FLUKE®
Calibration

52120A

Transconductance Amplifier

Getting Started

PN 3977724
February 2012

LIMITED WARRANTY AND LIMITATION OF LIABILITY

Each Fluke product is warranted to be free from defects in material and workmanship under normal use and service. The warranty period is one year and begins on the date of shipment. Parts, product repairs, and services are warranted for 90 days. This warranty extends only to the original buyer or end-user customer of a Fluke authorized reseller, and does not apply to fuses, disposable batteries, or to any product which, in Fluke's opinion, has been misused, altered, neglected, contaminated, or damaged by accident or abnormal conditions of operation or handling. Fluke warrants that software will operate substantially in accordance with its functional specifications for 90 days and that it has been properly recorded on non-defective media. Fluke does not warrant that software will be error free or operate without interruption.

Fluke authorized resellers shall extend this warranty on new and unused products to end-user customers only but have no authority to extend a greater or different warranty on behalf of Fluke. Warranty support is available only if product is purchased through a Fluke authorized sales outlet or Buyer has paid the applicable international price. Fluke reserves the right to invoice Buyer for importation costs of repair/replacement parts when product purchased in one country is submitted for repair in another country.

Fluke's warranty obligation is limited, at Fluke's option, to refund of the purchase price, free of charge repair, or replacement of a defective product which is returned to a Fluke authorized service center within the warranty period.

To obtain warranty service, contact your nearest Fluke authorized service center to obtain return authorization information, then send the product to that service center, with a description of the difficulty, postage and insurance prepaid (FOB Destination). Fluke assumes no risk for damage in transit. Following warranty repair, the product will be returned to Buyer, transportation prepaid (FOB Destination). If Fluke determines that failure was caused by neglect, misuse, contamination, alteration, accident, or abnormal condition of operation or handling, including overvoltage failures caused by use outside the product's specified rating, or normal wear and tear of mechanical components, Fluke will provide an estimate of repair costs and obtain authorization before commencing the work. Following repair, the product will be returned to the Buyer transportation prepaid and the Buyer will be billed for the repair and return transportation charges (FOB Shipping Point).

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To register your product online, visit http://register.fluke.com.

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Introduction

The Fluke 52120A Transconductance Amplifier (the Product) is a precision current amplifier that can:

- Accept full scale DC or AC inputs of 2 volts or 200 mA from any calibrator, signal generator or power supply
- Deliver proportional output current in ranges of 2 A, 20 A or 120 A at frequencies to 10 kHz
- Offer enhanced accuracy to 100 ppm when used in closed-loop mode with a 6105A Electrical Power Standard
- Operate in parallel with one or two other Products to deliver 240 A or 360 A
- Push current with compliance voltage of 4.5 V rms or 6.4 V peak
- Drive inductive loads to 1 mH
- Drive optional current coils to deliver test currents of 3000 A or 6000 A

How to Contact Fluke

To contact Fluke Calibration, call one of the following telephone numbers:

- Technical Support USA: 1-877-355-3225
- Calibration/Repair USA: 1-877-355-3225
- Canada: 1-800-36-FLUKE (1-800-363-5853)
- Europe: +31-40-2675-200
- Japan: +81-3-6714-3114
- Singapore: +65-6799-5566
- China: +86-400-810-3435
- Brazil: +55-11-3759-7600
- Anywhere in the world: +1-425-446-6110

To see product information and download the latest manual supplements, visit Fluke Calibration's website at www.flukecal.com.

To register your product, visit http://flukecal.com/register-product.

Safety Information

This Product complies with:

- EN/IEC 61010-1:2010
- CAN/CSA C22.2 No. 61010-1-04
- ANSI/UL 61010-1:2004
- EN 61326-1:2006

In this manual, a **Warning** identifies conditions and actions that pose danger to the user. A **Caution** identifies conditions and actions that can possibly damage the Product or the equipment under test.

