

Technical data

Model	STR-124	STR-224	STR-324
Weighing range (max)	120 g	220 g	320g
Readability (d)	0.1 mg	0.1 mg	0.1mg
Tare range	120 g	220 g	320g
Linearity	± 3 d	± 3 d	± 3 d
Reproducibility	2 d	2 d	2d
Calibration weight	100 g	200 g	200g
Minimum weight*	10 d	10 d	10d
Stabilization time	< 4 s	< 4 s	< 4 s
Reference weight min.	10 d	10 d	10d
Minimum piece weight**	1 d	1 d	1d
Warming up time	1 hr.	1 hr.	1hr
Weighing plate (Ø / W x D)	Ø 80 mm		
Dimensions (W x D x H)	220 (W) × 360 (D) × 345 (H) mm		
Operating temperature	(18-23)*C		
Humidity	(50-70)% R.H.		
Reference piece numbers for piece count	1, 10, 20, 50, 100		
Weighing units	g (gram), ct (carat), ozt (troy ounce), oz (ounce), GN (gran), dwt (pennyweight), lb (pound)		
Underfloor weighing	Yes		
Interface	RS 232C		
Power supply***	Mains power adapter input: AC220V±10% 50Hz±1Hz output: DC12V/600mA		
Auto power off	No		

1 Overview

The laboratory analytical balance STR is designed to meet the needs of laboratories, industry and commercial users and it offers very wide range of functions: weighing, parts counting, density determination, etc. This analytical balance has die cast aluminum housing. The glass cylinder protects against wind. The integrated RS-232-interface enables you (by using the optional software-kit) to automatically send the weighing data to PC. A high class professional analytical balance is equipped with all necessary features.

Description:

- **Electromagnetic force compensation technology.**
- High precision, sensitivity and rapid response time (<5 sec.).
- High quality materials and an optimized power supply.
- High reliability and long service life.
- A robust base made of powder coated aluminum cast.
- An easy-cleaning, durable and stable metal shell with glass wind protection.
- A removable stainless steel pan can be cleaned easily.
- A Level Indicator, four adjustable feet.
- External calibration, zeroing searches, parts counting function, tare function, density determination
- 7 Weighing units (g, ct, ozt, oz, GN, dwt, lb).
- Large LCD display with backlight, digit height 15 mm.
- An integrated RS-232-interface enables you to automatically send the weighing data to PC
- Powered by the external mains adapter.

1.1 Proper Use

The balance you purchased is intended to determine the weighing value of material to be weighed. It is intended to be used as a “non-automatic” balance, i.e. the material to be weighed is manually and carefully placed in the center of the weighing plate. As soon as a stable weighing value is reached the weighing value can be read.

1.2 Improper Use

- Do not use the balance for dynamic weighing. In the event that small quantities are removed or added to the material to be weighed, incorrect weighing results can be displayed due to the “**stability compensation**” in the balance. (Example: Slowly draining fluids from a container on the balance.)
- Do not leave permanent load on the weighing plate. This may damage the measuring system.
- Impacts and overloading exceeding the stated maximum load (max) of the balance, minus a possibly existing tare load, must be strictly avoided. Balance may be damage by this.
- Never operate the balance in explosive environment. The balance is not explosion protected.
- The structure of the balance may not be modified. This may lead to incorrect weighing results, safety-related faults and destruction of the balance.
- The balance may only be used according to the described conditions.

1.3 Control of inspection, measuring and test equipment

As part of quality assurance the measuring-related properties of the balance and the available adjusting weight must be checked regularly. The responsible user must define a suitable interval as well as the nature and scope of this test.

2 Warranty

- The company is liable for the defects within the framework of existing legislation.
- We warrant the product manufactured by us to be free from defective material or factory workmanship and agree to repair or replace this product which, under normal use and service, disclose the defect to be the fault of our manufacturing, with no charge for parts and service. If we are unable to repair or replace this product, we will make a full refund of the purchase price.
- Consult the user's manual for proper instruction regarding use of this instrument. Our obligation under this warranty is limited to repairing, replacing or making refund of this test equipment which proves to be defective within 24 months from the date of original purchase.



