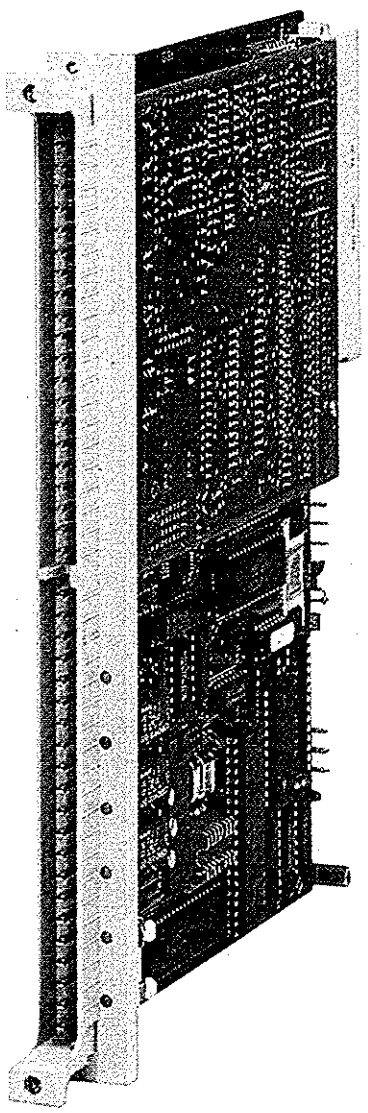
SIEMENS

Weighing and Batching
SIWAREX S Weighing and Batching System
Weighing Processor 7MH3305-1AB

Operating Instructions 06.90



Order No. C71000-B5976-C42-1

Table of Contents

NOTE:

Safe operation is dependent upon proper handling and installation by qualified personnel under observance of all warnings contained in this instruction manual. Non-observance can result in substantial property damage.

For the purpose of this instruction manual, a "qualified person" is one who is familiar with the installation, construction and operation of the equipment and has the qualifications required to perform his task.

1 General Information

1.1 Instructions for Using This Manual

These Operating Instructions are organized according to the following sections:

1 General information
Instructions for using this manual
List of abbreviations
Application

2 Principle of measurement
Time division principle

3 Hardware description
Construction of the weighing processor
Block diagram of the weighing processor
Mounting of the weighing processor
Technical data of the weighing processor
Setting-up of the weighing processor

4 Functions
Description of all important functions of the weighing processor
Flow diagrams of the processes during the batching
Flow diagrams of the processes during the adjustment

5 Software description
Adjustment
Weighing (batching)
Assignment of the data module
Program organization
Example of programs

6 Index

1.1.1 List of Abbreviations

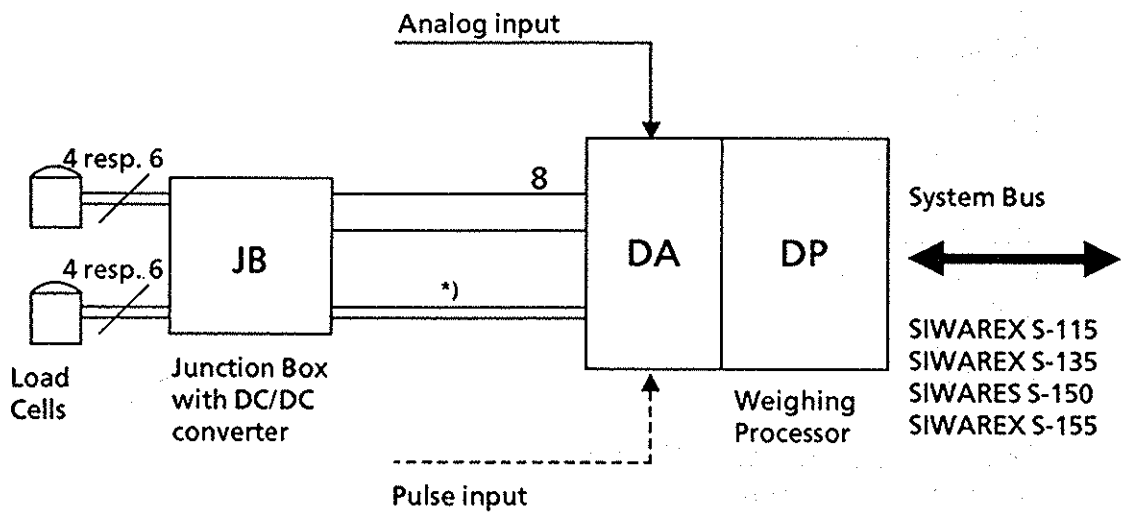
BW	Batch Weight
CD	Calibration Digit
CM	Cubic Centimetre
CP	Communication Processor
CPU	Central Processing Unit
CW	Calibration Weight
DA	Data Acquisition
DB	Data Module
DD	Data Double Word
DE	Digital Input
DM	Cubic Decimetre
DMS	Strain Gauge
DO	Digital Output
DP	Data Processing
DW	Data Word
EG	Expansion Device
FIFO	First In/First Out Memory
GR	Gramme
JB	Junction Box
KC	ASCII Format
KF	Fix-Point Format
KG	Floating-Point Format - Kilogramme
KH	Hexadecimal Format
KM	Bit Pattern Format - Cubic Metre
LIFAC	Linearization Factor
MM	Cubic Millimetre
PCB	Printed Circuit Board
PZO	Upper Test Value
PZU	Lower Test Value
SG	Specific Gravity
TO	Tons
VE	From End-Value
VZ	Sign
WP	Weighing Processor
ZG	Central Unit

1.2 Applications

The weighing processor can be used in weighing and batching control systems

- SIWAREX S-115
- SIWAREX S-135
- SIWAREX S-150
- SIWAREX S-155

Various load cells (strain gauge type) can be connected via corresponding junction boxes to the weighing processor (see Fig. 1), e. g.:



DA: Data Acquisition
DP: Data Processing
JB: Junction Box

*) high-flexible 8-leads cable (cord 0.75 mm²) screen: Cu-plait with PVC isolation cover, e. g.: LiYCY 8 x 0.75 mm2, order no. 7MH3702-8AB

Figure 1: Input Configuration

Up to six load cells can be connected in parallel. The total output resistance must be between 50 and 4010 ohms.

Current input (0/4 to 20 mA), voltage input (0 to 10 V), or potentiometer input can be applied optionally with corresponding junction boxes.

Besides the load cell input (see Fig. 1) the weighing processor also has a pulse input (e. g. for a cylindrical piston-meter) which can optionally be used and an analog input (8 bit ADC) which is - e. g. - preferably used for humidity corrections.

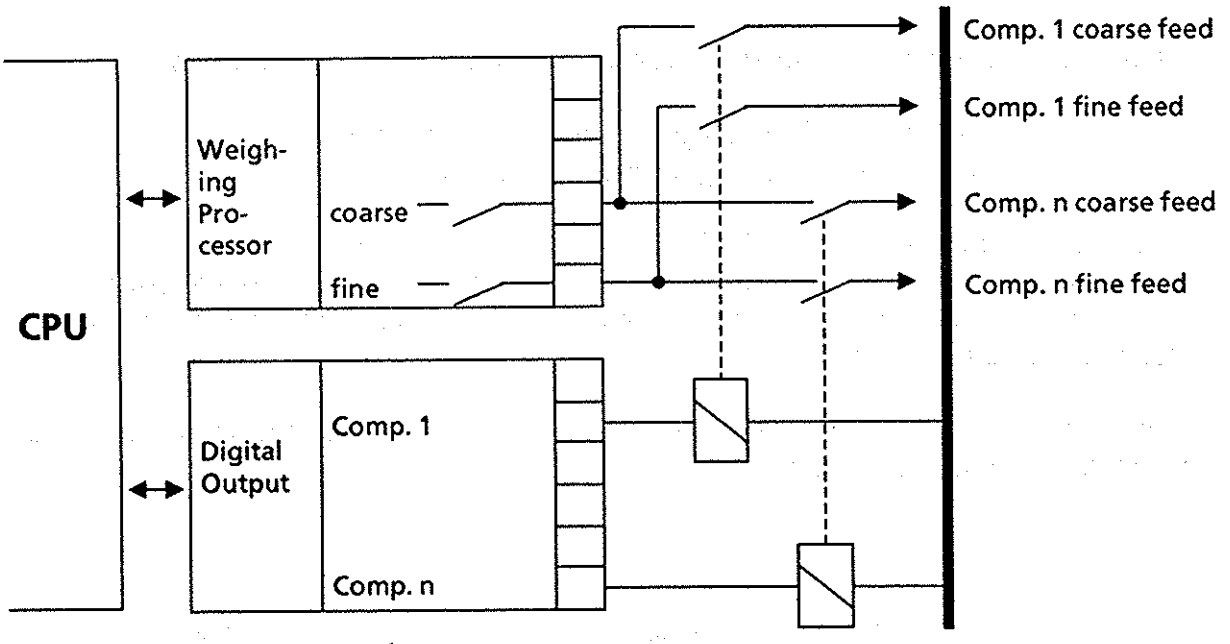


Figure 2: Multi-component Control

The Weighing Processor has single-component batching scale features, i. e., it provides the signals 'Fine Feed' and 'Coarse Feed' to fill or to empty one container (silo) according to a given recipe.

Complex control functions (multi-component control etc.) are implemented via the PLC's CPU (see Fig. 2).

1.2.1 Single-component Scale, Upward and Downward Batching

The weighing processor is designed for single-component applications:

- upward batching (supplement weighing) and
- downward batching (deduction weighing).

To provide exact batching which is independent of the cycle time of the CPU, potential-free relay outputs are installed to control the dosing valves (fine feed and coarse feed). An overload relay (break contact) provides the protection from overload and overfilling.

Multi-component applications are implemented via the PLC's CPU and appropriate software modules (see Fig. 3).

