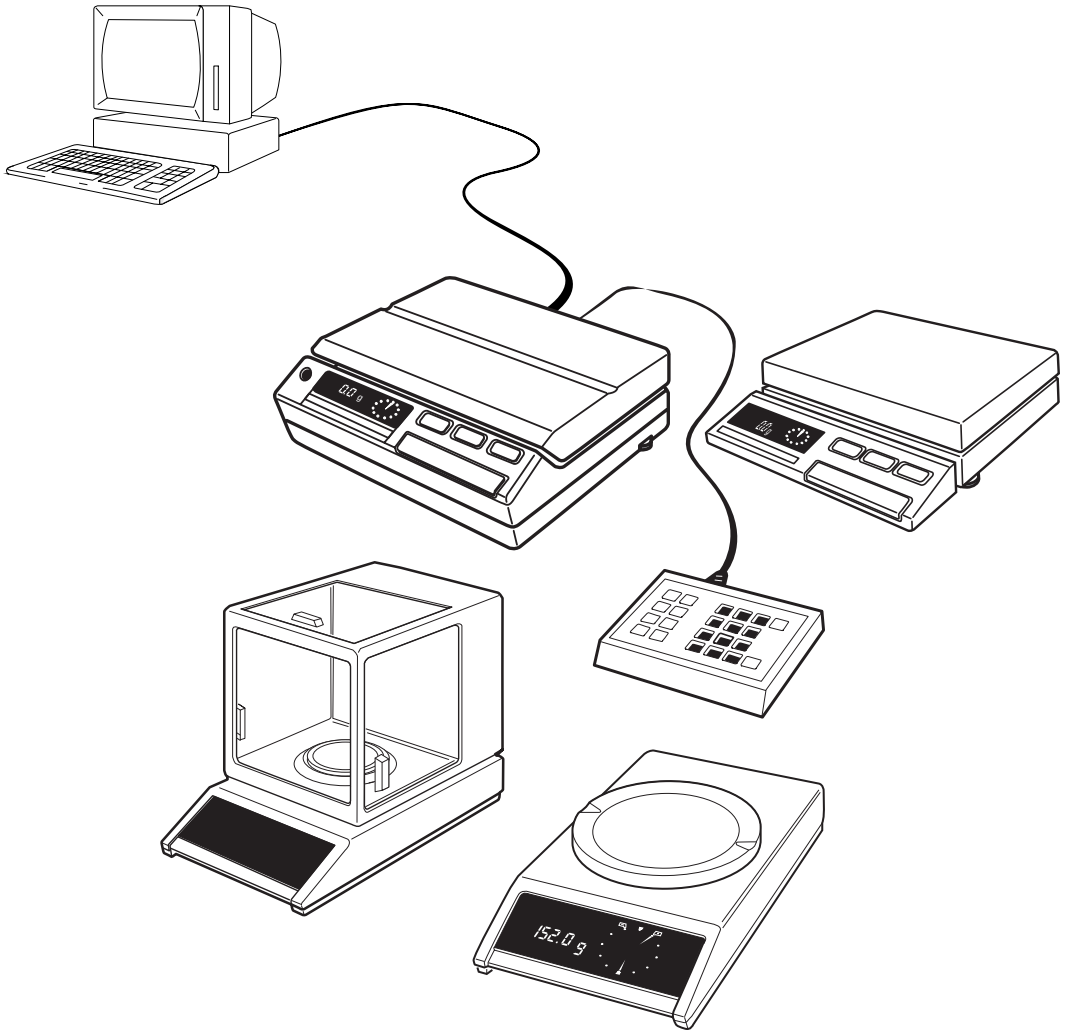
Operating instructions

Bidirectional Data Interface AM-/PM-/SM Balances and Scales

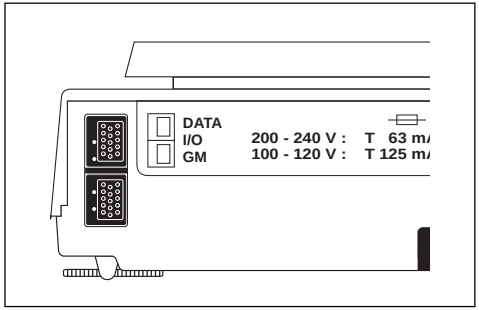
METTLER TOLEDO DataPac-M



METTLER TOLEDO

Contents Bidirectional Data Interface of the AM/PM/SM Balances and Scales – DataPac-M

1. Overview



Rear of balance with interface sockets

1.1 What are the interface capabilities?

The interface allows the balance to communicate with other devices, e.g. computers or terminals. In addition, remote operation of the balance is possible. Virtually all commands which can be entered using the Menu key can also be entered via the interface. Control is not only via the balance display but also through acknowledgements at the interface.

The METTLER TOLEDO AM/PM/SM balances are fitted with a bidirectional data interface (DATA I/O) and an interface for peripherals (GM) as standard. They can transmit weighing results to a peripheral device at the DATA I/O socket via 20 mA current loop or RS232C, and at the same time also receive commands to control the balance (full duplex operation). It is thus possible to integrate AM/PM/SM balances in a controlled weighing system.

The interface can also be used for:

- automatic transfer of weighing results
- taring and presetting of tare
- changing the weight unit
- calibration
- entering limits for checkweighings and dispensing weighings
- selecting the balance operating mode (matching to weighing sample, surroundings, etc.)
- controlling the display (dialog text, DeltaTrac)
- controlling peripherals
- identifying the balance
- defining the dialog with DataPac-M terminal

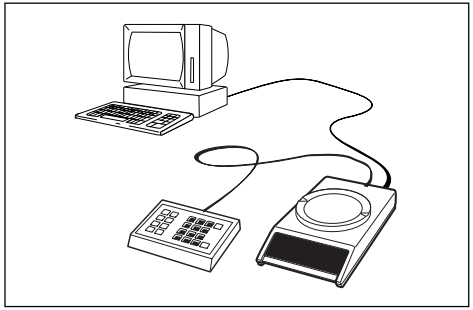
Software version

The present operating instructions describe the interface inserted software STANDARD V10.50.00. This number can be checked on the inserted software cassette or on the balance/scale display after switching on the balance or scale.

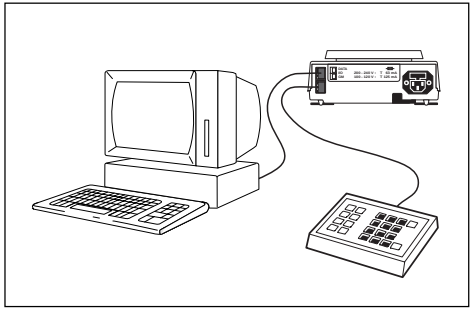
Applications, Technical Data, Accessories METTLER TOLEDO AM/PM/SM Balances and Scales

This is the name of the brochure that is enclosed with every AM/PM/SM balance or scale. Here you will find a complete overview of all peripherals and connection cables.

1.2 Dialog between computer and weighing station with the aid of DataPac-M



Weighing station terminal



Connection DataPac-M

The DataPac-M includes a keypad that operates together with the display of the balance as a weighing station terminal. This makes communication between a computer and the weighing station possible.

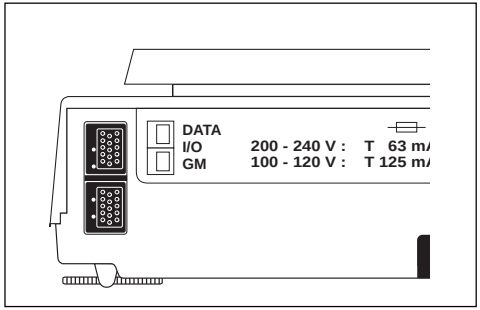
Thus, for example, weighing instructions to the operator can be transmitted from the computer. Or the operator can call up certain weighing programs from the computer, select partial programs with yes/no, or enter article and lot numbers.

Hardware of the DataPac-M
The DataPac-M comprises a keypad attachable to the GM socket of the balance as input device and the DataPac software, which is already included in the standard software of the AM/PM/SM balances. For dialog text the display of the balance is used. The computer is attached to the I/O interface of the balance.
The DataPac-M can be used after software version STANDARD V10.20.

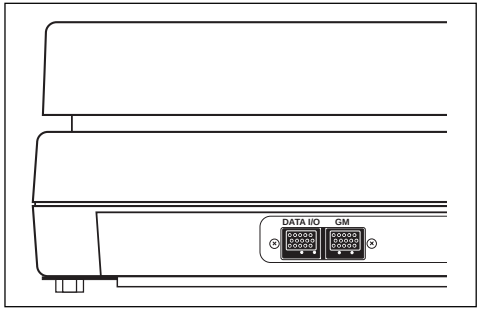
User software of the computer
The form of the dialog between a computer and the weighing station is defined using the computer. The operator response can be limited to a few alternatives, e.g. yes/no. This allows the programming effort to be considerably reduced.

DataPac-M description
Since the interface of the balance is used for the dialog, the present interface description also describes the operation of the DataPac-M (section 6).