For safe operation of this Product, follow all the warnings and cautions in this manual.

⚠⚠ Warning

To prevent personal injury:

- **Read all safety Information before you use the Product.**
- **Use the Product only as specified, or the protection supplied by the Product can be compromised.**
- **Use this Product indoors only.**
- **Be aware the 52120A binding posts may be connected to supply lethal voltages. If one terminal of a pair is connected, the other may also be at lethal potential.**
- **Use extreme caution when the current output terminals of the Product are connected to voltage circuits, as lethal voltage may be present.**
- **Always ensure the Product is in STBY mode and external circuits are not energized before you make cable connections or disconnecting either end of the cables.**
- **Do not energize voltage circuits unless the Product cables are either properly connected at both ends or disconnected at both ends.**

To prevent possible electrical shock, fire, or personal injury:

- **Make sure the ground conductor in the mains power cord is connected to a protective earth ground. Disruption of the protective earth could put voltage on the chassis that could cause death.**

- **Do not touch voltages >30 V ac rms, 42 V ac peak, or 60 V dc.**
- **Examine the case before you use the Product. Look for cracks or missing parts. Carefully look at the insulation around the terminals.**
- **Do not use and disable the Product if it is damaged.**
- **Do not use the Product if it operates incorrectly.**
- **Use only cables with correct voltage ratings.**
- **Do not use test leads if they are damaged. Examine the test leads for damaged insulation. Do a continuity test on the test leads.**
- **Do not connect to live output terminals. The Product can supply voltages that can cause death. Standby mode is not sufficient to prevent electrical shock.**
- **Do not use the Product around explosive gas, vapor, or in damp or wet environments.**
- **Use only the mains power cord and connector approved for the voltage and plug configuration in your country and rated for the Product.**
- **You must connect an earth ground to the Product at all times. If an earth connection is not made through the mains power cord, then make an earth connection to the rear-panel Auxiliary Protective terminal.**
- **Replace the mains power cord if the insulation is damaged or if the insulation shows signs of wear.**
- **Never connect line power to a Product input or output connector, other than the mains power receptacle.**

Symbols

Symbols used in this manual and on the Product are explained in Table 1.

Table 1. Symbols

Symbol	Description	Symbol	Description
⏚	Chassis ground	SP c US	Conforms to relevant North American Safety Standards.
CE	Conforms to European Union directives		Do not dispose of this product as unsorted municipal waste. Go to Fluke's website for recycling information.
⚠	Risk of Danger. Important information. See manual.	⚠	Hazardous voltage
⏚	Earth ground	N10140	Conforms to relevant Australian EMC requirements

Protective Earth (Grounding)

Protection Class 1 – Always operate the Product with an earth/ground connection to the earth ground conductor of the ac supply cable. The earth/ground connects before the ac line and neutral connections when the supply plug is put into the mains socket of the Product. If the last mains connection is made elsewhere, make sure the earth/ground connection is made before ac line and neutral.

Connect an applicable earth/ground to the auxiliary protective terminal on the rear panel if:

- it is possible the earth/ground connection will not connect before the ac line and neutral connections.
- the output terminals are connected to a potentially hazardous live circuit.

Instruction Manuals

The 52120A Manual set supplies complete information for operators. The set includes:

- *52120A Operators Manual* on the included CD-ROM (PN 3977736)
- *52120A Getting Started Manual* (PN 3977724)

One of each manual shown above is shipped with the instrument. You can order more copies of the manuals from Fluke. To learn more on how to place an order, refer to the How to Contact Fluke section.

