



# **GUILDLINE**

**Operation Manual**

**For The**

**6623A-PCS/1000/2000/3000**

**Precision Current Sources**

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**OM6623A-PCS-1\_2\_3000-5-00  
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# TABLE OF CONTENTS

<b>1. INTRODUCTION</b> .....	<b>1-1</b>
1.1. SCOPE.....	1-1
1.2. GENERAL DESCRIPTION.....	1-1
1.3. OVERVIEW .....	1-2
1.4. PRINCIPLE OF OPERATION .....	1-2
<b>2. INSTALLATION</b> .....	<b>2-1</b>
2.1. PRELIMINARIES .....	2-1
2.1.1. Power Voltage Selection .....	2-2
2.1.2. Fuse Replacement.....	2-2
2.1.3. Setup and Power On.....	2-2
2.2. INCOMING INSPECTION.....	2-4
2.3. 6623A-PCS/3000 FRONT PANEL.....	2-10
2.3.1. Power .....	2-11
2.3.2. Fault .....	2-11
2.4. 6623A-PCS/3000 REAR PANEL CONNECTORS AND CONTROLS.....	2-12
2.4.1. Line Input Connectors .....	2-13
2.4.2. Current Output Terminals .....	2-13
2.4.3. Input Control Connector.....	2-13
<b>3. QUICK OPERATION GUIDE</b> .....	<b>3-1</b>
3.1. OPERATION GUIDE .....	3-1
3.1.1. Recommended Test Setup Procedure for the 6623A-PCS/3000 .....	3-1
3.1.2. Setup Limits and Precautions for 6623A-PCS/3000.....	3-2
3.1.3. Checks and Precautions.....	3-2
<b>4. VERIFICATION AND CALIBRATION</b> .....	<b>4-1</b>
4.1. RATIO ACCURACY VERIFICATION.....	4-1
4.1.1. Purpose .....	4-1
4.2. TEST EQUIPMENT REQUIRED.....	4-1
4.3. PROCEDURE.....	4-2
4.3.1. VERIFICATION OF THE 3 A TO 15 A RANGE .....	4-2
4.3.2. VERIFICATION OF THE 15 A TO 150 A RANGE .....	4-2
4.3.3. VERIFICATION OF THE 150 A TO 1000/2000/3000 A RANGE.....	4-3
4.3.4. VERIFICATION OF THE 2000 A AND 3000 A RANGE OF CURRENTS.....	4-3

<b>5.</b>	<b>TROUBLESHOOTING AND MAINTENANCE.....</b>	<b>5-1</b>
<b>5.1.</b>	<b>INTRODUCTION.....</b>	<b>5-1</b>
5.1.1.	Error Messages .....	5-1
5.1.2.	Model CS1000 'Fault' Indicators.....	5-1
5.1.3.	Maintenance .....	5-1
5.1.4.	Maintenance Guidelines and Schedule .....	5-1
5.1.5.	Connection Problems .....	5-2
5.1.6.	Safety Features .....	5-2
<b>6.</b>	<b>APPENDICES .....</b>	<b>6-1</b>
<b>6.1.</b>	<b>GENERAL SPECIFICATIONS.....</b>	<b>6-1</b>
<b>6.2.</b>	<b>GENERAL SPECIFICATIONS (continued).....</b>	<b>6-2</b>

# LIST OF FIGURES

**FIGURE 1-1 : MODEL 6623A-PCS/3000 BLOCK DIAGRAM ..... 1-3**  
**FIGURE 2-1 : 6623A-PCS/3000, 15 A RANGE CONNECTIONS ..... 2-7**  
**FIGURE 2-2 :: 6623A-PCS/3000, 150 A RANGE CONNECTIONS ..... 2-8**  
**FIGURE 2-3 : 6623A-PCS/3000, 3000 A RANGE CONNECTIONS ..... 2-9**  
**FIGURE 2-4 : 6623A-PCS/3000 FRONT VIEW ..... 2-10**  
**FIGURE 2-5 : 6623A-PCS/3000 REAR VIEW ..... 2-12**  
**FIGURE 3-1 : 6623A-PCS/3000 TEST SETUP COMPLIANCE LIMITS ..... 3-2**

# LIST OF TABLES

<b>TABLE 3-1 : TEST CURRENT CABLE SIZE REQUIREMENTS</b> .....	3-3
<b>TABLE 4-2 : 6623A-PCS/1000/2000/3000 CURRENT CALIBRATION RESULTS</b> .....	4-4
<b>TABLE 5-3 : MAINTENANCE SCHEDULE</b> .....	5-2
<b>TABLE 6-1 : GENERAL SPECIFICATIONS</b> .....	6-1
<b>TABLE 6-2 : GENERAL SPECIFICATIONS (CONTINUED)</b> .....	6-2

## 1. INTRODUCTION

### 1.1. SCOPE

This document describes the installation, operation, specifications, maintenance and verification of the Model 6623A-PCS/1000/2000/3000 Precision Current Sources. Precautions associated with very high current connections are provided for purposes of user safety and current source reliability. This manual describes mainly the 6623A-PCS/3000 Precision Current Source as this model incorporates the full complement of features in all the models. Differences with respect to the 6623A-PCS/1000 and the 6623A-PCS/2000 models are stated where appropriate.

### 1.2. GENERAL DESCRIPTION

The Model 6623A-PCS/1000/2000/3000 Precision Current Sources supply positive and negative currents in the range of 3 A to 1000, 2000 or 3000 A depending on the model. The three models are essentially the same except for the test current capability and the cable connection terminal configuration. The 6623A-PCS/1000 enables test currents up to 1000 A to be realized and is supplied with one CS1000 current source chassis. The models 6623A-PCS/2000 and 6623A-PCS/3000 models provide for test currents up to 2000 and 3000 A and are supplied with two and three CS1000 current source chassis's respectively. The lower current models may be upgraded by the addition of one or two CS1000 chassis's.

Each CS1000 current source chassis consists of seven 150 A current source modules connected internally in parallel. The CS1000 is controlled by the Model 66259 Control Unit included with the 6623A-PCS Precision Current Source. The control unit provides three current ranges, selection of positive or negative currents and correction coefficients to control the accuracy of the three current ranges. Current ranges of 3 to 15 A, 15 to 150 A and 150 A to full scale current are provided. The first CS1000 chassis is preconfigured as the master unit and controls the additional units through the Model 66259 Control Unit. The 66259 Control Unit can be setup to automatically reverse the polarity of the supplied current at a selectable rate.

The 6623A-PCS Series is pre-wired and configured in a 22U high rack cabinet designed to operate at a nominal power line voltage of 208 to 240 VAC. The rack mount cabinet includes a bus bar arrangement to connect the CS1000 units in parallel and provide for suitable terminal connections to external cables. A terminal panel at the top of the cabinet provides for terminal connections for the two lower current ranges. These lower ranges are fused to provide suitable over current protection. All necessary interconnections of the CS1000 current sources are integrated into one cabinet such that no hardware reconfiguration is required over the full range of operation other than the connection of the current terminals to the correct range on the back panel. An Emergency Off switch is provided that can be placed in a convenient place close to the 6623A-PCS current source to allow a for the immediate interruption of the test current if an emergency should arise.

Refer to section 2-3 for front and rear views of the system and descriptions of indicators, controls and terminals.



## 1.3. OVERVIEW

The Model 6623A-PCS/1000/2000/3000 Precision Current Sources are precision sources of both positive and negative currents up to a full scale of 3000 A. Figure 1-1 illustrates the instrument circuits in block diagram form with the connections to the load. A Model 66259 Control Unit provided with the system is programmable and allows for selection of range and polarity of the test current. The Model 66259 Control Unit is provided with a control cable to allow the unit to be hand held or placed on a bench near the 6623A-PCS current source.

