The positive and negative Limit values can be set individually or simultaneously.

Operation Mode

The following operation modes for source outputs can be selected depending on the device under test (DUT) or application.

Normal	Default This mode is commonly used and enables applying and measuring voltage or current with the specified Limit values. For specific purposes, consider other modes.
Power supply	Available for PZ2110A, PZ2120A, PZ2121A, PZ2130A, and PZ2131A. This mode enables applying voltage with the faster slew rate. See "Power Supply Mode" on page 137.
High capacitance	Available for PZ2120A and PZ2121A This mode is effective in measuring a capacitive load. See "High Capacitance Mode" on page 138.
Laser diode	Available for PZ2120A and PZ2121A This mode is effective in measuring with pulse current. See "Laser Diode Mode" on page 138.

Power Supply Mode

Power supply mode is effective in using the module as a power supply. This mode enables applying voltage with the faster slew rate. For further information on the slew rate, refer to the data sheet. This mode is available for PZ2110A, PZ2120A, PZ2121A, PZ2130A, and PZ2131A.

Inrush current may occur when the output voltage transfers from 0 V to the specified value. When the inrush current reaches the current Limit, the PZ2100A module generally slows the voltage slew rate to keep the current below the Limit. This may increase the power-on time. Power supply mode maintains the slew rate while the inrush current exceeds the Limit.

Power supply mode is available for the following conditions.

- Voltage source and current measurement

- Measurement ranging mode is selected from FIXED, AUTO, or SEAMLESS. See "Measurement Range (Sense Range)" on page 153.
- When the measurement ranging mode is FIXED, the measurement range is selected as follows. For the PZ2110A, all ranges are available.
  - From 100 nA to 5 A ranges for PZ2120A and PZ2121A
  - From 100 μA to 500 mA ranges for PZ2130A
  - From 10 μA to 500 mA ranges for PZ2131A

NOTE In the power supply mode, the current that exceeds the Limit can flow into the device under test for a certain period of time.

High Capacitance Mode

High capacitance mode is effective in measuring a capacitive load greater than 0.01 μF. This mode is available for PZ2120A and PZ2121A.

If the measurement result data is not stable, enable this function. Then the measurement data may become stable. For example, this mode may reduce overshoot or may keep the operation stable with the rapidly changing load.

This mode can be applied to the measurements of capacitive devices up to 100 μF.

High capacitance mode is available for the following conditions.

- Voltage source and current measurement
- Measurement ranging mode is selected from FIXED or SEAMLESS. See "Measurement Range (Sense Range)" on page 153.
- Measurement range is set from 10 μA to 5 A when the measurement ranging mode is FIXED.

Laser Diode Mode

Laser diode mode is effective in applying pulse currents with the fast rise time and measuring devices such as a laser diode or a vertical cavity surface emitting laser (VCSEL). This mode is available for PZ2120A and PZ2121A.

When the laser diode mode is selected, the current source mode can apply pulse currents with the faster rise time than that in the standard mode at 1 mA, 10 mA, and 500 mA ranges, and at 5 A range with the pulse range priority of TRANSIENT. For the pulse range priority, see "Pulse Range Priority" on page 152.

The voltage source mode can apply pulse voltages with the faster rise time than that in the standard mode at 500 mA range.

When the voltage applied to the devices such as a laser diode or VCSEL exceeds a threshold, current will start to flow. The voltage source mode commonly can apply pulse currents with the faster rise time to these diode devices than the current source mode.

If the pulse peak of voltage source is set high enough, the current flowing through the device under test (DUT) is limited to the Limit value. Therefore, in this voltage source operation, the peak of the current pulse will be the specified Limit value.

Setting the pulse peak of voltage source higher will result in a faster rise time, but may also result in a larger overshoot.

Output Filter

The PZ2100A modules has a built-in output filter to obtain clean output signal without spikes or overshoots. However, using a filter may increase the settling time.

This function can be enabled or disabled. The module has the following settings for the output filter.

State On or Off

Enables or disables the output filter.

Auto On or Off

Enables or disables the function to automatically set the output filter to provide the best filter characteristics and cutoff frequency. When Automatic is set to On, the output filter is automatically set regardless of the specified Time Constant.

Time constant Filter time constant

Specifies a filter time constant from 500 ns to 10 ms for PZ2110A, PZ2120A, and PZ2121A; from 2 μs to 10 ms for PZ2130A and PZ2131A.

Low Noise Filter Adapter (PZ2130A and PZ2131A)

The PZ2130A and PZ2131A 5-channel SMU can be equipped with an external filter, Keysight PX0107A Low Noise Filter Adapter, to apply low-noise and clean output signal.

The adapter is attached to the D-sub connector on the front panel of the PZ2130A/PZ2131A and has five SMB connectors for outputs as shown below.

Figure 5-1 Low Noise Filter

For the supplemental characteristics of the adapter, refer to the data sheet.

The low noise filter setting is initialized and set to off by turning on the PZ2130A/PZ2131A or the reset command. When using the low noise filter adapter, the setting must be enabled after the module is powered off and then turned on, or after the module is reset.

WARNING **The body of the low noise filter adapter is electrically at the same potential as the Low force. To prevent electrical shock, do not touch any of measurement circuit at any time while a floating measurement in progress. Also use accessories that comply with IEC 61010-031. All terminals and the extended conductors must be isolated by using insulation caps, sleeves, etc.**

NOTE When using the low noise filter adapter, the output current should be limited to ±150 mA. If you set an output current value outside the range and try to supply current with the low noise filter enabled, an error message appears.

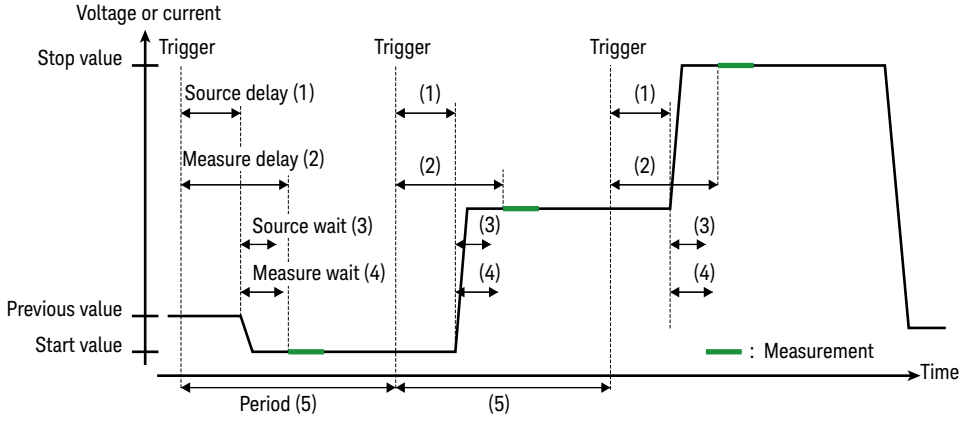
CAUTION Before making the output on with PX0107A Low Noise Filter Adapter, ensure that the low noise filter setting is enabled. Failure to heed this caution may result in damage to the PZ2130A/PZ2131A.

Source Output and Measurement Timing

The source output and measurement timing can be controlled by the following parameters. See Figure 5-2.

Source delay	The time from the trigger to the start of a source output
Measure delay	The time from the trigger to the start of a measurement
Source wait	The time that the source output value cannot be changed after the source channel starts output
Measure wait	The time that the measurement cannot be started after the source channel starts output
Period	The trigger interval Period can be defined for the TIMER or AUTO (AINT) trigger source and individually for the source output and measurement actions. For the trigger source, see "Trigger Source" on page 174.

Figure 5-2 Source Output and Measurement Timing (Sweep Output Example)



Timing Parameters

To set the delay and period, see "Trigger Parameters" on page 171.

To set the wait time, specify the following items.

State On or Off

Enables or disables the wait time.

Auto On or Off

Enables or disabls the automatic wait time.

Gain and Offset Parameters for calculating the wait time as the following formulas

- If State = On and Automatic = On,

  wait time = Gain × initial wait time + Offset
- If State = On and Automatic = Off,

  wait time = Offset
- If State = Off,

  wait time = 0

The initial wait time is automatically set and cannot be changed.

The wait control settings are ignored if the trigger source is TIMER.

Measurement Time

The measurement time depends on the aperture time, measurement range, and other measurement conditions. It can be expressed by the following equation.

Measurement time = Aperture time + Overhead time

Aperture time is the time required to acquire the measurement data. For accurate and reliable measurement, the aperture time should be increased. This value can be specified.

Overhead time includes other factors such as range change or data compensation. This value depends on the measurement conditions and cannot be specified.

Measurement Speed

Measurement Speed is selected to set the aperture time as follows.

Auto The value automatically selected as shown below

- PZ2110A

  1 PLC for 1 nA range to 100 nA range

  0.1 PLC for 1 μA range to 300 mA range
- PZ2120A and PZ2121A

  1 PLC for 100 nA range and 1 μA range

  0.1 PLC for other ranges
- PZ2130A and PZ2131A

  0.1 PLC for all ranges

Aperture time The value specified in the range shown below

- 800 ns to 13.422 s for PZ2110A
- 1 μs to 2.237 s for PZ2120A
- 66.667 ns to 2.237 s for PZ2121A
- 4 μs to 2.097 s for PZ2130A
- 2 μs to 2.097 s for PZ2131A

The value can be specified also in PLC.

Pulse Output

The PZ2100A modules except PZ2130A can apply pulse voltage or current. Figure 5-3 shows a pulse sweep output example.

The pulse output and measurement timing can be controlled by the following parameters. See Figure 5-3.

Source delay The time from the trigger to the start of a source output

Measure delay The time from the trigger to the start of a measurement

Pulse delay The time from the start of a source output to the start of a pulse (peak) output

Source wait The time the source output value cannot be changed after the trailing edge of a pulse

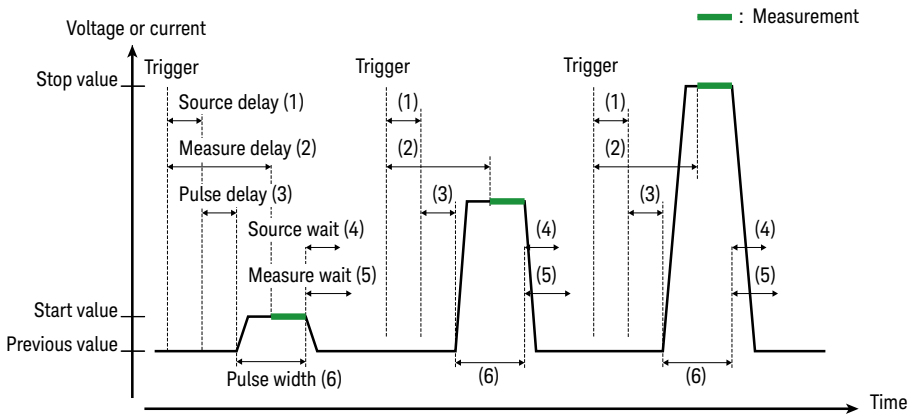
Measure wait The time the measurement cannot be started after the trailing edge of a pulse

Pulse width The time from the start of a pulse output to the end of a pulse (peak) output

The following show available values for each module.