52120A Getting Started Manual

This *52120A Getting Started Manual* contains a brief introduction to the Product. The Getting Started topics are:

- Safety Information
- Instruction manuals and their content
- How to unpack and examine the Product
- How to connect the Product to mains power
- Front and rear panel familiarization
- Maintenance
- General Specifications

52120A Operators Manual

The *52120A Operators Manual* contains data on how to install the Product and operate it from the front panel keys and in remote configurations. This manual also contains Product specifications and error codes. The Operators Manual topics are:

- Installation
- Operating controls and features, including front panel controls
- Remote operation
- Operator maintenance
- Calibration
- Accessories

How to Unpack and Examine the Product

The Product is shipped in a container built to prevent damage during shipping. Examine the Product carefully for damage and immediately report damage to the shipper. Instructions for inspection and claims are included in the shipping container.

When you unpack the Product, make sure all the standard equipment shown in Table 2 was shipped. Also examine the shipping document for more items. Refer to the Accessories chapter in the *52120A Operators Manual*. Report all shortages to the place of purchase or to the nearest Fluke Service Center. A performance test is shown in the Maintenance chapter in the *52120A Operators Manual*.

If it becomes necessary to ship the Product, use the container and inserts it was initially shipped in, if possible. If it is not available, you can get a transit case from Fluke. This container is applicable for most handling conditions, but gives less shock protection than the initial shipping container.

Table 2. Standard Equipment

Item	Model or Part Number
Transconductance Amplifier	52120A
Line Power Cord	Per ship-to location, see Table 3.
52120A Getting Started Manual	3977724
52120A Operators Manual on CD-ROM	3977736

Service Information

Each Product is warranted to the original purchaser for the period specified in the warranty and starts on the date received. The warranty is found at the front of this manual.

Factory authorized service and technical advice for the Product is available at Fluke Service Centers. A complete list of service centers is available at www.flukecal.com.

⚠⚠ Warning

To prevent possible electrical shock, fire, or personal injury, have an approved technician repair the Product.

How to Place and Rack Mount the Product

Always operate the Product in controlled electromagnetic environments such as calibration and measurement laboratories. Where rf transmitters, like mobile telephones are not used.

This Product can be used on a bench-top or in a rack. The rack-mount kit must be ordered separately from Fluke. See the How Contact Fluke section in this manual. The rack-mount kit part number is listed in the accessories table in the Operators Manual.

Note

There must be sufficient space on the sides of the Product for sufficient air flow. The Product can be rack mounted. See the Accessories table in the Operators Manual for the rack mount part number. The rack mount kit has instructions in how to rack mount the Product.

Cooling Considerations

⚠ Caution

The Product can overheat and become damaged if the area around the air intake is too small, the intake air is too warm, or the air filter becomes clogged.

To increase the life of the Product:

- Keep the area around the air filter a minimum of 4 inches from nearby walls or rack enclosures.
- Keep the inlet and exhaust perforations on the sides of the Product clear of blockages.
- Keep the air that goes in to the Product between 5 °C and 35 °C.
- Make sure exhaust from a different instrument is not pointed into the fan inlet.
- Clean the air filter at a maximum of 30 day intervals. More frequently if the Product is operated in a dusty environment. See the Maintenance section of this manual for instructions on how to clean the air filter.

How to Connect the Product to Mains Power

⚠⚠ Warning

To prevent possible electrical shock, fire, or personal injury:

- **Use only the mains power cord and connector approved for the voltage and plug configuration in your country and rated for the Product.**
- **Replace the mains power cord if the insulation is damaged or if the insulation shows signs of wear.**
- **Make sure the ground conductor in the mains power cord is connected to a protective earth ground. Disruption of the protective earth could put voltage on the chassis that could cause death.**
- **Do not disconnect or open the protective ground conductor inside or outside the Product. An open ground conductor can make the Product dangerous.**

⚠ Caution

When exposed to low temperatures for an extended time, such as air travel or storage, condensation may form inside the Product. To prevent damage to the Product, let it acclimate to its environment out of its shipping container a minimum of one hour before you connect it to mains power.

The Product automatically senses mains voltage between 100 and 240 volts. No line voltage or fuse selection is necessary. See the Maintenance section to learn how to replace the mains fuse.