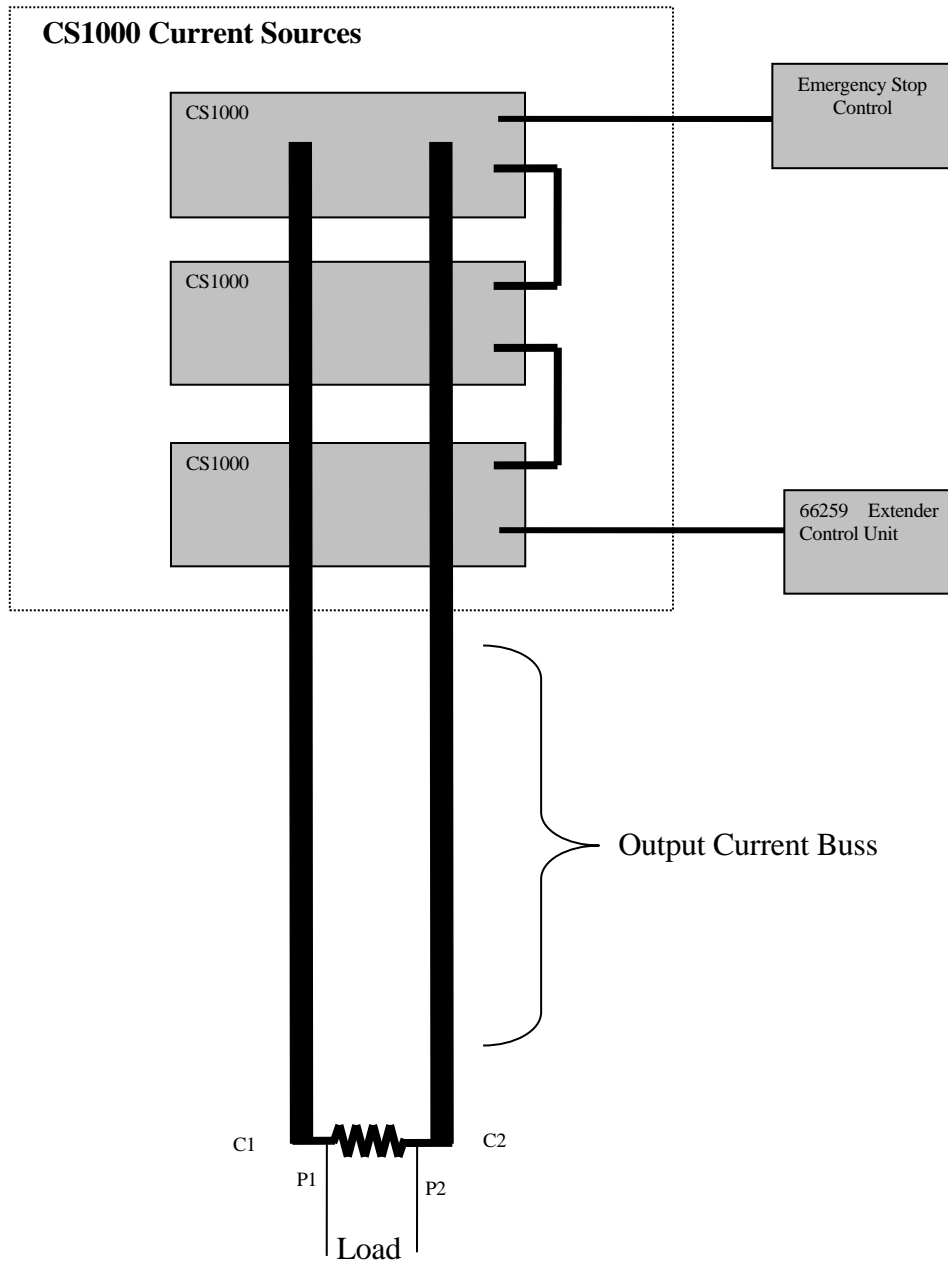
There are no adjustments within the 6623A-PCS current source that are required for proper operation, but the Model 66259 Control Unit must be set up with a specific range profile and test current calibration coefficients. The Model 66259 Control Unit is generally configured at the factory for the 6623A-PCS current source. A Summary of Coefficients for later reference as may be needed is provided with each 6623A-PCS current source.

A complete description of the Model 66259 Control Unit including calibration and control features is provided in a separate Operation Manual, (OM66259), with each 6623A-PCS current source.

## 1.4. PRINCIPLE OF OPERATION

The Model 6623A-PCS/1000/2000/3000 Precision Current Sources are modular in design. The base module consists of a fully integrated line operated 150 A direct current source printed circuit board. Seven of the 150 A modules are assembled in a single 5U rack mountable chassis. The direct current outputs are connected in parallel to a pair of bus bars. The control inputs of the CS1000 chassis's are connected in series such that the same input control current passes through all the 150 A modules. The control signals also provide for the selection of one of three available ranges.

The 150 A modules are designed such that if a fault is detected the outputs of the module are isolated from the main bus bar. In this way the remaining 150 A modules will continue to operate. Fault indicators are provided for each 150 A module in each chassis assembly so that the module at fault can be quickly identified.



**Figure 1-1 : Model 6623A-PCS/3000 Block Diagram**



## 2. INSTALLATION

### 2.1. PRELIMINARIES

Note that the Model 6623A-PCS/3000 Precision Current Source will include a separate Model 66259 Control Unit and Model 66236 Emergency Off Switch. The Model 66259 Control Unit is provided with a separate Operation Manual. The Model 6623A-PCS/3000 current source is shipped assembled in a 22U rack cabinet fully configured for 220 Volt, 50/60 Hz operation with a power requirement of two 30 A, 220 Volt circuits. The 6623A-PCS/1000 and 6623A-PCS/2000 models are assembled in the same 22U also fully configured for 220 Volt, 50/60 Hz operation with a power requirement of one 30 A, 220 Volt circuit.

#### Unpacking Procedure:

- a. Remove the 6623A-PCS/3000 Current Range Extender and the other items from the shipping container to a suitable location (refer to the drawing attached in back of manual).
- b. The following items are included with each new unit.
  - i. Operation Manual (OM6623A-PCS-1\_2\_3000)
  - ii. Spare 200 A Fuses, (GPN 099-32200), 2 per CS1000 and 2 for fly out panel
  - iii. Two Spare Fuse Cable Assemblies, 20 A, (GPN 31486-01-21)
  - iv. One 20 A, 1.5 m Red Connection Cable (GPN 996-00105)
  - v. One 20 A, 1.5 m Black Connection Cable (GPN 996-00104)
  - vi. One 150 A, 1.5 m Red Connection Cable (GPN 20239.03.02)
  - vii. One 150 A, 1.5 m Black Connection Cable (GPN 20239.04.02)
  - viii. 500 A, 2 m Red Connection Cables (GPN 20241.03.02) see Note 1
  - ix. 500A, 2 m Black Connection Cables (GPN 20241.04.02) see Note 1
  - x. One Emergency Stop Cable (GPN 31375-01-21)
  - xi. One Model 66236, Emergency Off Box Assy (GPN 31362-01-11)
  - xii. One Model 66259, Extender Control Unit with connection cable and power supply (31151-01-05)
  - xiii. One 9/16" wrench (GPN 953-00916)
  - xiv. One per 500 A Cable Assy, 3/8-16 x 1-1/2" bolt (GPN 817-01203) see Note 1
  - xv. One per 500 A Cable Assy + Twelve, 3/8" lock washer (GPN 841-01389) see Notes 1 and 2

- xvi. One per 500 A Cable Assy + Twelve, 3/8" flat washer (GPN 839-06666)  
see Notes 1 and 2
- xvii. Two Break Out Plates (GPN 31372-01-11)
- xviii. Twelve 3/8-16 x 1-3/4" bolt (GPN 817-01205) see Note 2

**Note 1: the number of 500 A connection cables (and associated hardware) is two, four, and six of each for the 6623A-PCS/1000, the 6623A-PCS/2000, and the 6623A-PCS/3000 respectively.**

**Note 2: to be used with breakout plate.**

### 2.1.1. Power Voltage Selection

There is no line input selection as the main assembly and CS1000 Chassis's are pre-set for 220 Volts operation. The 6623A-PCS/3000 is designed for universal use of AC power sources from nominal 208 Volts to 240 Volts in a frequency range of 50 Hz to 60 Hz.