2. Preparation



Rear of AM/PM balances



Rear of high-capacity PM scales

2.1 Connector sockets of the balances/scales

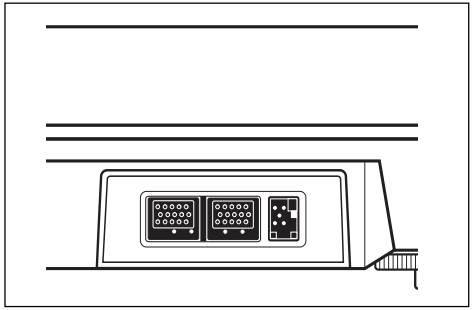
2.1.1 AM and PM balances

The balances have the following connector sockets:

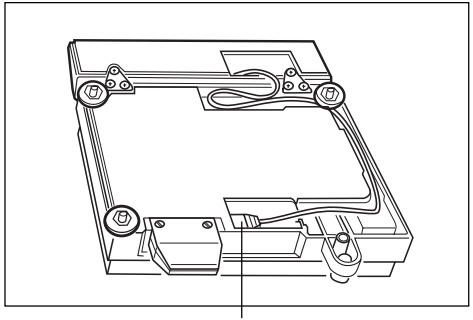
DATA I/O: Devices with RS232C or CL interface, e.g. a computer (bidirectional operation), printer, GA50 Peripheral Controller, adapter cable for data output using hand or foot switch (unidirectional operation)

GM: DataPac-M keypad, GM instruments with adapter plug, e.g. GM303 Control Unit, secondary display, LV10 Automatic Feeder, adapter cable for taring using hand or foot switch.

The coding pins at the sockets prevent improper insertion.



Rear of SM scales



SM terminal connector or
system connector
at base of scale

2.1.2 SM scales

In addition to the DATA I/O and GM sockets mentioned, the SM scales have a third socket on the underside of the weighing platform for the detachable SM terminal (scale display with keys).

Connection socket for the SM terminal
Different terminals
The SM scales can be operated with different terminals or, if in integrated in a network, also without terminal. As a rule, a base terminal is attached to the scale that has either a fluorescent display (VFD) or a liquid crystal display (LCD) (terminal model SM-F or SM-L). For special cases, so-called application terminals with integrated DataPac-M keypad are available (terminal model SM-AF with VFD or SM-AL with LCD).

Computer-controlled multistation weighing system with SM scales without terminal
If one or more weighing platforms of the SM scales are attached directly, i.e. without terminal, with the aid of the serial interface to a computer, each weighing platform must be fitted with an 34490 system connector.
The SM scales do not recognize any standby operation and could not be switched on even via the interface after a power outage. The system connector allows standby operation and is inserted in the same place where the absent terminal would be attached. It keeps the weighing platform permanently switched on.

2.2 Matching the interface to the unit to be attached (configuration)

The configuration is described in detail in the operating instructions and is thus repeated here only in brief.
To select the interface parameters, first the **configuration register** has to be entered as follows:

– Switch of balance/scale → standby — no display.

– press control bar and keep pressed until — ------ — -CONF- appears,

then release bar so that — rESEt appears.

When in the configuration register, briefly pressing the control bar allows switching from the **sector** "rESET" to the sectors "SCALE", "Unit" or "I-FACE".

In an individual sector, the desired **parameter** is selected by pressing and holding the control bar and then its value is determined by pressing the control bar briefly (default value = black).

2.2.1 Sector "I-FACE"

Data transmission mode (see section 4):

S. Stb	stable single values
S. ALL	current single values (stable or not)
SAuto	stable single value after each weight change
SCont	all values, continuous

Transmission rate (baud rate):

b 110	110 baud
b 2400	2400 baud
b 9600	9600 baud

Parity:

P E	Even
P -O-	Odd
P -S-	Space (use for 8-bit code)
P -N-	Mark (use for "no parity")

Pause between data lines and handshake:

PAUSE 0	for rapid peripherals (computer etc.)
PAUSE H	utilize handshake line
PAUSE 1	for slow peripherals (printer etc.),
PAUSE 2	1.0 or 2.0 sec. pause between the data lines

Auxiliary (suppression of auxiliary symbols)

Au oFF	Result with certification symbol <…> or * in animal wgh.
Au on	Suppression of these auxiliary symbols

2.2.2 Sector "Unit"

Start data output

With the AM/PM balances, which have only a control bar, this can also be used as an alternative method of initiating the data output.

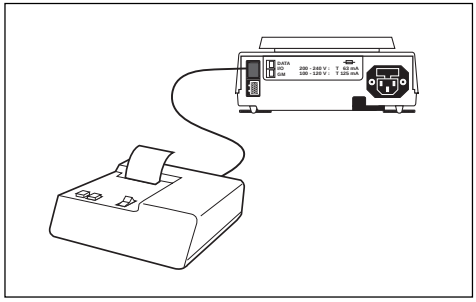
Art oFF	Control bar normal
Art on	Control bar + print/data output/start function

2.2.3 Sector "rESEt"

Resetting to default parameters (black):

– Press key and keep pressed until — YES — -End- — 0 888 g appears.

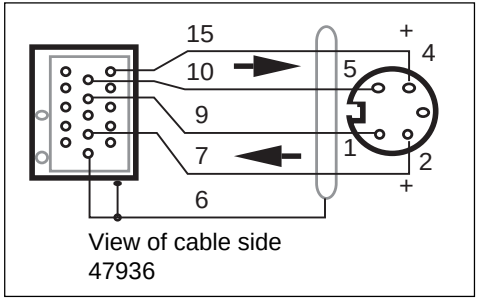
2.3 Attaching units with current loop interface



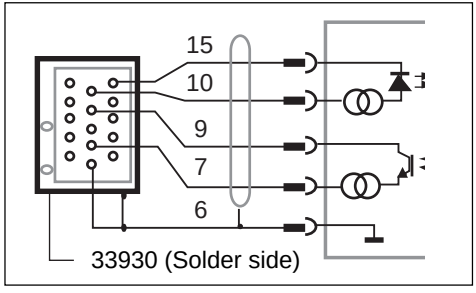
You will find a complete list of all cables in the brochure “Applications, Technical Data, Accessories METTLER TOLEDO AM/PM/SM Balances and Scales”.

The METTLER TOLEDO **GA44** Printer can be attached directly. The cable is enclosed with the printer (for additional cables: Order number 47926).

The balance should be configured with the default values.



For the attachment **of other METTLER TOLEDO units** with CL interface (solder side) the 47936 cable must be ordered. The illustration shows the wiring.



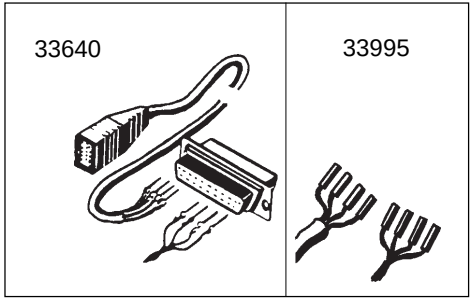
A **non-METTLER TOLEDO unit** can be attached to the BB balance as shown in the illustration. The non-METTLER TOLEDO unit must take over the power supply of the CL interface and here it is essential that the limiting data described in section 3.3 are observed. The I/O balance connector (“MiniMETTLER”) can be ordered as an accessory: 33930.

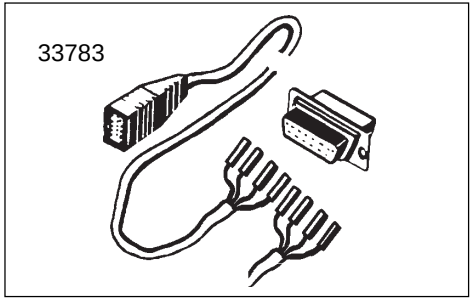
2.4 Attaching units with RS232C interface

You will find a complete list of all cables in the brochure “Applications, Technical Data, Accessories METTLER TOLEDO AM/PM/SM Balances and Scales”.

Prepared cables are available for the following units:

Printer	**EPSON**	**P-40**	Order No.	33688
Computer	**EPSON**	**PX-4**		33982
		HX-20		33955





For **other units** with an RS232C interface, **cables with freely attachable contacts** can be ordered. One end of the cable carries the permanently attached I/O balance connector, the other end the connector with the freely attachable contacts.

