724 Workstation Monitor
Installation, Operation and Maintenance

Figure 1. SCS 724 Workstation Monitor

Description

The SCS 724 Workstation Monitor continuously monitors the path-to-ground integrity of two operators and one conductive or dissipative worksurface. It has been designed and tested for use with SCS Dual-Wire Wrist Straps and Worksurface Mats. If the equipment is used in a manner not specified in these instructions, the protection provided by the equipment may be impaired. Use in any other application has not been evaluated by SCS and may lead to an unsafe condition.

The SCS 724 Workstation Monitor meets the requirements of ANSI/ESD S20.20 and recommendations of ESD Handbook ESD TR20.20 which includes "if the products that are being produced are of such value that knowledge of a continuous, reliable ground is needed, and then continuous monitoring should be considered or even required".

The 724 Workstation Monitor is available in three models:

Item	Description
724	724 Workstation Monitor, North America Power Adapter
724MO	724 Workstation Monitor, No Power Adapter
724K-WM11	724 Workstation Monitor Kit, with Wrist Strap and Worksurface Mat

The following accessories are available for the 724 Workstation Monitor:

Item	Description
770065	Verification Tester
724P	Power Adapter, 120VAC Input, 25VDC Output, North America Plug
724-PSEU	Power Adapter, 100-240VAC Input, 24VDC Output, UK & Euro Plugs
732	Dual Operator Remote
733	Operator Remote
770037	Terminal Block, Pack of 5
3057	Standby Jack
2389	Mat Interconnect Cord, 10'
2380D	Mat Monitor Cord, with Diode, 6'

Packaging

724 Workstation Monitor, North America

1   724 Workstation Monitor
1   732 Dual Operator Remote
1   Dual Operator Remote Cable
1   Power Adapter, North America
1   Monitor Ground Cord
1   2380D Mat Monitor Cord
1   Two-Wire Terminal Block
2   Long Mounting Screws
2   Short Mounting Screws
2   Cable Tie Mounts
2   Zip Ties
1   Certificate of Calibration

Figure 2. SCS 724 Workstation Monitor packaging contents

724MO Workstation Monitor, No Power Adapter

1 724 Workstation Monitor
1 732 Dual Operator Remote
1 Dual Operator Remote Cable
1 Monitor Ground Cord
1 2380D Mat Monitor Cord
1 Two-Wire Terminal Block
2 Long Mounting Screws
2 Short Mounting Screws
2 Cable Tie Mounts
2 Zip Ties
1 Certificate of Calibration

724K-WM11 Workstation Monitor Kit

1 724 Workstation Monitor
1 732 Dual Operator Remote
1 Dual Operator Remote Cable
1 Power Adapter, North America
1 Monitor Ground Cord
1 2380D Mat Monitor Cord
1 Two-Wire Terminal Block
2 Long Mounting Screws
2 Short Mounting Screws
2 Cable Tie Mounts
2 Zip Ties
1 2368 Elastic Dual-Wire Wristband
1 2360 Dual-Wire Wrist Cord
1 8811 Worksurface Mat Kit
1 Certificate of Calibration

Theory of Operation

The SCS 724 Workstation Monitor is designed to monitor the operation of the wrist strap grounding systems of two operators. To accomplish this, it uses a DC current source to measure a loop electrical resistance. The system uses a special wristband and wrist cord that contain two independent elements. The 724 Workstation Monitor employs two selectable test voltages (9 and 16 volts) and resistance limits (10 Megohms and 35 Megohms). It also monitors the grounding of one worksurface mat. The Workstation Monitor contains a current-limiting resistor. Resistance is monitored as the test voltage passes through one side of the wristband, through the skin of the wearer under the band, through the second side of the wristband, through the second conductor of the wrist cord that contains a current-limiting resistor, and finally back to the monitor.

NOTE: There is no power switch or power indication LED. LEDs will illuminate once a wrist strap is connected to the operator remote.
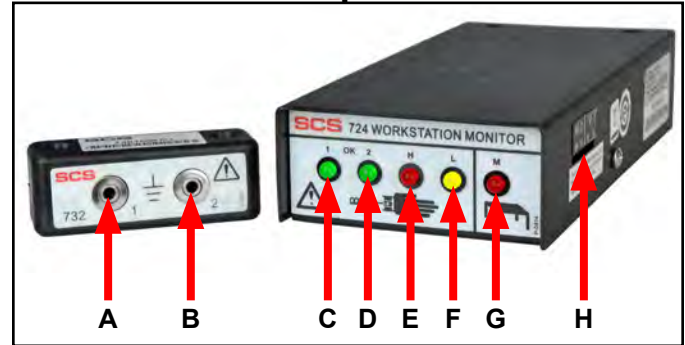
Features and Components

Figure 3. SCS 724 Workstation Monitor features and components

A. **Operator Remote Jack #1:** Connect the dual-wire wrist cord of operator #1 here to monitor their connection to ground.

