

Sartorius Comparator

Interface Description
for the CC Model Series



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General Information

This description is written for users who wish to connect their Sartorius Mass Comparator to a computer or a different peripheral device using the standard V24/V28-RS232C(-S)*)/423 interface port on the mass comparator.

By using an on-line computer, you can change, activate and monitor the functions of the mass comparator.

You can plug an external remote-control switch into the data interface port to activate these functions: print (data transfer), F1 or F2 key function, or tare.

If you interface an original Sartorius accessory device, such as a Sartorius Data Printer or a similar unit, with a mass comparator that has the factory-set menu codes, you do not need to change any settings.

*) = Sartorius pin assignment

General Specifications

Type of interface	Serial point-to-point connector
Operating mode	Asynchronous, full-duplex
Standard	V28, RS232C, RS423 specification
Handshake *)	2-wire interface: via software (XON/XOFF) 4-wire interface: via hardware handshake lines Clear To Send (CTS) and Data Terminal Ready (DTR)
Transmission rates *)	150, 300, 600, 1,200, 2,400, 4,800, 9,600, 19,200 baud
Character coding	7-bit ASCII
Parity *)	Mark, space, odd, even
Synchronization	1 start bit; 1 or 2 stop bits *)
Data output format *) of the balance	16 or 22 characters
Character format *)	– 1 start bit – 7-bit ASCII – 1 parity bit – 1 or 2 stop bits

*) = can be changed by the user

Data Output Formats

Depending on the menu code setting: 7 2 1 = no data ID code
or 7 2 2 = data ID code,

data will be output with either 16 (code 7 2 1) or 22 (code 7 2 2) characters.

For a data output of 22 characters, a 6-character ID, as defined in the application program selected, precedes the 16 characters.

Data Output Format with 16 Characters

Display segments that are not activated (+ or – sign, leading zeros other than zeros before the decimal point) are output as spaces.

The following data block format is output according to what is displayed on the balance:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
+	*	*	*	*	*	*	*								
	10 ⁷	10 ⁶	10 ⁵	10 ⁴	10 ³	10 ²	10 ¹	10 ⁰			*	*	*		
	0	0	0	0	0	0	0	0						CR	LF
*										*					
		.	.	.	.	.	.	.	.		E	E	E		
–			10 ⁶	10 ⁵	10 ⁴	10 ³	10 ²	10 ¹	10 ⁰						
			0	0	0	0	0	0	0						
			*	*	*	*	*	*	*						

* = space; E = unit

When data are output without decimals, the decimal point is suppressed (except when a certain display mode is selected).

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
+			*	*	*	*	*	*							
*	*	10 ⁷	10 ⁶	10 ⁵	10 ⁴	10 ³	10 ²	10 ¹	10 ⁰	*	*	*	*	CR	LF
-			0	0	0	0	0	0	0		E	E	E		

Data output example: +50001.18 g

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
+	*	5	0	0	0	1	.	1	8	*	g	*	*	CR	LF

Characters:

- 1st Plus or minus sign or space
- 2nd–10th Weight with a decimal point; leading zeros = space
- 11th Space
- 12th–14th Unit symbol or space
- 15th Carriage return
- 16th Line feed

* = space; E = unit

- If the weighing system has not stabilized, no unit symbol is output.
- For the display format parameter "last numeral off or only at stability" (blank last numeral by a rounding factor of 10 or display last numeral when the readout is stable), the 10th character in the string is a space. The reason: the last numeral without a decimal point is not blanked. Instead, it is given a definite zero; otherwise, the display would go completely blank when the mass comparator is unloaded. In this case, you will obtain the standard display format.