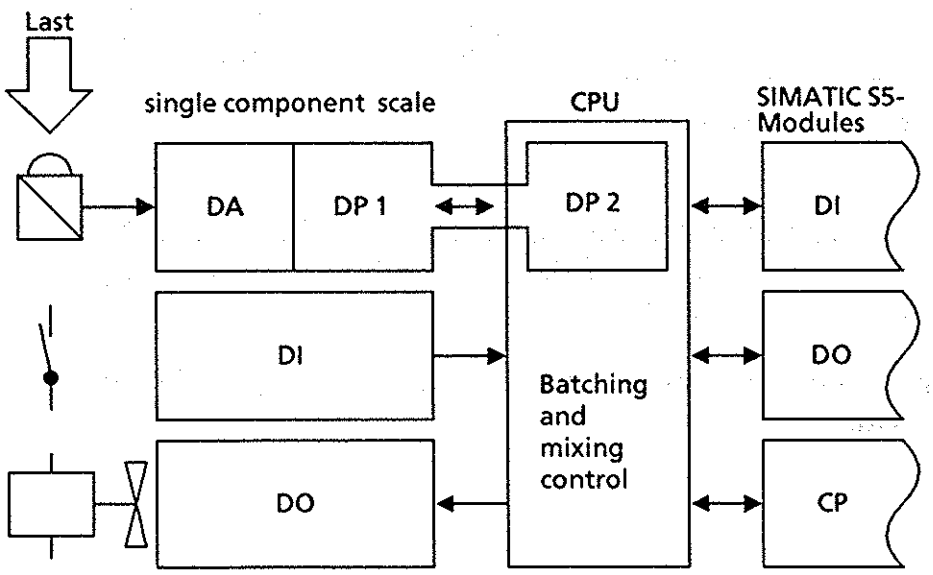


Figure 3: Job-sharing between Weighing Processor(s) and CPU

DA = Data Acquisition
DP = Data Processing
DI = Digital Input
DO = Digital Output
CP = Communication Processor

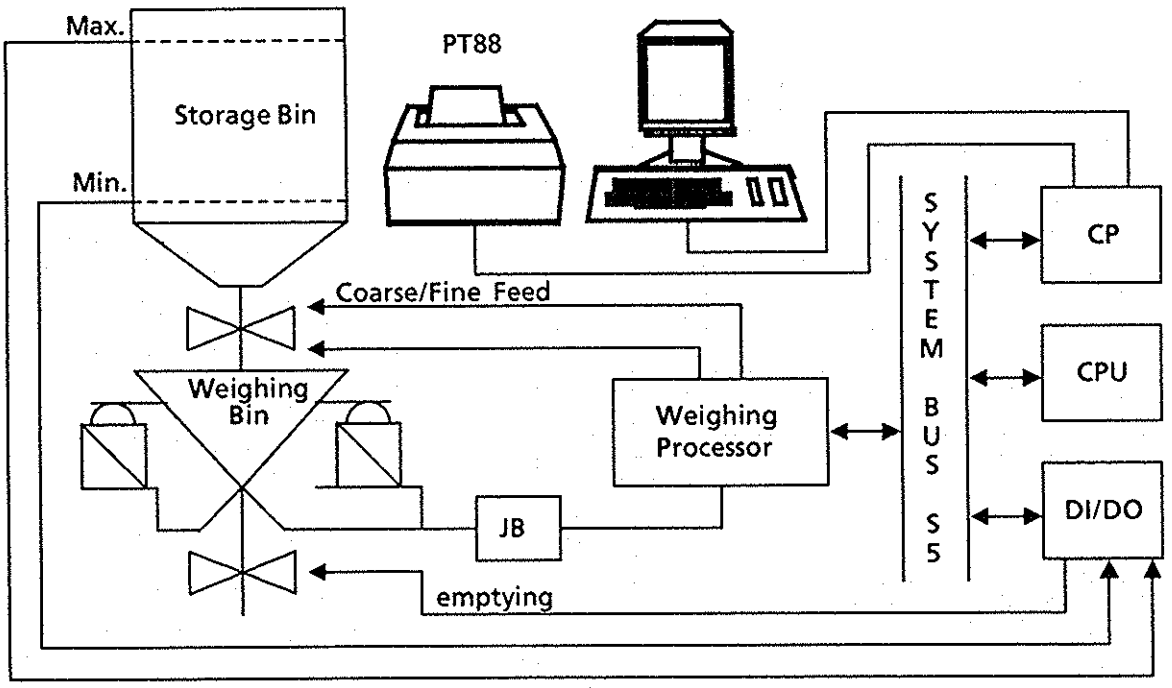


Figure 4: Single-component scale, Upward Batching

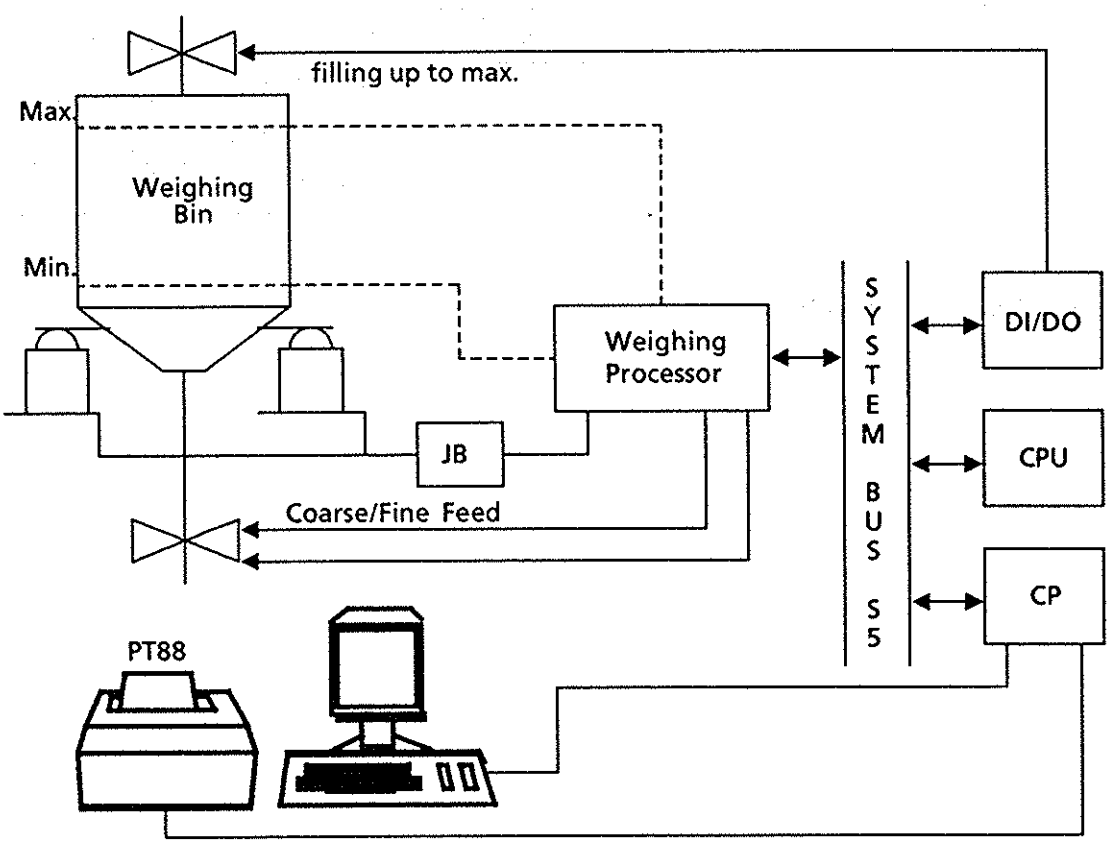


Figure 5: Single-component scale, Downward Batching

The limits of the weighing bin are acquired via software by status byte (DW36).

1.2.2 Multi-component Scale

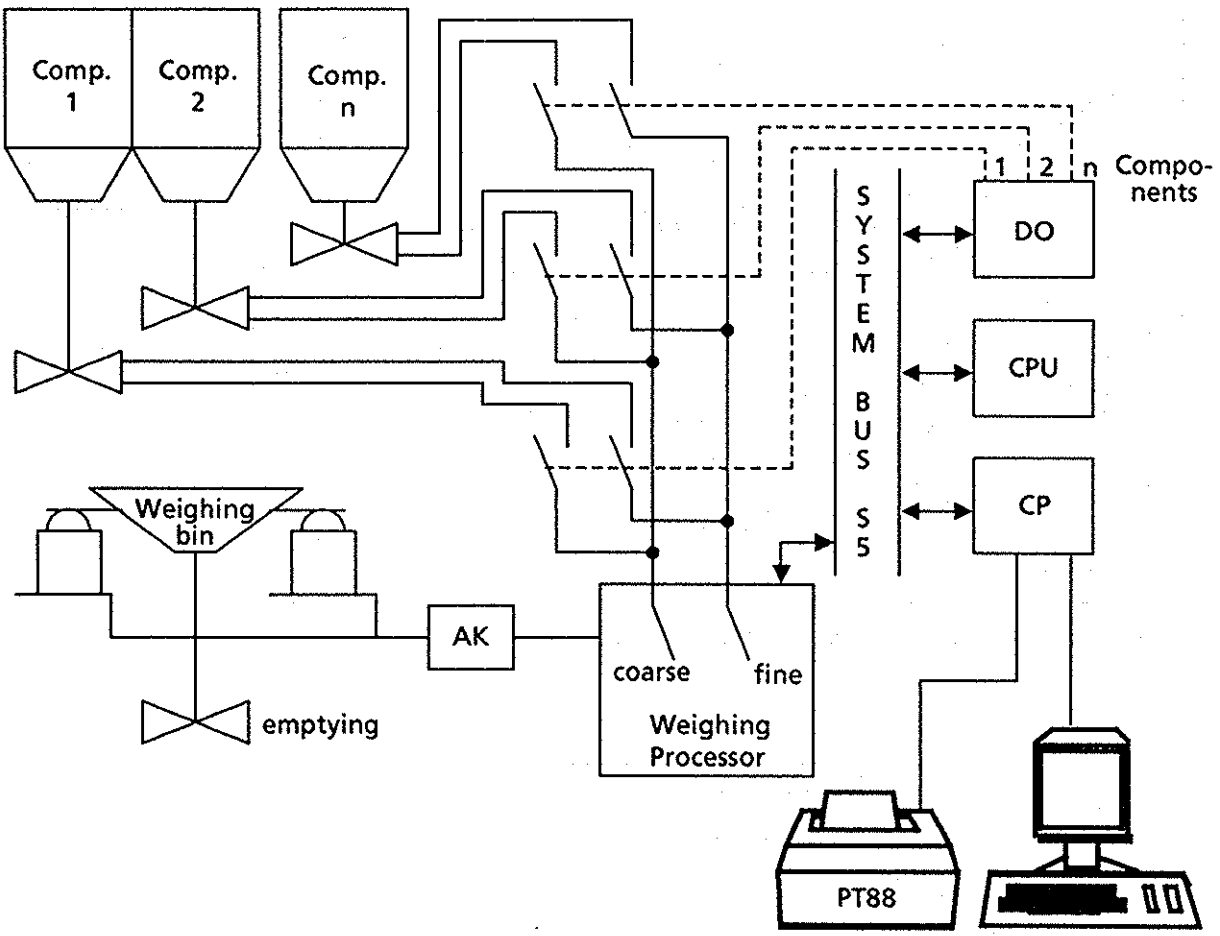


Figure 6: Multi-component Scale

1.2.3 Handling Modules

The handling modules described in section 5 (function modules, FBs) execute the data communication between the weighing processor (WP) and automation equipment (PLC) respectively between PLC and WP.