- 20 μs to 1 s for PZ2110A
- 50 μs to 1 s for PZ2120A
- 5 μs to 1 s for PZ2121A
- 50 μs to 1 s for PZ2131A

Figure 5-3 Pulse Output and Measurement Timing (Sweep Output Example)



Pulse Output Parameters

To set the delay, see "Trigger Parameters" on page 171.

To set the wait time, see "Timing Parameters" on page 143.

To apply the pulse output, specify the following pulse parameters.

Pulse delay	Pulse delay in Figures 5-3
Pulse width	Pulse width in Figures 5-3
Range priority	Range priority mode only for PZ2120A and PZ2121A For more details, see "Pulse Range Priority" on page 152.
Base	Pulse base voltage or current
Peak	Pulse peak voltage or current When the sweep output is enabled, the pulse peak value is determined by each sweep step.

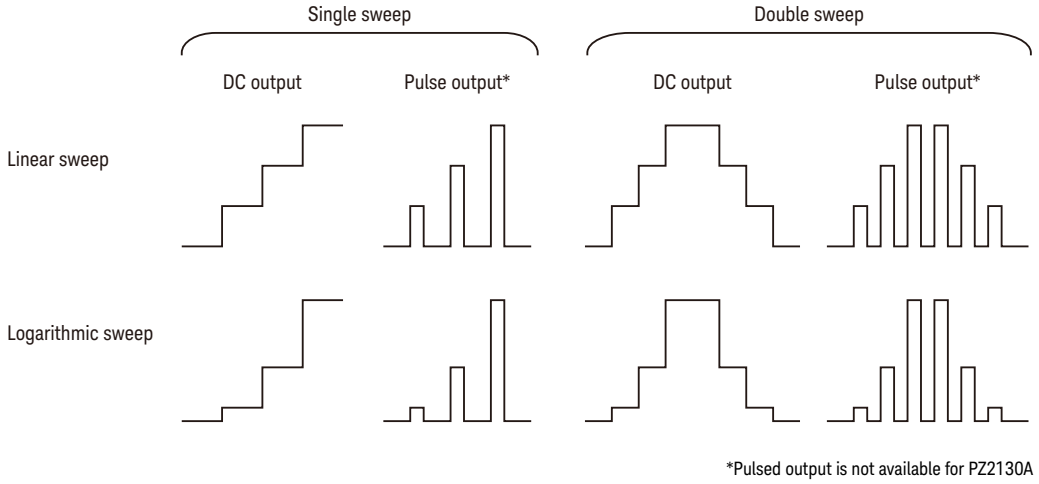
The pulse base is also treated as a sweep parameter. The pulse peak is the output level that changes associated with the trigger event.

NOTE Pulse parameters should be set within the range of available values. Each output range has the maximum values of peak, base, and duty cycle, and the programmable range of width. For details, refer to the data sheet. The positive and negative Limit values also should be considered.

Sweep Output

The PZ2100A series has the function to apply a sweep voltage or current in several shapes as shown in Figure 5-4 and performs the measurement for each sweep step as shown in Figures 5-2 and 5-3.

Figure 5-4 Variety of Sweep Outputs



Sweep Parameters

Start	The sweep start value
Stop	The sweep stop value
Points	The number of sweep steps
Step	The sweep step value or the incremental step value
Base	The pulse base level
Post	The output level after the sweep See “Output Value After the Sweep” on page 149.
Spacing	Linear or Logarithmic

	The scale of the sweep
Stair	Single or Double
	The sweep mode. Single means a sweep from the start to the stop. Double means a sweep from the start to the stop and then to the start.
Direction	Up or Down
	The direction from the start to the stop
Ranging	Best or Fixed
	The ranging mode when performing the sweep output. For more information of the ranging modes, see "Output Range (Source Range)" on page 151.

Output Value After the Sweep

The output value after the sweep can be specified.

To set output value after the sweep, using commands, enable the function and select the output value from the following.

Triggered	The value specified by the command: [:SOURce[ch]]:VOLTage[:LEVel]:TRIGgered[:AMPLitude] or [:SOURce[ch]]:CURRent[:LEVel]:TRIGgered[:AMPLitude]
Start	The sweep start value
Stop	The sweep stop value
Base	The pulse base value in the pulse parameters
	Also see "Pulse Output Parameters" on page 147.
Manual	The specified value
Immediate	The DC source value

NOTE When the output value after the sweep is set to Triggered, the output value after the pulse sweep output is set to the pulse peak value. If the pulse peak value is outside the DC range, an error message appears.

List Sweep

The PZ2100A series has the function to apply an arbitrary waveform output by specifying a list of output values and measure voltage or current at each output step. The source output and the measurement are performed at the specified interval. The minimum interval is 4 μs.

List Sweep Parameters

The source output and measurement timing is controlled by the trigger system. The interval can be set to a constant value when the trigger source is set to TIMER or AUTO (AINT).

To set these trigger parameters, see "Trigger Parameters" on page 171. The interval is set by **Period**. The number of output values is set by **Count**.

Ranging Mode

The PZ2100A series has several ranging modes for setting output and measurement ranges.

Output Range (Source Range)

The following ranging modes are available for the output range settings.

Fixed — Fixed range

The specified range is used.

Auto — Auto range

Auto is enabled, and the range is automatically selected to provide the best resolution of the output value. You can also specify the minimum range in the auto range operation.

For the list sweep output, see "Auto Range for List Sweep Output" on page 152.

Best — Best range

This mode is available for the linear and logarithmic sweep sources.

The linear sweep source automatically uses the minimum range which covers the whole sweep output.

The logarithmic sweep source automatically uses the range which provides the best resolution for each sweep step output.

For the shapes of the linear and logarithmic sweep outputs, see Figure 5-4 on page 148.

Auto Range for List Sweep Output

The list sweep output has two types of the auto range operation according to the trigger source settings. For the trigger source, see "Trigger Source" on page 174.

TIMER trigger source The output range is selected to provide the best resolution of the maximum output value in the list. The output range does not change during the list sweep.

AUTO trigger source The output range is selected at each output point as follows and may change at each output point.

- The maximum range is defined as the range to provide the best resolution of the maximum output value in the list.
- If the maximum range is smaller than the minimum range specified in the ranging parameters, the maximum range is used as the minimum range.
- At each output point, the output range is the larger of the minimum range and the range that provides the best resolution of the output value.

Pulse Output Range

Pulse output ranges may differ from DC output ranges depending on the product models or other conditions.

PZ2120A PZ2121A Current output ranges are automatically set according to Range Priority in the Pulse parameters. For more details, see "Pulse Range Priority" on page 152.

Voltage output ranges are selected according to the Limit value.

PZ2110A PZ2131A Pulse output ranges are determined basically in the same way as DC output ranges, but the following are different.

Auto	The output range is selected according to the larger of the DC source value and the pulse peak value.
Fixed	If the pulse peak value is outside the specified output range, an error message appears.

Pulse Range Priority

Range Priority is available for the current pulse outputs of PZ2120A and PZ2121A. With this function, the output range is automatically selected according to the measurement purpose.

Noise	High resolution

The output range is selected to provide the best resolution of the output value.

Transient Fast rise time

The output range is selected to provide the faster rise time. The maximum values of pulse width and duty cycle (period) are limited.

Power Large power applying

This option covers a wider range of widths and bases with one output range. The rise time may become slower than the transient mode.

To set the pulse range priority, see "Pulse Output Parameters" on page 147.

Measurement Range (Sense Range)

When the Limit (Compliance) value is specified, the measurement range is set to the minimum range that includes the Limit value.

Other ranges can also be specified by the FIXED ranging mode after the Limit value is set. Then the smaller range is used as the measurement range during the measurement.

The following ranging modes are available for measurement range settings.

Fixed Fixed range

The range is specified. This mode is available for all types of measurement. If the specified range is smaller than the measurement range defined by the Limit value, the specified range is used as the measurement range during the measurement.

Auto Auto range

Auto is enabled, and the range is automatically selected to provide the best resolution of the measurement value. You can also specify the minimum range in the auto range operation. There are three operation modes. See Table 5-1 on page 154.

Seamless Seamless current measurement ranging

Available for the current measurement by PZ2120A/PZ2121A and PZ2130A/PZ2131A. This mode enables users to measure current with the best resolution without changing ranges. For

more details, see "Seamless Current Measurement Ranging (PZ2120A and PZ2121A)" on page 155 and "Seamless Current Measurement Ranging (PZ2130A and PZ2131A)" on page 156.

If the range specified in the FIXED mode is smaller than the range defined by the Limit value, the measurement range changes at the start and end of the measurement; The measurement range changes to the specified range when the measurement starts, and the measurement range changes back to the range defined by the Limit value when the measurement is completed.

Table 5-1 Measurement Auto Range Operation

Mode	Description
Normal	Supports basic operation and downward changing operation described below.
Speed	Supports basic operation and upward and downward changing operations described below.
Resolution	Supports basic operation and upward changing operation described below.

- Basic operation

  The channel automatically sets the range which provides the best resolution in performing the measurement.

- Upward changing operation

  If measured data ≥ *value1*, the range changes up after the measurement.

  value1 = measurement range × *rate* / 100

- Downward changing operation

  If measured data ≤ *value2*, the range changes down immediately.

  value2 = measurement range × *rate* / 1000

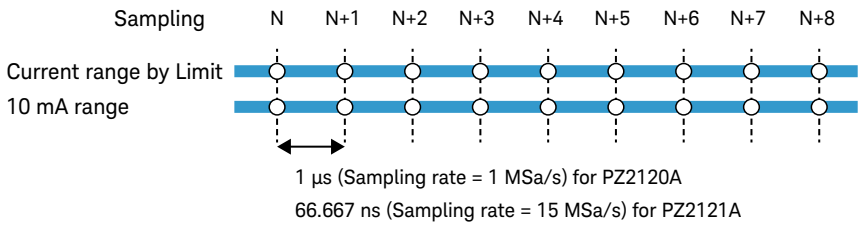
Seamless Current Measurement Ranging (PZ2120A and PZ2121A)

This section describes the seamless current measurement ranging of PZ2120A and PZ2121A. This function enables current measurement with the best resolution over multiple ranges without changing the range. It is useful for measuring dynamically changing currents.

This function is available for only the voltage source mode.

In this function, a current measurement is performed at multiple ranges simultaneously, and then the value with the best resolution is automatically selected. The PZ2120A/PZ2121A uses the 10 mA range in addition to the minimum range including the Limit value.

During the measurement, the measured values at the two ranges are acquired simultaneously. The minimum value and the resolution of the aperture time is 1 μs for PZ2120A or 66.667 ns for PZ2121A. For the aperture time, see "Measurement Time" on page 144.



When the Limit value is set to be less than or equal to ±10.5 mA, the seamless current measurement ranging is automatically disabled, and the measurement range is set to the minimum range including the Limit value.

Seamless Current Measurement Ranging (PZ2130A and PZ2131A)

This section describes the seamless current measurement ranging of PZ2130A and PZ2131A. This function enables current measurement with the best resolution over multiple ranges without changing the range. It is useful for measuring dynamically changing currents.