Unit symbols (standard mass comparator):

* * *	No stability parameter	t s	Singapore tael
g * *	Grams	t t	Taiwanese tael
k g *	Kilograms	g r *	Grains
c t *	Carats	d w t	Pennyweights
l b *	Pounds	m g *	Milligrams
o z *	Ounces	% * *	Percent
o z t	Troy ounces	p c s	Pieces (parts)
t l h	Hong Kong tael		

* = space

Special Codes

are output only if menu code 611, 614 or 615 is set (see the section entitled "Data Output Parameter(s)" in the "Installation and Operating Instructions" of the particular mass comparator you are using.

Special status-dependent codes

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
*	*	*	*	*	*	A	B	*	*	*	*	*	*	CR	LF

The following status codes are output for "A B":

* * :	Tare	H * :	Overload
C * :	Calibrate **)	L * :	Underload
- - :	All numerals shown in stable readout		

Special error-dependent codes

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
*	*	*	E	R	R	*	X	Y	Z	*	*	*	*	CR	LF

X = *, 0, 1, or 2 as a one-place error code

Y Z = two-place error index code

* = space

**) The displayed status code "C" will also be output when a print command for a single value is received.

Data Input Formats

Commands can be input via the mass comparator interface port to control the functions of application programs and of the mass comparator itself.

Control commands are distinguished according to those with upper-case letters or special characters and those with lower-case letters.

Format for Control Commands

Control commands can include up to 13 characters.

Each character must be transmitted with a start bit, a 7-bit ASCII-coded character, a parity bit and one or two stop bits.

You can define the parity, baud rate and handshake mode, including the number of stop bits, by programming the codes in the operating menu of the mass comparator (see page 17).

Formats:

ESC	K	CR	LF
-----	---	----	----

ESC	K	X	—	CR	LF
-----	---	---	---	----	----

ESC	K	X	X	X	X	X	X	X	X	—	CR	LF
-----	---	---	---	---	---	---	---	---	---	---	----	----

ESC = Escape

K = Command character

X = Number

. = Decimal point

— = Underline

CR = Carriage return

LF = Line feed

The characters CR and LF do not have to be transmitted in the data string.

Control Commands with Upper-Case Letters or Special Characters

ESC	P	CR	LF	Print
ESC	Q	CR	LF	Acoustic signal
ESC	S	CR	LF	Self-test
ESC	T	CR	LF	Tare

The commands "P" through "T" do not affect the code settings of the operating menu. The command "S" causes the processor to reinitialize (turns the mass comparator off and back on again).

The mass comparator will operate according to the commands available up until the processor is reinitialized. Once the mass comparator has been turned on, the processor will always recognize the codes entered by the user in the operating menu.

ESC	O	CR	LF	Block keypad
ESC	R	CR	LF	Release keypad

Adaptation to Ambient Conditions

ESC	K	CR	LF	Very stable
ESC	L	CR	LF	Stable
ESC	M	CR	LF	Unstable
ESC	N	CR	LF	Very unstable

Control Commands with Lower-Case Letters

All functions that can be selected by pressing the appropriate keys on the mass comparator or the control unit can also be activated by commands.

Standard:

ESC	f	0	_	CR	LF	function key	
-----	---	---	---	----	----	--------------	--

ESC	f	1	_	CR	LF	function key	
-----	---	---	---	----	----	--------------	--

ESC	f	2	_	CR	LF	function key	
-----	---	---	---	----	----	--------------	--

ESC	f	6	_	CR	LF	function key	
-----	---	---	---	----	----	--------------	--

ESC	s	0	_	CR	LF	info function	
-----	---	---	---	----	----	---------------	--

ESC	s	3	_	CR	LF	clear function	
-----	---	---	---	----	----	----------------	--

Each control command with the lower-case letters (such as f and s) must be terminated by an underline (ASCII = 5F Hex).

Synchronization and Data Output Parameters

Definition

During data communication between the mass comparator and an on-line device (computer), "telegram-style" information consisting of ASCII characters is transmitted by the interface.

For error-free data communication, the interface parameters, including the baud rate, parity and handshake mode, as well as the character format, must be the same for both units.

You can change these parameters in the operating menu of the mass comparator so that they match those of the on-line device.