Warranty claims shall be voided in case:

- Our conditions in the operation manual are ignored
- The appliance is used outside the described uses
- The appliance is modified or opened
- Mechanical damage or damage by media, liquids, natural wear and tear
- The appliance is improperly set up or incorrectly electrically connected
- The measuring system is overloaded

3 Basic Safety Precautions

- **Environmental conditions:** only use indoor, max. Altitude: 2000m, Operating temperature: $20^{\circ}\text{C} \pm 2^{\circ}\text{C}$, humidity of air: 45 ~ 60% R.H., Power fluctuations less than $\pm 10\%$.
- Do not use the scale in any high temperature fluctuations and avoid strong airflows, vibrations and dust. The balance could never get wet and make sure that the balance is not used in an environment with extreme temperature and humidity.
- Do not use the balance in explosive conditions.
- Only use the extender cable, which with ground wire.
- If the power line cable is damaged, the appliance must be unplugged immediately and the power line cable be replaced.
- Place the balance on a stable surface and set it horizontally with the help of the adjustable feet and the spirit level.
- The electronic balance is a precision measuring instrument and must be handled with great care. Violation of limit of weighing range or impact can cause permanent damage to the balance.
- The balance needs a warm up time for about 1 hour before using.
- Please do not use aggressive cleaning agents (solvents or similar agents), but a cloth dampened with mild soap suds. Ensure that no liquid penetrates into the device and wipe with a dry soft cloth.
- Do not overload the balance more than 20% of maximum load (Max). Do not press the pan with a hand!
- By maintenance please notice the information in Chapter "Maintenance and Servicing".

- If the balance seems not to operate properly, unplug it from the mains and do not use until checked by authorized service.
- All repairs and necessary regulations can be made by authorized personnel only
- **CAUTION!** Carefully read this operation manual before setup and commissioning.

4 Transportation and Storage

4.1 Acceptance check

When receiving the appliance, please check packaging immediately, and the appliance itself when unpacking for possible visible damage.

4.2 Packing



- Keep all parts of the original packaging for a possibly required return
- Only use original packaging for returning.
- Prior to dispatch disconnect all cables and remove loose/mobile parts.
- Reattach possibly supplied transport securing devices.
- Secure all parts such as the glass wind screen, the weighing platform, power unit etc. against shifting and damage.

5 Unpacking, Setup and Commissioning

5.1 Installation Site, Location of Use

The balances are designed in a way that reliable weighing results are achieved in common conditions of use. You will work accurately and fast, if you select the right location for your balance.

Therefore, observe the following for the installation site:

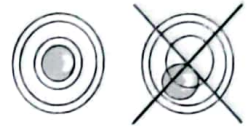
❖ Major weighing deviations (incorrect weighing results) may be experienced should electro-magnetic fields (e.g. due to mobile phones or radio equipment), static electricity accumulations or instable power supply occur. Change location or remove source of interference.

- Place the balance on a firm, level surface;
- Avoid extreme heat as well as temperature fluctuation caused by installing next to a radiator or in the direct sunlight;
- Protect the balance against direct draughts due to open windows and doors;
- Avoid jarring during weighing;
- Protect the balance against high humidity, vapors and dust;
- Do not expose the device to extreme dampness for longer periods of time.
- Non-permitted condensation (condensation of air humidity on the appliance) may occur if a cold appliance is taken to a considerably warmer environment. In this case, acclimatize the disconnected appliance for ca. 4 hours at room temperature.
- Avoid static charge of goods to be weighed or weighing container.

5.2 Unpacking / Installation

Carefully remove the balance from the packaging, remove plastic cover and setup balance at the intended workstation.

1. Take the balance and supplied accessories (a feeder, pan elements) out of the box.
2. Place the balance on a stable ground not affected by mechanical vibrations and airflows.
3. Level the balance with foot screws so that the air bubble in water-level is in the middle.
4. Plug the adapter to the power socket at the back of the balance.
5. Connect the power adapter to an AC220V $\pm$ 10% 50Hz $\pm$ 1Hz outlet.



Scope of delivery:

- Balance
- Glass Wind protection
- Weighing pan
- AC adapter
- Operating Instructions

5.3 Mains connection

Before connecting the mains adapter check if the printed voltage value is the same as the local supply voltage.