This function is available for only the voltage source mode.

In this function, a current measurement is performed at multiple ranges simultaneously, and then the value with the best resolution is automatically selected.

The following should be considered when the seamless current measurement ranging is enabled.

- The operation mode is internally set to the power supply mode regardless of the setting.

  For the power supply mode, see "Power Supply Mode" on page 137.

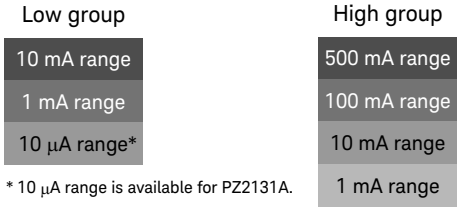
- The output voltage is limited to ±25 V for the low group with 30 V range.

  For the low group, see "Current Ranges for Seamless Current Measurement Ranging" on page 156.

Current Ranges for Seamless Current Measurement Ranging

For the seamless current measurement ranging, the PZ2130A/PZ2131A has two range groups: a low group and a high group.

Low group	10 μA, 1 mA, and 10 mA ranges 10 μA range is available for only PZ2131A and not available for PZ2130A.
High group	1 mA, 10 mA, 100 mA, and 500 mA ranges



The PZ2130A/PZ2131A automatically selects the low group or the high group according to the Limit value. If the Limit is specified greater than 10 mA, the high group is selected. Otherwise, the low group is selected.

The seamless current measurement ranging uses up to four current ranges in the selected range group.

The Limit is valid in the seamless current measurement ranging. The PZ2130A/PZ2131A does not use the larger current range than the range defined by the Limit as the minimum range including the Limit value.

You can specify the minimum range in the seamless current measurement ranging. The smaller range than the minimum range is not used, and you can avoid a settling time issue. The settling time of a smaller current range is generally longer than that of a larger current range. The current output at the smaller current range may not settle enough during the measurement. This may result in unexpected measurement values.

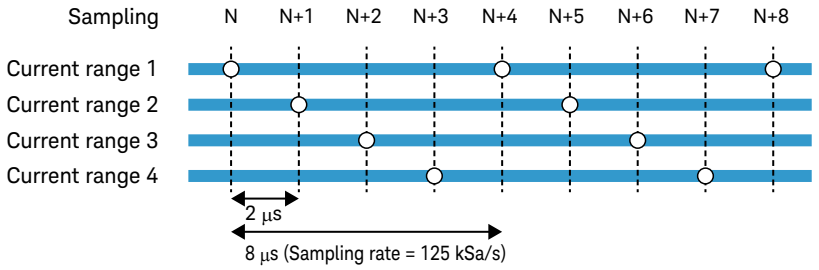
If the minimum range is set to the larger range than the measurement range defined by the Limit value, the seamless current measurement ranging uses only the range defined by the Limit value.

NOTE It is recommended to measure in the low group with a sufficiently large Limit value. If the output current reaches the Limit value in the low group, the measurement value is automatically set to positive or negative infinity.

Measurement Time for Seamless Current Measurement Ranging

During the measurement, the measured values at the four current ranges are acquired in sequence at the interval of 2 μs. Therefore, the measurement interval for each range is four times that of the other ranging modes, and the sampling rate is one fourth. The minimum value and the resolution of the aperture time is 8 μs regardless of the number of ranges used.

For the aperture time, see "Measurement Time" on page 144.



Output Resistance (PZ2110A)

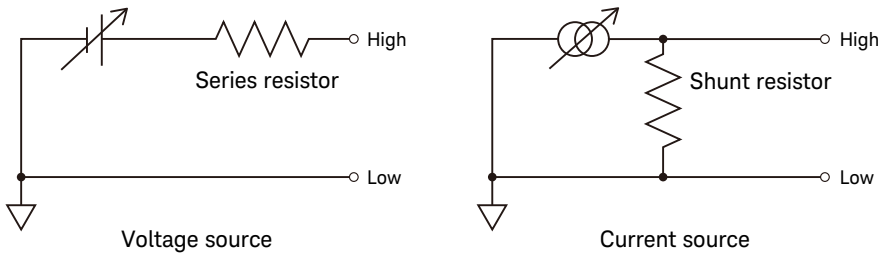
An ideal voltage source has a zero-Ω output impedance, and an ideal current source has an infinite output impedance. However, you cannot expect such ideal conditions in actual application environments.

The output resistance function enables the PZ2110A to work as a voltage source with a built-in constant series resistor or a current source with a built-in constant shunt resistor as shown in Figure 5-5. For example, when the High and Low terminals are shorted, the PZ2110A tries to apply 0.1 A with the setting of 0.1 V output voltage and 1 Ω output resistance.

Instead of installing a built-in resistor, the PZ2110A monitors the load current or voltage and adjusts the output to apply voltage or current as if the built-in resistor were installed.

Users can specify the series resistance from –2 MΩ to +2 MΩ or the shunt resistance from 0.2 Ω to 2 GΩ. Note that actual applicable resistance values depend on the circuit characteristics and the load.

Figure 5-5 Simplified Diagram of Output Resistance



Output Off Mode

The output off mode, or off state, is the condition immediately after the source output is turned off. The mode should be specified by programming before enabling the source output. For more details, refer to *SCPI Command Reference*.

The following settings are available for the output off mode.

High impedance

- Output switch: off
- The voltage source setup is not changed if the voltage output value is less than or equal to 42 V.

  If the voltage output value is greater than 42 V, the output value is set to 42 V.
- For PZ2110A, PZ2130A, and PZ2131A, the current source setup is not changed.
- For PZ2120A and PZ2121A, the current source setup is not changed if the current output value and range are less than or equal to 10 mA and 10 mA range.

  If the current output value and range are greater than 10 mA and 10 mA range, the output value is set to 10 mA, and the output range is set to 10 mA range.

Normal

- Output switch: off
- Source function: voltage source
- Voltage output value: 0 V
- Current Limit: 100 μA at the 100 μA range

Zero

- Source function: voltage source
- Voltage output value: 0 V
- Current Limit: 100 μA at the 100 μA range

NOTE The output off mode is ignored if an emergency condition such as interlock open or over voltage is detected. Then the output voltage is immediately set to 0 V, and the output switch is set to off.

Automatic Output On/Off

The PZ2100A module has output on/off functions when the trigger system changes the status. These functions are enabled or disabled individually.

Auto Output On The source output is automatically turned on just before the trigger system is initiated by programming.

Auto Output Off The source output is automatically turned off when all trigger systems change the status from busy to idle.

Interlock

The interlock function is designed to prevent electrical shock when a user touches the measurement terminals and also to prevent DUT damages caused by undesirable high voltage.

To perform high voltage measurement greater than ±42 V, the interlock terminals should be connected to an interlock circuit. The PZ2100A series has the mainframe interlock input on the mainframe's rear panel and the module interlock terminals on each module panel. Users must specify which interlock function is used for the mainframe and install the interlock circuit correctly. For details on installing the interlock circuit, see "Installing an Interlock Circuit" on page 86.

The PZ2100A cannot apply high voltage over the interlock threshold voltage level if the interlock terminals are open. The interlock threshold voltage level is programmable within ±42 V, and the default value is ±42 V. Set the threshold level to the voltage you think still safe.

If the threshold level is set to 0 V, the interlock function is the same as inhibit control.

The interlock function works as shown below.

- When the interlock terminals are open, the maximum output is limited to the threshold level.
- When the interlock terminals are shorted, the module can apply the maximum output voltage.
- When using the mainframe interlock, if the interlock terminal opens under a high voltage condition greater than the threshold level, the outputs of all channels in the mainframe will be immediately set to 0 V and off.

  When using the module interlock, if the module interlock circuit opens under a high voltage condition greater than the threshold level, the outputs of channels only in the module with a higher voltage output than the threshold will be immediately set to 0 V and off.

WARNING

Hazardous voltage, instrument maximum output voltage may appear at the High force, High sense, and Guard terminals if the interlock terminal is closed. To prevent electrical shock, do *not* expose these lines.

Une tension dangereuse, une tension de sortie maximale de l'appareil peut apparaître aux bornes High force, High sense et Guard si le couvercle de l'équipement est fermé. Afin d'éviter toute décharge électrique, n'exposez pas ces lignes.

Trace Buffer

The trace buffer collects the test result data until a buffer full is detected. The maximum data size is 30,000 blocks for each channel. The trace buffer is not cleared by the next measurement trigger. The next data is appended to the end of the previous data. If the buffer full is detected, the buffer stops collecting the following data.

The data flow is shown in Figure 5-6. One data block may contain multiple data, such as voltage measurement data, current measurement data, and source output data.

In Figure 5-6, the variables indicate the following data.

- VOLT: Voltage measurement data
- CURR: Current measurement data
- RES: Resistance measurement data
- RTV: Remote transient voltage measurement data
- TIME: Time data (timestamp of the measurement start trigger)
- STAT: Status data
- SOUR: Source output data

If data is stored in the trace buffer, its statistical data can be calculated. Calculable statistical data is as follows.

- MEAN: Mean value
- SDEV: Standard deviation
- MIN: Minimum value
- MAX: Maximum value
- PKPK: Peak to peak value

The trace buffer control (:TRACe:FEED:CONTrol) and the trace buffer size (:TRACe:POINts) can be set by using the **Channel** > **Trace** menu on the Menu view.

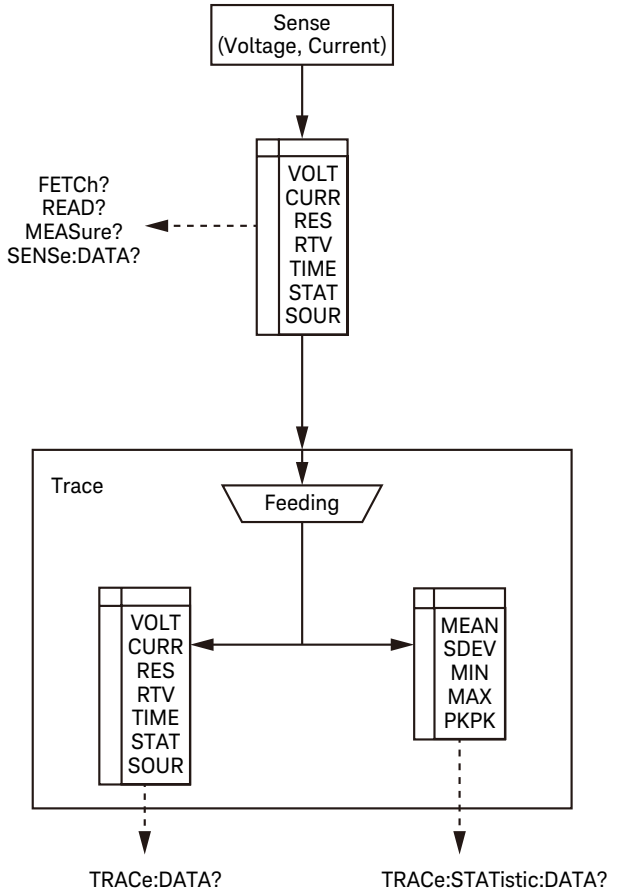
To display the trace buffer data, use the **Result** > **Trace** menu.