B. **Operator Remote Jack #2:** Connect the dual-wire wrist cord of operator #2 here to monitor their connection to ground.

C. **Operator #1 Pass LED:** Illuminates green when operator #1 is properly grounded.

D. **Operator #2 Pass LED:** Illuminates green when operator #2 is properly grounded.

E. **Operator Fail High LED:** Illuminates red when either operator #1 or #2 fail high. The buzzer will sound continuously when operator #1 is at fault, and it will sound intermittently when operator #2 is at fault.

F. **Operator Fail Low LED:** Flashes yellow when either operator #1 or #2 fail low.

G. **Worksurface Mat Fail LED:** Illuminates red and alarm sounds when the worksurface mat is not properly grounded.

H. **Operator Test Limit and Test Voltage Switches:** The operator test limits may be set to either 10 megohms or 35 megohms, and the operator test voltage may be set to either 9V or 16V. The additional ranges have been added to accommodate global electrical static discharge requirements. Selection of the operating parameters are left up to the user's discretion.
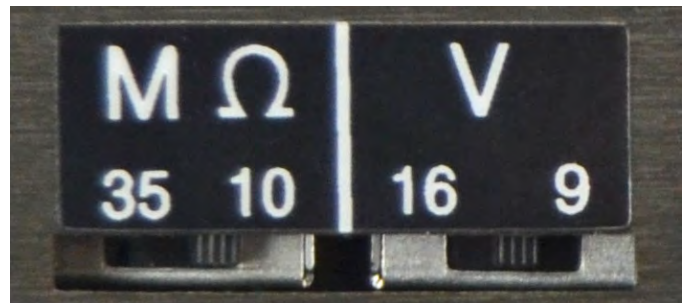

Figure 4. Operator test limit and test voltage switches located on the right-side of the monitor

OPERATOR MONITORING

The wrist strap monitoring function is activated by plugging a wrist strap dual conductor ground cord into either one of the jacks on the SCS 732 or 733 Operator Remote. If the resistance of the wrist strap loop is within the limits of the selected range (1.5 Megohms to 10 Megohms or 1.5 Megohms to 35 Megohms) on the Workstation Monitor, the cord, the wristband, and the contact to the arm of the wearer, it is considered to be functioning correctly. At this time, one of the (OK) green LEDs (1 or 2) will be illuminated on the front of the monitor.

The wrist strap of the second operator is measured in the same way. Operators are identified by the two (OK) green LEDs (1 & 2). However, the same high wrist strap red LED (H) and low yellow (L) LED illuminate when a fault is detected. The green LED that extinguishes identifies the operator that is experiencing the fault condition.

If the resistance of the wrist strap loop is higher than the selected range (10 Megohms or 35 Megohms) on the Workstation Monitor, an (OK) wrist strap green LED (1 or 2) extinguishes, and a high wrist strap red LED (H) illuminates with an audible alarm. This is an indication of a high resistance in the wristband, or poor contact between arm and band. If the resistance in the loop is under 1.5 Megohms, it is an indication of a low resistance meaning one or both current-limiting resistors are bypassed. The low yellow LED (L) will flash and an (OK) green LED (1 or 2) will remain illuminated.

OPERATOR TEST VOLTAGE

There is a concern about the voltage that is applied to an operator while they are connected to a monitor. Some of today's electronic components are extremely sensitive to electrostatic discharge from a person (less than 10 volts). The user should determine if these voltages can damage the device being handled. The following chart for the 724 Workstation Monitor illustrates the level of voltage that will appear on the operator under various resistance conditions.

A low resistance condition also can be caused by touching a grounded object or by standing on a conductive surface. This may trigger the low resistance alarm on the 724 Workstation Monitor.