The function modules are subdivided as follows:

- Handling modules

Calibration:	FB 200	SIW: JUST	Libr. No. 60988
Read data:	FB 201	SIW: LESE	Libr. No. 60988
Pre-set value: (transmit data)	FB 202	SIW: SOLL	Libr. No. 60988

  For identification of release status each FB receives a library number.

- Initialization OB's 20, 21, 22

Initialization:	FB 254	SIW: ANLF
Time delay	FB 255	SIW: 5S

- Supply program for calibrating the scale

  FB 203 SIW: ANW:JUST

A demonstration program FB 231 and one data module DB 231 (in KF = fix-point format) exist on the floppy disk which make able to load a cold booting program. With this program first steps can be performed successfully.

Able to be run

The FBs are to be run on systems SIWAREX S-115, -135, -150, and -155. To get a complete running weighing system which can consist of several scales, the FBs are to be addressed in a user program and the pertaining DBs to be provided for (see program example).

Firmware State WP

The described handling modules request release no. 4 of model 7MH3305-1AB (i. e. EPROM DP (data processing) S2550-D25-W3-6, EPROM DA (data acquisition) S2551-D9-D).

Interface PLC - WP

The interface to the user program consists of one data module for each scale onto the FBs have access. This DB has to be initialized with 106 data words (DW 0 up to DW 105).

Parameters

As parameters the function modules need the hardware address of the weighing processor. This and further parameters are not transferred to the FB via function module parameter but via the data module (DB) called-up in the program.

Timer reservation

One timer (T) has to be reserved for the FB SIW:5S (initializing delay) which is called-up with function blocks (OBs) 20, 21, and 22.

Flags and counters

Flags and counters will not be reserved so that, with regard to this, there are no restrictions for the user programs. Only in the used data module each data word will be allocated with a fixed meaning.

Function blocks for initializing (OB 20, 21, and 22)

Function blocks for initializing (OB 20, 21, and 22) FB SIW:5S and FB SIW:ANLF have to be called up in OBs 20, 21, and 22 (see program example).

Mains failure (OB 22)

After mains failure the actual status of the scale remains stored on the WP. However, should a mains failure occur during the cyclic processing of the FBs not all data will be actual. Apart from that, the status 'coarse/fine' of the scale will remain stored although it is not valid any longer. For this reason, on re-start of the PLC, the cyclically processed FB has to be addressed to acquire the actual status to avoid fault reactions in the program run.

According floppy disks are provided for the different programming units:

PG 635	handling modules	7MH3835-1AB11	(S5-DOS)
PG 675	handling modules	7MH3875-1AB11	(CP-M)
PG 685	handling modules	7MH3885-1AB11	(S5-DOS)
PG16-20	handling modules	7MH3820-1AB11	(S5-DOS)

2 Principle of Measurement

2.1 Time-division Method

Data acquisition is performed according to a digital resistance-compensation method, the time-division principle.

Time-division principle

The load cell's output U is amplified, filtered and fed into a U/f converter. The U/f converter provides polarity evaluating pulses with a frequency proportional to the input voltage U.

The pulses are fed to a counter (B), whose output is connected with a comparator's first input channel. The data for the comparator's second input channel are provided from a second counter (A) with counter range 'n'. This counter is continuously controlled by a clock generator (Q) with period $T = n/f_q$. The comparator provides a rectangular wave signal, whose pulse duration T_1 is in proportion with the actual counter reading Z_B of counter B. The rectangular wave's pulse period corresponds with the counter range n (40 000) of counter A.

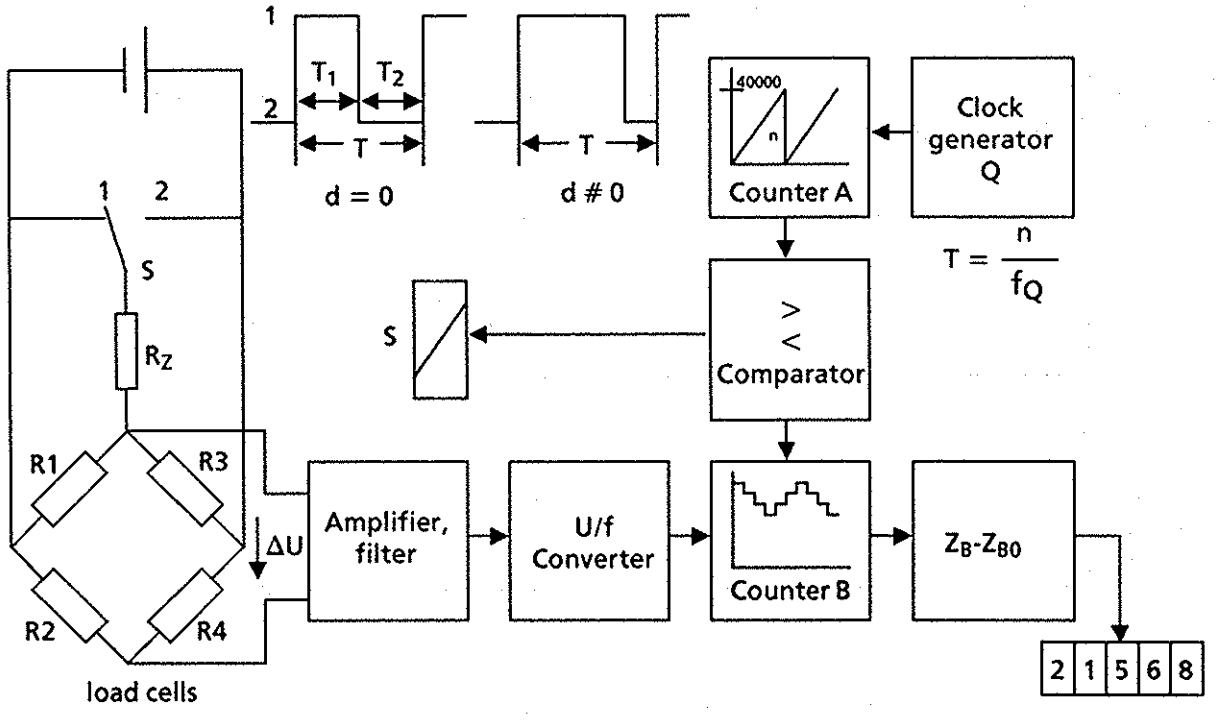


Figure 7: Time-division Principle

The wave signal is used to connect the resistance R_z "to and fro" between one diagonal point of the Wheatstone Bridge (e. g. a load cell) and the two bridge's feeding lines.

The switching is performed according to the signal's pulse duration and off period.

If the pulse duration T_1 is equal to the period T, the resistance R_Z is connected in parallel to one arm of the bridge for the whole period (100 % of the time). If the pulse duration T_1 is zero, then the resistance R_Z is connected in parallel to the other arm of the bridge for 100 % of the time.

In case of a pulse duration ratio of $T_1/T_2 = 1/2$ twice the resistance of R_Z is connected in parallel to both arms of the bridge (average value over the period T). Thus the effective resistance over the bridge's arm can be modified by changing the pulse duration ratio, such that the detuning caused by load application can be compensated. If the bridge is not detuned (i. e. the load cells are not under load) the counter B reads n/2, the pulse duration ratio

$$T_1/T = T_2/T = 1/2$$

is symmetric.

The bridge is not detuned additionally by resistance R_Z, thus the mean value of diagonal voltage U is equal to zero and the system is in balance.

To utilize the whole counting range the bridge is pre-detuned with two separate resistances R_{Vu} and R_{Vo} (in down and upper bridge arms). If the load cells are under load, the pulse duration ratio is changed via ΔU and counter Z_B as long as the effective resistances over the bridge's arms compensate the detuning caused by the load, i. e. until the counter B is at stand-still.

If the resistance R_Z is selected accordingly, the variation of counter B's reading Z_B is in proportion to the applied load.

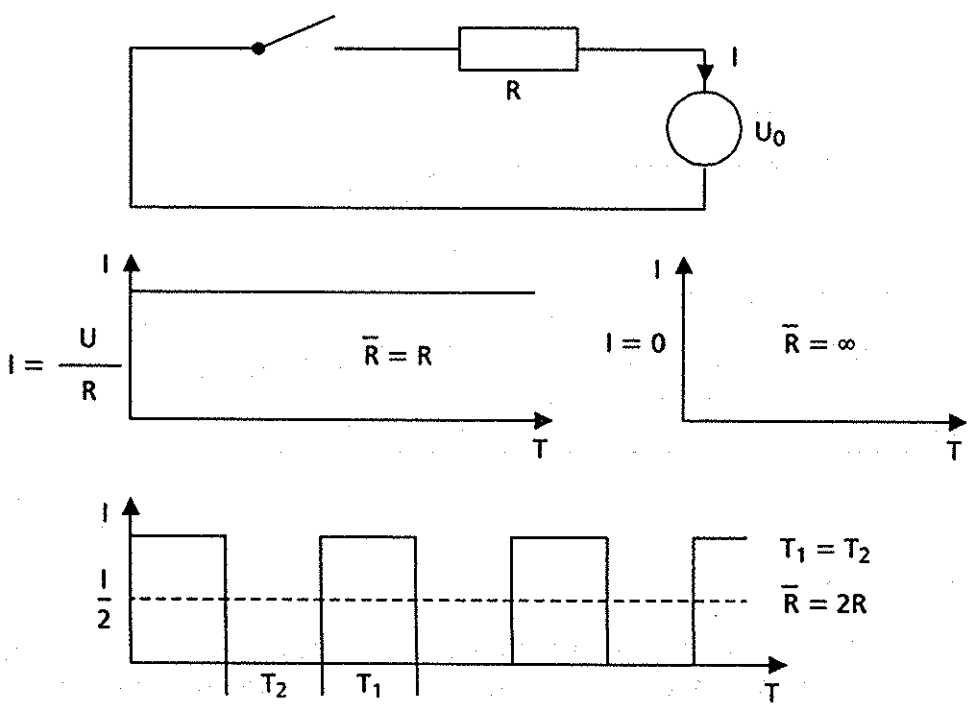


Figure 8: Average Value of the Time-divided Resistance

3 Hardware

3.1 Construction

The weighing processor consists of a base PC board (double europe size) PCB 1 and a plug-in PC board PCB 2, where the data acquisition tasks are implemented (see Fig. 9).

Inputs and outputs to the processor are implemented via a 43 pin front connector. Various LED indicators are integrated in the front panel.