Two 30 A, 220 Volt line cords with NEMA L6-30P molded plugs are supplied with the 6623CS-3000 current source. The 6623A-PCS/1000 and 6623A-PCS/2000 are supplied with one line cord. Where the molded plugs, NEMA L6-30P, on the line cords do not match the local power outlet sockets; the plugs can be removed and replaced with one that does fit the local service. The plug should be re-wired as follows:

Black wire	-	Line 1 input
White wire	-	Neutral or Line 2 input
Green wire	-	Ground (safety)

### 2.1.2. Fuse Replacement

Spare 200 A and 20 A fuses are supplied for replacement in the 15 A and 150 A terminal panel should the current rating be exceeded on these ranges. The fuses can be accessed by removing the fly out panel at the top of the rack cabinet.

**NOTE: care should be taken when replacing fuses such that they are installed in the same mechanical fit as before and that the fuse leads are NOT bent.**

### 2.1.3. Setup and Power On

Refer to section 2-3 for front and rear views of the system and descriptions of indicators, controls and terminals.

- a. Verify that the power switches are off inside the 6623A-PCS/3000 cabinet.
- b. Remove any excess packing material from around the front and back panels that are provided for shipping purposes only. Verify that the Line Voltage to be used matches the Line Voltage setting marked on the back panel of the 6623A-PCS/3000. If the Line Voltage to be used does not match, contact Guildline Instruments Limited for instructions before proceeding.

- c. Connect the Model 66259 Control Unit using the 7 conductor cable, (GPN 31168-01-21) provided. One end with smaller circular connector is to be connected to the mating connector on the top panel of the 66259 marked 'EXTENDER' and the other end with the larger diameter connector to the connector on the back panel of the lowest CS1000 unit marked 'INPUT'.
- d. Verify that the other CS1000 units are interconnected with short cables, the 'OUTPUT' of the lowest unit to the 'INPUT' of the next higher unit.
- e. Install the Model 66236 Emergency Off Switch by connecting the cable, (GPN 31375-01-21) to the top 7 pin circular connector on the last CS1000 Current Source inside the 6623A-PCS/3000 cabinet. Note that the Terminator Plug will need to be removed. One or the other must be installed to allow proper operation of the 6623A-PCS units.

**Note: A termination plug, GPN 31061-01-09, must be connected to the last CS1000 unit in the 6623A-PCS/3000 if the Emergency Off Switch is removed.**

- f. Connect the input power cords from the 6623A-PCS/3000 rack cabinet to the 208-240 VAC power outlets rated at 30 A each.
- g. Turn on the power switches of the two 30 A power bars at the back of the rack cabinet. Each power bar has two 15 A sections with circuit breaker protection. You should see the green 'POWER' indicator on each 15 A section of the power bars light up. Note that the 6623A-PCS/1000 and 6623A-PCS/2000 models will have only one power bar installed.
- h. Plug the model 66259 power supply to a suitable 120 to 240 VAC, 50/60 Hz source and connect the power supply output to the 66259 connector marked 'POWER'. Turn on the power switch to the 66259 Control Unit. You should see the touch screen and red 'POWER' indicator on the front panel light up.
- i. Turn on the power switch to the bottom CS1000 unit in the 6623A-PCS and then the next units above. You should see the red 'POWER' indicator on the front panels light up. The yellow fault indicators on the CS1000 modules will light 'ON' for about 6 seconds then remain off.
- j. There should not be any yellow 'Fault' indicators remaining on. There are a set of 6 yellow indicators visible within the front grill which indicate when a fault is experienced in any of the 6 internal 150 A slave current source modules. If some of these should remain on, the power can be re-cycled off and on a number of times to clear the fault.

**Note: Do not turn the CS1000 Current Sources off or on while a current is being requested unless an emergency occurs.**

### 2.2. INCOMING INSPECTION

If no errors are displayed during power up of the individual CS1000 units then the 6623A-PCS Precision Current Source is ready to be used once the load is connected to either the main bus bar or one of the two lower current range terminals. Refer to the 66259 Operation Manual for information on setting up and using the Control Unit to source current.

Use the following set up procedure to verify the functional performance of the 6623A-PCS Precision Current Source.

**Note 1:** A proper range profile must have been created in the non-volatile memory of the 66259 Control Unit before proceeding. Refer to the 66259 Operation Manual

**Note 2:** Do not connect a load to more than one of the range terminals at any one time. It is essential that only one set of C1 and C2 current terminals be connected at any one time and shunt current leads of sufficient size are connected to the correct C1 and C2 range terminals for a specific measurement current. Ensure that the correct output terminals are connected for the selected range.

Initially the measurement of the potential across a 0.01 ohm shunt of known resistance value on the 15 A range terminals is tested to ensure that the 15 A range is functional. Then the potential across a known 0.001 ohm shunt on the 150 A range terminals is tested to ensure that the 150 A range is functional. Finally, the potential across a known 0.0001 ohm shunt on the main bus terminals is tested to ensure that the highest range is functional. A high resolution DVM is needed to verify that the correct test current is provided. If the shunt standards used are not known to be within  $\pm 0.03\%$  of nominal ohms value then some variation in the measured results can be expected.

The following is a step by step procedure for connecting the resistors and for setting up the 6623A-PCS properly to make the measurements.

#### **Note:**

**To start the system, turn on the following equipment in specified order. Turn on Bridge or 66259 Controller. Turn on each of the 1000 A Current Sources. Connect the load (e.g. shunt) to the correct output terminals. Only have one load connected to the output terminals at any one time. Start measurement as described below. Do not disconnect the load, or connect a load, while the measurement is running. Do not turn off the 1000 A Current Sources while the measurement is running.**

**To stop the system, turn off the following equipment in specified order. Stop the measurement. Disconnect the load (e.g. shunt). Turn off each of the 1000 A Current sources. Turn off the Bridge or 66259 Controller.**

- Step 1)** Connect a 0.01 ohm shunt standard to the 30 A terminals of the 6623A-PCS fly out panel at the top of the cabinet and connect the DVM to the potential terminals of the shunt standard. Use the 10 AWG, 30 A, test leads for the current connections. The SCW Lead supplied should be used for the potential terminal connections. See Figure 2-1.
- From the front panel of the model 66259 Control Unit set to stage 1 by increasing or decreasing the value at the upper right hand section of the display of the opening screen. Normally the 66259 will power on in stage 1.
  - From the main menu, configure the current setup as follows:
  - Select 'Current' function key and enter 10 for a test current value of 10 A.
  - Toggle if necessary the '+ve' function key at the top left of the display to change the polarity to a positive polarity and press the 'OK' menu function and see that the main menu returns showing a +10 A selection.
  - Press 'Start' function key to initiate a positive current of 10 A. Note that once the 'Start' function key is pressed it will revert to show 'Stop'.
  - Reference the DVM to verify that a potential of + 0.1000 volts  $\pm$  0.0005 volt is displayed. Note that the DVM should be suitably zeroed with no current being sourced before making measurements.
  - A negative test current can be selected by toggling the '-ve' function key at the top left of the main display window.
  - Press the 'Stop' function key to return the test current to the off state.
- Step 4)** Record the voltage values displayed on the DVM.
- Step 5)** Disconnect a 0.01 ohm shunt standard from the 15 A terminals of the 6623A-PCS fly out panel at the top of the cabinet and connect a 0.001 ohm shunt standard to the 150 A terminals of the fly out panel. Connect the DVM to the potential terminals of the shunt standard. Use the 150 A cables supplied to make the current connections. See Figure 2-2.
- From the front panel of the model 66259 Control unit set to stage 2 by pressing the 'Setup' function key and increasing or decreasing the value at the upper right hand section of the display of the opening screen then press the 'Exit' function key to revert back to the main menu.
  - From the main menu, configure the current setup as follows:
  - Select 'Current' function key and enter 100 for a test current value of 100 A.
  - Toggle if necessary the '+ve' function key at the top left of the display to change the polarity to a positive polarity and press the 'OK' menu function and see that the main menu returns showing a +100 A selection.
  - Press 'Start' function key to initiate a positive current of 100 A. Note that once the 'Start' function key is pressed it will revert to show 'Stop'.