To save the trace buffer data, use the **File** > **Save** > **Trace** menu.

To read the trace buffer data from an external computer, the SCPI commands shown in Figure 5-6 can be used.

NOTE Do not forget to save or read the data before turning the PZ2100A off. The trace buffer is cleared by turning the instrument off.

Figure 5-6 Data Flow to Trace Buffer for Each Channel



Program Memory

The program memory stores command strings temporarily. The stored program can be executed by using the Menu view, or automatically when PZ2100A is turned on. Instrument power-off deletes the programs other than the power-on programs in the program memory.

The program memory can eliminate several processes in the program execution, such as transferring commands, checking command syntax, and converting commands to the internal codes. Thus, using the program memory speeds up program execution. If frequently used command strings are stored in the program memory, interface/computer activity is minimized.

The program memory can be defined by using SCPI commands while the PZ2100A is in the remote mode. See Keysight PZ2100A series *SCPI Command Reference*.

- Number of programs saved in the memory: 100
- Number of programs used for start-up automatic execution: 1
- Total memory size: 100 KB
- Maximum length for a line: 256 bytes
- Maximum number of characters of program name: 32 with alphabets, numbers, hyphens, and underscores

To use the program memory from the front panel, use the **Utilities** > **Program** menu on the Menu view. See Table 5-2 for the execution status changes.

Table 5-2 Program Control and Status Changes

Control	Present execution status		
	Running	**Paused**	**Stopped**
Run	Error	to Running	to Running
Pause	to Paused	Paused	Stopped
Step	Error	to Running to Paused	to Running to Paused

Control	Present execution status		
	Running	**Paused**	**Stopped**
Stop	to Stopped	to Stopped	Stopped
Continue	Error	to Running	Error

Channel Grouping

This function is used to control the channel output timing automatically so that the channel keeps the output while the other channel performs measurement.

The grouped channels start the source output in the order of channel number, then start the measurement at the same time, and keep the output until the measurement is completed. If delay time and wait time are set, this is adjusted by these values.

The maximum number of channel groups is two. If only the group 1 is set, channels that are not included in the group 1 are automatically assigned to the group 2.

If the grouping is released, the channels work independently regardless of the condition of the other channel.

To use the channel grouping, use the **Utilities** > **Group** menu.

Conditions for the channels to group:

- Trigger source (Trigger value) must be the same.
- If the trigger source is set to TIMER, the trigger period (Period value) of the source output trigger (transient action) must be the same. This is not applicable if the trigger count (Count value) is set to 1.

NOTE **About Wait Time**

If wait time is set, channels cannot start measurement or source output change until the wait time elapses. Use the **Channel** > **Measure** > **Wait** menu or the **Channel** > **Source** > **Wait** menu for setting the wait time.

For the grouped channels, the wait time starts at the timing of the last output change (DC output change or pulse level transition from peak to base) by the last source output channel.

Trigger System

Keysight PZ2100A series supports the ARM-TRIGGER model described in *1999 SCPI Command Reference*.

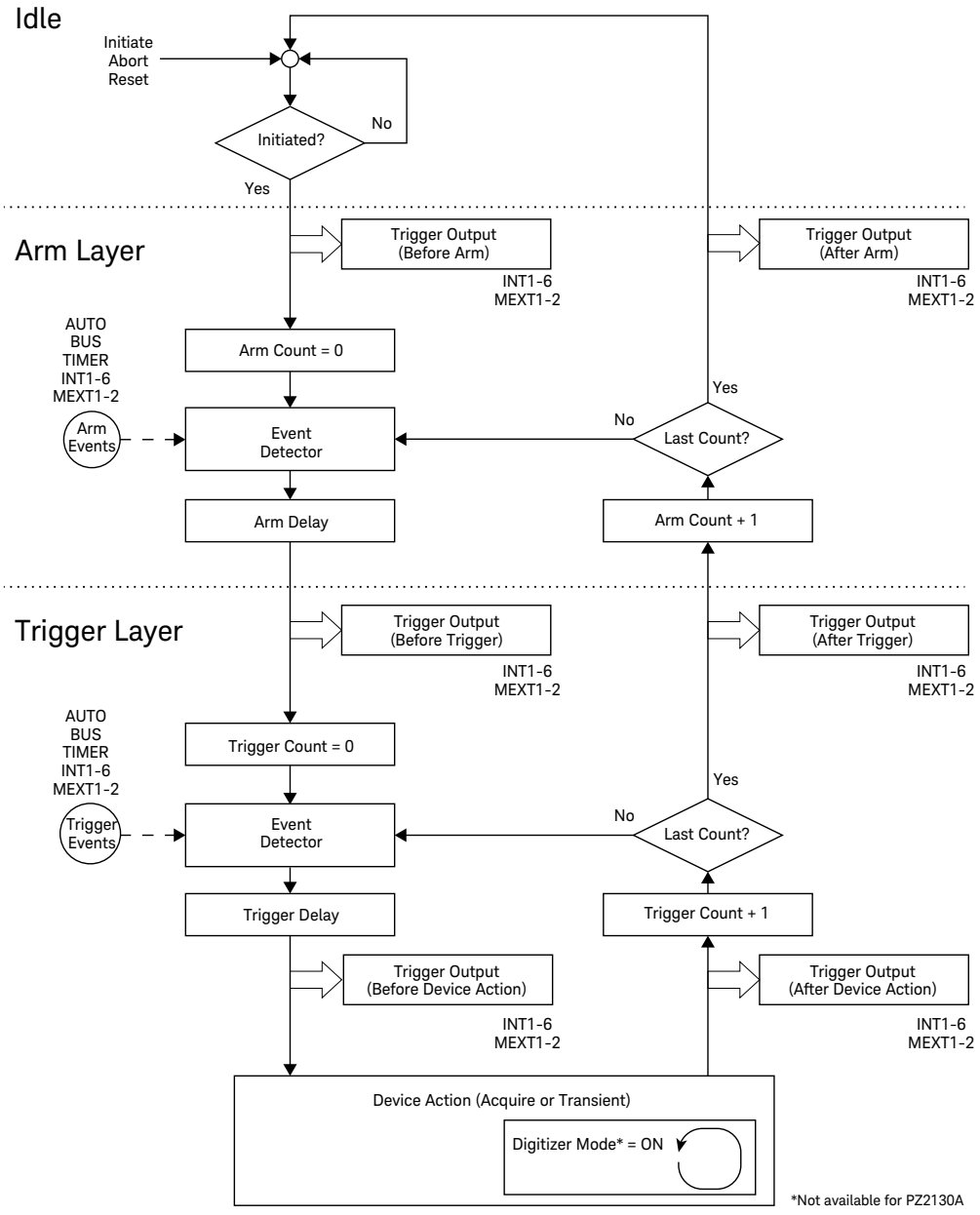
Operation summary of the trigger model is described below. Also see Figure 5-7.

1. When the trigger system is initiated, the control state moves to the arm layer and the arm count is set to zero.
2. The trigger system waits for the arm event that is a signal from the trigger source of the arm.
3. When the arm event is detected and the arm delay time elapses, the control state moves to the trigger layer and the trigger count is set to zero.
4. The trigger system waits for the trigger event that is a signal from the trigger source of the trigger.
5. When the trigger event is detected and the trigger delay time elapses, the device action is executed and the trigger count increases by one.
6. Steps 4 and 5 are repeated until the trigger count reaches the specified value. Then the control state moves to the arm layer and the arm count increases by one.
7. Steps 2 to 6 are repeated until the arm count reaches the specified value. Then the control state moves to the idle layer.

This trigger model is independently applied to two device actions: Transient (source output) and Acquire (measurement). These two device actions can start simultaneously or separately.

Multiple modules can perform the synchronous operation or asynchronous operation.

Figure 5-7 Keysight PZ2100A Series Trigger System



Device Action

The PZ2100A Source/Measure Unit modules provide the following device actions. Also see Figure 5-8.

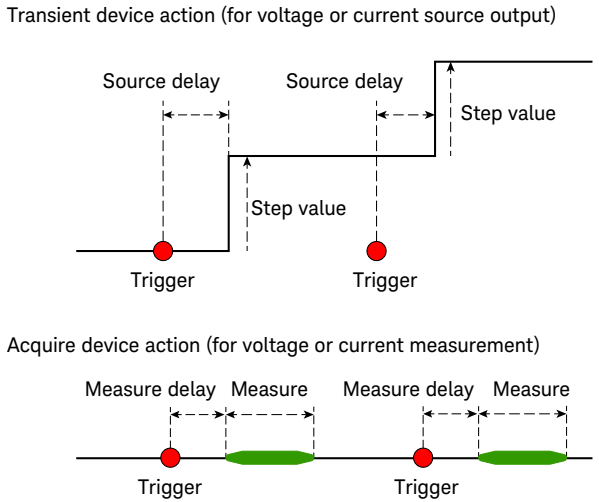
Transient Source (output)

When the trigger event is detected and the source delay time elapses, the one output value is started to apply.

Acquire Measurement

When the trigger event is detected and the measure delay time elapses, the one measurement value is acquired.

Figure 5-8 Transient and Acquire Device Actions



Trigger Parameters

You can set the arm and trigger parameters of each channel. The following parameters are set for the source output trigger (Transient device action) and for the measurement trigger (Acquire device action).

Count The maximum number of the arm count or the trigger count

This parameter should be set in the range of 1 to 500000 for PZ2120A and PZ2121A, 1 to 200000 for PZ2130A and PZ2131A, or 1 to 1000000 for PZ2110A.

For Transient device action, the infinite trigger count is available. To set the trigger count to infinity, set the parameter to 2147483647 (0x7FFFFFFF) or INFinity.

The maximum count is limited according to the following, Arm count × Trigger count × Sampling points ≤ 500000 (200000 for PZ2130A and PZ2131A, 1000000 for PZ2110A), where Sampling points is the points parameter of the digitizer mode.

If the count settings exceeds the limit, an error message will be displayed when the trigger system is initiated. The limit is not applicable when users set the infinite trigger count for Transient device action.

Delay — Delay time for the arm or the trigger

This parameter should be set in the range of 0 to 100000 s.

Period — Interval for the arm or the trigger

This parameter should be set in the range of 4 μs to 100000 s.

The interval is available for the trigger source of TIMER and AUTO (AINT). For the AUTO (AINT) trigger source, also see "Trigger Source" on page 174.

Trigger Terminals and Trigger Lines

This section describes the trigger terminals and lines of the PZ2100A series. Also see Figure 5-9.

The mainframe has a digital I/O connector on the rear panel, which has seven terminals (EXTernal or EXT): EXT1, EXT2, EXT3, EXT4, EXT5, EXT6, and EXT7. Each terminal can be configured as an external trigger input or output. For more information about the digital I/O terminals, see "Digital I/O Connections" on page 74.