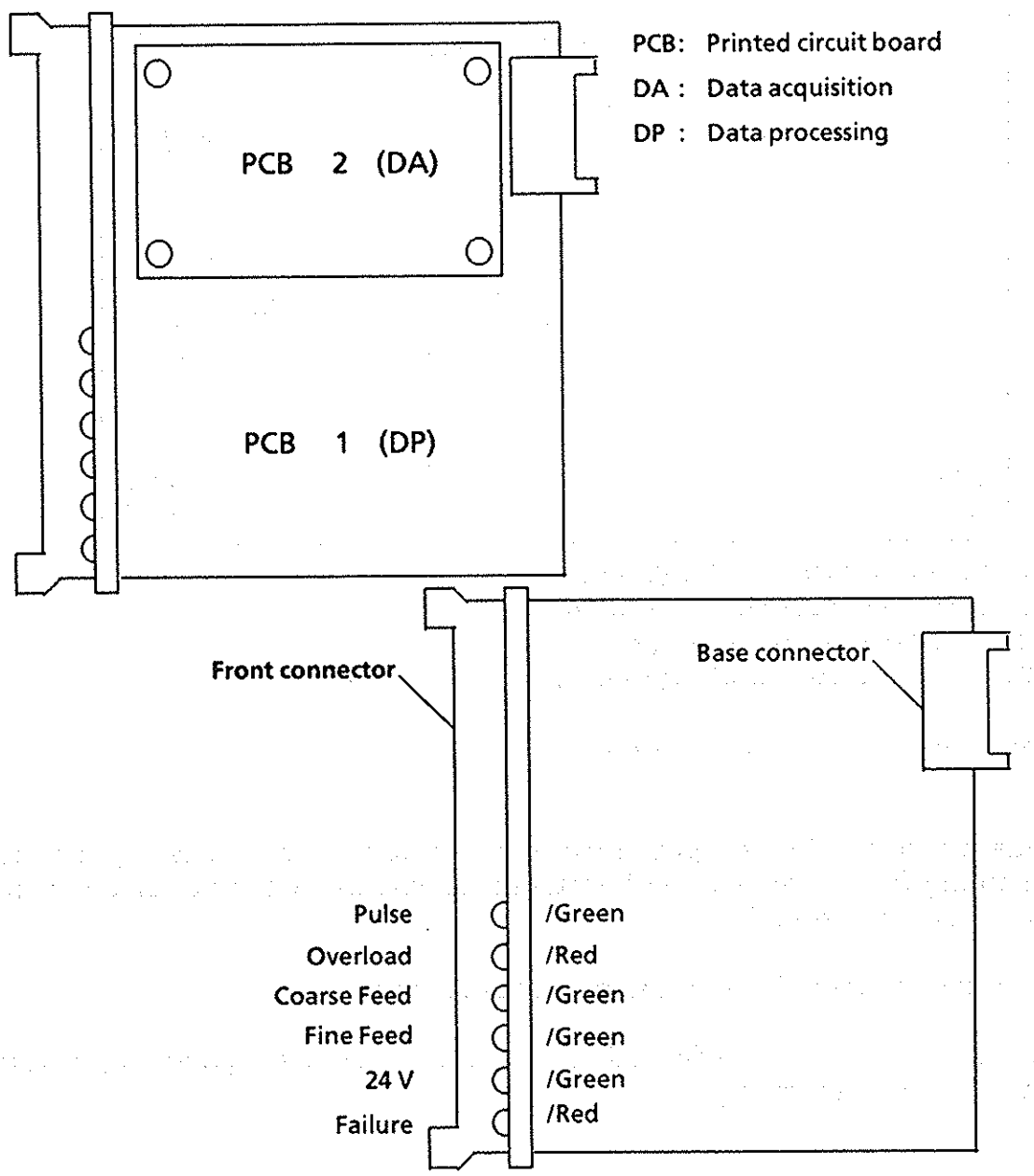
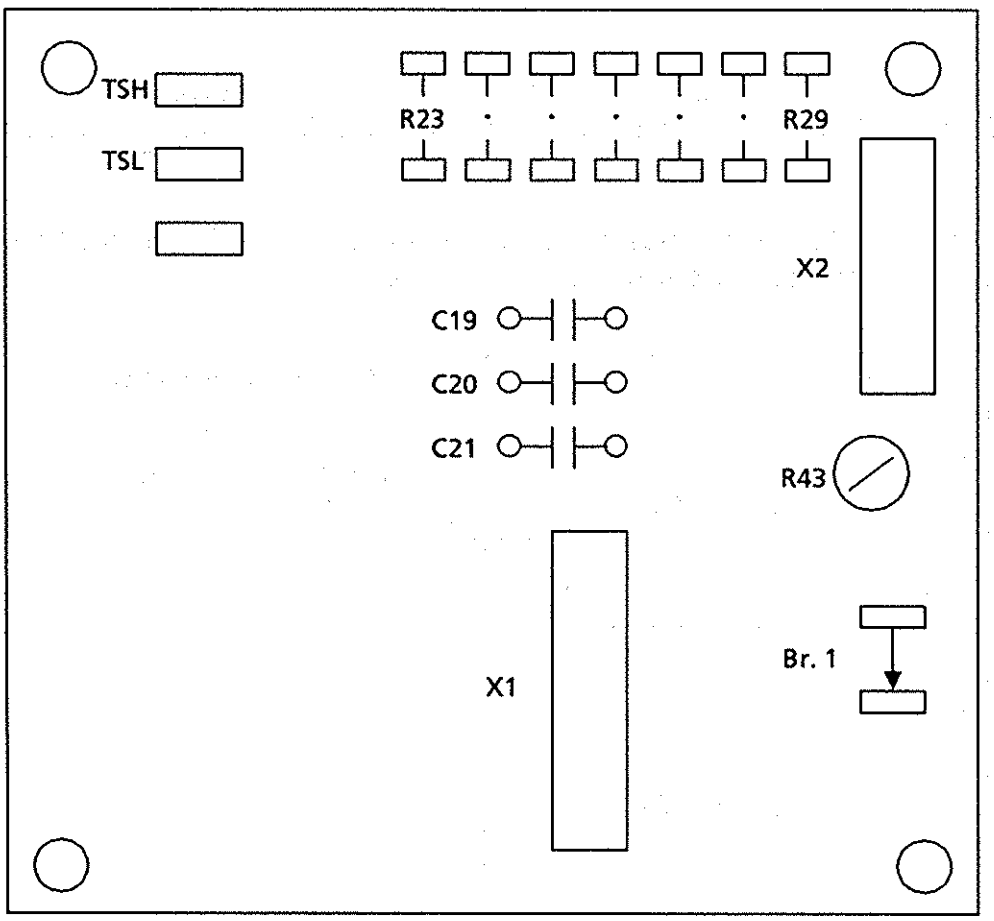


Figure 9: Weighing Processor's Hardware Configuration

3.1.1 Construction of Data Acquisition System



X1: Connection to the Base PCB (8-pole)
X2: Connection to the Base PCB (14-pole)
TSH: Time-divider test signal high (see 3.1.2)
TSL: Time-divider test signal low (see 3.1.2)

Figure 10: Location of Jumpers and Connectors

To evaluate e. g. a cylindrical piston-meter or a cellular wheel sluice, a pulse input with a limiting frequency of 50 cps is installed, so volumetric closing can be realized (see 4.17, Pulse Acquisition).

The potential-free input is also located on the DA board (PCB 2).

Thus the DA board can be adjusted for pulse input or strain gauge input (time-division principle) respectively.

3.1.2 Adjustment of Data Acquisition System
(Calculating of tuning resistors)

See also 3.5.4: Tuning Resistors (series 24 E)

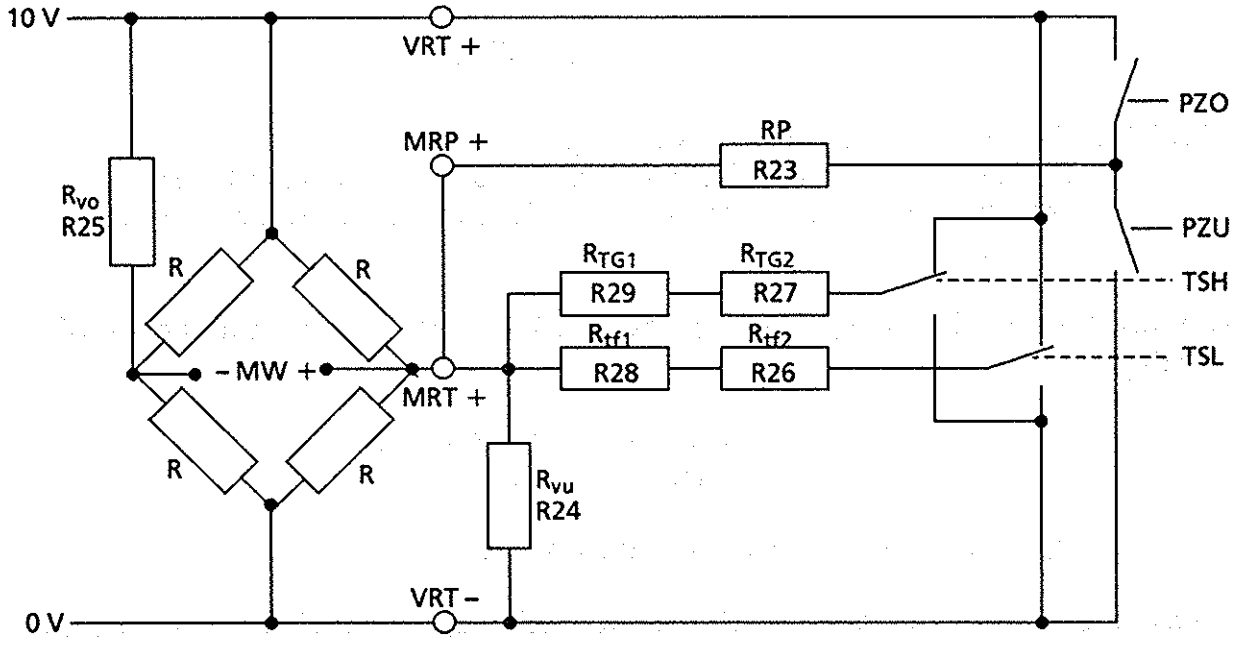


Figure 11: Circuit Diagram of Load Cell(s) with Tuning Resistors

R_{24}, R_{25}: Bridge pre-tuning resistors R_{VO} and R_{VU}
They have to be metal film resistors with a temperature coefficient of 10 ppm/K and an accuracy of 0.1 %.

$$R_{vo} = R_{vu} = 2 \cdot R_{tg}$$

Please note: If the calculated resistor is not available, the next higher one of the row is to be chosen.