- Reference the DVM to verify that a potential of  $+ 0.1000$  volts  $\pm 0.0005$  volt is displayed. Note that the DVM should be suitably zeroed with no current being sourced.
- A negative test current can be selected by toggling the '-ve' function key at the top left of the main display window.
- Press the 'Stop' function key to return the test current to the off state.

**Step 6)** Record the voltage values displayed on the DVM.

**Step 7)** Disconnect a 0.001 ohm shunt standard from the 150 A terminals of the 6623A-PCS fly out panel at the top of the cabinet and connect a 0.0001 ohm shunt standard to the main bus terminals. Connect the DVM to the potential terminals of the shunt standard. Use at least two of the 500 A cables supplied for each of the positive and negative current connections. See Figure 2-3.

- From the front panel of the model 66259 Control unit set to stage 3 by pressing the 'Setup' function key and increasing or decreasing the value at the upper right hand section of the display of the opening screen then press the 'Exit' function key to revert back to the main menu.
- From the main menu, configure the current setup as follows:
- Select 'Current' function key and enter 1000 for a test current value of 1000 A.
- Toggle if necessary the '+ve' function key at the top left of the display to change the polarity to a positive polarity and press the 'OK' menu function and see that the main menu returns showing a +1000 A selection.
- Press 'Start' function key to initiate a positive current of 1000 A. Note that once the 'Start' function key is pressed it will revert to show 'Stop'.
- Reference the DVM to verify that a potential of  $+ 0.1000$  volts  $\pm 0.0006$  volt is displayed. Note that the DVM should be suitably zeroed with no current being sourced.
- A negative test current can be selected by toggling the '-ve' function key at the top left of the main display window.
- Press the 'Stop' function key to return the test current to the off state.

**Step 8)** Record the voltage values displayed on the DVM.

**Note: The tests should execute with no errors indicated and should indicate a voltage value approximating the actual resistance values of the shunt standards times the test current values. This is not the 6623A-PCS full rated accuracy but serves a functional test for the purposes of determining the instrument has been received in proper working order. Refer to section 4 for a full verification procedure.**