Condition	9V-10 Megohms	9V-35 Megohms	16V-10 Megohms	16V-35 Megohms
No Skin Resistance	0.9V	0.9V	1.6V	1.6V
200K Ohm Skin Resistance	1.0V	1.0V	1.8V	1.8V
Likely Case Before Alarm	2.5V	3.6V	4.4V	6.4V
Worst Case Before Alarm	4.5V	7.1V	8.0V	12.6V
Absolute Worst Case	9.0V	9.0V	16.0V	16.0V

AUDIBLE ALARM SETTINGS

For wrist strap malfunctions, the 724 Workstation Monitor indicates a different tone for each operator – a continuous tone for operator #1 and a fast chirping beep for operator #2. The volume of the wrist strap alarm is adjusted by selection of the internal DIP switch 1. For worksurface malfunctions, a slow chirping beep is made. This alarm sound is turned on or off by selection of DIP switch 2. The DIP switches are accessible through a slot located on the bottom side of the monitor.
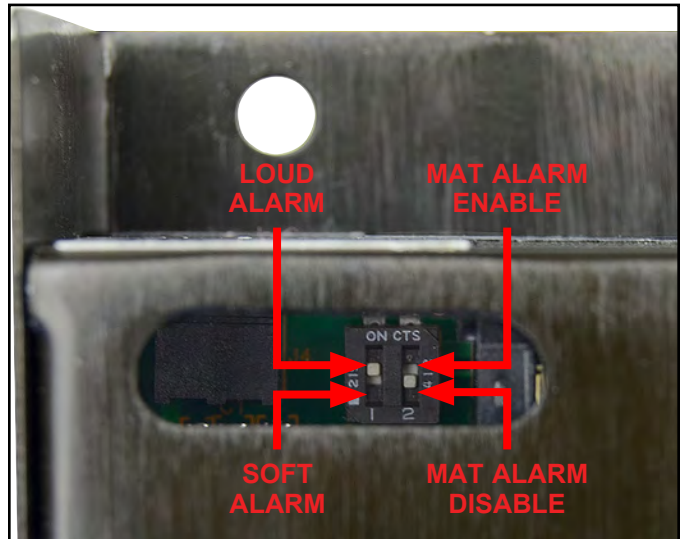

Figure 5. Audible alarm DIP switches located on the bottom side of the 724 Workstation Monitor

ORKSURFACE MONITORING

The 724 Workstation Monitor monitors its connection to ground and the grounding of a worksurface. A loop resistance is measured from the monitor, through the mat monitor cord to the worksurface, across the conductive layer of the worksurface, through the grounding wire of the worksurface to an electrical ground and finally back to the monitor through the monitor's ground wire. If the resistance of the loop exceeds 3.7 Megohms, the worksurface high red LED (M) will illuminate and all green LEDs will be extinguished. If audible alarm DIP switch 2 is in the ON position (Figure 5), the audible alarm will activate. If no ESD worksurface is to be monitored, the mat monitor cord and the ground wire of the 724 Workstation Monitor must be connected to an electrical ground. This is done to ensure that the 724 Workstation Monitor is providing a ground connection for the operators. Again, if the loop resistance exceeds 3.7 Megohms, the worksurface high red LED (M) will illuminate and the audible alarm will sound if enabled.

The ground wire from the worksurface and the ground wire from the 724 Workstation Monitor must be attached to separate electrical grounds. The worksurface monitoring function is active whenever the monitor is powered.

Disconnect the mat monitor cord to prevent possible damage to the 724 Workstation Monitor before testing the resistance of the worksurface with a high voltage megohmmeter.
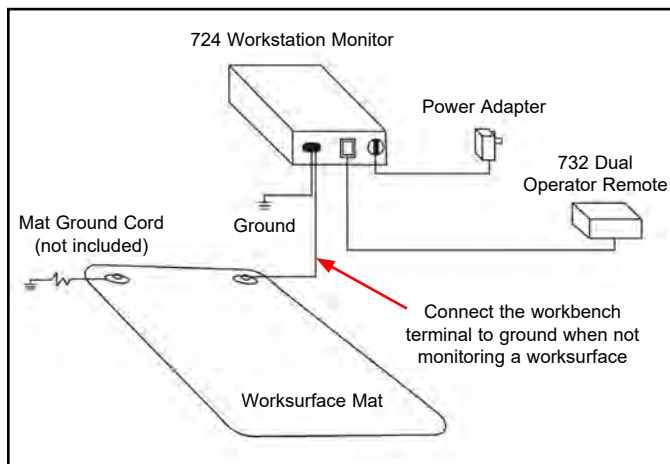
Installation

Figure 6. Installing the 724 Workstation Monitor

1. Remove the monitor from the carton and inspect for damage.

2. Determine the mounting location of the 724 Workstation Monitor. The front panel should be visible to the operator(s). Use the included short screws if desired.

3. Connect the 724 Workstation Monitor to the 732 Dual Operator Remote using the included cable.

4. Determine the mounting location of the 732 Dual Operator Remote. The front panel should be accessible to the operator(s). Use the included long screws if desired.

5. Locate the black two-wire terminal block that is packaged with the monitor. Use a small blade screwdriver to secure the mat monitor cord and ground cord to their respective terminals in the terminal block.