R_{27}, R_{29}: Time division resistors R_{TG1} and R_{TG2}. They are for the high tuning signal. They have to be metal film resistances with a temperature coeffifient of 10 ppm/K and a tolerance of 0.1 %.

The compensation resistance is to be computed as:

$$R_{tg} = 2 \cdot \frac{R_b}{n} \cdot \frac{\frac{1+K}{1-K}}{\frac{1+K}{1-K} - 1} \ \Omega$$

n: number of load cells in parallel connection
R_b: resistance of strain gauge bridge
K: nominal characteristic value e. g. 2 mV/V (K = 0.002)

Please note: If the calculated resistor is not available, the next lower one of the row is to be chosen.

For $R_{tg} >> R_b$ above equation can be simplified to:

$$R_{tg} = \frac{R_b}{K \cdot 2 \cdot n}$$

R26, R28: Time division resistor R_{tf1} and R_{tf2}.
R_{tf1} and R_{tf2} are for the low tuning signal. They have to be metal film resistors with a temperature coefficient of 10 ppm/K and a tolerance of 0.1 %.

The series connection of R_{tf1} and R_{tf2} must be 20 times the series connection of R_{tg1} and R_{tg2}:

$$R_{tf1,2} = 20 \text{ times } R_{tg1,2}$$
$$R_{tf1,2} = R_{tf1} + R_{tf2}$$

R_{tg} = Time divider resistance (series 24 E)

Please note: If the calculated resistor is not available, the next lower one of the row is to be chosen. The higher R_{tg} is chosen the more sensitive the time divider becomes.

R23: Test value resistor R_p.
It is used to detune purposefully the Wheatstone Bridge. R_p has to be a metal film resistor with a temperature coefficient of 10 ppm/K. R_p must be at least able to detune 25 % of full measuring range (10 000 parts). It must satisfy the requirement

$$2 R_{tg} > R_p > R_{tg}$$

This responds to a detuning of 10 000 to 20 000 parts.
R_p must be chosen a bit higher than R_{tg}.

The command 'determine test value' (DW 12, bit 0) will only be positively finished if detuning is between 9 000 and 19 740 parts.

Please note: If the calculated resistor is not available, the next higher one of the row is to be chosen.

R_{43}: With this potentiometer the zero amplifier's amplification can be adjusted. Amplification has to be such that the weight value does not overshoot (aperiodic transient phenomenon). The potentiometer is pre-adjusted ex works for a characteristic value of 2 mV/V and can be optimized if necessary.

Remarks: To optimize the speed of adjustment, if other load cells with different characteristic values are used, the amplification can be accomodated. For

lower characteristic values a higher amplification has to be adjusted (turn potentiometer R_{43} to the left).

(Adjustment can be done via commands "test-detuning upwards" (DW) and "test-detuning downwards". Optimal adjustment: see section 3.7, Step Response).

Additional connection of a capacitor C21 for higher damping of oscillation has the consequence that amplification has to be reduced (see: Step Response). In the parameter byte (DW 52) the software control gain must be switched off (bit 11 = '1').

Capacitor C21: MKL 2,2µF Best.-Nr.: B32110-D3225-M
MKL 3,3µF Best.-Nr.: B32110-D3335-M
MKL 4,7µF Best.-Nr.: B32110-D3475-M

Br1: Jumper 1 must be soldered in. Here the 0 V of the DC/DC converter (±15 V) is connected with the ground of the measuring circuit.

Test points TSH/TSL:

At the test points TSH and TSL the behaviour of the time-division resistor can be checked with an oscilloscope. Test point TSH is led out additionally to pin 16 of the front connector.

Adjustment: 0.1 ms/Div, 5 V

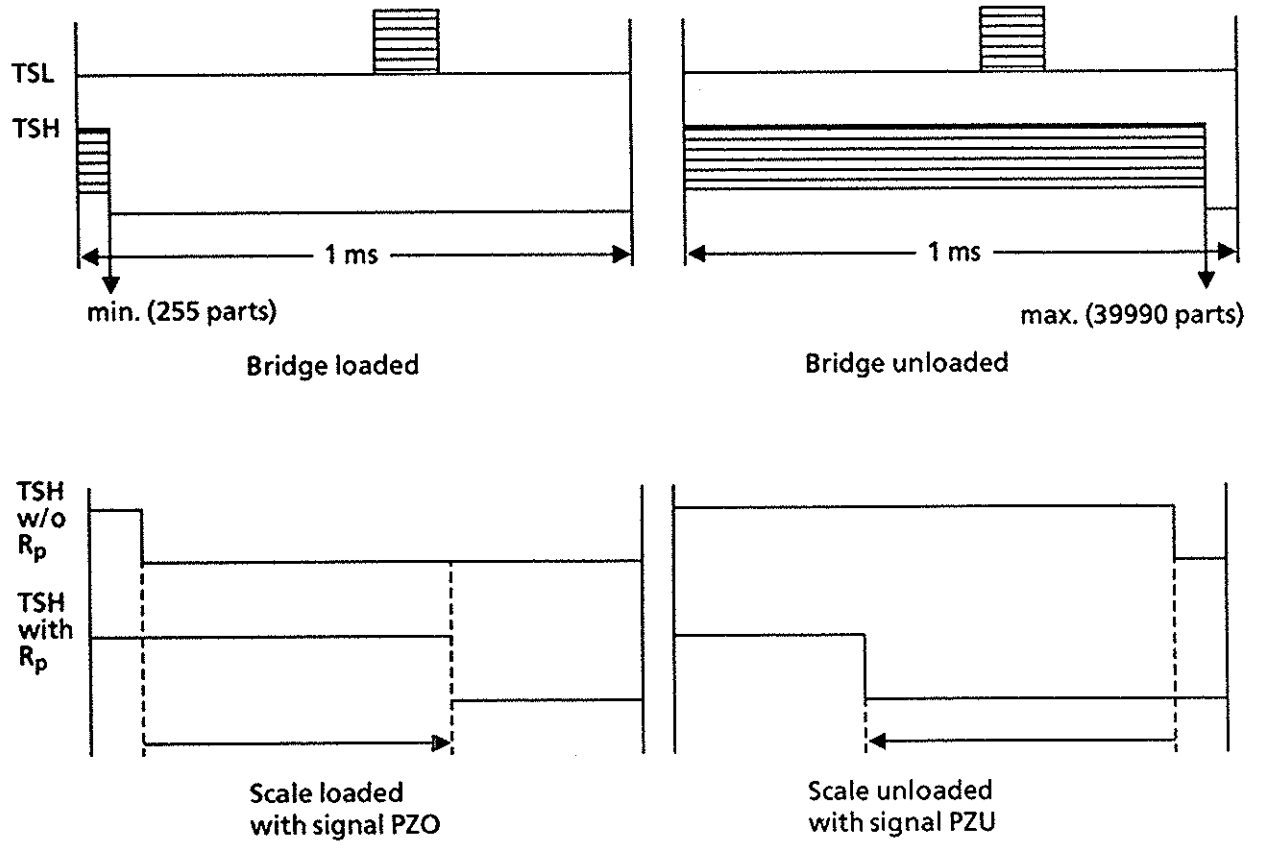


Figure 12: Test Value Determination

TSL and TSH signals are each divided in 200 parts. 200 parts of TSL are equal to one part of TSH. On this way the whole resolution of 200 x 200 = 40 000 parts results.

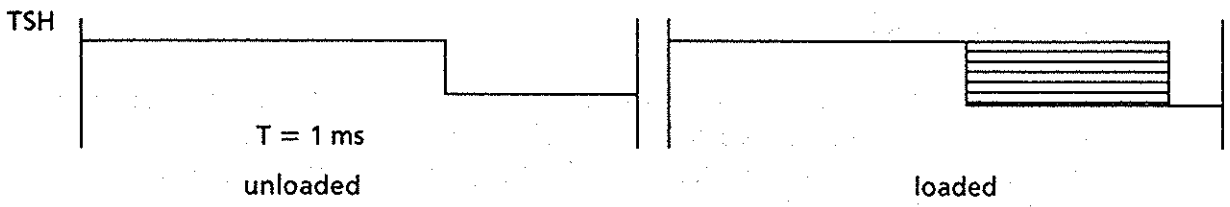


Fig. 13: Bridge without Pre-Detuning

As to be seen from the diagram only half of the measuring range is available if the bridge is not pre-detuned that is to say, the resolution is only 20 000 parts. If the bridge is pre-detuned with R_{VO} and R_{VU}, than 40 000 parts are available.