Because the Product can pull more current than a standard 10 A IEC connector, the Product has a 16 A power connector on the rear panel. A mains power cord with 16 A capacity is also supplied with the Product. Table 3 is a list of power cord types available from Fluke.

Table 3. Line Power Cord Types Available from Fluke

Country	Fluke Part Number
UK	1998167
Europe	1998171
Australia, New Zealand, China	1998198
USA, Japan	1998209
Other (no plug fitted)	1998211

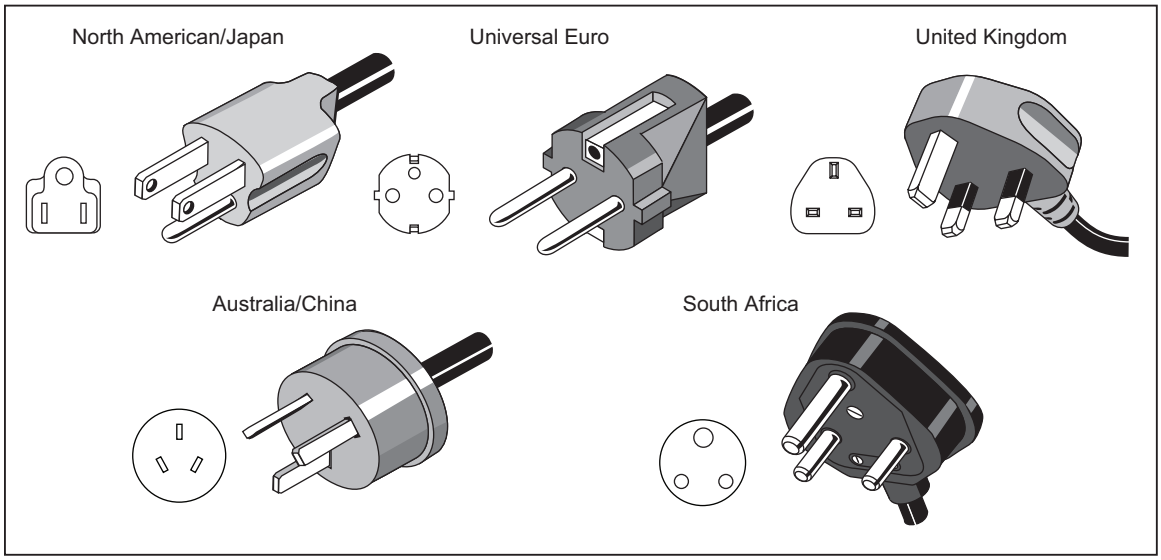

Figure 1. Line Power Cord Types Available from Fluke

Note

Typical maximum power requirement of the Product at 115 V is 1500 VA. Make sure the mains supply outlet is rated for this load and has a grounded three-prong outlet. Make sure the outlet ground connector is connected to earth ground.

If a mains power cord is supplied without a mains connector, use the color codes below when you connect a connector to the power cord.

Line = Brown
Neutral = Blue
Earth = green/yellow

Front-Panel Features

Table 4 is a list of front-panel controls and connections.