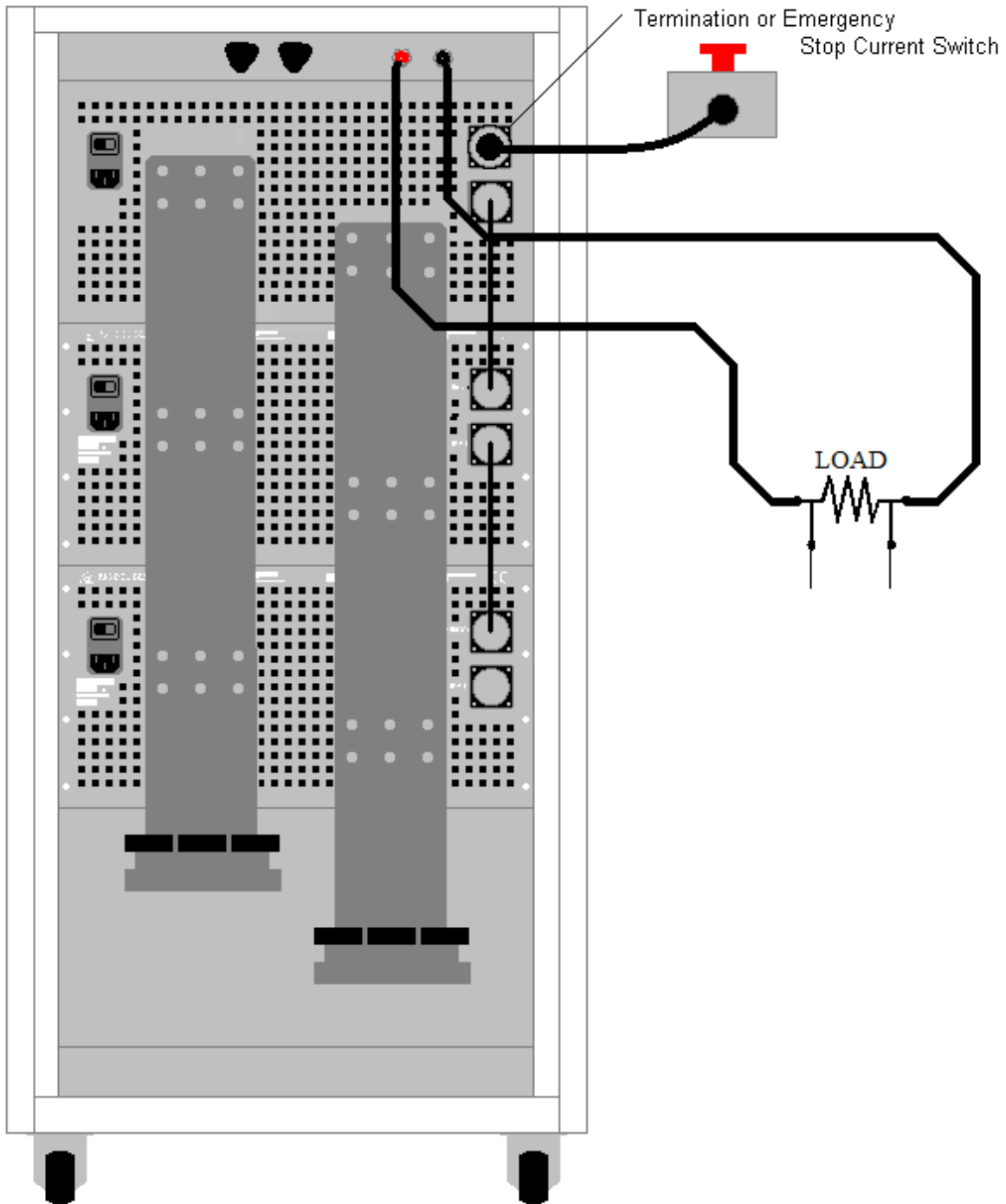


Figure 2-1 : 6623A-PCS/3000, 15 A Range Connections

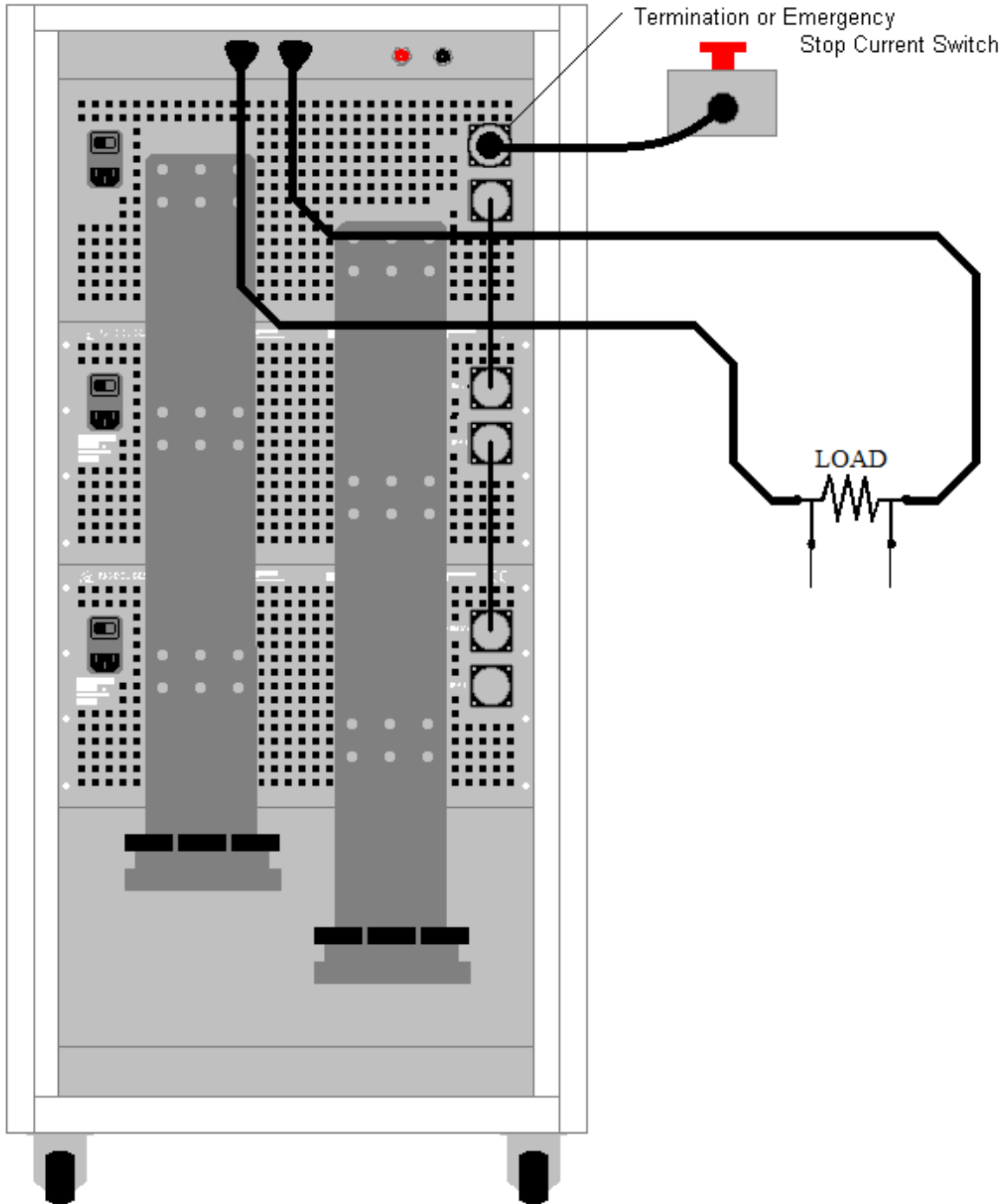


Figure 2-2 :: 6623A-PCS/3000, 150 A Range Connections

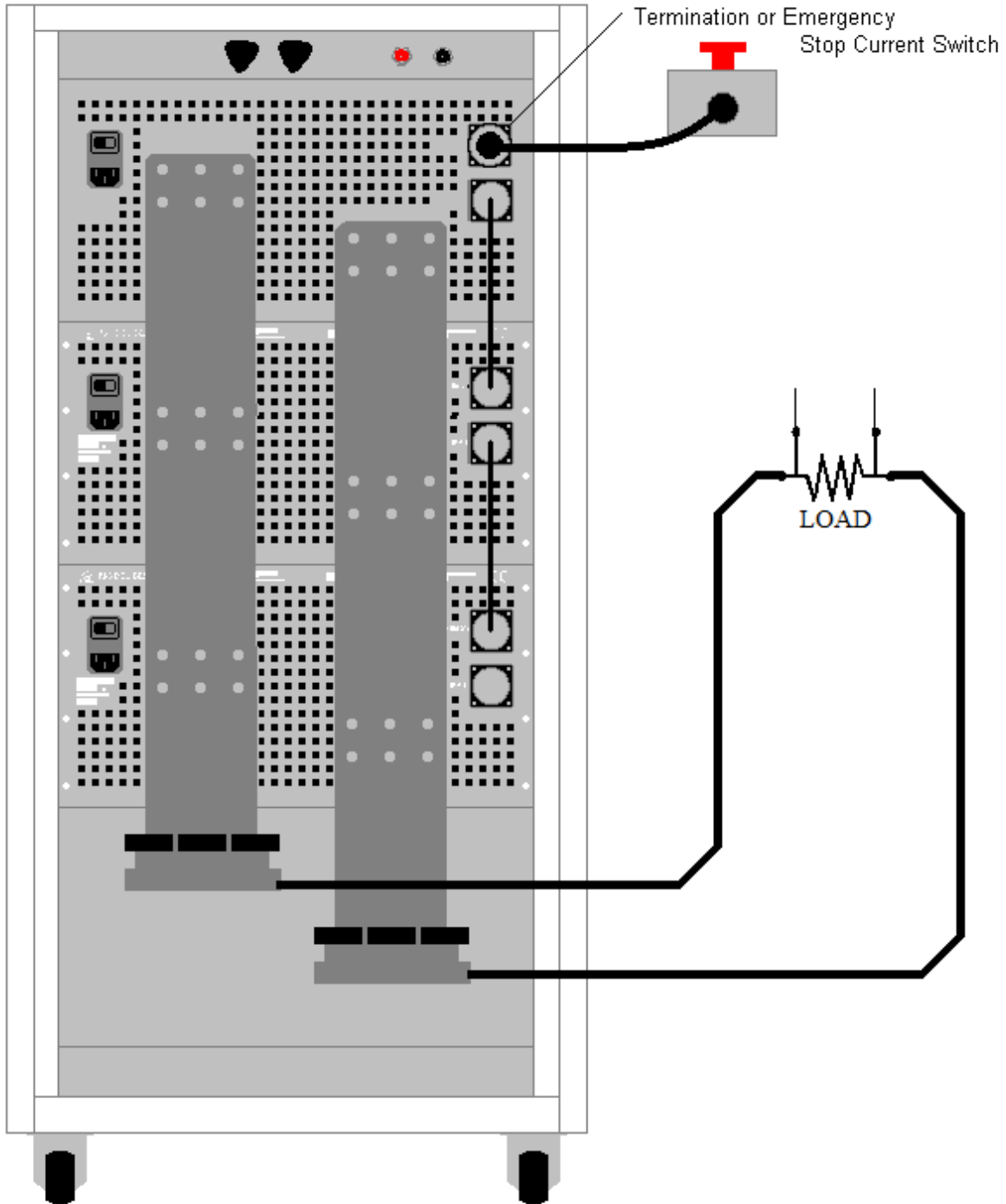


Figure 2-3 : 6623A-PCS/3000, 3000 A Range Connections

## 2.3. 6623A-PCS/3000 FRONT PANEL

There are no controls on the front panel of the 6623A-PCS/3000.

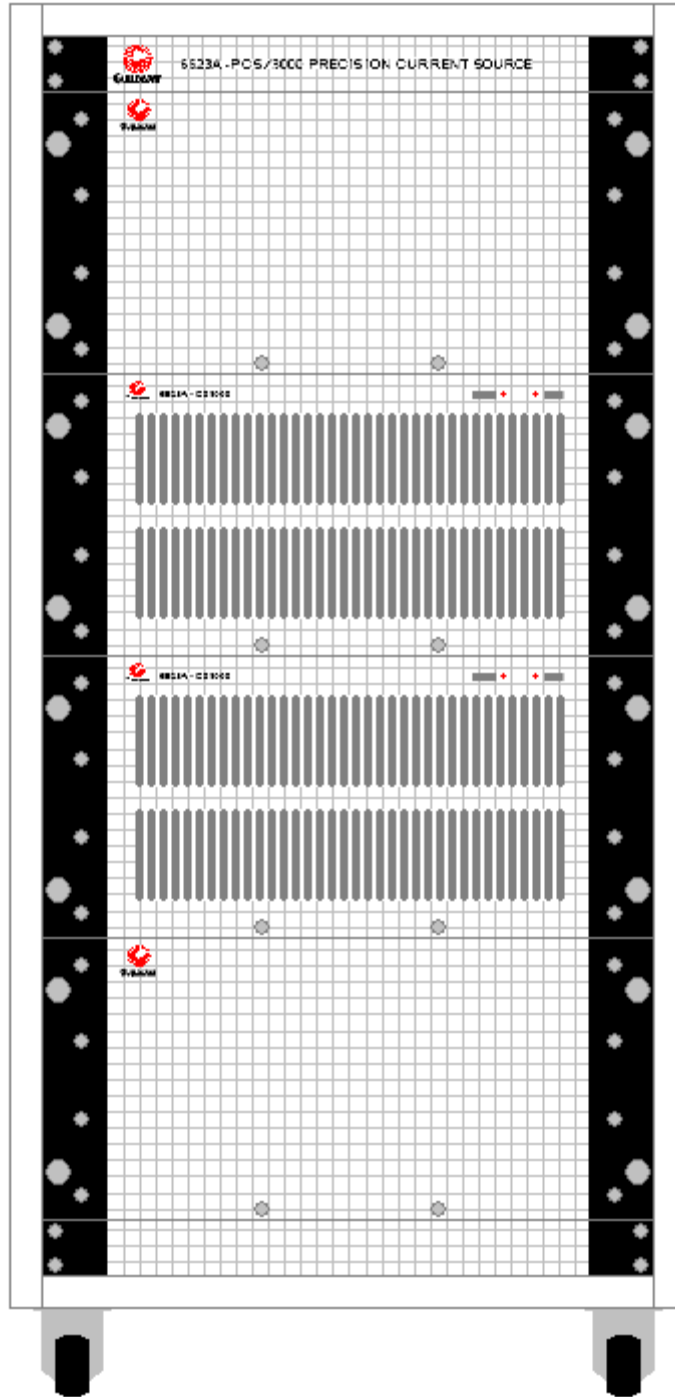


Figure 2-4 : 6623A-PCS/3000 Front View

### **2.3.1. Power**

The power-on indicators are lighted when the AC power is applied to the specific units and the power switch on the rear panel is 'ON'.