3.1.3 Construction of Data Processing System

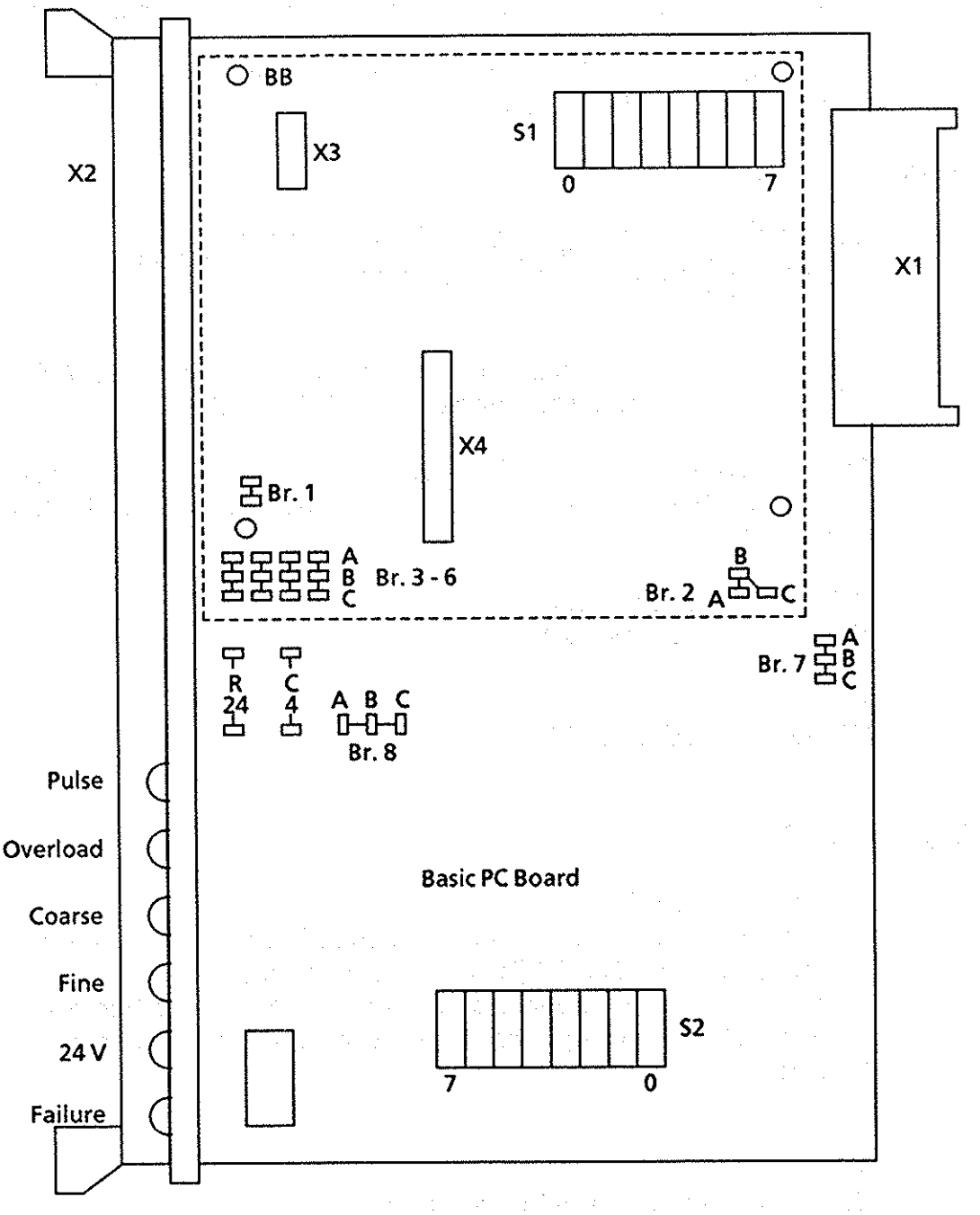


Figure 14: Location of Jumpers

X1: Basic connector to system bus (PLC), 48 pins, compatible to SIMATIC S5
X2: Front connector (42 pins), to process
X3: Connector to DA (8 pins)
X4: Connector to DA (14 pins)
BB: Spacers to fix PC board 2
F1: Fuse for 24 volts supply (DA system and load-cell feeding fine/250 V/1 A/ medium response time, picofuse

3.1.4 Adjustment of Data Processing System

S1: **Encoding switch S1 for addressing of weighing processors via system bus**

The WP is addressed just like an analog I/O module according to SIMATIC S5 standards. Maximal 128 WPs can be addressed.

Adjustments between 128 and 255

	128	64	32	16	8	4	2	1	valency
S1	1	0	0	0	0	0	0	0	e. g. 128
	7	6	5	4	3	2	1	0	switch

'1': threading switch unhinged, resp. DIL switch "open/off",
'0': threading switch hinged, resp. DIL switch "on".

For addressing only 1 byte is taken up per each weighing processor, that means that the second WP can have the address of 129 if the first WP has the address 128.

WP 1 - address 128
WP 2 - address 129
. - .
. - .
WP 128 - address 255

Coding Switch S2:

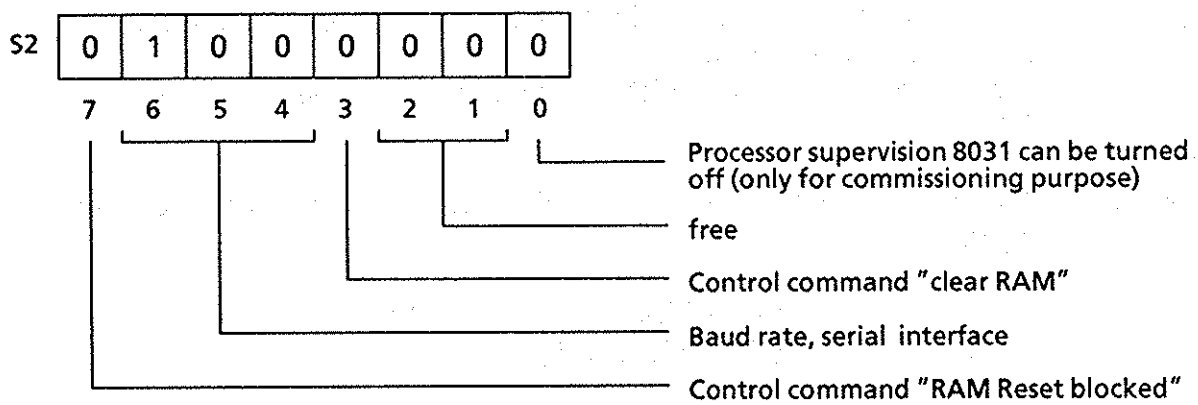
S2: 0, 1, 2 (bit address)
Jumpers to adjust the transmission speed for serial interface DA - DP. Basic adjustment 9600 Bd (is not to be changed).
0: signal status 0 = supervision of processor 8031 switched off
signal status 1 = supervision of processor 8031 switched on
1: free
2: free

S2: 3
Control command 'reset buffered RAM'
The RAM is deleted (reset) by switching on the feeding voltage and with open S2,3 or by opening of S2,3 under voltage connection.

S2: 4, 5, 6
Transmission rate for serial interface (TTY) to display or operator panels. Basic adjustment 1200 Bd (do not change).

S2: 7
Control command "RAM Reset Blocked" by software
By opening the switch S2,7 no RAM reset by software is possible. By switching on the feeding voltage and with open S2,7 or by opening S2,7

under voltage connection the command "Adjustment Blocked" is activated.



Switch S2	6	5	4	
	0	0	0	19.200 bits/sec
	0	0	1	9.600 bits/sec
	0	1	0	4.800 bits/sec
	0	1	1	2.400 bits/sec
	1	0	0	1.200 bits/sec
	1	0	1	600 bits/sec
	1	1	0	300 bits/sec
	1	1	1	110 bits/sec

'1' = threading switch unhinged, resp. DIL switch "open/off"
'0' = threading switch hinged, resp. DIL switch "on"

Jumpers 3-6: are used to adapt for serial I/O devices
The TTY-interface can be active (feeding for 20 mA line current internal-ly) or passive (feeding for an external 20 mA line)

Adjustments:
passive 3-6: A-B inserted
active 3-6: B-C inserted

R24: The analog input can be used as current input 0 to 20 mA or 4 to 20 mA respectively.

Basic adjustment	**Analog input**
R24 not inserted	0 to 5 V
R24 of value 250 ohms and tol. 0.1 % inserted	current input 0 to 20 (4 to 20) mA*

* The parameter word (DW 52, bit 1) can be between 0 to 20 mA and 4 to 20 mA

C4: is used to suppress interference pulses at the analog input. Basic adjustment 220 nF. In case of high-frequent input voltage, the

capacitance has to be smaller, in case of low-frequent input voltage to be greater. A ceramic type has to be inserted.

Jumper 8: The analog input cable's shield (or the analog input AI-, pin 27) can be connected with ground.
For potential-free transmitters, jumper 8 B - C has to be inserted (see 4.16).

Jumper 2, 7: Are used for hardware reset adjustment. The WP can be reset via signal

$\overline{\text{CPKL}}$	(SIWAREX S-135/150/155) or
RESET	(SIWAREX S-115).

It can also produce a self reset (during switching-on of the 5 V supply). Both possibilities can be selected.

The hardware reset by the signal

$\overline{\text{CPKL}}$ or RESET

is pre-adjusted in the PLC.

The following adjustments can be used:

Reset via PLC:	jp 2/ B - C	jp. 7/ B - C
Self-reset:	jp 2/ A - B	jp. 7/ A - B
Both resets:	jp 2/ A - B	jp. 7/ B - C