In addition to these parameter settings, you can define the data output parameter of the mass comparator so that data are transmitted depending on various conditions – for more information, see the "Installation and Operating Instructions" of the mass comparator you are using.

If you do not plug a peripheral device into the interface port on the mass comparator, this will not generate an error message. In this case, data will be output but not received.

Handshake

The mass comparator interface (Sartorius Balance Interface = SBI) has a 23-byte transmit buffer and a 40-byte receive buffer.

You can access the operating menu of the mass comparator to define various handshake parameters:

Software handshake: controlled by "XOFF" and "XON"

Hardware handshake: – after "CTS" send 2 characters
– after "CTS" send 1 character

What happens when you define a software handshake?

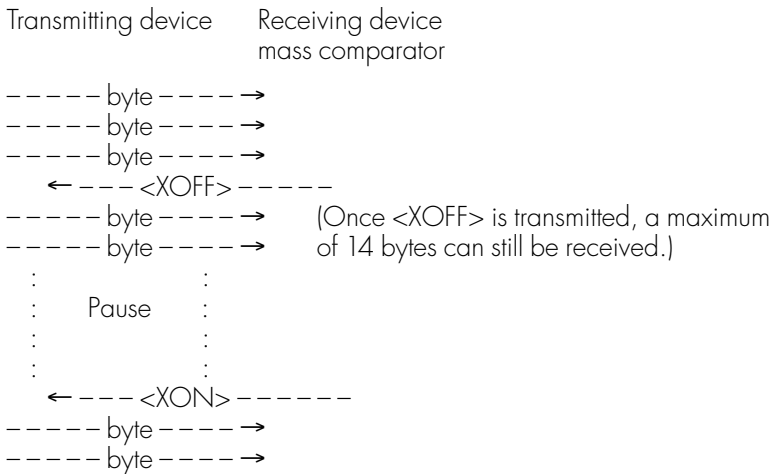
Receiving device:

"XOFF" will not be transmitted until the receive buffer has stored the 26th character. The enable command "XON" is given after the buffer has transmitted all characters up to the 14th character.

If the device addressed does not understand the control command, the SBI receiving device will continue to operate additionally with a hardware handshake after it has received another 6 characters.

For data communication with a software handshake, "XON" must be sent by a device when it is turned on in order to enable another on-line device to exchange data.

Sequence:



Transmitting device:

The importance of such handshake control for data transmission becomes especially apparent

- when the continuous automatic data output parameter is defined
- when data output is controlled by application programs.

Once <XOFF> is received, it prevents further transmission of characters. When <XON> is received, it re-enables the transmitting device to send data. The transmitting device is always enabled for sending data after it has been switched on.

If data transmission is interrupted by the control line (CTS) or the command <XOFF> while a data block is being output from an application program (only for printing a section of text with several lines of data), the readout will be locked into the display at the same time.

Data output will be blocked until the interface receives an enabling signal.

Activating a Data Output Process

You can define the data output parameter so that output is activated when a print command is received, or is activated automatically. You have two options for the automatic mode: data output can be either synchronous with the mass comparator display or activated at defined intervals (to select the parameter, see the "Installation and Operating Instructions").

Data Output by Print Command

The print command can be transmitted by a software command or by pressing the print key.

You can connect an external universal switch for remote control to the mass comparator interface port (for the print function, see the "Installation and Operating Instructions") in addition to an interface cable for a different device. For the switch, use pins 8 and 15 of this port and a cable up to 1.5 m or 5 ft long.

If data output is requested by a software command (see the section on "Data Input Formats"), you can install a 15 m (50 ft) cable for RS232C or a 300 m (984 ft) cable for RS423.

Automatic Data Output

In the "auto print" operating mode, the data are output to the interface port without requiring a print command. You can choose to have data output automatically at defined print intervals with or without the stability parameter. Whichever parameter you choose, the data will be output as the readouts appear on the mass comparator display.