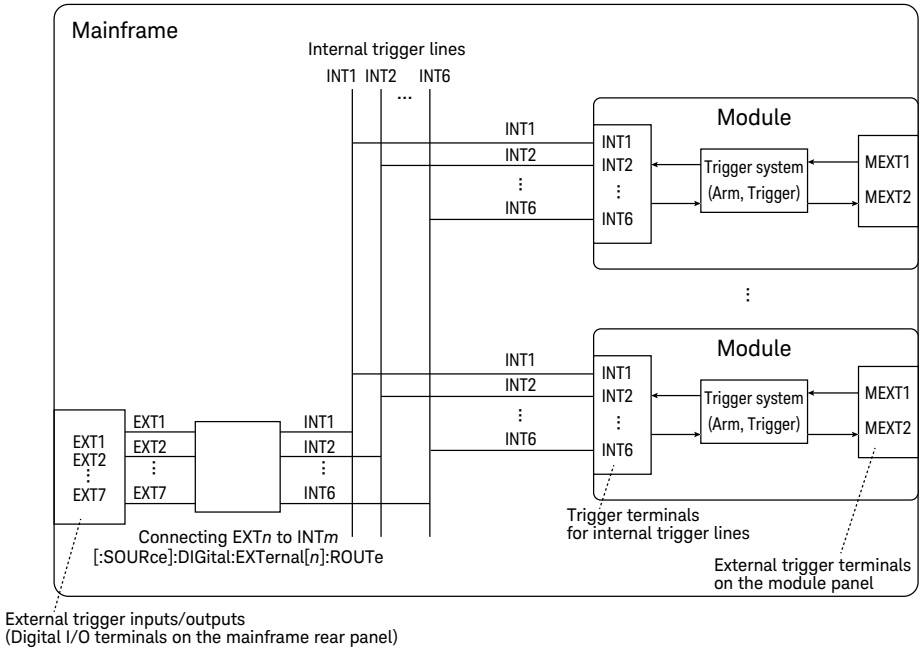
The PZ2100A mainframe has six internal trigger lines (INTernal or INT): INT1, INT2, INT3, INT4, INT5, and INT6. You can connect the external trigger inputs and outputs to the six internal trigger lines using the [:SOURce]:DIGital:EXTernal[n] :ROUTe command.

Each PZ2100A module has six terminals for the mainframe's internal trigger lines. Each module also has two external trigger terminals on the panel (MEXTernal or MEXT): MEXT1 and MEXT2. For more information about the external trigger terminals, see "PZ2100A Source/Measure Unit Modules" on page 36.

You can select the trigger source and trigger outputs from the six internal trigger terminals (INT1, INT2,..., INT6) and the external trigger terminals on the module panel (MEXT1 and MEXT2).

You can also use the seven digital I/O terminals on the mainframe rear panel (EXT1, EXT2,..., EXT7) as a trigger source and trigger outputs. First, select an internal trigger terminal as the trigger source or trigger output. Second, connect it to a digital I/O terminal by the [:SOURce]:DIGital:EXTernal[n] :ROUTe command.

Figure 5-9 Trigger Terminals and Trigger Lines



Trigger Source

The trigger source must be set to the arm event and the trigger event individually.

AUTO (AINT) Triggers at the specified interval

The timing is controlled by the software. Depending on the controller, the interval may be larger than the specified value.

BUS Triggers generated by the commands such as *TRG, :TRIGger[:ALL][:IMMediate], and :ARM[:ALL][:IMMedate].

TIMER Triggers at the specified interval

The timing is controlled by the hardware.

INT1, INT2,..., INT6
Triggers synchronizing with the signal from a mainframe internal trigger line.

MEXT1, MEXT2 Triggers synchronizing with the signal from an external trigger terminal on the module panel.

Trigger Output

Keysight PZ2100A series provides the trigger output at the timing shown in Figure 5-7. The trigger output terminal can be selected from the following.

INT1, INT2,..., INT6
The mainframe internal trigger lines

MEXT1, MEXT2 The external trigger terminals on the module panel

Digitizer Mode in the Trigger System

The digitizer mode enables users to acquire multiple measurement values without increasing the trigger count.

Generally, only one measurement is performed in one device action. To acquire multiple measurement values, the trigger process needs to be repeated.When the digitizer mode is enabled, multiple measurements are performed in one device action shown in Figure 5-7.

For more information, see “Digitizer Mode” on page 175. This mode is not available for PZ2130A.

Digitizer Mode

The digitizer mode enables users to acquire multiple measurement values without increasing the trigger count as shown in Figure 5-7 on page 170.

The PZ2100A module can acquire multiple values at the minimum interval of 800 ns for PZ2110A, 1 μs for PZ2120A, or 66.667 ns for PZ2121A, which is shorter than the minimum period of trigger TIMER 4 μs.

The PZ2131A can acquire multiple values at the minimum interval of 2 μs. If the seamless current measurement ranging is enabled, the minimum interval is 8 μs. The digitizer mode is not available for PZ2130A.

As described in "Digitizer Mode in the Trigger System" on page 174, only one measurement is generally performed in one device action. To acquire multiple measurement values without the digitizer mode, the trigger process needs to be repeated.

When the digitizer mode is enabled, multiple measurements are performed in one device action. The number of measurements should be specified.

Sampling Measurement

The PZ2100A provides several sampling measurements using the trigger system. For PZ2130A/PZ2131A 5-Channel Precision SMU, the trigger settings can be specified for each channel.

Sweep Measurement with TIMER Trigger

Figure 5-10 shows an example of sweep measurements with the trigger source of TIMER, or triggers at the specified interval. This allows users to measure at the accurate interval. The minimum interval is 4 μs.

Table 5-3 shows the trigger setting for Figure 5-10.

To perform the sampling measurement,

- Set the sweep and trigger parameters. For setting parameters, see "Sweep Parameters" on page 148 and "Trigger Parameters" on page 171.
- Initiate the trigger system.

Figure 5-10 Example of Sweep Measurement with TIMER Trigger

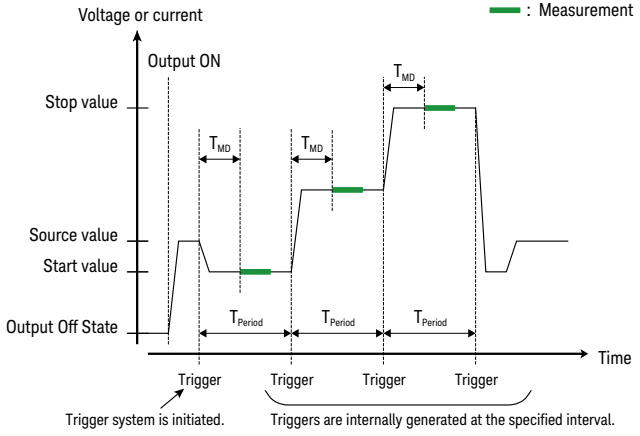


Table 5-3 Trigger Setting for Figure 5-10

Parameter	Source	Measure
Count	Number of sweep steps	
Delay	0	T_{MD}
Period	T_{Period}	
Trigger source	TIMER	

Pulse Measurement with TIMER Trigger

Figure 5-11 shows an example of pulse measurements with the trigger source of TIMER, or triggers at the specified interval. This allows users to measure at the accurate interval. The minimum interval is 4 μs.

Table 5-4 shows the trigger setting for Figure 5-11.

To perform the sampling measurement,

- Set the pulse and trigger parameters. For setting parameters, see "Pulse Output Parameters" on page 147 and "Trigger Parameters" on page 171.
- Initiate the trigger system.

Figure 5-11 Example of Pulse Measurement with TIMER Trigger

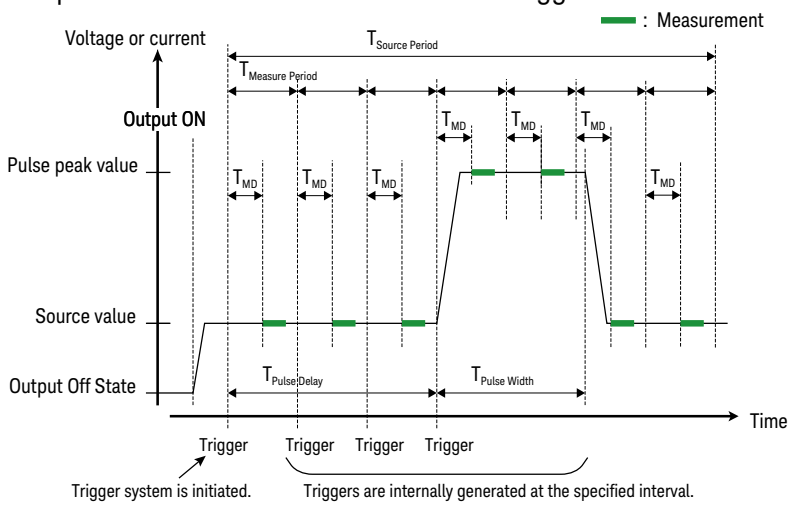


Table 5-4 Trigger Setting for Figure 5-11

Parameter	Source	Measure
Count	1	Number of measurements
Delay	0	T_{MD}
Period	$T_{Source\ Period}$	$T_{Measure\ Period}$
Trigger source	TIMER	

Pulse Measurement with Digitizer Mode

Figure 5-12 shows an example of pulse measurements with the digitizer mode. As described in "Digitizer Mode" on page 175, the digitizer mode is effective in high-speed measurements.

Table 5-5 shows the trigger setting for Figure 5-12.

To perform the pulse measurement with the digitizer mode,

- Enable the digitizer mode and specify the number of measurements and the measurement time.
- Set the pulse and trigger parameters. For setting parameters, see "Pulse Output Parameters" on page 147 and "Trigger Parameters" on page 171.
- Initiate the trigger system.

Figure 5-12 Example of Pulse Measurement with Digitizer Mode

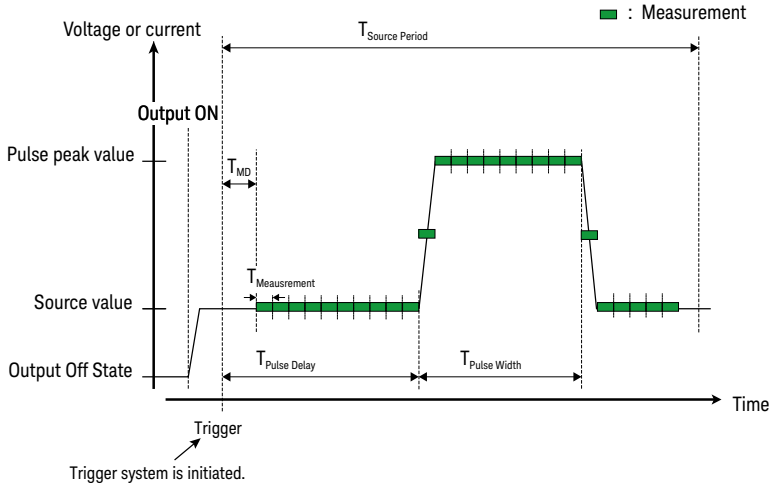


Table 5-5 Trigger Setting for Figure 5-12

Parameter	Source	Measure
Count	1	
Delay	0	T_{MD}
Period	$T_{Source\ Period}$	
Trigger source	TIMER	

Repeated Pulse Measurement with Digitizer Mode

Figure 5-13 shows an example of pulse measurements with the trigger source of TIMER and the digitizer mode.

Table 5-6 shows the trigger setting for Figure 5-13.