	Order No.
Cable set with 25-pin connector (male), e.g. for printer	33640
Cable set with 25-pin coupling (female), e.g. for IBM-PC, IBM-XT	33995
Cable set with 9-pin coupling (female), e.g. for IBM-AT, Toshiba T1000	33783

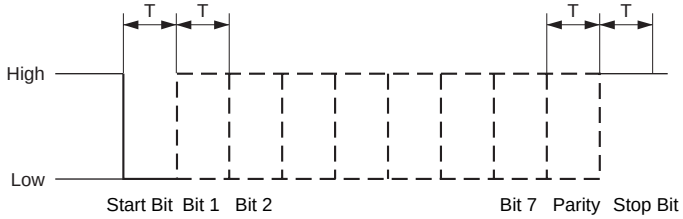
Depending on whether the unit to be attached is a data terminal unit (DTE see also 3.4) or a data communications unit (DCE), the cable must be wired as follows:

		Connector, view from cable end			
		11 6 1	1 13 14 25	1 5 6 9	
Balance	Description of the function	DTE	DCE	DTE	DCE
2, green	data (commands) for balance		2	3	3 2
12, brown	data from balance	3	2	2	3
13, white	signal ground	7	7	5	5
3, yellow	handshake for balance	4/20	5/6	4/7	6/8
	short-circuiting link (optional)	20/4	6/5	7/4	8/6
		5	4	8	7
		6	20	6	4
		8		1	

3. Interface

3.1 How does the interface function?

Serial data transmission



The data are transmitted serially, i.e. character by character one character after the other. Each character is represented by a 7-bit binary code. The individual bits of the character are also transmitted serially. A wire pair thus suffices for the data transmission in one direction.

In the idle state (no data transmission), the relevant data line is active (20 mA quiescent current with current loop, potential “high” with RS232C).

The transmission of a 7-bit character is initiated with a start bit (transition from 20 to 0 mA or “high” to “low”) followed by the 7 data bits. The order of the data bits starts with the least significant bit (LSB) and ends with the most significant bit (MSB).

A subsequent parity bit allows the correctness of the data transmission to be checked. It is added to the number of “1’s” of the data bits of a character to make an even or odd number (even or odd parity).

The 10th bit (stop bit) is again “high” and shows the end of the transmission for this character. A chain of characters transmitted successively is called a data string.

The AM/PM/SM interface

The balance has an RS232C voltage-controlled data interface and a passive 20 mA current loop interface (CL), both led out to the DATA I/O socket.
These interfaces can be used both unidirectionally and in bidirectional full duplex operation.
The data outputs of both interfaces operate in parallel. Both outputs can be used at the same time, but only one input either CL or RS232C.

The data inputs are ready to receive as soon as the display has been switched on. The data outputs remain blocked until the start routine is complete.

Transmission principle: serial by bit, asynchronous (1 start bit), 7-bit code ASCII ISO646 + parity bit, 1 stop bit (receive), 2 stop bits (send)

In bidirectional operation, switching off the other device or a break in the interface cable (BREAK) resets the balance/scale to the configured status. In other words, all functions that have been triggered by commands via the interface (transmission mode, tare preset, text display, etc.) are reset.

Configuration of the interface parameters is described in section 2.2.

Operating modes:
- **Free Mode**
- **Handshake Mode**
  Software handshake according to “Technical Information Bulletin” TIB: “The METTLER TOLEDO CL Interface”. Order No. in section 3.3 “General information regarding METTLER TOLEDO CL interface”.

These operating modes can also be used for the RS232C interface.

Matching of data supply and demand between balance and unit to be attached

Data losses can selectively be prevented as follows without the need for handshake lines:

1. With the **handshake mode** (software handshake)
2. With an **adjustable pause** time between the data strings of up to 2 seconds.
3. By **selective request** of the weighing result with the command SI $^{C_R L_F}$. If the balance can not provide a valid result, it sends “SI” immediately. The controlling computer is thus informed at all times that it must once again request a measured value.

The hardware handshake described in what follows also offers a possibility to control the data flow.

3.2 Hardware handshake RS232C

With the aid of a separate signal line (DATA I/O socket pin 3, connection cable yellow litz wire), the transmission of data via the RS232C interface of the AM/PM/SM balances can be “curbed”, i.e. the balance sends data only if the attached device reports operational readiness. The attached device must have handshake functions and be wired in accordance with section 2.4.

The signal is evaluated when “PAUSE H” has been set in the configuration and when the line is actually wired up.

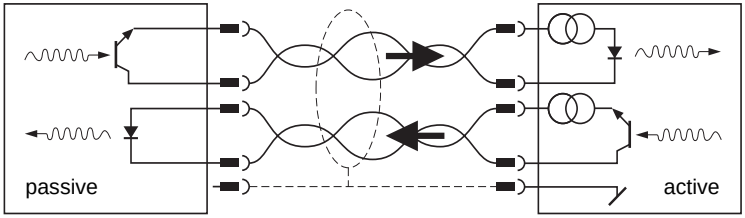
If a positive voltage is applied to the handshake line or if it is open, the balance sends. In the case of a negative voltage it does not send. If the level changes from positive to negative during a transmission, maximum 2 additional characters are transmitted.

If this handshake function is used, the data output may not be triggered with an auxiliary switch as described in section 4.2.

3.3 General information regarding CL interface

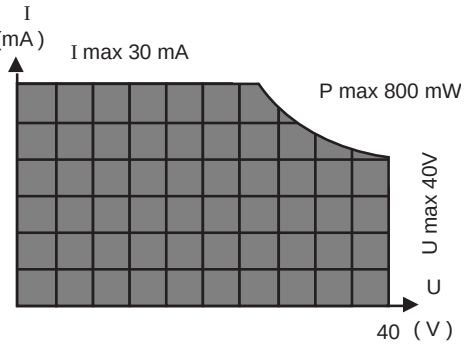
The CL interface of the balance is primarily suitable for transmissions over relatively long distances (> 15 m) or for operation of the balance in the case of severe power line disturbances. It is completely separated galvanically from the balance by an optocoupler and thus prevents the intrusion of disturbances in the electronics.

The CL interface has two passive transmission loops independent of each other.



The passive current loops of the balance must thus be supplied by external current sources. To avoid damage to the CL interface by these external current sources, it is essential to observe the following limiting data:

The U/I characteristic of the source must lie within the hatched area.



The interfaces of the METTLER TOLEDO units require the following specifications:

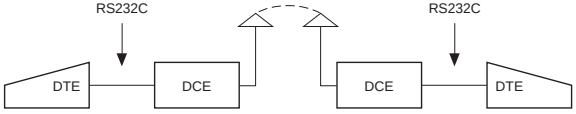
- voltage excursion of source 15 V (+10%/–0%)
- current (high) between 18 mA and 24 mA
- rate of change 2...20mA/µs
- cable: shielded, twisted pairs,
  0,14 mm^2, 125 ohm + 130nF/km
  max. length: 1000 m/300 baud, 500 m/2400 baud

For further information see also “The METTLER TOLEDO CL Interface”,
720106 (German), 720107 (English), 720108 (French), 720109 (Spanish).

3.4 General information regarding RS232C interface

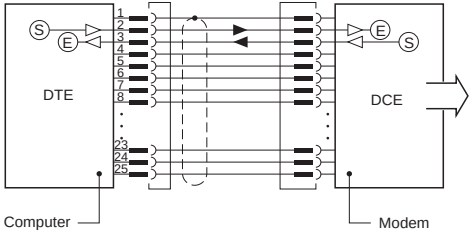
Voltage-controlled interface in accordance with the standards EIA RS232C, DIN 66020. These standards conform to the CCITT recommendations V.24 and V.28.

A distinction is made between two types of equipment:
– Data Terminal Equipment (DTE), e.g. teleprinter, printer, IBM-PC
– Data Communications Equipment (DCE), e.g. modem, transmitter



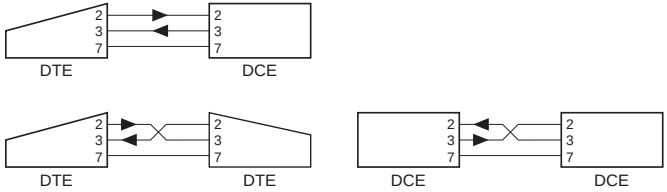
The RS232C interface was originally conceived to link such data terminal equipment with data communications equipment. The lines and signals have been designed for this original configuration, which is still in use today.

Example:



– A DTE unit sends its data via connection 2 (data direction DTE → DCE).
– A DCE unit sends its data via connection 3 (data direction DCE → DTE)

For short distances (< 15 m) where data highways are not practical, the RS232C interface is also used for any two units, i.e. the combinations DTE – DTE and DCE – DCE are entirely possible. Certain signals and lines can be omitted in such cases. A minimum configuration can be implemented with two (unidirectional operation) or three lines (bidirectional operation).



In addition to the above-mentioned interface lines the most common handshake lines are shown below:

DTE	1	Protective Ground		1
	2	Transmit Data	TxD →	2
	3	Receive Data	RxD ←	3
	4	Request to Send	RTS →	4
	5	Clear to Send	CTS ←	5
	6	Data Set Ready	DSR ←	6
	7	Signal Ground	GND	7
	8	Data Carrier Detect	DCD ←	8
	20	Data Terminal Ready	DTR →	20

DCE

The definition of the above terms is from the angle of the DTE.

4. Data output

4.1 Initiating the data output

The balance has always a current weighing result available that can either be stable or unstable, valid or invalid. All four combinations are possible.

Depending on the application, the data output can be initiated in the following ways:

– Print key or control bar of the balance
– external print key (auxiliary switch or “PRT” key on GA44)
– automatic operation (configuration: “S.Auto”, “S.Cont”)
– commands via the interface (send commands)
– loading or unloading the balance (send commands “SR”, “SNR”)

The **default setting** for the data transmission mode is:

S. Stb A stable single value is transmitted if the data transmission has been triggered by a key.

The transmission mode can be modified in the **configuration register** (I-Face), (see also section 2).