Only use the original supplied mains adapter. Otherwise there is a risk that the Scale be impaired.

5.4 Connection of peripheral devices

The balance may send data to a computer or a printer through RS232C port.

When cooperating with the balance, a computer should be equipped with a program which enables processing data from the balance.

Before connecting or disconnecting of additional devices (printer, PC) to the data interface, always disconnect the balance from the power supply.

5.5 Initial Commissioning

In order to obtain exact results with the electronic balances, your balance must have reached the operating temperature (warming up time 1 hour). During this warming up time the balance must be connected to the power supply (mains, accumulator or battery).

The accuracy of the balance depends on the local acceleration of gravity.

Please read the information carefully in chap. "Adjustment".

5.6 Adjustment

As the acceleration value due to gravity is not the same at every location on earth, each balance must be coordinated - in compliance with the underlying physical weighing principle - to the existing acceleration due to gravity at its place of location (only if the balance has not already been adjusted to the location in the factory). This adjustment process must be carried out for the first commissioning, after each change of location as well as in case of fluctuating environment temperature. To receive accurate measuring values it is also recommended to adjust the balance periodically in weighing operation.

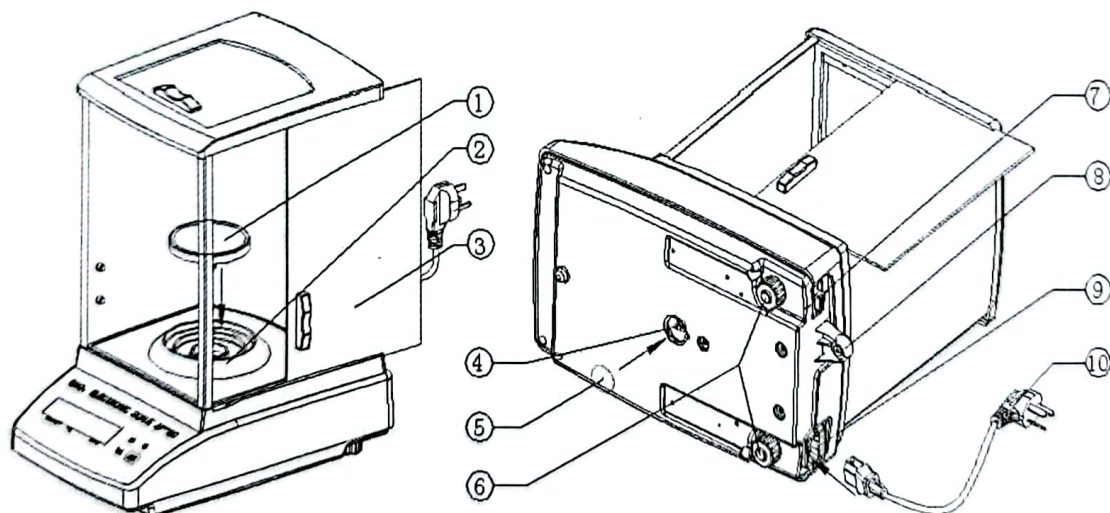
5.7 External calibration

Adjustment with recommended adjustment weight (default setting) Weight value of the required adjustment weight sees chap. 1 "Technical data". Weights of different nominal values may be used for adjustment but are not optimal for technical measuring.

Operations sequence:

- Observe stable environmental conditions. A warming up time (1 hour) is required for stabilization.
- Press the [ON]-Key, turn on the balance.
- Then press the [CAL]-Key, keep it pressed until the acoustic signal gets mute and the weighed value "C XXX" for the required adjustment weight appears flashing. (e.g.: C 100 means 100 g)
- During the flashing display put the required adjustment weight carefully in the center of the weighing plate.
- The flashing display disappears.
- After successful adjustment the balance automatically returns to weighing mode.
- Take away the adjustment weight, the display shows ZERO.
- If an error message "C----F" is displayed in the event of an adjustment error or incorrect adjustment weight. Wait until the balance is again in weighing mode and repeat the adjustment procedure.