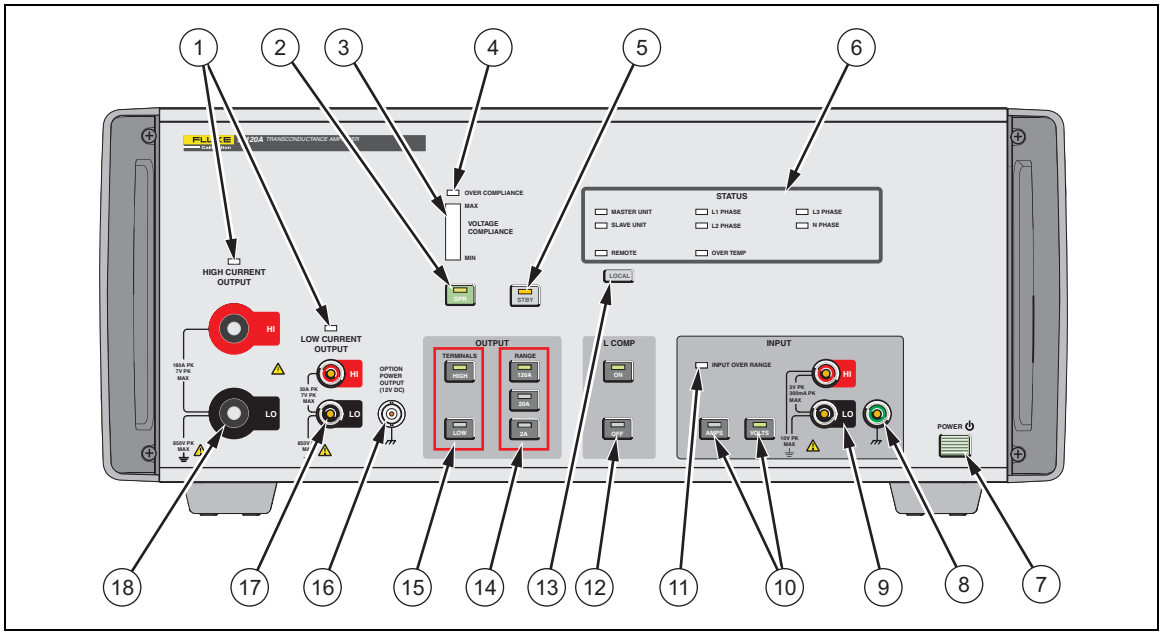

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Figure 2. Front-Panel View

Table 4. Front-Panel Features

Item	Description
1	**Current Output Indicators** Output on indicator. In STBY (standby) mode, these two indicators will be Amber. In OPR (operate) mode, the indicator for the selected terminals will be illuminated green.
2	OPR The **OPR** (Operate) key places the Product in operate mode. Operate mode is indicated by the lit indicator on the OPR key. The indicator over the set output terminals also shows green.
3	**Voltage Compliance Level Indicator**
4	**Over Compliance Indicator** Indicates when the Product senses the voltage developed across the current terminals due to the current through the load impedance has exceeded the specified level. This condition also automatically puts the Product in standby to remove the output current.
5	STBY The STBY (Standby) key puts the Product in standby mode. Standby mode is indicated by the lit indicator on the STBY key. The output indicators above the output terminals also shows amber.
6	**Status Indicators** Indicates the status of the different functions of the Product. See the *52120A Operators Manual* to learn more about the status indicators.

Table 4. Front-Panel Features (cont.)

Item	Description
⑦	**Mains Power Switch** The power switch turns the power on and off. The switch is a latching push-push type. When the switch is latched in, power is on. *Note* *The front panel power switch operates electronically and is not an isolation switch. The main power ON/OFF isolation switch is on the rear panel.*
⑧	**Chassis ground connection**
⑨	**Input Terminals** Used to input voltage or current to the Product.
⑩	AMPS VOLTS Sets the INPUT to receive voltage or current.
⑪	**INPUT OVER RANGE Indicator** Comes on when the input exceeds the limit.
⑫	ON OFF Sets LCOMP on or off. LCOMP ON is used for highly inductive loads. See the Specifications for inductive loading limits.
⑬	LOCAL Sets the Product for local (front panel) control when it is in remote mode.
⑭	120A 20A 2A Sets the output range to 2, 20, or 120 amps.
⑮	HIGH LOW Puts the output current on the High Current or Low Current output terminals.
⑯	**OPTION POWER OUTLET** BNC connector that sources 12 V dc to power the cooling fan of a connected accessory such as a 25 turn coil.
⑰	**LOW Current Output Terminals** Used with 2 A and 20 A output ranges.
⑱	**HIGH Current Output Terminals** Used with all output ranges.