S. All A current single value (stable or unstable) is transmitted if the data transmission has been triggered by a key.

S. Auto A stable value is automatically transmitted after every load change. (Magnitude of change, see Table under SNR command, section 5.5.)

S. Cont All values are transmitted automatically in step with the configured pause – with “Pause 0” in step with the display update speed, see also SIR command, section 5.6 – or with handshake.
Nonstable weighing results are marked in the identification block with “SD” with stable ones with “S␣” (see section 4.2, Data format).

In bidirectional operation these transmission modes can be selected **via the interface** with send commands (see section 5), irrespective of the configured transmission mode.

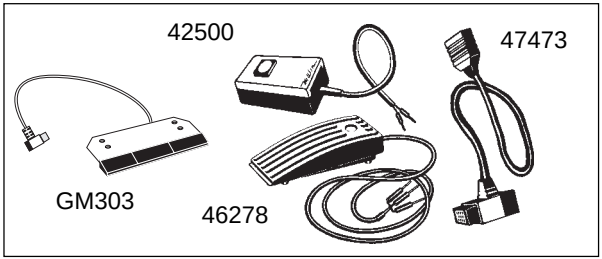
Transmission mode	corresponding send command
S. Stb *	S
S. All *	SI
S. Auto	SNR
S. Cont	SIR

* initiate transmission with key

In the case of an interface break, the transmission mode is lost if it has been selected via the interface. On the other hand, the configured transmission mode remains stored until a new one is configured.

Note: The default setting for the **pause** between the data strings is 1 second (for GA44 Printer). In the case of operation with a computer this pause is too long. Therefore, in most cases, it has to be configured at (0).

4.2 Data output using auxiliary switch



The data output can be initiated by a hand or foot switch.
If a hand switch is needed directly at the balance for the AM/PM balances, the GM303 Control Unit can be installed.
If the switch has to be positioned somewhat apart from the balance, a separate hand or foot switch can be used.
An adapter cable is also needed for the attachment of this switch. This extends the I/O interface socket of the balance to the rear and carries a 2-pin socket on a Tee joint for attachment of a hand or foot switch.

Adapter cable	Order No.	47473
Hand switch		42500
Foot switch		46278

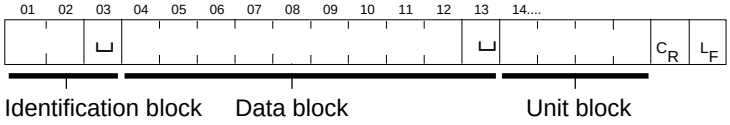
If the data output is triggered using the auxiliary switch (or by means of the PRT key at the GA44 Printer), the handshake function described in 3.2 is not possible.

4.3 Data format

Format of weighing result

Each valid weighing result is available at the data output in a standard format. The data string can be divided into three blocks. It is always terminated with Carriage Return ($^{C}_{R}$) and Line Feed ($^{L}_{F}$).

␣ = (Space)



Char.	Information	Code	Explanation
01	Type of data initiation	␣	triggered from the **balance** with auxiliary switch or print key, or animal weighing, triggered in any way
		S	triggered via the **interface** with Send commands or balance in the "Send Continuous" mode ("S.Cont")
02	Status messages	␣	stable result
		D	unstable result (dynamic)
		*	animal weighing[1)]
04…12	Weighing result	x	9 characters, result right-aligned including sign "–" directly in front of the first numeral, decimal point; leading zeros are replaced by spaces. Outside the DeltaRange or if unstable results, the last digit is shown as a ␣. Drops therefore the decimal point, it will be replaced by ␣.
14...	Weighing unit	x	0…4 characters, terminated immediately with $^{C}_{R}$ $^{L}_{F}$: g or one of 10 other units, depending on requirements.

Example:
SD␣␣␣␣-24.37␣g $^{C}_{R}$ $^{L}_{F}$

[1)] * can be replaced by ␣, if "Au on" is configured in sector I-FACE.

Messages on invalid weight result

In special operating modes (e.g. during overload, underload, error message etc.) the balance can not provide a valid weight result. It thus sends only a status message. This also indicates whether the data output has been initiated by means of a key or command or configuration.

Status messages on initiation by means of a **key** (“Print”, “PRT”, auxiliary switch) and configuration **“S. All”**or **“S. Cont.”** :

␣I $^{C_R}{}_{L_F}$	invalid result[2)]
␣I + $^{C_R}{}_{L_F}$	overload
␣I - $^{C_R}{}_{L_F}$	underload

Status messages on initiation of the data output by means of **commands** or through the transmission mode **“S.Cont”:**

SI $^{C_R}{}_{L_F}$	invalid result[2)]
SI + $^{C_R}{}_{L_F}$	overload
SI - $^{C_R}{}_{L_F}$	underload

If the balance transmits neither a result nor a status message after initiation of the data output, this means that it is waiting for a stable weight value.

[2)] e.g. data transfer during taring process which could not be completed because of instability

General status messages

TA $^{C_R}{}_{L_F}$	Message in bidirectional operation of the balance: The automatic taring process after switching on the balance is complete or taring has been performed with a key.
CB␣< Text > $^{C_R}{}_{L_F}$	Response on calibration
STANDARD ␣␣␣V10.50.00 $^{C_R}{}_{L_F}$	Start message, software version
Error messages	→ section 8

Examples of printouts

Configuration **“S. Cont”**

```
********************

Standard   V10.50.ØØ
S       -Ø.Ø2 g
SI
TA
S        Ø.ØØ g
SD       8.2  g
SD     2ØØ.4  g
SI+
S      195.47 g
S      195.46 g
```

Configuration **“S. All”**

```
********************

Standard   V10.50.ØØ
        -Ø.Ø5 g
 I
         Ø.ØØ g
 D      17.8  g
        19.25 g
        19.24 g
        19.24 g
```

5. Commands to control the balance

5.1 General information regarding command set

AM/PM/SM balances with full duplex interfaces can not only send weighing results but also receive control commands at the same time. These commands are described in what follows.

Entry of cammands

After software version STANDARD V10.42, uppercase or lowercase letters can be used for commands.

Each command must be terminated with the character sequence CARRIAGE RETURN ($^{C}_{R}$) und LINE FEED ($^{L}_{F}$).

Per command, maximum 64 text characters are possible incl. $^{C}_{R}$ $^{L}_{F}$.

A command without associated parameters generally resets the appropriate function.

Note: Simple examples for application programs can be found in section 7.

The following symbols are used in this section:

␣	space
: =	definition
parameter	parameter
[ ]	optional

Interface commands and applications

Commands that intervene in an application, abort this application.

For example, the U command terminates the unit switching by means of the control bar. The D, DY and B commands terminate piece counting (Stk, PCS) and percent calculation (%).

Switching on the balance

In bidirectional operation of the interface the handshake is set up on startup before the switch-on zero has been determined. It is thus essential that the computer waits for the message “TA” from the balance before it sends commands. Otherwise, it must be anticipated that, e.g. SR and B commands are overwritten during this operation.

Communication failures

Commands that could not yet be executed are overwritten by newly received ones, i.e. they are lost.

A BREAK condition (see section 3) clears all commands and the balance again behaves as if it had been switched off and then on.

If the balance has not received a command properly or can not evaluate or execute it, it sends an appropriate error message (see section 4.3).

5.2 Cmd**:** **S** (Send value)

Format: **S** $^{C_R}{}_{L_F}$

Function: **The balance sends the next possible stable weighing result.**

Notes: On stability, the current result is sent immediately.
With “S $^{C_R}{}_{L_F}$” send commands previously transmitted can be cancelled by overwriting.

Example:

Computer		**Balance**
S $^{C_R}{}_{L_F}$	→	
		↓
		stability
		↓
	←	S␣␣␣␣100.00␣g $^{C_R}{}_{L_F}$
		or on overload
	←	SI+ $^{C_R}{}_{L_F}$
		or on underload
	←	SI- $^{C_R}{}_{L_F}$

5.3 Cmd**:** **SI** (Send Immediate value)

Format: **SI** $^{C_R}{}_{L_F}$

Function: **The balance sends the current weighing result.**

Note: Unstable results are marked with the status message “D” (dynamic); with valid results “SI” is transmitted. (→ 4.3 Data format).

Example:

Computer		**Balance**
SI $^{C_R}{}_{L_F}$	→	
	←	SD␣␣␣␣98.54␣g $^{C_R}{}_{L_F}$
		or on stability
	←	S␣␣␣␣100.00␣g $^{C_R}{}_{L_F}$
		or if invalid
	←	SI $^{C_R}{}_{L_F}$
		or on overload
	←	SI+ $^{C_R}{}_{L_F}$
		or on underload
	←	SI- $^{C_R}{}_{L_F}$

5.4 Cmd**:** **SR** (Send value and Repeat)

Format: **SR [␣*threshold*] $^{C_R}\,^{L_F}$**

Function: **The balance sends the next possible stable result and then on each load change of a certain magnitude a dynamic and the subsequent stable result.**

Parameter: The magnitude of the load change can be entered in absolute terms as a *threshold* value, in the weight unit selected under “Unit 1”, numerical value at least 3d*.) If only “SR $^{C_R}\,^{L_F}$” is entered, the magnitude is 12.5% relative to the last stable value or at least 30d*.