6. The 724 Workstation Monitor may be grounded using either its North American power adapter or the included green monitor ground cord. See Figures 7 and 8.
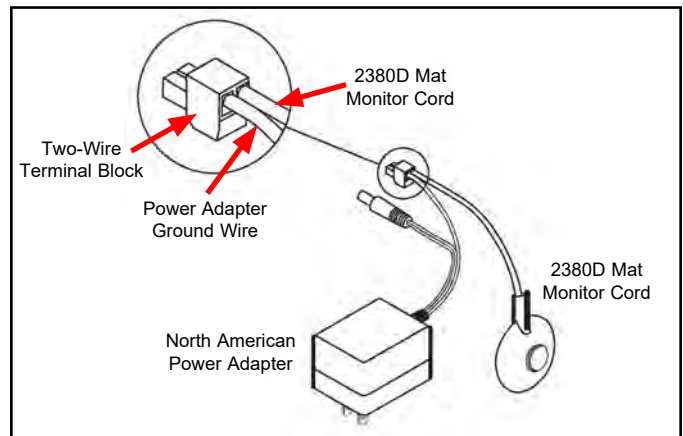

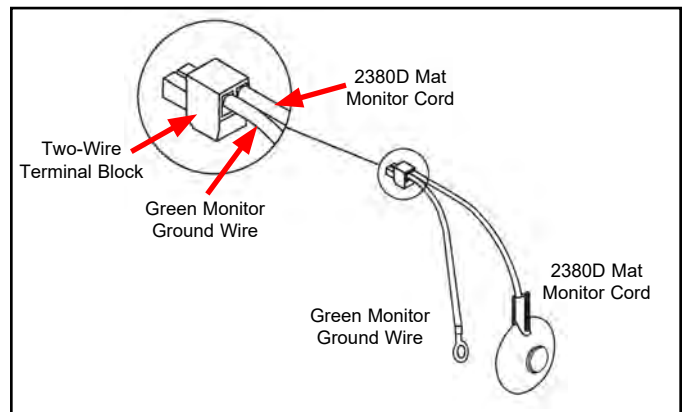Figure 7. Using the North American power adapter to ground the 724 Workstation Monitor

Figure 8. Using the included green monitor ground cord to ground the 724 Workstation Monitor

7. Plug the two-wire terminal block into the back of the 724 Workstation Monitor.

8. Route the mat monitor cord from the back of the monitor to the grounded worksurface mat. Use the SCS 3034 or 3050 10mm Female Socket to secure the cord to the worksurface mat.

9. If using the monitor ground cord, attach its ring terminal to a ground point. It is important that this ground cord is attached to a different ground point than that of the worksurface mat. The face plate screw of a grounded AC wall outlet may provide a convenient connection point.

10. Connect the power adapter to the power jack located on the back of the monitor. Route the wire from the supply to a nearby AC outlet, and plug it into the outlet. Make sure the voltage and frequency match those listed on the power supply. The monitor is now powered.

NOTE: Worksurface must have a conductive layer. SCS continuous monitors are not recommended for use with homogeneous matting.

Operation

USING THE MONITOR
1. Fit the wristband snugly onto your wrist.

2. Connect the wrist cord to the wristband.

3. Plug the wrist cord into the monitored jack labeled "1" on the 732 Dual Operator Remote. The corresponding operator LED will illuminate solid green on the 724 Workstation Monitor. This indicates that the operator is properly grounded.

4. If this does not happen, examine the wrist cord for continuity or damage and your wristband to ensure that it fits securely. If you have dry skin, apply an approved dissipative hand lotion such as Menda Reztore™ ESD Hand Lotion.

Figure 9. Using the 724 Workstation Monitor

FAULT CONDITIONS

- **Red Wrist Strap LED (H) & Audible Alarm**
  This indicates that a high resistance condition (greater than 10 Megohms or 35 Megohms) exists for an operator or wrist strap assembly. If two operators are connected to the monitor the high condition is with the operator whose green LED has extinguished. Check the operator for good contact between the wrist and band. Check the ground cord and connections for continuity. Some operators have difficulty in providing sufficient continuity to the wristband due to dry skin or arm hair. They may need to reposition the wristband on the arm or use an approved skin moisturizer such as Menda Reztore™ ESD Hand Lotion.

- **Yellow Wrist Strap LED (L) & No Audible Alarm**
  This indicates that a low resistance condition (less than 1.5 Megohms) exists between the operator and ground. One or both of the one megohm current-limiting resistors are being bypassed. A low resistance condition can be caused by touching a grounded object or by standing on a conductive surface.