3.2 Block Diagrams

3.2.1 Block Diagram Weighing Processor

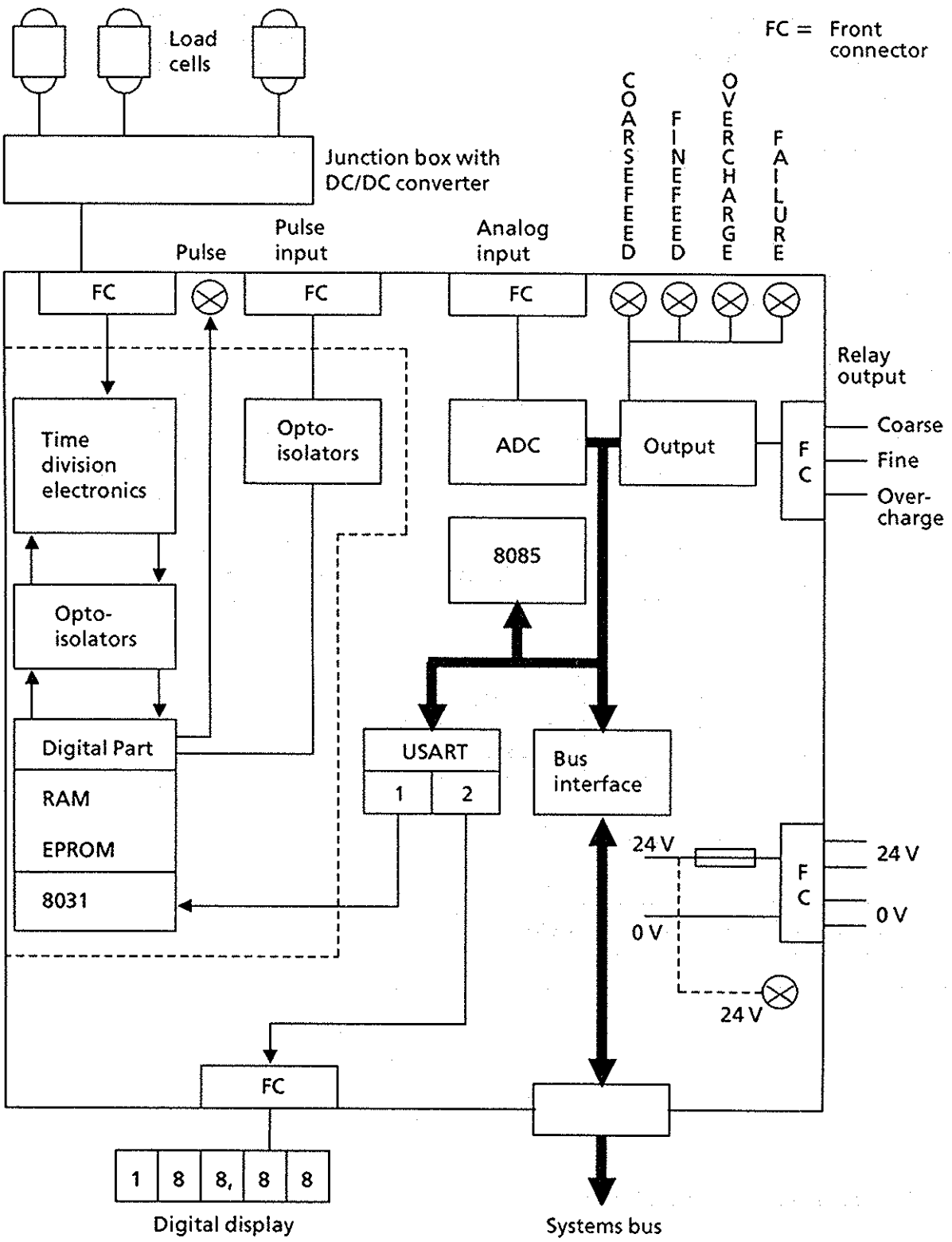


Figure 15: Block Diagram Weighing Processor

3.2.2 Block Diagram Data Acquisition System

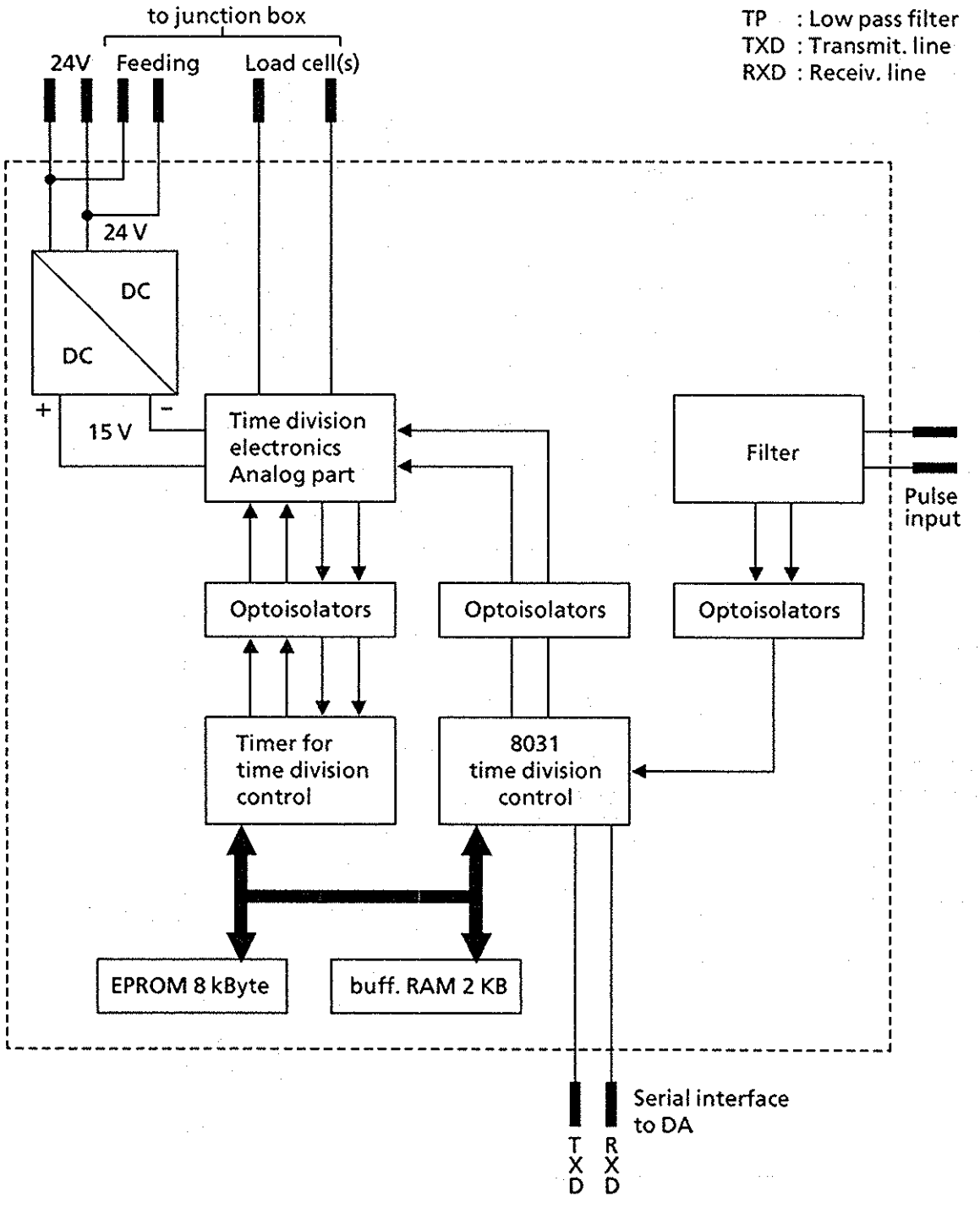


Figure 16: Block Diagram Data Acquisition System

3.2.3 Block Diagram Data Processing System

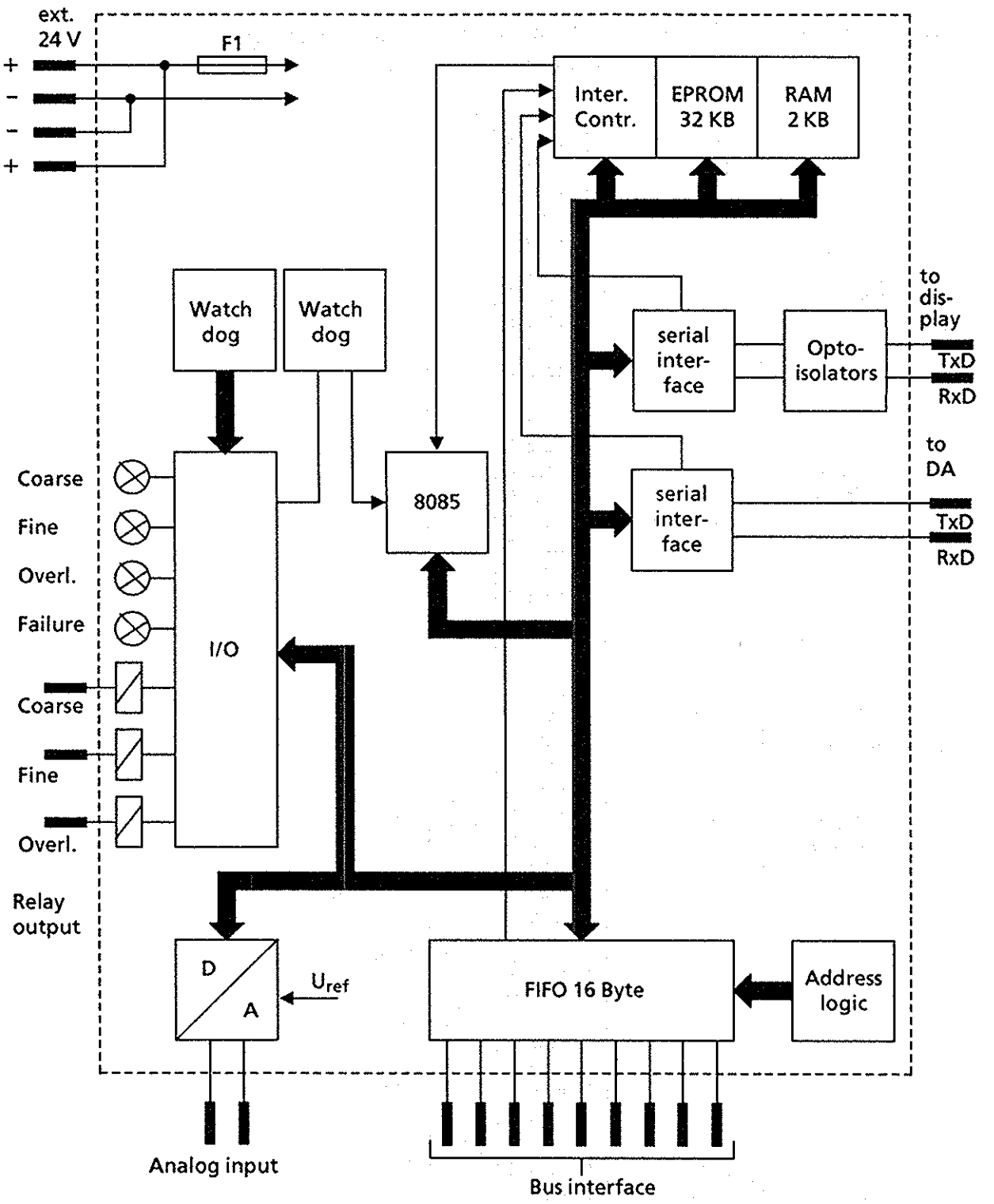


Figure 17: Block Diagram Data Processing System

3.3 Installation

3.3.1 Front Connector Assignment

Front connector K (Order No. 6XX3081) Screwing connection
(Order No. 6XX3068) Crimp connection