Notes: The entry of a threshold value is advisable primarily in automatic additive weighing operation. Here, an absolute response threshold is necessary since with “SR $^{C_R}\,^{L_F}$” the threshold fixed as a relative value would increase with increasing total weight.

This automatic transmission mode remains in force until the balance receives some other send command or the interface experiences a break.

* d = digit = smallest display increment

Example:

Computer		**Balance**
SR $^{C_R}\,^{L_F}$	→	↓
		stability
	←	S␣␣␣␣100.00␣ g $^{C_R}\,^{L_F}$
		↓
		deflection
	←	SD␣␣␣115.78␣ g $^{C_R}\,^{L_F}$
		↓
		stability
	←	S␣␣␣␣150.00␣ g $^{C_R}\,^{L_F}$
		etc.

Certified balances: The SR command leads to the error message “EL”. However, it is usable after configuration “Au on”.

If *threshold* is not added, the load change is 25% or 30 d.

5.5 Cmd: SNR (Send Next value and Repeat)

Format: **SNR** $^{C_R}\,^{L_F}$

Function: **The balance sends the next stable result and then after every load change automatically a further stable result.**

Notes:

Readability balance (g)	0,0001	0,001	0,01	0,1	1
Load change (g) ≥	0,2	1	1	1	5

In contrast to the SR command no dynamic values are transferred.

This automatic transmission mode remains in force until the balance receives any other type of send command or the interface experiences a break.

Example:

Computer		**Balance**
SNR $^{C_R}\,^{L_F}$	→	↓
		stability
	←	S␣␣␣␣100.00␣ g $^{C_R}\,^{L_F}$
		↓
		deflection min. 1 g
		↓
		stability
	←	S␣␣␣␣150.00␣ g $^{C_R}\,^{L_F}$
		etc.

Certified balances: This command leads to the error message “EL”. However, it is usable after configuration “Au on”.

5.6 Cmd: SIR (Send Immediate value and Repeat)

Format: **SIR** $^{C_R}\,^{L_F}$

Function: **The balance sends in every case the current result and then automatically all further results, at a maximum rate in step with the balance display (i.e. approx. every 130 ms; SW < 10.50 every 160 ms).**

Notes: Particularly suitable for dynamic weight determination. Owing to the large data volume of the balance the baud rate must be correspondingly high if no value is to be lost.

If a printing interval of 0.0 has not been configured, the transmit clock corresponds to the pause time (1 or 2 seconds). Intermediate values are lost.

This automatic transmission mode remains in force until the balance receives any other type of send command or the interface experiences a break.

Example:

Computer		**Balance**
SIR $^{C_R}\,^{L_F}$	→	
	←	SD␣␣␣␣98.54␣ g $^{C_R}\,^{L_F}$
	←	SD␣␣␣␣95.76␣ g $^{C_R}\,^{L_F}$
	←	SD␣␣␣␣95.32␣ g $^{C_R}\,^{L_F}$
	←	S␣␣␣␣␣95.40␣ g $^{C_R}\,^{L_F}$
		etc.

5.7 Cmd: **T** (Tare)

Format: **T ^{C_R} $_{L_F}$**

Function: **With this command, taring can be performed via the interface and the balance switched on again after a power outage.**

Notes: If an SI or an SIR command follows a T command while the balance is still waiting for stability, it returns “SI”.
If no stable condition has been attained after approx. 10 s, the error message “EL” follows.

With the AM/PM balances, –OFF– appears in the display after a power outage. The balance can be switched on again with "T ^{C_R} $_{L_F}$"

The time needed for taring can vary; no acknowledgement is sent when it is complete. In the case of overload/underload, taring can not be performed. The error message “EL” is sent immediately.

Example:

Computer		**Balance**
T ^{C_R} $_{L_F}$	➞	Instability:
		– – – – – – (wait)
		Stability: 0.00 g

5.8 Cmd: **TI** (Tare Immediately)

Format: **TI ^{C_R} $_{L_F}$**

Function: **The balance is tared immediately without waiting for stability.**

Notes: Applications for this command are:
– Taring of the balance during a consumption measurement or during a continuous dispensing operation.
– Taring from a computer that defines the stability criterion itself.
– Taring in an externally clocked system.

If taring is by chance performed below the startup zero point the balance must store this zero point again. As here a high stability is necessary; taring can take up to 12 s. No acknowledgement follows when the operation is complete.

Example:

Computer		**Balance**
TI ^{C_R} $_{L_F}$	➞	Unstable or stable state:
		0.00g

5.9 Cmd: **B** (Base)

Format: **B [␣*offset*] $^{C_R}{}_{L_F}$**

Function: **After receipt of this command the balance continuously subtracts the value *offset* from all weighing results (tare preset).**

Parameter: *offset* : =
Numerical value, max. 7 digits.
Enter sign only for negative values. "B $^{C_R}{}_{L_F}$" cancels the command.

offset refers to the unit that has been programmed in the configuration under Unit 1. The value must lie within the admissible weighing range, i.e.
offset + tare weight = 0…maximum load.

offset is rounded off to the balance resolution before calculation.

Notes: The tare symbol appears in the display. Taring cancels the offset command. If the offset value is outside the weighing range, the error message "EL $^{C_R}{}_{L_F}$" will be transmitted.

Example:

Computer	**Balance**
	Display: 0.00 g
	↓
B␣100 $^{C_R}{}_{L_F}$ →	Display: -100.00g

5.10 Cmd: **U** (Unit)

Format 1: **U [␣*unit*] $^{C_R}{}_{L_F}$**

Function: **Selection of the weight unit.**

Parameter: *unit* : =
g, kg, lb, oz, ozt, tl, GN, dwt, ct, C.M., k., no entry (no display of unit, Display value in the base unit of the balance.

Entry of "U $^{C_R}{}_{L_F}$" only cancels the U command and switch back to the unit which is configured under Unit 1.

Uppercase letters can also be entered.

Note: The entered U command remains active until it is overwritten by another command or the interface experiences a break.

Example:

Computer	**Balance**
	Display: 2054 g
	↓
U␣kg $^{C_R}{}_{L_F}$ →	Display: 2.054 kg

Certified balances: As *unit*, only units allowed by the respective Bureau of Standards can be selected.

Format 2: **U [*dec*] ␣*divisor* [␣*name* [␣*step*]] ^{C_R} ^{L_F}**

Function: **Definition of a weight unit with self-selected divisor (scaling)**.

Parameters: *dec* : =
Number of places after the decimal point (truncated if weighing result more accurate than resolution allows).

divisor : =
Number which divides all weighing results referred to the unit configured under “Unit 1”. Magnitude at least 1 d (smallest readout increment).

name : =
#, PCS for display “PCS”
STK, Stk for display “Stk”
% for display “%”

step : =
Readout increment in digits: 1, 2, 5, 10, 20, 50, 100

Notes: *dec*, *divisor*, *name* and *step* can be used according to requirements.

Without entry of *dec*, the converted values are outputted with the maximum number of places after the decimal point allowed by the balance.

With no entry of the *name*, no unit is either displayed or transmitted.

step should always be specified with balances with DeltaRange (recallable fine range).

Example: Programing of the balance/scale as a piece counter with the piece weight entered as divisor.

Computer	**Balance/scale**
	Load 1 PCS
	↓
	123.4 g
U 0␣123.4␣PCS ␣1 ^{C_R} ^{L_F} →	1 PCS
	Load 50 PCS
	↓
	50 PCS

Certified balances: The U command leads to the error message “EL”. However, it is usable after configuration “Au on”.

5.11 Cmd: **MI** (Modify ambient vibration) after SW version 10.42

Format: **MI [␣*number*] $^{C}_{R}$ $^{L}_{F}$**

Function: **Setting the vibration adapter**
(configuration of the balance via the interface)

Parameter:

number : =		Balance display
1	Very stable surroundings short weighing time	
2	Normal surroundings (default setting)	
3	Unstable surroundings relatively long weighing time	

"MI $^{C}_{R}$ $^{L}_{F}$" resets the vibration adapter to the default setting.

Note: The weighing time also depends on the balance model, readout increment and on whether the animal weighing mode has been selected.

Example:

Computer	**Balance display**
MI␣3 $^{C}_{R}$ $^{L}_{F}$ ➡	

5.12 Cmd: **ML** (Modify display adaption) after SW version 10.42

Format: **ML [␣*number*] $^{C}_{R}$ $^{L}_{F}$**

Function: **Setting the weighing process adapter and selection of the animal weighing mode or start of animal weighing** (configuration of the balance via the interface)

Parameter:

number : =		Balance display
1	In dispensing, all decimal places are always displayed	
2	In dispensing/weighing, the last decimal place is suppressed until stability (default setting) except if “dd off” has been selected	
3	Absolute weighing, - - - - - - is displayed during weighing until stability	∞
4	Select animal weighing mode or start animal weighing	

Entry of "ML $^{C}_{R}$ $^{L}_{F}$" resets the weighing process adapter to the default setting.