Rear-Panel Features

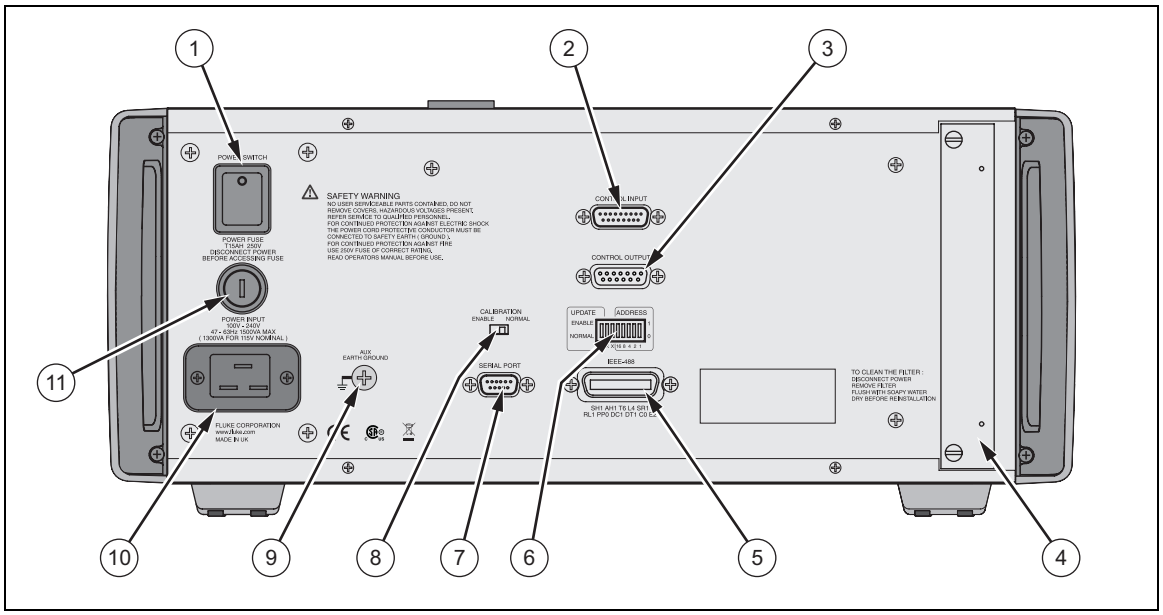

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Figure 3. Rear-Panel View

Table 5. Rear-Panel Features

Item	Description
1	**Main Power ON/OFF Switch** This is the mains isolating switch.
2	**Control Input** Used to control the Product from a MASTER unit. Either another 52120A or a 6100 series Electrical Power Standard.
3	**Control Output** Used to control another 52120A (SLAVE) through its control Input. This Product acts as the master.
4	The **Air Filter** covers the air intake to keep dust and debris out of the chassis.
5	The **IEEE-488 (GPIB)** connector is a standard parallel interface for remote operation of the Product. See the Remote Control section of the *52120A Operators Manual*.
6	Combined GPIB address switch and firmware UPDATE ENABLE / NORMAL selector.
7	Serial Port for firmware upload

Table 5. Rear-Panel Features (cont.)

Item	Description
⑧	The **CALIBRATION ENABLE / NORMAL** switch is used to write enable and disable the nonvolatile memory that stores calibration constants. See the Calibration section of the *52120A Operators Manual* to learn more about calibration of the Product. Set to NORMAL for normal operation.
⑨	The **AUXILIARY PROTECTIVE** terminal is internally grounded to the chassis.
⑩	**Mains Power Receptacle** Grounded three-prong connector that accepts the line power cord.
⑪	**Fuse Holder** Holds the mains power fuse. See the Maintenance section for the fuse replacement procedure.

Input and Output Connections

⚠ Caution

To prevent damage to the Product, do not connect mains power to any signal input or output terminal.