6 Operating elements



1. Weighing pan

4. Underfloor weighing widget

7. RS232 Interface

10. AC adapter

2. Pan support ring

5. Sealing cap

8. Level Indicator

3. Wind protection

6. Adjustable feet

9. Power socket

7 Basic Operation

After new purchase of the balance or after a long storage, you have to calibrate the balance before the first commissioning. Level the balance with the adjustable feet horizontal until the air bubble in the level is in the center of the Level Indicator. Give the balance after changing the location a warm-up time min. 1 hour before using. This time is necessary for the balance to adapt to the eventual temperature.

7.1 - [Power On/OFF]

Press the  button to turn on the balance. The display shows the message "ON". Then the max. weighing range is displayed. The balance will carry out a self-test (F----1 to F----9). When the "0.0000 g" in display appears, the balance is ready for operation.

Press the  button and keep it pressed, until the display shows the message "OFF". The balance will switch off then.

7.2 TARE

When the pan is empty and indication is different than zero press [TARE] key.

Weighing with tare: Place the weighing box and press the [TARE] button. After standstill control the zero display appears. The weight of the container is now internally saved. Weigh the material, the net weight will be indicated. The weight of the weighing container will be displayed as a minus number after removing the weighing container. The tare weight is saved until it is deleted. Remove the load from the balance and press the [TARE] button. The tare procedure can be repeated as many times as necessary, for example with initial weighing of several components for a mix (add-on weighing). The limit is reached when the total weighing range capacity is full.

7.3 CAL - [calibration with external weight]

The balance has an external calibration function.

The adjustment procedures see chap. "External calibration".

7.4 - [multifunctional key]

The  button is a multi-function button. You can change the balance mode between weighing mode, print mode and counting mode. The default setting is set to the weighing mode. More Information about the mode settings see chapter "Configuration & Explain of the function setting".

7.4.1 Weighing unit selection [weighing mode]

Under the weighing mode, use the  key to choose weighing units: g (gram), ct (carat), ozt (troy ounce), oz (ounce), GN (gran), dwt (pennyweight) and lb (pound).

$$\begin{aligned} 1 \text{ g} &= 5 \text{ ct} \\ &= 0.032150747 \text{ ozt} \\ &= 0.035273962 \text{ oz} \\ &= 15.43235835 \text{ GN} \\ &= 0.643014931 \text{ dwt} \\ &= 0.0022046226 \text{ lb} \end{aligned}$$

7.4.2 Print function [print mode]

The balance can be connected via the RS232C interface directly to a printer or PC.

Under the print mode, use the  key to send a print command to the output device.

7.4.3 Pieces counting function [counting mode]

Before the balance can count parts, it must know the average part weight (i.e. reference). Proceed by putting on a certain number of the parts to be counted. The balance determines the total weight and divides it by the number of parts, the so-called reference quantity (1, 10, 20, 50, or 100). Counting is then carried out on the basis of the calculated average piece weight.

As a rule: The higher the reference quantity the higher the counting exactness.

Follow these steps:

- Change the balance into counting mode.
- Place as many pieces to add-up as required by the reference quantity. Press the $\left(\frac{1}{100}\right)$ button to enter the setting menu. The display now shows the number "1" and the unit "Pcs". Using the $\left(\frac{1}{100}\right)$ button select the reference quantity (1, 10, 20, 50, or 100).
- After successful reference determination the current quantity is displayed and the unit "Pcs".
- Remove reference weight. The balance is now in parts counting mode counting all units on the weighing plate.

7.5 Underfloor weighing

Objects unsuitable for placing on the weighing scale due to size or shape may be weighed with the help of the underfloor weighing device.

Proceed as follows:

- Switch off the balance
- Open the Sealing cap at the balance bottom.
- Suspend hook for underfloor weighing carefully and completely.
- Place weighing balance over an opening.
- Attach load to hook and carry out weighing procedure.



- Always ensure that all suspended objects are stable enough to hold the desired goods to be weighed safely (danger of breaking).
- Never suspend loads that exceed the stated maximum load (max) (danger of breaking).
- Always ensure that there are no persons, animals or objects that might be damaged underneath the load.
- After completing the underfloor weighing the opening on the bottom of the balance must always be closed (dust protection).

8 Density determination (Hydrostatic weighing)

According to the Archimedes' principle, any object, wholly or partially immersed in a fluid, is buoyed up by a force equal to the weight of the fluid displaced by the object. In other words, an immersed object is buoyed up by a force equal to the weight of the fluid it actually displaces.