Notes: When used for the first time, the command "ML␣4" selects the animal weighing mode; in all other cases it starts an animal weighing.

The cycle time is selected with the MI command:

approx. 4 s approx. 6 s approx. 8 s

The result is marked with "␣" for identification if the configuration has not been changed with "Au on".

Example:

Computer		**Balance display**
ML␣1 ^{C_R} ^{L_F}	➞	∞

5.13 Cmd: **MS** (Modify stability detection) after SW vers. 10.42

Format: **MS [␣*number*]** ^{C_R} ^{L_F}

Function: **Setting the automatic stability detection** (configuration of automatic stability detection "ASd" via the interface)

Parameter: *number* : =

1 Coarse for good weighing results not with standing unstable surroundings; the balance recognizes stability despite small fluctuations.

2 Default setting

3 Fine

4 Very fine, for best weighing results in stable surroundings; the balance recognizes stability only if the fluctuations remain very small.

"MS ^{C_R} ^{L_F}" resets the stability detection to the default setting.

Example:

Computer		**Balance display**
MS␣4 ^{C_R} ^{L_F}	➞	

As soon as the surroundings are completely stable, the ASd indicator disappears.

5.14 Cmd: **MZ** (Modify Auto Zero) after SW version 10.42

Format: **M Z [␣*number*] ^{C_R} $_{L_F}$**

Function: **Off/on switching of Auto Zero** (configuration of Auto Zero “AZ” via the interface)

Parameter: *number* : =

0 off

1 on (default setting)

"MZ ^{C_R} $_{L_F}$" resets Auto Zero to the default setting

Notes: Auto Zero corrects zero point drifts or contamination of the weighing pan automatically, but only in the range of the internal decimal places not displayed.

Conditions for response of Auto Zero are:

Balance display must show 0000000 and ASd indicator must have blanked out for at least one weighing cycle (depends on balance model).

Example:

Computer		**Balance display**
MZ␣0 ^{C_R} $_{L_F}$	➡	no visible effect (the zero point is no longer automatically corrected)

5.15 Cmd: **MA** (Modify DeltaDisplay) after SW version 10.42

Format: **MA [␣*number*] ^{C_R} $_{L_F}$**

Function: **Off/on switching of weighing-in aid** (configuration of the DeltaDisplay “dd” via the interface)

Parameter: *number* : =

0 off

1 on (default setting)

"MA ^{C_R} $_{L_F}$" resets the weighing-in aid to the default setting.

Note: At the start of weighing-in during rapid dispensing, the DeltaDisplay suppresses the last place of the balance display. In fine dispensing, it is switched on again.

Example:

Computer		**Balance display**
MA␣^{C_R} $_{L_F}$	➡	In dispensing/weighing the last decimal place is suppressed until fine weighing-in.

5.16 Cmd: **M** (Modified settings reset) after SW version 10.42

Format: **M ^{C_R} ^{L_F}**

Function: **Simultaneous resetting of all M commands to the default setting**

Notes: For all M commands, it generally holds that they should not be used dynamically.

When an interface break (BREAK) occurs, the settings made with the M commands are lost. In contrast to the send commands, the settings are reset to the default setting and not to the values configured using the Menu key.

Example:

Computer		**Balance**
M ^{C_R} ^{L_F}	➡	Default setting of all configurations initiated via the interface

5.17 Cmd: **ID** (Identify)

Format: **ID ^{C_R} ^{L_F}**

Function: **The balance sends its identification (3 lines):**

< Software Version >
TYPE: < balance type >
INR: < identification number >

Example:

```
STANDARD     V10.50.00 CR LF
TYPE  :    PM 4600 CR LF
INR   :      720889 CR LF
```

5.18 Cmd: **CA** (Calibrate) after SW version 10.45

Format: **CA** $^{C_R}\,_{L_F}$

Function: **The balance is calibrated.**
With balances without a built-in (internal) calibration weight, the value of the (external) calibration weight to be loaded appears in the display. The following display 0.000 g signals that the balance should be unloaded.

The progress of the calibration is reported via the interface.

Computer		**Balance**
CA $^{C_R}\,_{L_F}$	→	busy
	←	CB␣␣␣– – – – – – – $^{C_R}\,_{L_F}$
	↓	
	* ←	CB␣␣␣␣0.000␣ g $^{C_R}\,_{L_F}$ if loaded, balance must be unloaded
	↓	
	* ←	CB␣␣␣200.000␣ g $^{C_R}\,_{L_F}$ load calibration weight
	↓	
	* ←	CB␣␣␣␣0.000␣ g $^{C_R}\,_{L_F}$ unload balance
	↓	
	←	CB␣1 $^{C_R}\,_{L_F}$ successful or
	←	CB␣0 $^{C_R}\,_{L_F}$ unsuccessful or
	←	EL $^{C_R}\,_{L_F}$ inadmissible

* These steps are unnecessary with balances with an internal calibration weight.

5.19 Cmd: **D** (Display)

Format: **D ␣*text* [; *unit* [*symbol*]]** $^{C_R}\,_{L_F}$

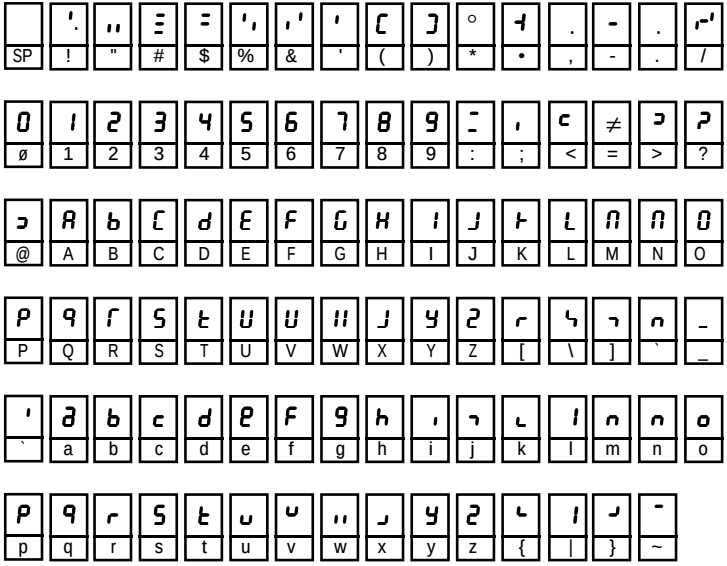
Function: **A text combined with a weight unit and a weight symbol is displayed. "D** $_x{}^{C_R}\,_{L_F}$**" clears the display, "D** $^{C_R}\,_{L_F}$**" frees it again for the weight display.**

The balance continues to operate normally during the display. The execution of send commands is not affected.

Parameter: *text* : =
All printable characters of the ISO646 code table. The limited representation by the 7-segment display should be taken into account.
text is shown left justified. If *text* is longer than the balance display allows, the **section first inputted** is cut off.

Representation of text characters in balance display

The following table shows the 7 segment display for all 95 printable characters of the ISO 646 code table.



unit : =	Balance display
U	g (kg, lb, …; selected unit)
#, PCS	PCS
STK,Stk	Stk
%	%

symbol : =	Balance display
B	B (brutto = gross)
N	N (net)
T	T (tare)
G	G (gross)

Note: While the D command is effective, a * is shown in the top left of the display. It indicates that the display is no longer linked with the balance, but is controlled via the interface.

Examples:

Computer	**Balance display**
	400.0 g
D␣ Prog . 5 $^{C_R}{}_{L_F}$ →	* Pro9. 5
	N
D␣ 285.94; UN $^{C_R}{}_{L_F}$ →	* 285.94 g

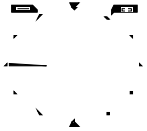
Certified balances: For *unit* only “U” can be selected if “Au on” has been configured beforehand.

5.20 Cmd: **DY** (Display Y)

Format: **DY [␣*target* [␣*tol 1* [␣*tol 2*]]] $^{C}_{R}$ $^{L}_{F}$**

Function: **Entry of target weight and tolerances for checkweighings or dispensing weighings with the DeltaTrac.**

Function: The DeltaTrac is controlled so that it supports dispensing and checkweighings by analog, optical signals.



2 tolerance vanes appear above the DeltaTrac and show the admissible limits of the weight deviation.

During weighing-in, a coarse indicator moves from 9 o-clock in the direction of 6 o-clock and a fine indicator from 9 o-clock in the direction of 12 o-clock.

When the fine indicator is between the two tolerance vanes, the target weight has been reached with the selected accuracy.

Parameters: *target* : =
Target weight; numerical value, max. 7 digits, decimal point as required, minimum value 100 d.

tol. : =
Admissible deviation from target weight, min. 2.5 d

Definition	**Weight deviation** downward (-)	upward (+)
none	-2,5%	+2,5%
tol 1	*tol 1*	*tol 1*
tol 1 and *tol 2*	*tol 2*	*tol 1*

target and *tol* refer to the weight unit configured under "Unit 1".