### **2.3.2. Fault**

The fault indicator on the CS1000 modules is lighted to indicate that a fault condition has been detected in the master 150A printed circuit board which controls the remaining six 150A internal current source boards.

There are a set of 6 yellow indicators visible within the front grill which indicate when a fault is experienced in any of the 6 slave internal 150 A current source modules. A fault will cause the particular current source to be disconnected and will allow the remaining units to continue to function.

Note that the 6623A-PCS/1000 and 6623A-PCS/2000 models will have only one or two CS1000 Current Source modules respectively.

## 2.4. 6623A-PCS/3000 REAR PANEL CONNECTORS AND CONTROLS

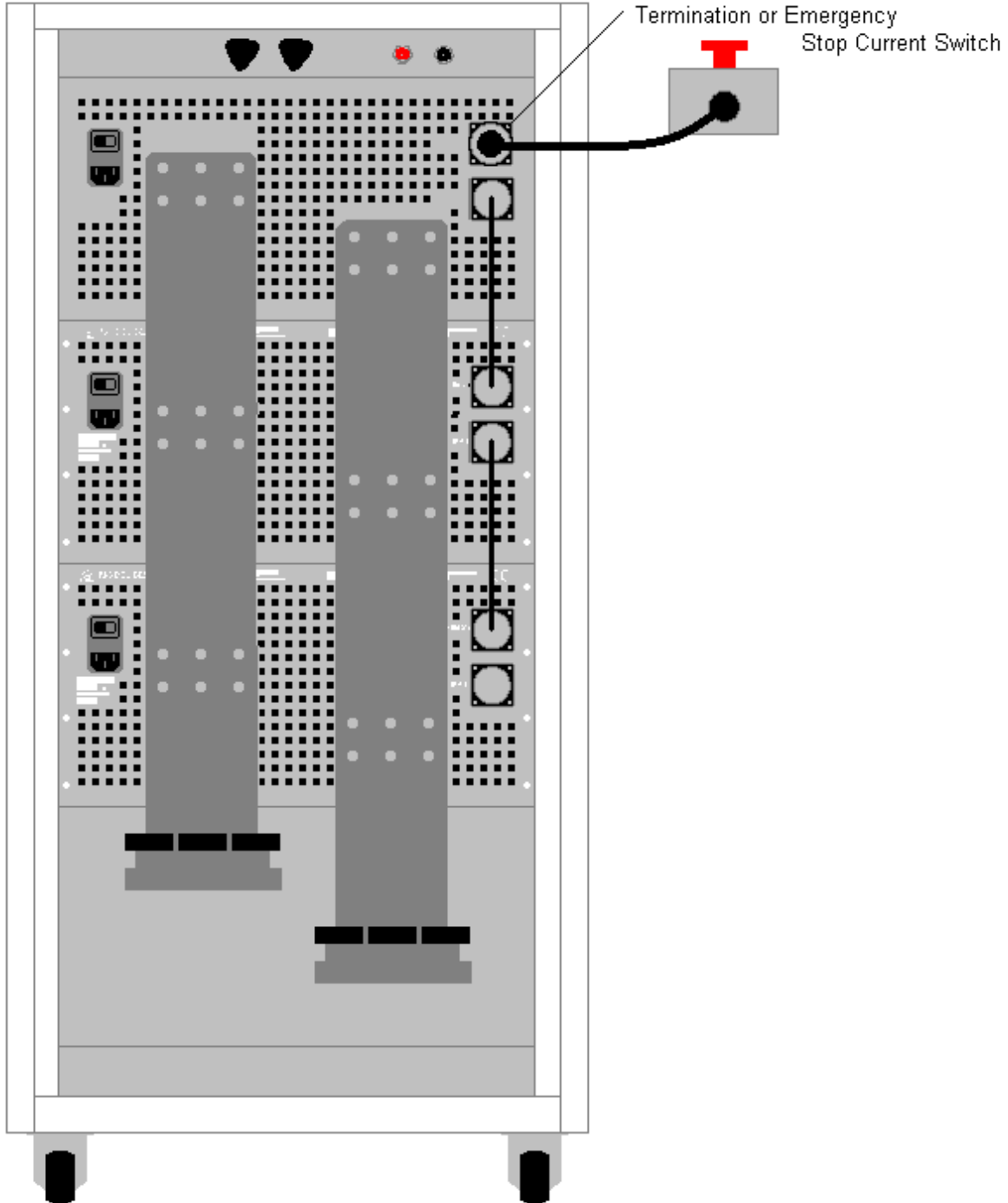


Figure 2-5 : 6623A-PCS/3000 Rear View

### 2.4.1. Line Input Connectors

The **Line Input Connectors** are a combination of a 3-prong AC standard male IEC connector, an ON/OFF switch. The CS1000's have a 15 A circuit breaker as part of the Line Input Connector. The line input connectors accommodate nominal voltages of 208 to 240V.

### 2.4.2. Current Output Terminals

The current output terminals consist of two sets of two binding posts and a multi-connection pair of main bus bar terminals. The binding posts are labeled as + and - for each current range of 15 A, and 150 A maximum. One set of the terminals are to be connected to the current terminals of the load under test whenever the 6623A-PCS Current Source is to be used.

**Note: It is essential that only one set of current terminals be connected at any one time to a load.**

The 15 A terminal output is protected from over-current with a 20 A fuse behind the fly out panel. The 150 A terminal output is protected from over-current with a 200 A fuse behind the fly out panel. There are two sets of connection points on the main bus bars to connect the 500 A cables up to a 3000 A connection capability.

### 2.4.3. Input Control Connector

The 'INPUT' connector is a 7 pin circular connector which is used to connect the necessary signals to the model 66259 Control Unit. Note that the bottom CS1000 Current Source is reserved as the master unit and the 66259 Control Unit is to be connected to the bottom unit only.

### 2.4.4 Output Control Connector

The 'OUPUT' connector is a 7 pin circular connector which is used to connect the necessary signals to the second CS1000 Current Source 'INPUT' connector. The 'OUPUT' connector of second CS1000 is connected to the 'INPUT' of the next unit.

**Note that the 'OUTPUT' of the last or upper CS1000 module must have a termination plug, (GPN 31061-01-09) installed for proper operation or be replaced with the model 66236 Emergency Off Switch.**

**Note that if the Emergency Off Switch is triggered it may be reset by twisting the large red knob so that the switch is released from the Off position.**



### 3. QUICK OPERATION GUIDE

#### 3.1. OPERATION GUIDE

This section contains information regarding the setup for the sourcing of positive or negative direct currents using the 6623A-PCS/3000 Precision Current Source. This guide is provided for manual control of the 6623A-PCS/3000 from the front panel of the 66259 Control Unit. The 66259 Operation Manual should be consulted to reference all the features of the control unit.

##### 3.1.1. Recommended Test Setup Procedure for the 6623A-PCS/3000

The following is a basic procedure for connecting a load to the 6623A-PCS and for setting up the 66259 Control Unit.