- **Red Worksurface LED (M)**
  This indicates that a high resistance condition (> 3.7 Megohms) exists across the conductive layer of the worksurface and/or the ground connections. Check the worksurface, ground cords and their connections for continuity. Note the audible alarm may also sound if enabled.

SCS 3057 STANDBY JACK
Since the activating switches are located in the SCS 732 and 733 Operator Remotes, the normal operating procedure is for the operators to disconnect their cords from the remotes when leaving the workstation. However, an optional Standby Jack that allows the wrist cord to remain plugged into the remotes is available. Simply attach it to any convenient location then disconnect the cord from the wristband and connect it to the Standby Jack. The green PASS LED on the 724 Workstation Monitor will illuminate upon connection. The yellow FAIL LOW LED will slowly flash if the Standby Jack is grounded. It can be grounded by attaching a ground wire to the screws or back plate. It can also be grounded if the plate is attached to a grounded metal surface. The operator should reconnect the wrist cord to their wristband upon returning to the workstation.

Figure 10. SCS 3057 Standby Jack

SCS 733 OPERATOR REMOTE

The SCS 733 Operator Remote is used to separate the two wrist strap jacks featured on the 732 Dual Operator Remote. This provides a separation up to approximately 10 feet away from the 724 Workstation Monitor. The 733 Operator Remote is to be used in conjuction with the 732 Dual Operator Remote that is supplied with the 724 Workstation Monitor.

See technical bulletin TB-9020 for installation instructions.

Figure 11. SCS 733 Operator Remote

Calibration

Frequency of recalibration should be based on the critical nature of those ESD sensitive items handled and the risk of failure for the ESD protective equipment and materials. In general, SCS recommends that calibration be performed annually.

Use the SCS 770065 Verification Tester to perform periodic testing (once every 6-12 months) of the 724 Workstation Monitor. The Verification Tester can be used on the shop floor within a few minutes virtually eliminating downtime, verifying that the tester is operating within tolerances.

See TB-9083 for more information.

Figure 12. SCS 770065 Verification Tester

Specifications

Workstation Monitor Dimensions	6.5" x 3.125" x 1.375" (16.5 x 7.9 x 3.5 cm)
Operator Remote Dimensions	2.75" x 1.0" x 1.0" (7.0 x 2.5 x 2.5 cm)
Power Adapter Requirements (North American power adapter included)*	Input: 100-120 VAC 50/60 Hz · Output: 25 VDC @ 50 mA rated load
Output Plug Polarization	Center Negative
Output Plug Dimensions	5.5 mm O.D. x 2.1 mm I.D. x 9.5 mm Length
Test Voltage	9 VDC / 16 VDC Open circuit (Typical Value)
Test Current	Less than 3 microamps (Typical Value)
Environmental Operating Conditions	Indoor use only
Temperature	Maximum: 110°F / 43°C · Minimum: 50°F / 10°C
Humidity	Maximum relative humidity 80% for temperatures up to 31°C to 50% relative humidity at 40°C.

SCS 724-PSEU Power Adapter with UK / Europe Plugs sold separately

Environmental Conditions

This equipment has been tested and found to be safe to operate within these environmental conditions. This is not a warranty of equipment performance within these conditions.

- Indoor use only
- Ingress Protection: IPX0
- Altitude: Up to 2,000m
- Mains supply voltage fluctuations up to ±10% of the nominal voltage.
- Transient overvoltage up to the levels of overvoltage category III.
- Temporary overvoltage occurring on mains supply.
- Pollution degree 2.
- Temperature: Maximum 110ºF / 43ºC Minimum 50ºF / 10ºC
- Humidity: Maximum relative humidity 80% for temperatures up to 31ºC decreasing linearly to 50% relative humidity at 40ºC.

FCC
Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide a reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their own expense.

Modifications to this device shall not be made without the written consent of SCS. Unauthorized modifications may void the authority granted under Federal Communication Rules and Industry Canada Rules permitting the operation of this device.

ICES Statement
This Class A digital apparatus complies with Canadian ICES-003.
Cet appareil numérique de la classe A est conforme à la NMB-003 du Canada.

WEEE Statement
The following information is only for EU-members States: The mark shown to the right is in compliance with Waste Electrical and Electronic Equipment Directive 2002/96/EC (WEEE). The mark indicates the requirement NOT to dispose the equipment as unsorted municipal waste, but use the return and collection systems according to local law.

CE Statement
Meets CE (European Confomity) requirements.

cULus Statement
Meets UL Safety Requirements.

Made in China

Limited Warranty, Warranty Exclusions, Limit of Liability and RMA Request Instructions

See the SCS Warranty -