"DY $^{C}_{R}$ $^{L}_{F}$" resets the DeltaTrac to the usual dynamic graphic indicator.

Example: **Computer**

DY␣ 200␣18␣9 $^{C}_{R}$ $^{L}_{F}$ ➡

Balance display
DeltaTrac range from 6 to 12 o-clock corresponds to 200 g, fine indicator at –tolerance vane means weight deviation = –9 g, at +tolerance vane = +18 g.

Notes: A possible tare preset with the aid of the B command must be added to the target weight.
A subsequent DX command clears the DY command.

5.21 Cmd: **DX** (Display X) after SW version 10.42

Format 1: **DX [␣*number* [␣*number*]] [␣T] ^{C_R} ^{L_F}**

Function: **Control of one or two indicators and the tolerance vanes of the DeltaTrac**

Format 2: **DX [␣*number* [- *number*]] [␣T] ^{C_R} ^{L_F}**

Function: **Control of a range between two indicators and the tolerance vanes of the DeltaTrac**

Parameter: *Number* : =

Natural number in the range 0…59, corresponding to the minutes of a clock.

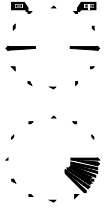
"DX ^{C_R} ^{L_F}" fades out the controlled indicators.

Notes: The DX command is intended for a static display. For dynamic control of the DeltaTrac as a weighing-in aid etc., DY should be used.

A DY command following a DX command clears the DX command.

Examples: **Computer** **DeltaTrac**

DX␣15␣45␣T ^{C_R} ^{L_F} →



DX␣15 - 23 ^{C_R} ^{L_F} →

5.22 Cmd: **W** (Write)

Format: **W ␣*s0* [␣*t1* ␣*s1* … ␣*t4* ␣*s4*] ^{C_R} $_{L_F}$**

Function: **Control of a GM54 Output Module or an LV10 Automatic Feeder attached to the GM socket.**
The 8 output contacts are closed/opened with the 8-bit status word *s0*. If required, it can be overwritten after time *t1* with the status word *s1*. The W command thus allows up to 4 status changes to be preprogrammed.

Parameter: *s (status)* =:
Decimal value between 0…255, corresponding to the 8-digit binary number which opens/closes the output contacts C_0…C_7. Contact closed = binary value 1.

Example:

Contact	C_7	C_6	C_5	C_4	C_3	C_2	C_1	C_0
Status	off	off	off	off	off	off	**on**	**on**
Binary numb.	0	0	0	0	0	0	1	1
s								3

Calculation of *s*:

Contact	C_7	C_6	C_5	C_4	C_3	C_2	C_1	C_0
Dec. value	128	64	32	16	8	4	2	1

Parameter: *t (time)* =: 25…65535 (ms)
Accuracy: ± 3%, max. ± 50 ms

Note: "W ^{C_R} $_{L_F}$" or an interface break opens all contacts. If the computer sends a second W command to the balance before the first has been executed, the first is overwritten.

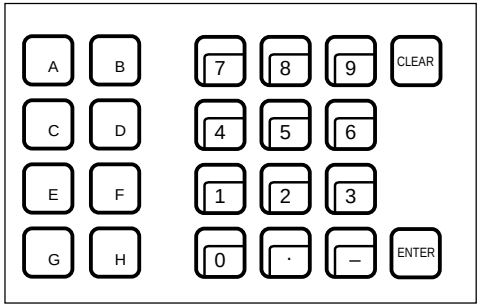
Example 1: **Computer** W␣1␣500␣130 ^{C_R} $_{L_F}$

→ **GM54 Output module**
C_7 C_6 C_5 C_4 C_3 C_2 C_1 C_0
---
off-off-off-off-off-off-off-**on**
500 ms
↓
on-off-off-off-off-off-**on**-off

Example 2: **Computer**
W␣255␣100␣ 2 ␣200␣8␣300␣ 32␣400␣128 ^{C_R} $_{L_F}$

→ **GM54 Output module**
C_7 C_6 C_5 C_4 C_3 C_2 C_1 C_0
---
on-on-on-on-on-on-on-on
100 ms
↓
off-off-off-off-off-off-**on**-off
200 ms
↓
off-off-off-off-**on**-off-off-off
300 ms
↓
off-off-**on**-off-off-off-off-off
400 ms
↓
on-off-off-off-off-off-off-off

6. DataPac-M



DataPac-M keypad

6.1 DataPac-M terminal

The DataPac-M terminal has three key fields:

– Function keys **A…H**, independent of the other keys.
– Numeric keypad **0…9** with decimal point and sign – (These keys can also be programmed as additional function keys.)
– Correction key **CLEAR** and termination key **ENTER**, the latter can also be programmed as a PRINT key.

The keypad operates together with the balance display as a terminal which sends and receives data and can thus enter into dialog with a partner device, usually a computer.

With the aid of the enclosed felt pen, the function keys can be inscribed according to the application requirements. The inscription can be removed with alcohol.

The keypad is provided with a cable with a MiniMettler connector and can be plugged into the GM socket at the rear of the balance.

Function keys

When one of these keys is pressed, the DataPac-M immediately sends the key code KF␣…(Key Function) to the computer:

Computer		**DataPac-M**
KF␣ A $^{C_R}{}_{L_F}$	←	AB…H
KF␣ B $^{C_R}{}_{L_F}$	←	
:		
KF␣ H $^{C_R}{}_{L_F}$	←	

Note:
The function keys can also be pressed during a numeric entry without influencing it.

Other keys

Their action differs according to the application. It is described in what follows.

6.2 Cmd: **D** (Display/Dialogue mode set)

Format: **D [*format*] [x[*text*]] $^{C_R}\,^{L_F}$**

Function: **Selection of the dialog mode and the format of the response of the DataPac-M to the computer with transmission of dialog text from the computer to the display of the balance.**

Note: General information on DataPac-M, see 1.2.

Dialog mode: There are 2 dialog modes. They can be selected through the insertion or omission of *format* in the D command sent from the computer to the balance.

Terminal mode:

Parameter *format* :

Transmission of the D command **with** *format* sets the DataPac-M keypad to the terminal mode. In other words, keyed-in numeric values are written into the balance display, can be corrected with CLEAR and are transmitted to the computer after ENTER has been pressed.

At the same time, the possibilities to enter numeric values using the DataPac-M keypad are restricted to the following:

format : =			Example
N	(natural)	Numbers from digits 0…9	1059
R	(real)	as N, also "-" and "."	-10.59
G	(general)	as R, but several "-","."	1.0-5.9
Q	(query)	1/0	(Display: YES/no)

With numeric entries, the DataPac-M transmits the following codes to the computer:

Computer		**Balance display**	**DataPac-M**
K␣␣123 $^{C_R}\,^{L_F}$	←	123 or weighing result	123 ENTER

Parameter *text* :

This parameter is defined in the same way as in the D command in section 5.19 (all printable characters of the ISO646 code table).

Transmission of the D command with ␣text overwrites the balance display with text. (Transmission with ␣ alone overwrites it with "blanks".)

Subsequently, only **one** numeric entry is possible. It remains in the balance display even after ENTER until the computer continues with a further D command.

CLEAR or ENTER without preceding numeric entry transmits only its key code to the computer.

Computer		**Balance display**	**DataPac-M**
KF**x** _ $^{C_R}\,^{L_F}$	←	no change	CLEAR
KF**x** ^ $^{C_R}\,^{L_F}$	←	no change	ENTER

(_ is ASCII character hex 5F, "underline",
^ the ASCII character hex 5E)

Sending of the D command without x*text* redisplays the weighing result.

Any number of numeric entries are subsequently possible.
After ENTER, the weighing result always reappears.

CLEAR or ENTER without preceding numeric entry acts as follows:

Computer		Balance display	DataPac-M
no action		no change	CLEAR
weighing result	←	flashes briefly	ENTER

"Power on" /BREAK:

Switching on the balance or a break in the data line sets the DataPac-M keypad to the terminal mode as if the command "DG $^{C}_{R}$ $^{L}_{F}$" had been sent.

Function key mode:

Parameter *format* :

Sending the D command **without** *format* sets the DataPac-M keypad to the function key mode. Here, in the case of numeric entries the key code is sent directly to the computer without being shown in the balance display:

Computer		Balance display	DataPac-M
KD␣1 $^{C}_{R}$ $^{L}_{F}$	←	flashes briefly	123
KD␣2 $^{C}_{R}$ $^{L}_{F}$	←		
KD␣3 $^{C}_{R}$ $^{L}_{F}$	←		

Parameter *text* :

has the same function as in the terminal mode except that CLEAR transmits its key code "KF_␣ $^{C}_{R}$ $^{L}_{F}$" in all cases.

Note:

If the balance display is cleared or a text is displayed, a * appears at the top left to show that the display is no longer linked to the balance, but is controlled via the interface.