If you select the auto print setting, data will be transmitted immediately the moment you turn on the mass comparator. Automatic data output can be stopped and restarted either when you press the print key, or when an external print command is received, if you have set menu code 6 2 1.

Settings for the Interface Parameters

Baud Rate	Code
150 baud	5 1 1
300 baud	5 1 2
600 baud	5 1 3
1,200 baud *	5 1 4
2,400 baud	5 1 5
4,800 baud	5 1 6
9,600 baud	5 1 7
19,200 baud	5 1 8

Parity	Code
Mark parity	5 2 1
Space parity	5 2 2
Odd parity *	5 2 3
Even parity	5 2 4

Number of Stop Bits	Code
1 stop bit *	5 3 1
2 stop bits	5 3 2

Handshake Mode	Code
Software handshake	5 4 1
Hardware handshake with 2 characters after CTS *	5 4 2
Hardware handshake with 1 character after CTS	5 4 3

* = factory setting

Special Interface Functions

Data Input/Output to/from the Female Interface Connector

You can plug an external switch for remote control into the female interface connector (such as foot switch YPE 01 RC with the two functions "tare" and "print"). If you change the menu code setting, you can interface both a control unit display and our universal remote-control switch to your mass comparator.

Pin assignment for the female interface connector:

Pin	Standard Switch Function (Code 8 10 2)	Universal Switch Function (Code 8 10 1)
15	Print	"Universal switch" (see below)
17	F1 key	Not connected
18	F2 key	Not connected
19	Tare	Not connected

Interface function	Code
Universal remote-control switch	8 10 1
Standard switch	* 8 10 2

External, Universal Remote-Control Switch (only with Code 8 10 1)

You can plug an external, universal remote-control switch into the interface port on the mass comparator.

To change the function of this switch, set the appropriate menu code listed below.

Functions	Code
Print	* 8 4 1
Tare	8 4 2
F1 key	8 4 3
F2 key	8 4 4

* = factory setting

Pin Assignment Chart

Female Interface Connector:

25-position D-submini, DB25S with screw lock hardware for cable gland

Male Connector Required: (please use connectors with the same specifications)

25-pin D-submini, DB25S, with shielded cable clamp assembly (Amp type 826 985-1C) and fastening screws (mate screws for female screw lock, Amp type 164 868-1)

Pin Assignment:

Pin 1: Signal Ground

Pin 2: Data Output (TxD)

Pin 3: Data Input (Rx D)

Pin 4: "Signal Return" (Tx D/Rx D)

Pin 5: Clear to Send (CTS)

Pin 6: Internally Connected

Pin 7: Internal Ground

Pin 8: Internal Ground

Pin 9: Reset_In***)

Pin 10: -12 V

Pin 11: +12V

Pin 12: Reset_Out***)

Pin 13: +5 V

Pin 14: Internal Ground

Pin 15: _____

Pin 16: _____

Pin 17: _____

Pin 18: _____

Pin 19: _____

Pin 20: Data Terminal Ready (DTR)

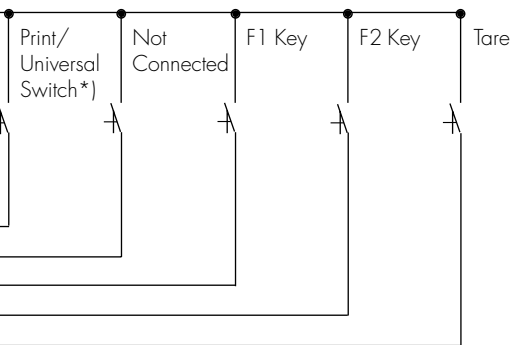
Pin 21: Supply Voltage Ground "COM"