**Turn on the 66259 Controller. Turn on the CS1000 Current Sources. Connect the load to one of the three current ranges of the 6623A-PCS/3000 High Direct Current Source only AFTER turning on the CS1000 Current Sources. See section 2.2 for details on the three available ranges.**

**Do not turn off the 66259 Controller or CS1000 Current Sources while the measurement is running.**

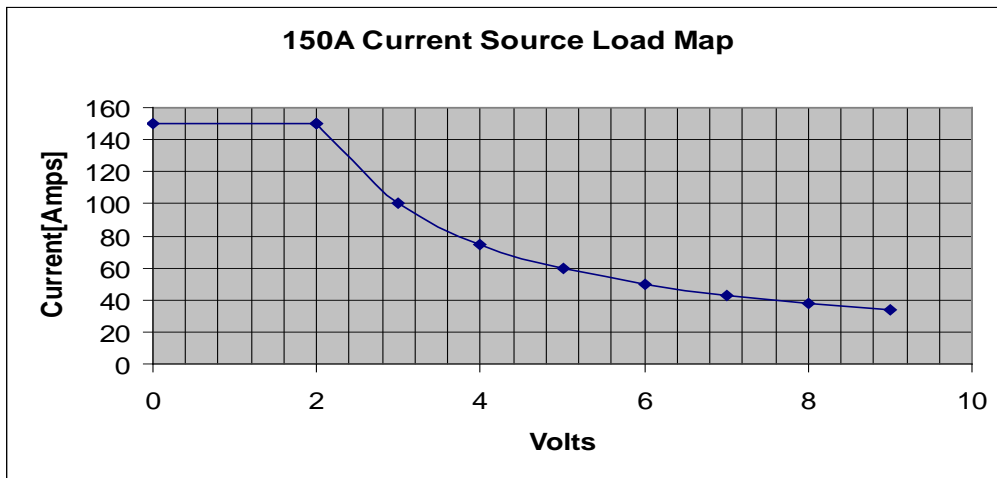
**Do not connect or disconnect the load (e.g. shunt) while the measurement is running**

- From the front panel of the model 66259 Control unit set to stage 1, 2 or 3 by increasing or decreasing the value at the upper right hand section of the display of the opening screen. Normally the 66259 will power on in stage 1 for a current range of 3 to 15 A. Stage 2 has a range of 15 to 150 A and stage 3 has a range from 150 A to the maximum available current.
- From the main menu, configure the current setup as follows:
- Select 'Current' function key and enter a number for a test current value within the selected range of test current.
- Toggle if necessary the '+ve' function key at the top left of the display to change the polarity to a positive polarity and press the 'OK' menu function and see that the main menu returns showing a value selected.
- Press 'Start' function key to initiate a positive current. Note that once the 'Start' function key is pressed it will revert to show 'Stop'.
- A negative test current can be selected by toggling the '-ve' function key at the top left of the main display window.
- Press the 'Stop' function key to return the test current to the off state.

### 3.1.2. Setup Limits and Precautions for 6623A-PCS/3000

See Figure 3-1 for the available compliance limits for various load current ranges.

The current output is power limited to approximately 2000 watts per CS1000 unit with an approximate voltage compliance of 8 volts below 30 A and reducing to 1.5 volts above 150 A.



**Figure 3-1 : 6623A-PCS/3000 Test Setup Compliance Limits**

### 3.1.3. Checks and Precautions

- Select the lowest current range that provides the current required for the test.
- Select current leads suitable to handle the maximum test current for a particular range, either the 15 A, 150 A or multiples of the 500 A high current leads. Undersized leads will cause the temperature of the cable and that of the load to increase significantly.

**CAUTION: Loose High Current Connections Can Create Very High Temperatures and Arcing.**

**It is recommended to keep the 6623A-PCS/3000 power off when the instrument is not in use for extended periods of time.**

Test Current Range (A)	Number of Cables in Parallel	Minimum Cable Size (AWG)
3 to 15	1	10
15 to 150	1	1/0
150 to 300	1	4/0
300 to 500	1	MCM350
500 to 1000	2	MCM350
1000 to 2000	4	MCM350
2000 to 3000	6	MCM350

**Table 3-1 : Test Current Cable Size Requirements**



## 4. VERIFICATION AND CALIBRATION

### 4.1. RATIO ACCURACY VERIFICATION

This procedure covers the ratio accuracy verification of the 6623A-PCS/3000 High Direct Current Source.

#### 4.1.1. Purpose

The purpose of this procedure is to assure that the 6623A-PCS/3000 High Direct Current Source meets the manufacturer's specifications. It is recommended that these procedures be performed after any corrective maintenance activity, or if the operator perceives a problem with respect to accuracy or on an annual basis to verify performance.

The following procedure is to be used to verify the calibration of the High Current Range Extender.

### 4.2. TEST EQUIPMENT REQUIRED

Test equipment of equivalent performance may be substituted from the list provided.

Description	Model
DC Current Shunt Standard	Guildline 9230A-100-0.01Ω
DC Current Shunt Standard	Guildline 9230A-300-0.001Ω
DC Current Shunt Standard	Guildline 9230A-1000-0.0001Ω
DC Current Shunt Standard	Guildline 9230A-3000-0.00001Ω
High Accuracy DMM	Agilent 2458A or equivalent

**Notes: 1.** The 6623A-PCS/3000 is calibrated at the factory using a temperature controlled environment to within  $\pm 1.5$  °C. If the ambient conditions in the laboratory are not sufficiently controlled to within  $\pm 1.5$ °C the additional uncertainties due to temperature variations need to be taken into account.

**2.** The tolerances specified in Table 4-1 are based on the resistance values of the Shunt Standards being within  $\pm 200$  uΩ/Ω of nominal resistance value. If resistance value of a Shunt Standard is not within these limits appropriate adjustments to the measured potentials should be calculated.

### 4.3. PROCEDURE

#### 4.3.1. VERIFICATION OF THE 3 A TO 15 A RANGE

1. Connect the current terminals of the 9230A-100-0.01 $\Omega$  Shunt Standard to the 6623A-PCS 15 A range terminals. Connect the potential terminals of the shunt to the DMM. See Figure 2-1. Ensure that adequate size cables of 10 AWG or larger are used to connect the current terminals.
2. Select a positive test current of 3 A on stage 1 of the 66259 Control Unit and allow a few minutes for the test current to stabilize.
3. Measure and record the potential on the Shunt Standard.
4. Select a negative polarity on the 66259 Control Unit. Ensure that adequate time is allowed for full stabilization of the measurement.
5. Measure and record the potential on the Shunt Standard.
6. Verify that the measured values are within the values specified in Table 4-1.
7. Repeat steps 2 to 6 but select test currents of 6, 10, and 15 A.
8. See the 66259 Operation Manual for proper operation of the Control Unit. If the measured values are out of tolerance the calibration coefficients can be changed to bring the test currents within tolerance.

#### 4.3.2. VERIFICATION OF THE 15 A to 150 A RANGE

1. Remove the 9230A-100-01 $\Omega$  Shunt and connect the current terminals of the 9230A-300-0.001 $\Omega$  Shunt Standard to the 6623A-PCS 150 A range terminals. Connect the potential terminals of the shunt to the DMM. See Figure 2-2. Ensure that adequate size cables of 4/0 AWG or larger are used to connect the current terminals.
2. Select a positive test current of 15 A on stage 2 of the 66259 Control Unit and allow a few minutes for the test current to stabilize.
3. Measure and record the potential on the Shunt Standard.
4. Select a negative polarity on the 66259 Control Unit. Ensure that adequate time is allowed for full stabilization of the measurement.
5. Measure and record the potential on the Shunt Standard.
6. Verify that the measured values are within the values specified in Table 4-1.
7. Repeat steps 2 to 6 but select test currents of 50, 100, and 150 A.
8. If the measured values are out of tolerance the calibration coefficients can be changed to bring the test currents within tolerance.