For the density determination of solid material, the solid is weighed first in air and then in the measuring liquid. Because of the density of the water is 1.0 g/cm^3 , can determine the volume of the displaced water and also the volume of object. From the weight difference results the buoyancy calculates the density.



- **The density is determined with help of the underfloor weighing device.**
- **Hydrostatic density determinations succeed only with the objects, which have a higher density than water (1 g/cm^3).**

Example:

A piece of metal in the air weight 100 g and weighs 80 g in water. Therefore, the object has 20 g (= 20 cm^3) water displaced. Its volume is therefore 20 cm^3 . Now it is easy to determine the density of the metal piece.

8.1 Density determination of solids

For the density determination of solid material, the solid is weighed first in air [A] and then in the measuring liquid [B]. If the density of the buoyancy medium [ρ_0] is known, the density of the solid [ρ] is calculated as follows:

$$\rho = \frac{A}{A - B} \rho_0$$

ρ = Density of the sample

A = Weight of the sample in air

B = Weight of the sample in the measuring liquid

ρ_0 = Density of the measuring liquid

8.2 Determining density of liquids

For density determination of liquids, a glass sinker is used, whose volume ([V] see embossing) is known. The glass sinker is weighed first in air [A] and then in the liquid [B] whose density is to be determined. According to the Archimedes' principle, any object, wholly or partially immersed in a fluid, is buoyed up by a force equal to the weight of the fluid displaced by the object. The volume [V] of the glass sinker is same as the volume of the displaced liquid.

Buoyant force of the glass sinker = weight of the glass sinker in air [A] - weight of the glass sinker in the measuring liquid [B]

That implies that:

$$\rho = \frac{A - B}{V} + \rho_A$$

ρ = Density of the sample liquid

A = Weight of the glass sinker in air

B = Weight of the glass sinker in the measuring liquid

V = Volume of the glass sinker

ρ_A = Density of air (0.0012 g/cm³)

8.3 Influencing magnitudes and error sources

- Air Pressure
- Temperature
- Volume deviation of the sinking object ($\pm 0.005 \text{ cm}^3$)
- Surface tension of the liquid
- Air bubbles
- Immersion depth of the sinking object
- Porosity of the object

9 Displayinformation / Error messages

F---1	Date over display scope
F---2	A/D-switch disorder
F---3	Function key disorder
F---5	Sensor signal disorder / Load Cell defect
F---L	Lower zero position of sensor signal
F---H	Weighing capacity is exceeded
C---F	Calibration error, instability or not at zero point during calibrating
C---H	Calibration error, items on the pan or at higher zero point during calibrating
E-----	Storage calibration data error, re-calibration is necessary
-----	Zero point of the scale disorder / mechanical defect of the scale



Should other error messages occur, switch balance off and then on again. If the error message remains inform manufacturer.

10 Interface RS 232C

An integrated RS-232-interface enables you to automatically send the weighing data to PC. Relevant codes and control commands are specified as following.

10.1 Technical Data

- 8-bit ASCII Code
- 1 start bit, 8 data bits, 1 stop bits, no parity bit
- Bit rates supported include: 600, 1200, 2400, 4800 and 9600 bit/s. (default setting is 600)
- Miniature plug is necessary (9 pin D-Sub)
- For operation with interface faultless operation is only ensured with the correct G&G – interface cable (max. 2m)

10.2 Description of the data transfer

Symbols

-/+	minus-sign / for positive numbers this is output as blank
Data	value of weight / decimal, depending on weighing value
Unit	Units / Pcs.
STP	stop character
CR	Carriage Return

Data format: 14-bits Output (ASCII Code):