Pin 22: Not Connected

Pin 23: Not Connected

Pin 24: Supply Voltage Input +15..25 V

Pin 25: +5 V

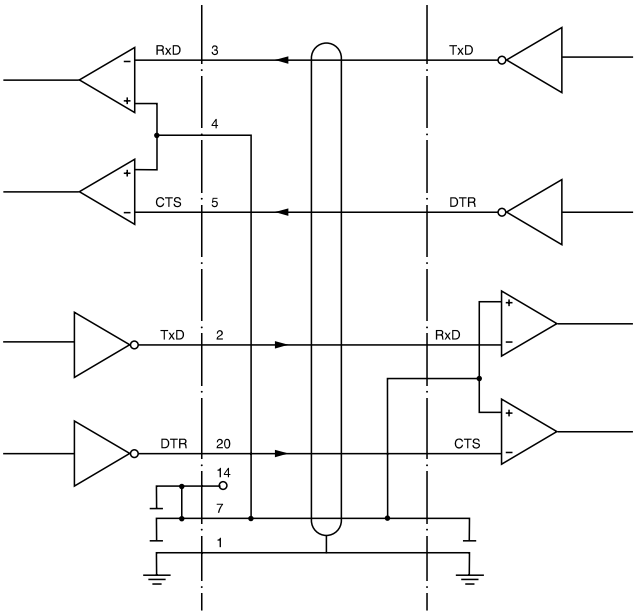
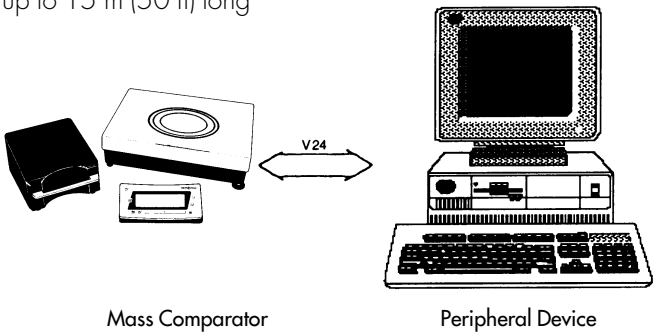


*) = To change the pin assignment, see "Data Input/Output to/from the Female Interface Connector" on page 18

**) = Hardware restart

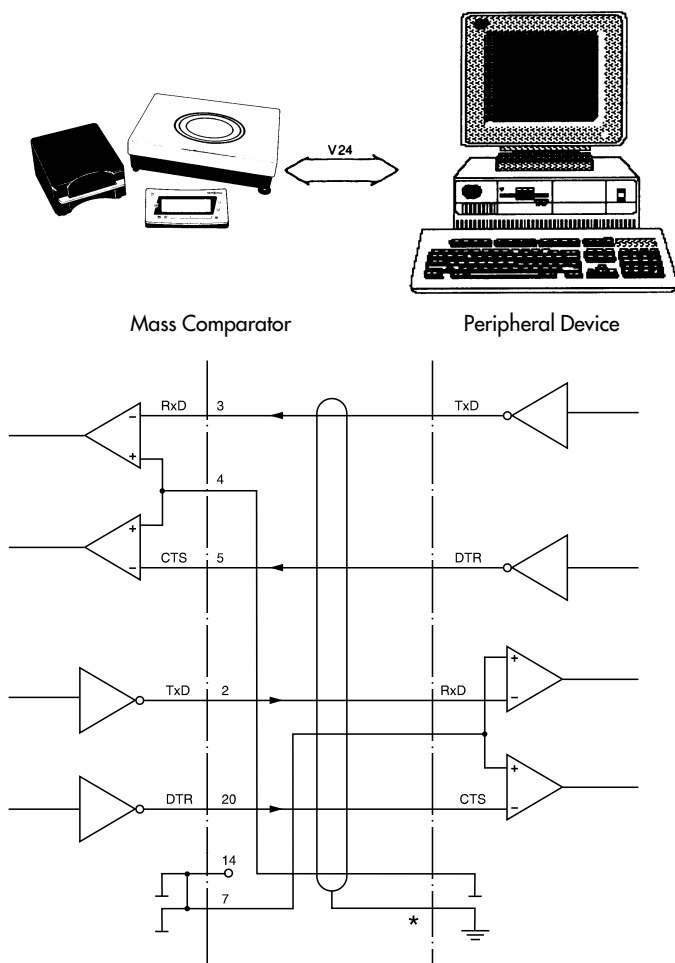
Cabling Diagrams

Diagram for interfacing a computer or a different peripheral device to the mass comparator using the RS 232 C/V24 standard and interface cables up to 1.5 m (50 ft) long