### **4.3.3. VERIFICATION OF THE 150 A to 1000/2000/3000 A RANGE**

1. Remove the 9230A-300-0.001 $\Omega$  Shunt and connect the 9230A-1000-0.0001 $\Omega$  Shunt to the 150 A to 3000 A range terminals. Connect the potential terminals of the shunt to the DMM. See figure 2-3. Ensure that adequate size pairs of cables of 350MCM or larger are used to connect the current terminals.
2. Select a positive test current of 150 A on stage 3 of the 66259 Control Unit and allow a few minutes for the test current to stabilize.
3. Measure and record the potential on the Shunt Standard.
4. Select a negative polarity on the 66259 Control Unit. Ensure that adequate time is allowed for full stabilization of the measurement.
5. Measure and record the potential on the Shunt Standard.
6. Verify that the measured values are within the values specified in Table 4-1.
7. Repeat steps 2 to 6 but select test currents of 500 and 1000 A.
8. If the measured values are out of tolerance the calibration coefficients can be changed to bring the test currents within tolerance.

### **4.3.4. VERIFICATION OF THE 2000 A AND 3000 A RANGE OF CURRENTS**

1. Replace the 9230A-1000-0.0001 $\Omega$  Shunt with the 9230A-3000-0.00001 $\Omega$  Shunt. Ensure that at least 6 cables of 350MCM size or larger are used to connect both sides of the current terminals.
2. Select a positive test current of 1000 A on stage 3 of the 66259 Control Unit and allow a few minutes for the test current to stabilize.
3. Measure and record the potential on the Shunt Standard.
4. Select a negative polarity on the 66259 Control Unit. Ensure that adequate time is allowed for full stabilization of the measurement.
5. Measure and record the potential on the Shunt Standard.
6. Verify that the measured values are within the values specified in Table 4-1.
7. Repeat steps 2 to 6 but select a test current of 3000 A.
8. If the measured values are out of tolerance the calibration coefficients can be changed to bring the test currents within tolerance.

Range (A)	Nominal Current (A)	Measured Values Ix (mV)	Tolerance limits (mV)
<b>3 to 15</b>	<b>3</b>		<b>29.86 – 30.14</b>
<b>(0.3% ±5 mA)</b>	<b>6</b>		<b>59.77 – 60.23</b>
	<b>10</b>		<b>99.65 – 100.35</b>
	<b>15</b>		<b>149.50 – 150.50</b>
<b>15 to 150</b>	<b>15</b>		<b>14.93 – 15.08</b>
<b>(0.3% ±30 mA)</b>	<b>30</b>		<b>29.88 – 30.12</b>
	<b>50</b>		<b>49.82 – 50.18</b>
	<b>100</b>		<b>99.67 – 100.33</b>
	<b>150</b>		<b>149.52 – 150.48</b>
<b>150 to 3000</b>	<b>150</b>		<b>14.93 – 15.07</b>
<b>(0.35% ±150 mA)</b>	<b>300</b>		<b>29.88 – 30.12</b>
	<b>500</b>		<b>49.81 – 50.19</b>
	<b>1000</b>		<b>99.63 – 100.37</b>
	<b>2000</b>		<b>19.93 – 20.07</b>
	<b>3000</b>		<b>29.89 – 30.11</b>

**Table 4-2 : 6623A-PCS/1000/2000/3000 Current Calibration Results**



# 5. TROUBLESHOOTING AND MAINTENANCE

## 5.1. INTRODUCTION

This section covers troubleshooting, repair and verification of the 6623CS High Direct Current Source.

### 5.1.1. Error Messages

The 66259 Control Unit does not display error messages. However, under certain connection faults or setup fault conditions the '**CURRENT ACTIVE**' light on the front panel will turn off when current would normally be active. The connections and the setup should be checked if this occurs. Refer to the 66259 Operation Manual for further information on connections and setup parameters.

### 5.1.2. Model CS1000 'Fault' Indicators

The Fault indicator of the CS1000 current source front panel will light up when a fault is detected with the master current source module. This may be due to improper connections to the range extender, improper measurement setup or an actual circuit failure. There are a set of 6 yellow indicators visible within the front grill of each CS1000 which will indicate when a fault is experienced in any of the slave 150 A current source modules. Note that when a fault is detected on a particular current source module only that module is disconnected from the current output bus. The remaining units will continue to operate but the total current output will be proportionally reduced.

### 5.1.3. Maintenance

Preventive maintenance is limited to checking the instrument operation, test current accuracy, cooling fan operation. The Service Manual available on request from Guildline Instruments Limited provides complete alignment and test information required if the 6623A-PCS/3000 fails to meet performance specifications.

### 5.1.4. Maintenance Guidelines and Schedule

The following section provides a guide to problem diagnosis and a schedule for maintenance. It is recommended that verification of the system be performed annually or whenever it is apparent that currents may be out of specification. Under certain circumstances where verification fails then the adjustments should be made as required. Specific verification procedures are provided in section 4 of this manual. Detailed alignment, repair and calibration procedures are found in the Service Manual.

Maintenance Item	Procedure	Interval
System Error Indications	Follow guidelines in this section 6.1.1	As may be required
No Current Output	Verify load is connected to correct range then check that the fuses for the lower ranges are not open circuit	As may be required
General Checks	Check cooling fans and cable connections and fault indications	Every 3 months
Current Source Accuracy	Perform Verification	Annually
System Long Term Maintenance	Perform Current Source Alignment Check and Calibration/Verification	Every 3 years

**Table 5-3 : Maintenance Schedule**

### 5.1.5. Connection Problems

Connection problems can be resolved by measuring the voltages across the load resistance or that of a shunt standard. Ensure that the load is connected to the correct current range terminals. Verify that cables are connected as per Figures 2-1, or 2-2 or 2-3 for specific ranges.

### 5.1.6. Safety Features

The 66259 Control Unit will shut off the test current under certain fault conditions detected within the unit. **Always ensure that test current cables of sufficient number and size are tightly attached to the correct 6623A-PCS output terminals and the load resistance under test. Severe arcing and burning can occur if cable connections are not tight.**

## 6. APPENDICES

### 6.1. GENERAL SPECIFICATIONS

6623A-PCS/1000/2000/3000 Current Range Extender General Specifications		
Operating Temperature to Full Specification	+23 ± 3	°C
	+73 ± 5.4	°F
Operating Temperature Maximum Range <50% RH	+18 to +28	°C
	+64.4 to +82.4	°F
Storage Temperature Maximum Range	-20 to +60	°C
	-4 to +140	°F
Operating Humidity	20 to 70	% RH
Storage Humidity	15 to 80	% RH
Power Requirements (Maximum): 1000 A	2600	VA
Power Requirements (Maximum): 2000 A	4700	VA
Power Requirements (Maximum): 3000 A	6800	VA
Voltage Requirements (1)	208 - 240 ±10%	VAC
Line Frequency	50 ±5% or 60 ±5%	Hz
Weight: 1000 A	200 / 90.9	lbs/kg
Weight: 2000 A	250 / 113.6	lbs/kg
Weight: 3000 A	300 / 136.4	lbs/kg
Dimensions	D 932 , W 552 , H 1135	mm
	D 36.7 , W 21.8 , H 44.7	in

**Table 6-1 : General Specifications**

**NOTE: 1. The 6623A-PCS/3000 High Direct Current Source is always configured for 208 to 240 VAC 50/60 Hz operation at the point of shipment. No voltage selection is required in this range.**

## 6.2. GENERAL SPECIFICATIONS (continued)

6623A-PCS/1000/2000/3000 High Direct Current Sources General Specifications, (3 Year)			
Temperature Coefficient		±0.004	%/°C
Warm-up time to full rated accuracy		15	Minutes
Test Current Programmed through the 66259 Control Unit	15 A Range	±3 to ±15	A
	150 A Range	±15 to ±150	A
	1/2/3000 A Range	±150 to ±1/2/3000	A
	15 A Compliance	+/-7.5	V
	150 A Compliance	+/-1.9	V
	1/2/3000 A Compliance	+/-1.9	V
	1/2/3000 A Power Limits	2000/4000/6000	W
	15 A Accuracy	±0.3 ±5	% + mA
	150 A Accuracy	±0.3 ±30	% + mA
	1/2/3000 A Accuracy	±0.35 ±150	% + mA
15 A Stability (10 Min.)	±0.005 ± 2	% + mA	
150 A Stability (10 Min.)	±0.005 ± 3	% + mA	
1/2/3000 A Stability (10 Min.)	±0.005 ± 100	% + mA	

**Table 6-2 : General Specifications (continued)**