Application DataPac-M, Example 1:

Weighing-in of additives 1, 2, etc. of a chemical substance No. 44

Computer		Balance display	DataPac-M	Comment
KF␣A ^{C_R} ^{L_F}	←		A	By pressing key A of the DataPac-M keypad, the operator requests the computer to prepare the weighing-in program for substance No. 44 (in the computer, function key A is assigned to the weighing-in program for substance No. 44).
DQ␣SUB 44 ? ^{C_R} ^{L_F}	→	* SUb 44 ?		The computer prepares the operator response by setting the DataPac-M keypad to the terminal mode, at the same time the response range of the operator is restricted to “yes/no” and acknowledged with “Sub 44?”.
K␣␣1 ^{C_R} ^{L_F}	←	* YES	1 ENTER	The operator responds with “yes”.
DQ␣Add 1 ^{C_R} ^{L_F}	→	* Add l		The computer requests that additive 1 be weighed in.
K␣␣1 ^{C_R} ^{L_F}	←	* YES	1 ENTER	The operator reports its readiness with “yes”.
D ^{C_R} ^{L_F}	→	0.000 g		The computer initiates the display of the weighing result and sets the DataPac-M keypad to the function key mode so that ENTER acts as a PRINT key and CLEAR can be used to transmit a correction signal.
␣␣␣␣␣␣12.050␣g ^{C_R} ^{L_F}	←	12.050 g	ENTER	The operator weighs in additive 1.
DQ␣ADD 2 ^{C_R} ^{L_F}	→	* Add 2		The computer requests that additive 2 be weighed in.

Application DataPac-M, Example 2

Storage of the article number and determination of the weight of a series of products

Computer		Balance display	DataPac-M	Comment
KF␣B ^{C_R} $_{L_F}$	←		B	By pressing key B of the DataPac-M keypad, the operator requests the computer to make storage program 26 ready.
DQ␣SAFE␣26 ^{C_R} $_{L_F}$	→	* SAFE 26		The computer acknowledges with “SAFE 26” and prepares a yes/no response.
K␣␣1 ^{C_R} $_{L_F}$	←	YES	1 ENTER	The operator responds with “yes”.
DR␣– –.– – ^{C_R} $_{L_F}$	→	* – –.– –		The computer requests entry of the article number with – –.– – and with DR prepares a limited response comprising numbers and a decimal point.
K␣␣45.12 ^{C_R} $_{L_F}$	←	* 45.12	45.12 ENTER	The operator enters the article number.
DQ ^{C_R} $_{L_F}$	→	0.000 g		The computer enables the display for the weighing result and prepares a yes/no response.
S␣␣␣␣␣59.456␣g ^{C_R} $_{L_F}$	←	* 59.456 g		The operator loads the article. The “send auto” configured balance sends a stable weighing result to the computer.
DR␣ – –.– – ^{C_R} $_{L_F}$	→	* – –.– –		The computer requests the operator to enter the next article number.

7. Programs to get started

7.1 Communication with the balance

The below auxiliary programs enable a computer to operate as a simple terminal. They can be used to send control commands via the interface to the balance and likewise to display a weighing result and status message on the screen. It is thus possible to observe the basic mode of action of the commands.

Interface parameters (default setting of the balance):
2400 baud, even Parity, 7 data bits and 1 stop bit

Warning: The punctuation must be adhered to exactly when typing in the programs.

Terminal program for IBM-PC

```
10 OPEN "coml:2400,E,7,1,CS,CD,DS,RS,LF" AS #1
20 IF LOC(1)>0 THEN PRINT INPUT$(LOC(1),#1);
30 K$=INKEY$  :  IF K$< >"" THEN PRINT#1,K$; : PRINT K$;
50 GOTO 20
```

Terminal program for Epson HX-20

```
10 TITLE "TERM"
20 WIDTH20,4
30 OPEN"O",#1,"COM0 : (57E1F)"
40 OPEN"I",#2,"COM0 : (57E1F)"
50 IF LOF (2)>0 THEN PRINT INPUT$(LOF(2),#2);
60 K$=INKEY$:IFK$< >"" THEN PRINT#1,K$; :PRINTK$;
70 IF K$=CHR$(13)THEN K$=CHR$(10):PRINT#1,K$; :PRINTK$;
80 GOTO 50
```

Terminal program for Epson PX-4

```
10 OPEN "O",#1,"COM0:(C7E1F)"
20 OPEN "I",#2,"COM0:(C7E1F)"
30 IF LOC(2) >0 THEN PRINT INPUT$(LOC(2),#2);
40 K$=INKEY$ : IF K$< > "" THEN PRINT#1,K$; : PRINT K$;
50 IF K$=CHR$(13) THEN K$=CHR$(10) : PRINT#1,K$; : PRINT K$;
60 GOTO 30
```

7.2 Evaluation of the weighing data

For further processing of the weighing result the data string from the interface must be analyzed. The data string structure shown in section 4.3 can be examined as follows:

1. Read in data string
2. Examine first three characters of the data string
   (i.e. S␣␣, SD␣, SI, SI+, SI–, TA, EL, ET, ␣␣␣, ␣D␣, ...)
3. Process remaining data string in accordance with the first part

Program example in BASIC

Evaluation of the string

"S␣␣␣␣␣␣␣23,4 g"
leading zeros
Identification

X$ is the received data string from the balance

```
60 IDENT$ = LEFT$(X$, 3)    (search for identification)
70 IF IDENT$ = "S␣␣" THEN GOSUB 110
```

further distinctions with IF as listed under paragraph 2.

```
110 WEIGHT = VAL (MID$ (X$, 3))    (search for weighing result)
120 LE = LEN (X$)                  (search for weight unit, 120...160)
130 FOR I = LE-1 TO 1 STEP –1
140 ST = INSTR(I,X$," ") : IF ST <> 0 THEN I = 1
150 NEXT
160 UNIT$ = RIGHT$(X$,LE-ST)
```

further processing of WEIGHT and UNIT$

Evaluation of the weighing data

Program example in PASCAL

GetString1 = Input buffer

```
BEGIN
    inputstring :=GetString1;
    Weight := ''; Unit :=''; j := 1;
    Ident := Copy (inputstring, 1, 3);
    IF Ident = 'S ' THEN
    BEGIN
        WHILE (Ord (inputstring[j]) < 65) AND
        (j <=Length (inputstring)) DO
        BEGIN
            Weight := Weight + inputstring[j];
            j := j + 1;
        END;
        Unit := Copy (inputstring, j, 4);
    END ELSE
```

further distinctions with IF as listed under paragraph 2,

further processing of Weight and Unit

```
END.
```

Program example in C

```
char  InputString[30];
char  Unit[5];
char  Ident[4];
float Weight;

sscanf(InputString,"%3s%f%s",Ident,&Weight,Unit);

if(strcmp(Ident,"S") == 0)  /* stable weight */;
```

7.3 Use of commands to control the balance

Use of base, unit, DeltaTrac and send and repeat command (bidirectional communication)

Task: Control of packages with small parts (e.g. screws) with the aid of the DeltaTrac

Weight of package (tare)		51,50	g
Piece weight of parts		1,58	g
Number of parts per package PCS		100	
Tolerances for DeltaTrac	+1 PCS =	1,85	g
	–5 PCS =	7,90	g

Program in BASIC for EPSON PX-4:

```
10 OPEN "I",#1"COM0:(C7E1F)"
20 OPEN "O",#2"COM0:(C7E1F)"
30 PRINT#2,"B 51.5" (tare preset)
40 PRINT#2,"U0 1.58 PCS 1" (integer number of pieces in single steps)
50 PRINT#2,"DY 209.5 1.58 7.9" (target weight and tolerances for DeltaTrac)
60 PRINT#2,"SR" : CLS
70 INPUT#1,X$ : PRINT X$
80 GOTO 70
90 END
```

Note for users of Epson HX-20:

Only the interface parameters in lines 10 and 20 are different, “C7E1F” changes to “57E1F”.

8. Malfunctions

8.1 What happens if …?

… one of the following error messages is transmitted at the interface?

ES	A received command is wrong (Syntax Error); the required command structure has not been adhered to.
EL	A received command is semantically (in content) wrong (Logistical Error). It is syntactically correct but can not be executed for some reason or other. Example: tare command, if balance in overload or underload.
ET	The received character sequence has not been correctly received (Transmission Error). Probably the transmission parameters of computer and data interface of the balance do not match.

… the data output is too slow/too fast?	The standard setting for the pause between the data strings is 1 second (for GA44 Printer).The pause can be selected in the configuration register, sector I-FACE: PAUSE 0, H, 1, 2 seconds. H = handshake, no pause.
… functions not be executed as described?	Owing to technical improvements, certain functions have been changed or supplemented. The start message on the balance display or the version of the software used must be checked. Possibly the balance in question is a certified unit in which certain functions are blocked in compliance with national regulations.
… the balance displays – – – – – –?	The “busy line” shows that the balance is busy. It appears when the balance/scale is waiting for stability after taring, after weighing-in (∞) or in animal weighing. However, it also shows that the computer is receiving keypad entries of the DataPac-M – transmitted in the handshake mode, see 3.1. – too slowly.

In troubleshooting note also the operating instructions of the balance.

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