Input Terminals

The input terminals of the Product are 4 mm binding posts. Table 6 shows the maximum voltage and current that can safely be applied to the input terminals.

⚠ Caution

To prevent damage to the Product, do not apply voltage between the HI and LO input terminals when input current is set. This can cause the burden resistor to change its resistance value and invalidate the calibration for current input.

Table 6. Maximum Voltage and Current on Input Terminals

Output Current Range	Maximum Voltage Input HI and LO	Maximum Current Input HI to Lo	Maximum Voltage HI or LO to Earth
2 A and 20 A	2 V rms, 3 V pk	200 mA rms	30 V pk
120 A	1.2 V rms, 1.7 V pk	120 mA rms, 170 mA pk	30 V pk

When the input terminals are configured for current input, a precision burden resistor is connected across the HI and LO terminals to make a voltage from the input current.

The green 4 mm binding post is connected to the chassis of the Product. This is a signal connection and must not be used for a protective earth connection.

Output Terminals

There are two sets of output terminals on the Product. They are not referenced to ground. Each of the four terminals can be connected to a signal source with a maximum voltage of 850 V pk (600 V rms). Table 7 shows the maximum voltage and current that can be safely applied to the output terminals.

Table 7. Maximum Voltage and Current on Output Terminals

Output Current Terminal	Maximum Voltage Input HI and LO	Maximum Current Input HI to Lo	Maximum Voltage HI or LO to Earth
2 A and 20 A	7 V pk	30 A pk	600 Vrms, 850 Vpk
120 A	7 V pk	170 A pk	600 Vrms, 850 Vpk

⚠⚠ Warning

To prevent possible electrical shock, fire, or personal injury:

- **Use extreme caution around the output terminals. Lethal voltages may be present.**
- **Make sure the Product is in standby mode and external circuits are not energized before you connect or disconnect cables between the Product and the circuit under test.**
- **Do not turn on voltage circuits unless the cables between the Product and circuit are connected or disconnected at both ends of the cable.**
- **Do not connect a connector or terminal, other than the mains input connector to line power.**

Product Connection Cables

Three signal cable sets are shipped with the Product. All cables are rated for 600 V. Two low current cables are the same and interchangeable. They can be used on the Product input or the low current output. Two heavy duty individual conductor cables are used to connect the high current output of the Product to the load.

⚠⚠ Warning

To prevent electrical shock or personal injury, use only cables supplied with the Product to connect the output current terminals to the load. Before you touch an exposed connector, make sure external voltage is isolated.

Safe Working Practice

The high current output LO and low current output LO are electrically connected internally. Similarly, the two output HI terminals are connected internally. If one of the terminals is connected to high voltage, one of the other output terminals will be at the same voltage.

⚠⚠ Warning

To prevent electric shock or personal injury, remove all cables from the current terminals that are not used. When you make connections to a circuit that can be energized with voltages, always make the connection at the Product before you connect to the external circuit. Voltage can be present at the loose ends of cables.

How to Connect the Product to an External Circuit

1. Remove power from external circuits.
2. Push STBY to set the Product to standby.
3. Remove all connections to the terminals of the Product that are not used for the test.
4. Connect the test leads to the HI and LO terminals of the Product.
5. Connect the test leads to the external circuit.
6. Push OPR to set the Product to operate.

How to Disconnect the Product from an External Circuit

1. Remove power from external circuits.
2. Push STBY to set the Product to standby.
3. Disconnect the test leads from the external circuit.
4. Disconnect the test leads from the Product.

When you connect a high current cable to a load, make sure the connections are tight. A loose connection can cause voltage over compliance and set the Product into standby (STBY) mode. A loose connection can cause the connection to overheat.