To perform the repeated pulse measurement with the trigger source of TIMER and the digitizer mode,

- Enable the digitizer mode and specify the number of measurements and the measurement time.

- Set the pulse and trigger parameters. For setting parameters, see "Pulse Output Parameters" on page 147 and "Trigger Parameters" on page 171.
- Initiate the trigger system.

Figure 5-13 Example of Repeated Pulse Measurement with Digitizer Mode

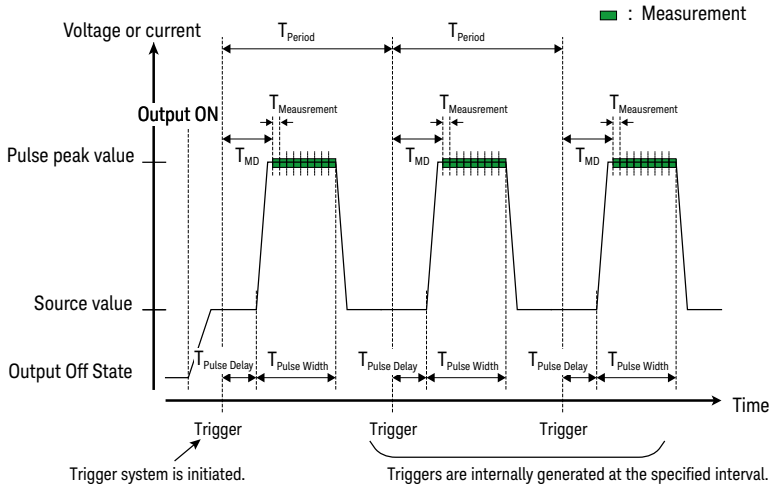


Table 5-6 Trigger Setting for Figure 5-13

Parameter	Source	Measure
Count	Number of pulses	
Delay	0	T_{MD}
Period	T_{Period}	
Trigger source	TIMER	

Module Synchronous Operation

The PZ2100A series has several ways to perform module synchronous operation. You can synchronize the multiple modules using the trigger system. This section describes the three examples of them.

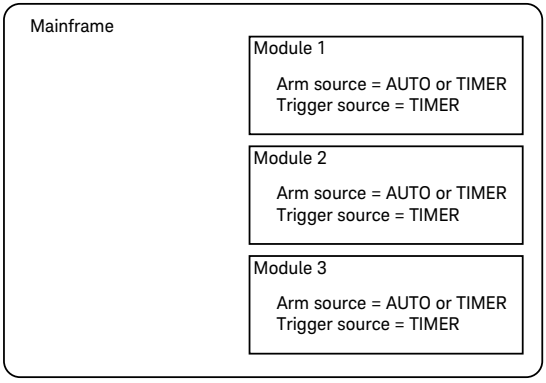
For information about the trigger lines, see "Trigger Terminals and Trigger Lines" on page 172.

Using TIMER Trigger and Channel Grouping

All modules have the trigger source set to TIMER and the arm source set to AUTO or TIMER, and belong to a same channel group.

For the trigger source, see "Trigger Source" on page 174.

For the channel grouping, see "Channel Grouping" on page 168.

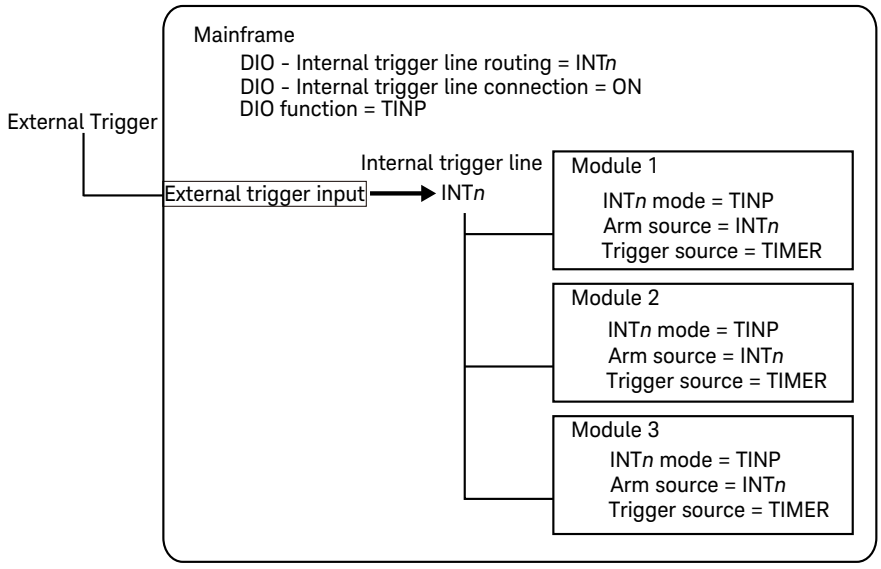


The delay between the modules will be 100 nanoseconds or less.

Using Mainframe Trigger Terminal

You can synchronize the modules using the external trigger source and the trigger input terminal on the mainframe.

The internal trigger line is used to synchronize the modules. The arm source should be set to the internal trigger line (INT1, INT2, ..., or INT6).

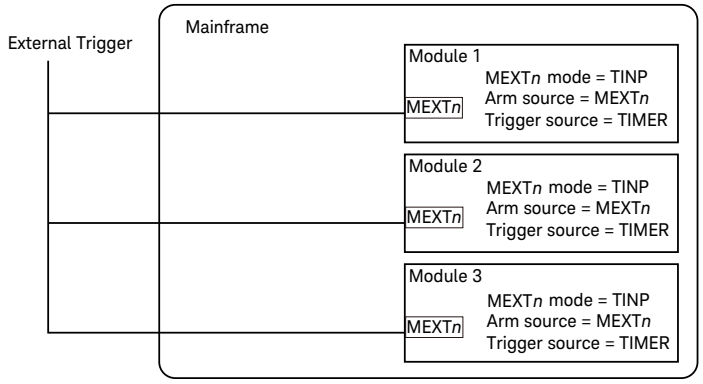


You need only a cable connecting to the external trigger source and the trigger input terminal.

The delay between the modules will be 100 nanoseconds or less.

Using Module Trigger Terminal

You can synchronize the modules using an external trigger source and the external trigger terminal (MEXT1 or MEXT2). You can see the terminals Trig 1 and 2 on the module panel. To operate this synchronization, connect the external trigger source to each module with cables and set the arm source to MEXT1 or MEXT2.



This operation allows you to easily synchronize the modules with other instruments.

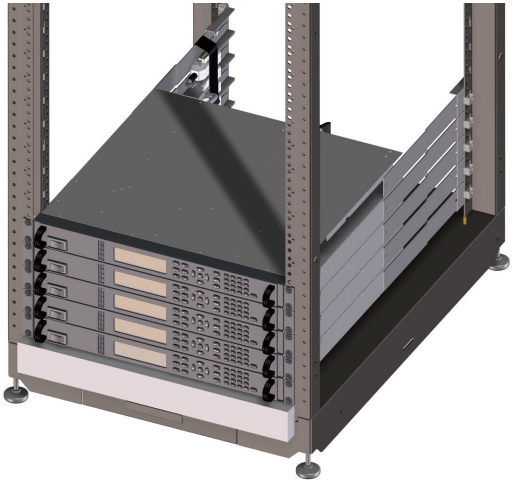
The delay between the modules will be a few microseconds or less.

Mainframe Synchronous Operation

The PZ2100A series has several ways to perform mainframe synchronous operation. You can synchronize the multiple mainframes using the trigger system. This section describes the two examples of them.

Users can stack multiple PZ2100A mainframes without gaps as shown in Figure 5-14. For rack installation, see “Rack Installation” on page 67.

Figure 5-14 Stacking Mainframes in a 19-inch Rack



Using an external trigger source allows you to synchronize the modules in a mainframe as described in “Module Synchronous Operation” on page 181. This way is effective in synchronizing the modules over mainframe by sending the same trigger signal to multiple mainframes.

The following sections describe how to synchronize the modules over mainframe *without an external trigger source*.

- “Using Mainframe Trigger Terminal”
- “Using Module Trigger Terminal”

Using Mainframe Trigger Terminal

This operation uses any one of modules as a trigger source and the cable used to connect the external trigger terminal on the primary mainframe to the external trigger terminals on the secondary mainframes.

For the primary mainframe that the trigger source module is installed:

- Digital I/O terminal must be the external trigger output (TOUT) and connected to the internal trigger line.
- For the trigger source module:
  - Internal trigger terminal must be the trigger output (TOUT).
  - Arm trigger output port must be the internal trigger line (INT*n*).
  - Arm trigger output state must be ON.
  - Trigger output edge position must be “Before Arm” (BEF).
- Internal trigger terminals of the other modules must be the trigger input (TINP).
- Arm source of the all modules must be the internal trigger line (INT*n*).
- Trigger source of the all modules must be the timer (TIMER).

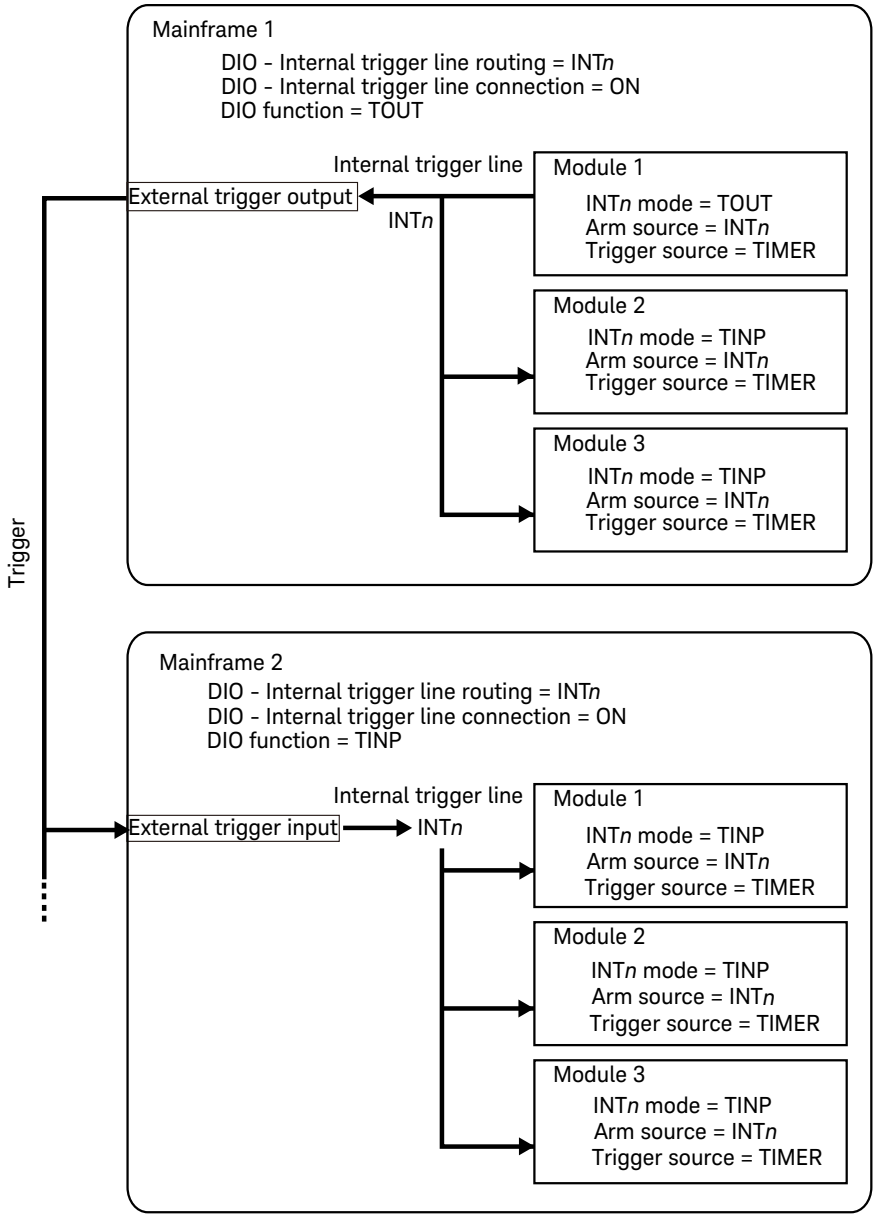
For the secondary mainframes:

- Digital I/O terminal must be the external trigger input (TINP) and connected to the internal trigger line.
- Internal trigger terminals of the all modules must be the trigger input (TINP).
- Arm source of the all modules must be the internal trigger line (INT*n*).
- Trigger source of the all modules must be the timer (TIMER).