-/+	Data	Unit	STP	CR
2 bits	7 bits	3 bits	1 bit	1 bit

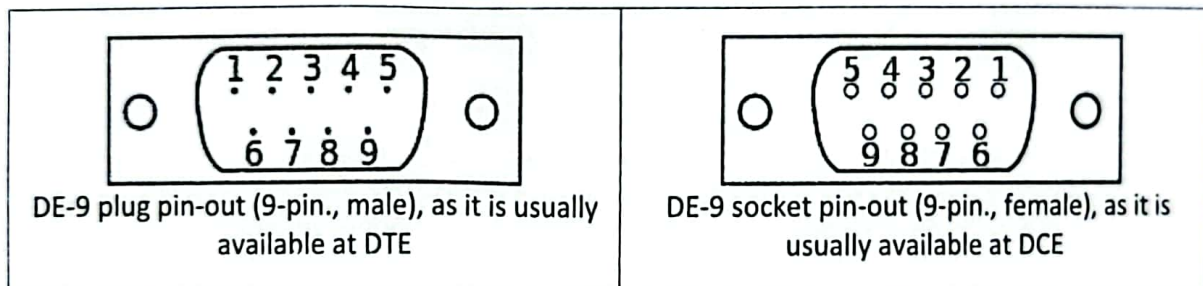
10.3 Remote control instructions

Via the RS232 data interface, the computer can control the balance with subsequent commands.

If the transmit / device setting is 27 (27=1B_{hex}, default setting), the remote control commands are sent to the balance by ASCII code:

1BH+70H (ASCII Code p): sending data	(Print)
1BH+71H (ASCII Code q): calibration function is active	(CAL - Key)
1BH+72H (ASCII Code r): Counting function is active	
1BH+73H (ASCII Code s): Weighing unit selection	
1BH+74H (ASCII Code t): Taring	(TARE - Key)

10.4 RS232 Pinout (9-pin D-Sub)



DTE - data terminal equipment (Terminals resp. computer)

DCE - data circuit-terminating equipment (Balance)

Signal			Pin	Origin	
Abbreviation	Name	Typical purpose	DE-9	DTE (e.g. PC)	DCE (e.g. Balance)
RxD	Receive Data	Carries data from DCE to DTE.	2	Input	Output
TxD	Transmit Data	Carries data from DTE to DCE.	3	Output	Input
GND	Ground		5	-	-

Application Example:

If the setting is C3---2, C4---27 (default setting), the codes shown in VB as following:

```
MSComm1.Settings = "600,n,8,1"
```

```
MSComm1.Output = Chr(&H1B) + Chr(&H70) 'sent a print commando
```

```
'or MSComm1.Output = Chr(27) + Chr(112)
```

```
'or MSComm1.Output =Chr(27) +"p"
```

```
Do
```

```
DoEvents
```

```
Loop Until MSComm1.InBufferCount = 14
```

```
a = MSComm1.Input
```

```
Print a
```

11 Configuration & Explain of the function setting

The settings of the balance can be changed in the setting menu. This way, the balance can be adjusted to individual weighing requirements. By the factory the user menu has been set in a way that normally no more changes must be made, only at special conditions of use.

Overview:

In the off state press the [CAL] button and keep it pressed, press the [⏻] button turn on the balance. Now the balance is accessed to the setting menu. Using the [CAL] button the individual menu items (C1-C4) can be selected one after the other. Press the [TARE] button to change the setting value. After all points have been configured, press [CAL] button returns the balance automatically into weighing mode.

a) C1 = sensitivity setting - values: 0 1 2 3 4

The higher the value, the lower the sensitivity and higher stability.

Filter 0: Setting for dispensing.

Filter 1/2: Sensitive and fast, very quiet using location.

Filter 3/4: Robust but slow, busy using location.

Default setting is 2 or 1.

b) C2 = filtering strength setting - values: 0 1 2 3

The higher the value, the lower the sensitivity and higher stability.

Filter 0: Setting for dispensing.

Filter 1/2: Sensitive and fast, very quiet using location.

Filter 3: Robust but slow, busy using location.

Default setting is 2 or 1.

c) C3 = serial port setting - transmission speed (RS-232)

2(600), 3(1200), 4(2400), 5(4800), 6(9600) - Default setting is 2.

d) C4 = device number / communication setting (RS-232)

Press [TARE] button changes the value smaller. Press [↵] button changes the value bigger. The number corresponds to the first data signal to the command control of the computer.

Default setting is 27 (1B_{hex}).

e) C5 = setting of work mode for balance

0(weighing mode), 1 (print mode), 2 (counting mode) - Default setting is 0.

f) Save settings

After all points have been configured, press [CAL] button returns the balance automatically into weighing mode.

g) Restore the factory settings