Type of cable: AWG 24 specification

Diagram for interfacing a peripheral device to the mass comparator using the RS 423/V10 standard and interface cables up to 300 m (984 ft) long



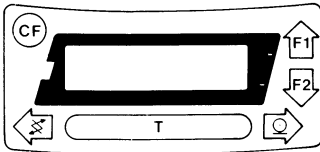
Type of cable: AWG 24 specification

*) The protective ground is on one side only

Brief Instructions for Setting a Menu Code

Turn your mass comparator off and then back on again.
While all segments are displayed, briefly press the tare control.

If "-L-" is displayed, change to the "-E-" mode using the menu access switch.



Select the desired code number as follows:

- press (F1) to increase it or
- (F2) to decrease it.

Select the left-hand, middle or right-hand place as follows:

- press the (←) key to go toward the left
- press the (→) key to go toward the right

Confirm your code selection by pressing the tare control (T).

Adjust the menu access switch back to the original setting - readout: -L-.

To leave the menu, press (CF).

Quick-Reference Guide to All Menu Code Settings

This list of menu parameters compiled from the "Installation and Operating Instructions" of your mass comparator gives you a quick-reference guide to the code settings.

If you need to change any of the factory settings, we recommend that you enter these changes along with the date and, if necessary, your initials under the column heading "Changes."

Interface Parameters

Baud Rate	Code	Changes
150 baud	5 1 1	
300 baud	5 1 2	
600 baud	5 1 3	
1,200 baud	5 1 4	*
2,400 baud	5 1 5	
4,800 baud	5 1 6	
9,600 baud	5 1 7	
19,200 baud	5 1 8	

Handshake Mode	Code	Changes
Software handshake	5 4 1	
Hardware handshake with 2 characters after CTS	5 4 2	*
Hardware handshake with 1 character after CTS	5 4 3	

Parity	Code	Changes
Mark parity	5 2 1	
Space parity	5 2 2	
Odd parity	5 2 3	*
Even parity	5 2 4	

Number of Stop Bits	Code	Changes
1 stop bit	5 3 1	*
2 stop bits	5 3 2	

* = factory setting

Utilities

Data Output Parameter			Changes
W/o stability	6	1 1	
After stability	6	1 2	*
At stability	6	1 3	
Auto w/o stability	6	1 4	
Auto after stability	6	1 5	

Data ID Codes	Code	Changes
Without	7 2 1	*
With	7 2 2	

Automatic Data Output			Changes
Stop with key	6	2 1	
Not stoppable	6	2 2	*

Print Interval after			Changes
1 disp. update	6	3 1	*
2 disp. updates	6	3 2	
5 disp. updates	6	3 3	
10 disp. updates	6	3 4	
20 disp. updates	6	3 5	
50 disp. updates	6	3 6	
100 disp. updates	6	3 7	

Auto Tare after Data Output			Changes
Off	6	4 1	*
On	6	4 2	

Additional Parameters

Data Input/Output via Interface	Code	Changes
Universal switch	8 10 1	
Standard switch	8 10 2	*

Universal Switch (only for code 8 10 1)	Code	Changes
Print	8 4 1	*
Tare	8 4 2	
F1 key	8 4 3	
F2 key	8 4 4	

* = factory setting

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The Sartorius logo consists of the word "sartorius" in a bold, lowercase, sans-serif font. A vertical line passes through the center of the letter 'o', which is highlighted with a yellow circle.