See the example shown in Figure 5-15.

The delay between the modules will be a few microseconds or less.

Figure 5-15 Using Mainframe Trigger Terminal



Using Module Trigger Terminal

This operation uses any one of modules as a trigger source and the cable used to connect the external trigger terminal (MEXT1 or MEXT2) on the trigger source module to the external trigger terminals on other modules.

For the trigger source module:

- External trigger terminal must be the trigger output (TOUT).
- Arm trigger output port must be the external trigger terminal (MEXT*n*).
- Arm trigger output state must be ON.
- Trigger output edge position must be “Before Arm” (BEF).

For the modules other than the trigger source module:

- External trigger terminal must be the trigger input (TINP).

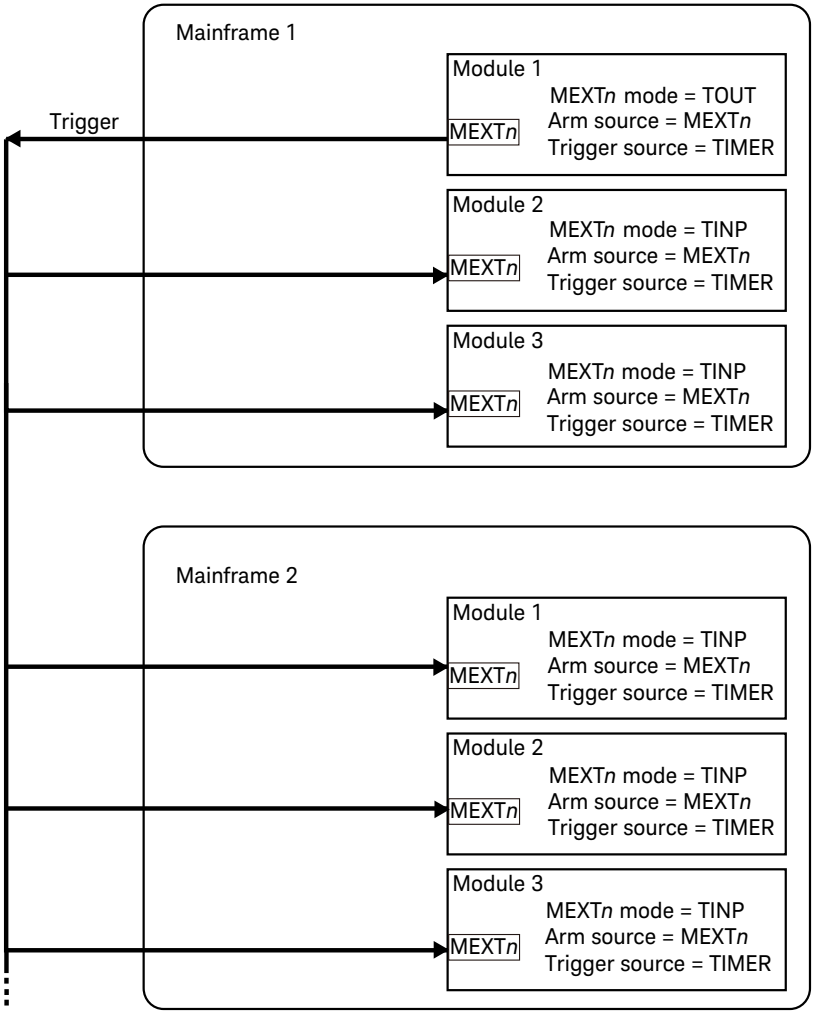
For all modules:

- Arm source must be the external trigger terminal (MEXT*n*).
- Trigger source must be the timer (TIMER).

See the example shown in Figure 5-16.

The delay between the modules will be a few microseconds or less.

Figure 5-16 Using Module Trigger Terminal



Remote Transient Voltage Measurement (PZ2120A and PZ2121A)

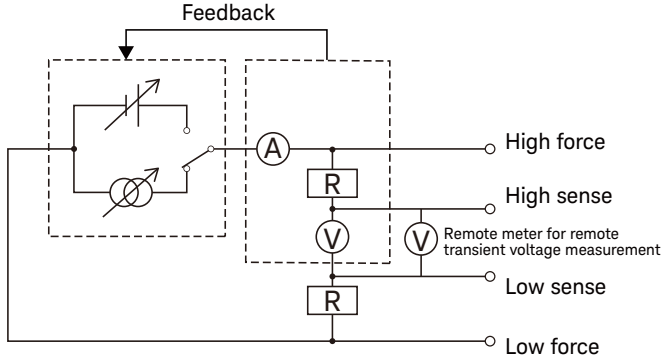
PZ2120A and PZ2121A provide the remote transient voltage measurement. This function is effective in measuring pulse voltage with the width of a few to dozens of microseconds.

This function is available for only the current source mode.

This function is available all current and voltage ranges.

The remote transient voltage measurement has a dedicated voltmeter with higher bandwidth as shown in Figure 5-17. It reduces the influence of capacitance, inductance, and voltage drop on the measurement cable of the 4-wire connection when applying narrow pulsed current.

Figure 5-17 Remote Transient Voltage Measurement (PZ2120A and PZ2121A)



Protection from Emergency

The protection from emergency is effective in preventing damages to the mainframe and modules due to high temperature, over voltage, over current, or other conditions. The PZ2100A series provides the mainframe and module protection, the protection coupling for multiple modules, and the mainframe protection function such as the protection state, the fault output, and the inhibit input.

Mainframe Protection

When the PZ2100A mainframe detects an emergency, the mainframe will be in the protection state and turn off all modules in the mainframe. And the protection state activates the mainframe fault output. For details of the fault output, see "Fault and Inhibit System Protection" on page 191.

The mainframe emergency includes over temperature, internal communication failure, or fan control failure.

If the emergency shutdown occurs, perform the self test by the *TST? command. The emergency condition will be solved after the instrument passes the self test.

Module Protection

The PZ2100A modules have two types of protection. One is an emergency shutdown and the other is an immediate output-off.

When the over temperature or the module system error such as power supply failure or internal communication failure is detected, the emergency shutdown occurs. The module is powered off and two module LED indicators turn red.

When the output is on and the module detects an emergency such as the over voltage, over current, and interlock open, the output automatically turns off; the output voltage is immediately set to 0 V, the output switch is set to off, and the module "Status" LED indicator turns off. If the emergency condition continues for a certain period of time after the immediate output-off, the emergency shutdown occurs.

Under the module emergency condition, any channel output cannot be on.

To recover from the emergency shutdown, use the *TST command.
To recover from the immediate output-off, use the :OUTP:PROT:CLE command.

Protection Coupling

Keysight PZ2100A series provides the protection coupling function.

When any module in the mainframe detects an emergency, the protection coupling causes the immediate output-off on the other modules with output-enabled channels.

Users can enable or disable the protection coupling by the front panel menu or the command. The default setting is that the protection coupling is enabled.

Fault and Inhibit System Protection

When the mainframe inhibit input is active, all modules in the mainframe will be in the immediate output-off and the mainframe will be in the protection state.

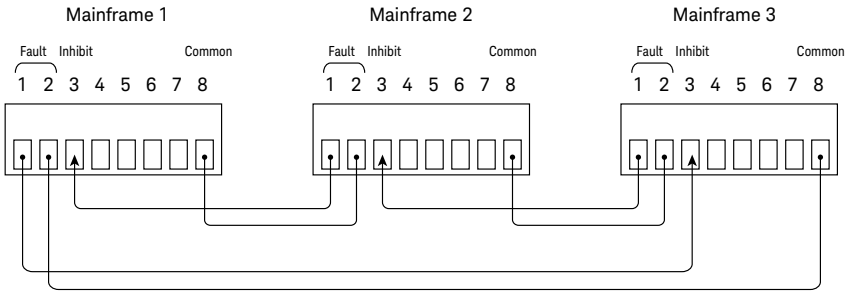
The mainframe will also be in the protection state if any module in the mainframe detects an emergency or the mainframe detects its emergency.

The protection state activates the mainframe fault output.

The inhibit input and fault output are assigned to digital I/O terminals on the rear panel of the mainframe. For more information about the pin configuration, see "Digital I/O Connections" on page 74.

Figure 5-18 shows an example of the fault and inhibit system protection. When the fault outputs and the inhibit inputs are connected in a daisy chain between mainframes, a module emergency will disable all outputs of the mainframes without intervention by either the controller or external circuitry. In this system protection, the fault outputs and inhibit inputs must be set to the same polarity.

Figure 5-18 Example of Fault and Inhibit System Protection



The protection state and the fault output on the digital I/O terminal remain active even if the module emergency condition is released. Users need to disable the protection state explicitly by the :OUTPut:PROTection:CLEar command.

6 Initial Settings

The PZ2100A module is initialized when you turn on or reset it. This chapter shows the initial settings.

System Initial Settings

Table 6-1 to Table 6-3 show the system initial settings of the PZ2100A series.

Table 6-1 System Settings

Setup item	Factory default	Reset	Power on
Model number	(Not Changed)	(Not Changed)	
Serial number	(Not Changed)	(Not Changed)	
Date and time	(Not Changed)	(Not Changed)	
Time zone	(Not Changed)	(Not Changed)	
Network Time Protocol (NTP)	ON	(Not Changed)	
Line frequency	50 Hz	(Not Changed)	
Interlock threshold voltage	42 V	(Not Changed)	
Interlock mode	DIO (mainframe)	(Not Changed)	
Key press sound	ON	(Not Changed)	
Power-on program	Reset	(Not Changed)	
Group setting[a]	All channels are in the group 1.	(Not Changed)	
Group enabled	ON	(Not Changed)	
Persona model number	The model number on the front panel	(Not Changed)	
Persona manufacturer	Keysight Technologies	(Not Changed)	
Program variable	(None)	(Not Changed)	(None)
Program selection	(None)	(Not Changed)	(None)
Program status	Idle	Idle	

Setup item	Factory default	Reset	Power on
Data byte order	Normal (Little Endian)	Normal (Little Endian)	
Data format	ASCII	ASCII	
Data elements	Voltage, current, resistance, time, status, source	Voltage, current, resistance, time, status, source	
Status register data format	ASCII	ASCII	
Automatic time stamp reset	OFF	OFF	
Mass storage directory	/ (root)	/ (root)	
Format of the captured image of front panel display	PNG	PNG	
Front panel display	Meter view (single layout)	Meter view (single layout)	
On/Off key behavior	Single channel	(Not changed)	
Remote display mode	ON	(Not changed)	

a. Group setting is not restored when the total number of channels has changed from the latest saving.