Maintenance

⚠⚠ Warning

To prevent possible electrical shock, fire, or personal injury:

- **Do not operate the Product with covers removed or the case open. Hazardous voltage exposure is possible.**
- **Use only specified replacement fuses.**
- **Remove the input signals before you clean the Product.**
- **Turn the Product off, remove the mains power cord, and disconnect all input and output cables before you clean the Product.**
- **Disconnect the mains power cord before you remove the Product covers.**

How to Replace the Mains Input Fuse

The mains input fuse holder is on the rear panel of the Product. To replace the fuse:

1. Switch the Product off with the rear-panel main power ON/OFF switch.
2. Remove the power cord from the mains input connector.
3. Use a flat-blade screwdriver to turn the fuse holder cap counterclockwise until the cap can be pulled from the holder.
4. Replace the fuse with a new one. See Table 8 for approved fuses.

Table 8. Approved Replacement Fuses

Manufacturer	Part Number	Rating
⚠ Fluke	4109196	Anti-surge T 16A 500V 6.35 X 32 mm
⚠ SIBA	70 065 65 16A	
⚠ For safety, use exact replacement only.		

How to Clean the Air Filter

⚠ Caution

The Product can become too hot and be damaged if the area around the air intake is too small, the intake air is too warm, or the air filter becomes clogged.

You remove the air filter from the rear panel of the Product. To remove the air filter:

1. Switch the Product off with the rear-panel main power ON/OFF switch.
2. Remove the power cord from the mains input connector.
3. Loosen the two screws at the top and bottom vertical panel that covers the air filter.

Note

There must be 19 inches of clearance behind the Product to remove the air filter.

4. Pull the air filter out of the Product.
5. Clean the air filter with soapy water.
6. Dry the air filter thoroughly.
7. Install the air filter and tighten the knurled screws.

How to Clean the Product

Clean the external surfaces of the Product with a soft cloth dampened with water or a non-abrasive solution that will not damage plastic.

⚠ Caution

To prevent damage to the Product, do not use aromatic hydrocarbons or chlorinated solvents to clean the Product. These can cause damage to the plastic parts of the Product.

General Specifications

For performance specifications, see the *52120A Operators Manual*.

Warmup Time ..... Twice the time since last warmed up, to a maximum of 30 minutes.

Line Power

- Voltage range ..... 100 V to 240 V
- Frequency ..... 47 to 63 Hz
- Voltage variations ..... ±10 % about line voltage
- Power consumption ..... <1500 VA
- Transient overvoltage ..... Impulse withstand (overvoltage) Category II of IEC 60364-4-443

Dimensions (HxWxL)

- With feet ..... 192 mm x 432 mm x 648 mm (7.6 in x 17.0 in x 25.5 in)
- Without feet ..... 178 mm x 432 mm x 648 mm (7.0 in x 17.0 in x 25.5 in)

Weight ..... 25 kg (54 lbs)

Temperature

- Operating ..... 5 °C to 35 °C (41 °F to 95 °F)
- Calibration (tcal) ..... 16 °C to 30 °C (61 °F to 86 °F)
- Storage ..... 0 °C to 50 °C (32 °F to 122 °F)
- Transit ..... -20 °C to +60 °C (-4 °F to +140 °F) <100 hours

Humidity (non-condensing)

- Operating ..... <80 %, 5 to 31 °C (41 °F to 88 °F) ramping linearly down to 50 % at 35 °C (95 °F)
- Storage ..... <95 %, 0 to 50 °C (32 °F to 122 °F)

Altitude

- Operating ..... 2,500 m (8,200 ft) maximum
- Non-Operating ..... 12,000 m (39,400 ft) maximum

Shock and Vibration ..... MIL-PRF-28800F Class 3

Safety ..... Complies with EN/IEC 61010-1:2010, CAN/CSA C22.2 No. 61010-1-04, ANSI/UL 61010-1:2004

EMC ..... Complies with EN 61326-1:2006, CISPR 11 (EN 55011:2004), FCC rules part 15, sub part B, Class A

Indoor user only ..... Pollution degree 2; installation category II

Agency Approvals ..... CE,