Table 6-2 Digital I/O Terminals Settings

Setup item		Factory default	Reset	Power on
Pin function	Pin 1	Fault output	(Not Changed)	
	Pin 2	Trigger input	(Not Changed)	
	Pin 3	Inhibit input	(Not Changed)	
	Pin 4	Trigger input	(Not Changed)	
	Pin 5	Trigger input	(Not Changed)	
	Pin 6	Trigger input	(Not Changed)	
	Pin 7	Interlock	(Not Changed)	
	Pin 8	Common	Common	
Signal level		Low	(Not Changed)	
Polarity		Negative	(Not Changed)	
Internal trigger line connected to the digital I/O terminals		INT1	(Not Changed)	
Connections between the internal trigger lines and the digital I/O terminals		OFF	(Not Changed)	

Table 6-3 Communication Settings

Setup item	Factory default	Reset	Power on
DHCP	ON	(Not Changed)	
DNS	0.0.0.0	(Not Changed)	
Auto IP	ON	(Not Changed)	
IP address	192.168.0.1	(Not Changed)	
Subnet mask	255.255.255.0	(Not Changed)	
Gateway	0.0.0.0	(Not Changed)	

Setup item	Factory default	Reset	Power on
Hostname	K-PZ2100A-*xxxxx* *xxxxx* is the suffix of serial number.	(Not Changed)	
mDNS	ON	(Not Changed)	
Desired hostname	K-PZ2100A-*xxxxx*.local *xxxxx* is the suffix of serial number.	(Not Changed)	
Desired service name	""	(Not Changed)	
GPIB address	26	(Not Changed)	
Telnet prompt	"SCPI> "	(Not Changed)	
Telnet welcome message	"Welcome to PZ2100A"	(Not Changed)	
LAN interface	ON	(Not Changed)	
Socket interface	ON	(Not Changed)	
Telnet interface	ON	(Not Changed)	
VXI11 interface	ON	(Not Changed)	
HiSLIP interface	ON	(Not Changed)	
GPIB interface	ON	(Not Changed)	
USB interface	ON	(Not Changed)	
Web server	ON	(Not Changed)	

Module Settings

Table 6-4 to Table 6-8 show the module initial settings of the PZ2100A series.

Table 6-4 Output Settings

Setup item		Factory default	Reset	Power on
Source output state		OFF	OFF	
Function to set the output filter automatically		ON	ON	
Cutoff frequency of the output filter		1/(2π × 5 μs)	1/(2π × 5 μs)	
Time constant of the output filter		5 μs	5 μs	
Output filter		ON	ON	
Operation mode		Normal	Normal	
Automatic output off		OFF	OFF	
Output off mode		Normal	Normal	
Automatic output on		ON	ON	
Function to set the output resistance filter automatically		ON	ON	
Cutoff frequency of the output resistance filter		1/(2π × 5 μs)	1/(2π × 5 μs)	
Time constant of the output resistance filter		5 μs	5 μs	
Output resistance filter	PZ2110A	ON	ON	
Output resistance mode	PZ2110A	Fixed	Fixed	
Output series resistance	PZ2110A	0 Ω	0 Ω	
Output shunt resistance	PZ2110A	2 GΩ	2 GΩ	
Output resistance	PZ2110A	OFF	OFF	

Table 6-5 Measurement Settings

Setup item		Factory default	Reset	Power on
Aperture time		2 ms	0.1/(*Line frequency*)	
Function to set the aperture time automatically		ON	ON	
Number of power line cycles (NPLC)		0.1	0.1	
Function to set the NPLC automatically		ON	ON	
Current measurement range based on the Limit value		100 μA range	100 μA range	
Function to automatically set the current measurement range based on the Limit value		ON	ON	
Negative current Limit value		100 μA	100 μA	
Positive current Limit value		100 μA	100 μA	
Current automatic ranging		ON	ON	
Lower limit for the current automatic ranging	PZ2110A	1 μA range	1 μA range	
	PZ2120A PZ2121A	10 μA range	10 μA range	
	PZ2130A	100 μA range	100 μA range	
	PZ2131A	10 μA range	10 μA range	
Current automatic ranging mode		Normal	Normal	
Current automatic ranging threshold		90	90	
Upper limit for the current automatic ranging	PZ2110A	300 mA range	300 mA range	
	PZ2120A PZ2121A	3.5 A range	3.5 A range	
	PZ2130A PZ2131A	500 mA range	500 mA range	

Setup item		Factory default	Reset	Power on
Lower limit for the seamless current measurement ranging	PZ2110A	(None)	(None)	
	PZ2120A PZ2121A	100 nA range	100 nA range	
	PZ2130A	100 μA range	100 μA range	
	PZ2131A	10 μA range	10 μA range	
Seamless current measurement ranging		OFF	OFF	
Current measurement range		100 μA range	100 μA range	
Sense function mode		Normal	Normal	
Disabled measurement functions		"RES"	"RES"	
Enabled measurement functions		"VOLT", "CURR"	"VOLT", "CURR"	
Remote transient voltage measurement		OFF	OFF	
Number of sampling measurement points		1	1	
Duration of sampling measurements		2 ms	0.1/(*Line frequency*)	
Trigger signal for acquire device action		INT1	INT1	
Trigger enabled for acquire device action		OFF	OFF	
Voltage measurement range based on the Limit value	PZ2110A	20 V range	20 V range	
	PZ2120A PZ2121A PZ2130A PZ2131A	6 V range	6 V range	
Function to automatically set the voltage measurement range based on the Limit value		ON	ON	
Negative voltage Limit value	PZ2110A	20 V	20 V	
	PZ2120A PZ2121A PZ2130A PZ2131A	6 V	6 V	

Setup item		Factory default	Reset	Power on
Positive voltage Limit value	PZ2110A	20 V	20 V	
	PZ2120A PZ2121A PZ2130A PZ2131A	6 V	6 V	
Voltage automatic ranging		ON	ON	
Lower limit for the voltage automatic ranging	PZ2110A	500 mV range	500 mV range	
	PZ2120A PZ2121A PZ2130A PZ2131A	6 V range	6 V range	
Voltage automatic ranging mode		Normal	Normal	
Voltage automatic ranging threshold		90	90	
Upper limit for the voltage automatic ranging	PZ2110A	200 V range	200 V range	
	PZ2120A PZ2121A	60 V range	60 V range	
	PZ2130A PZ2131A	30 V range	30 V range	
Voltage measurement range	PZ2110A	20 V range	20 V range	
	PZ2120A PZ2121A PZ2130A PZ2131A	6 V range	6 V range	
Function to automatically set the measurement wait time		ON	ON	
Gain value of the measurement wait time		1	1	
Offset value of the measurement wait time		0	0	
Measurement wait time enabled		ON	ON	

Table 6-6 Source Settings

Setup item		Factory default	Reset	Power on
Current base level		0	0	
Current base type		Immediate	Immediate	
Current sweep center		0	0	
Current source mode		Fixed	Fixed	
Current sweep point		1	1	
Current post level		0	0	
Current post type		Immediate	Immediate	
Current post enabled		ON	ON	
Current source range		100 μA range	100 μA range	
Current source automatic ranging		ON	ON	
Lower limit for the current automatic ranging	PZ2110A	100 nA range	100 nA range	
	PZ2120A PZ2121A	100 nA range	100 nA range	
	PZ2130A	100 μA range	100 μA range	
	PZ2131A	10 μA range	10 μA range	
Current sweep span		0	0	
Current sweep start		0	0	
Current sweep step		0	0	
Current sweep stop		0	0	
Current triggered level		0	0	
Current immediate level		0	0	
Source output mode		Voltage	Voltage	
Continuous trigger output enabled		OFF	OFF	
Source output shape		DC	DC	

Setup item		Factory default	Reset	Power on
Source list sweep output level		Empty	Empty	
Source list sweep trigger output enabled		Empty	Empty	
Source list sweep trigger output signal		Empty	Empty	
Source list sweep start point		1	1	
Pulse delay		0	0	
Pulse range priority		Transient	Transient	
Pulse width	PZ2110A	20 μs	20 μs	
	PZ2120A PZ2121A	100 μs	100 μs	
	PZ2130A	(None)	(None)	
	PZ2131A	100 μs	100 μs	
Source sweep direction		UP	UP	
Source sweep points		1	1	
Source sweep ranging		Best	Best	
Source sweep spacing		Linear	Linear	
Source sweep mode		Single	Single	
Trigger signal for source device action		INT1	INT1	
Trigger enabled for source device action		OFF	OFF	
Voltage base level		0	0	
Voltage base type		Immediate	Immediate	
Voltage sweep center		0	0	
Voltage source mode		Fixed	Fixed	
Voltage sweep point		1	1	
Voltage post level		0	0	
Voltage post type		Immediate	Immediate	

Setup item		Factory default	Reset	Power on
Voltage post enabled		ON	ON	
Voltage source range	PZ2110A	20 V range	20 V range	
	PZ2120A PZ2121A PZ2130A PZ2131A	6 V range	6 V range	
Voltage source automatic ranging		ON	ON	
Lower limit for the voltage automatic ranging	PZ2110A	500 mV range	500 mV range	
	PZ2120A PZ2121A PZ2130A PZ2131A	6 V range	6 V range	
Voltage sweep span		0	0	
Voltage sweep start		0	0	
Voltage sweep step		0	0	
Voltage sweep stop		0	0	
Voltage triggered level		0	0	
Voltage immediate level		0	0	
Function to automatically set the source wait time		ON	ON	
Gain value of the source wait time		1	1	
Offset value of the source wait time		0	0	
Source wait time enabled		ON	ON	

Table 6-7 Trigger System Settings

Setup item	Factory default	Reset	Power on
Bypass for event detector	OFF	OFF	
Device action count	1	1	
Device action delay	0	0	
Event source	AINT	AINT	
Interval of timer trigger source	4 μs	4 μs	
Trigger output signal	INT1	INT1	
Trigger output enabled	OFF	OFF	

Table 6-8 Trace Buffer Settings

Setup item	Factory default	Reset	Power on
Data placed in the trace buffer	Sense	Sense	
Trace buffer control mode	Never	Never	
Trace buffer size	30000	30000	
Statistical operation for the trace buffer	Mean	Mean	
Rule for reading the timestamp data in the trace buffer	Absolute	Absolute	

Edition 2, June 2023

PZ2100-90010
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