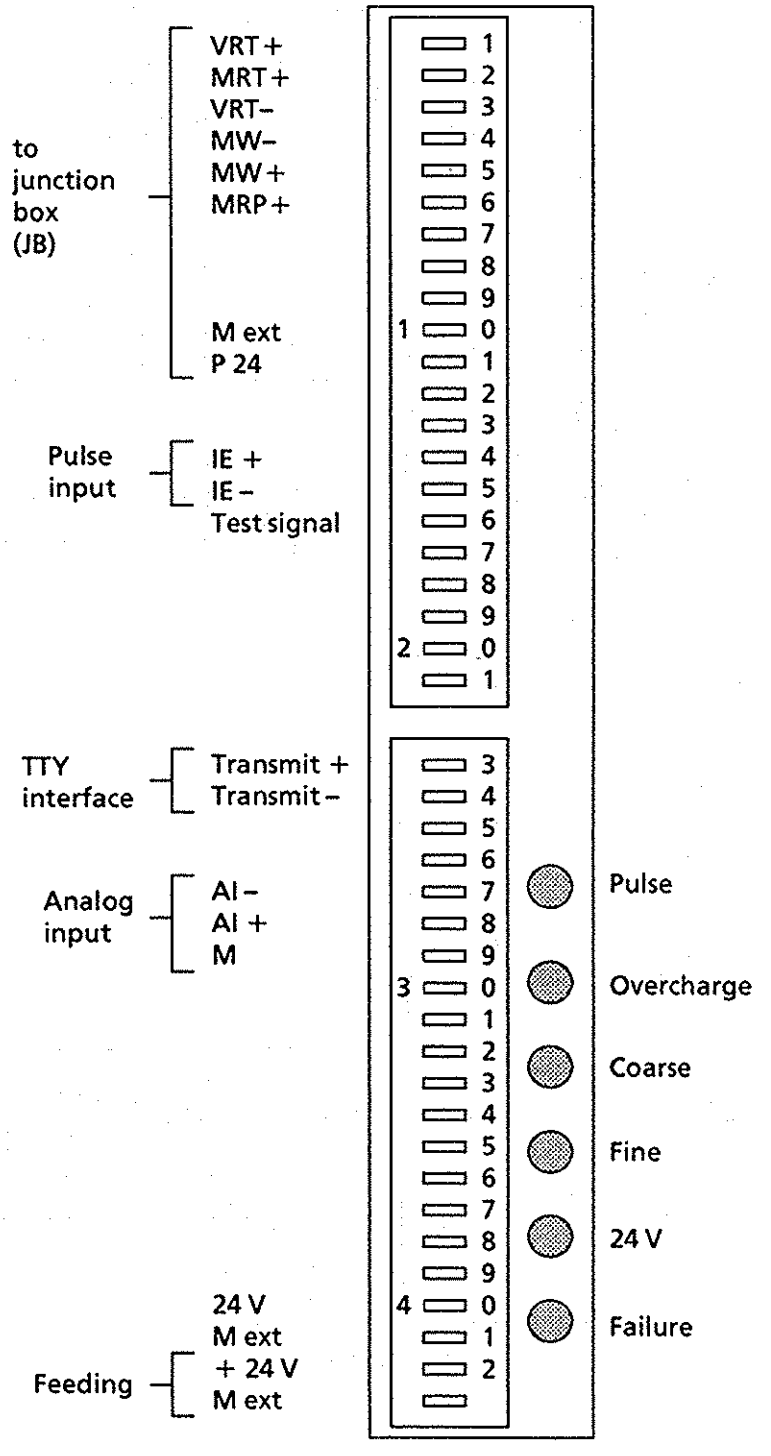


Figure 18: Front Connector Assignment

3.3.2 Front Connector Assignment (Example)

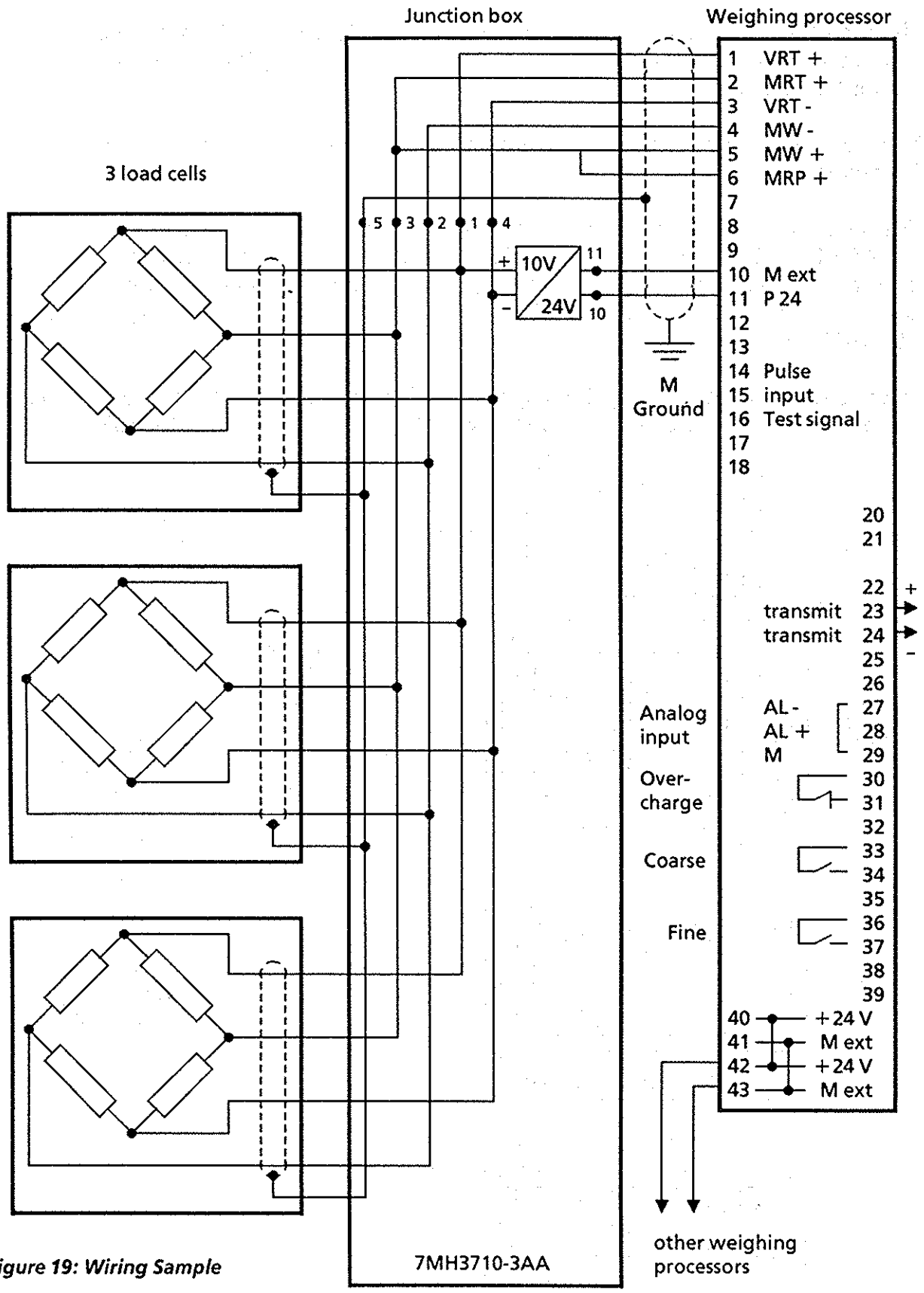


Figure 19: Wiring Sample

If the load cell output voltage should be measured for test, the lines 2, 4, and 5 have to be cut off. The measure voltage can be determined on lines 4 and 5. In case of loading the load cell the measured voltage must rise in positive direction.

3.3.3 Connection Possibilities

The weighing processor is connected with the PLC's CPU via the system bus (48 pin basic connector). The width of the weighing processor is 1/3 SEP (standard width, this means 1 SIMATIC slot).

The possibilities of plugging-in weighing processors into the PLCs is shown in the following Fig. 21.

The weighing processor is to be handled like an analog input module. For the SIWAREX S-115 it is foreseen to be plugged-in into the central controller CR 700-2/3 or into the expansion unit EG 701-3, for SIWAREX S-135/-155 into the central controller and for system SIWAREX S-135/-150/-155 also into the expansion units 183/185/186.

In the System S-115 an adaption capsule (Order No. 6ES5 491-0LB11) for the weighing processor is required (see relevant SIWAREX S-115 Manual C7100-G5976-C1).

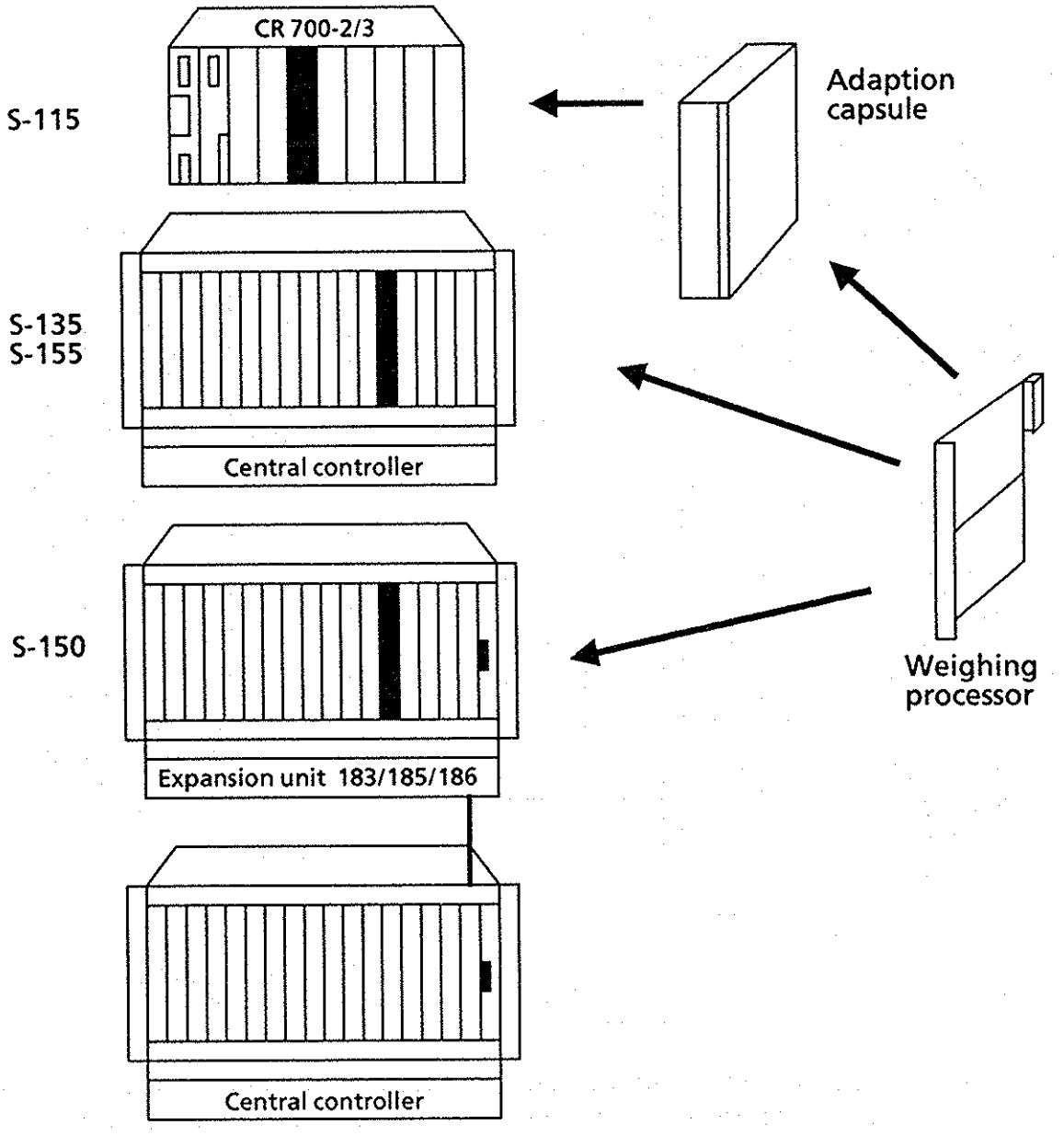


Figure 20: Plug-in Possibilities SIWAREX S-115, -135, -150, and -155

3.3.4 Construction Recommendations

The same conditions concerning power supply, panel mounting, cooling, wiring, protection, and monitoring are valid as for SIMATIC S5 (see Construction Recommendations SIMATIC S5).

The connection of the load cell cable is shown in detail in Fig. 22.

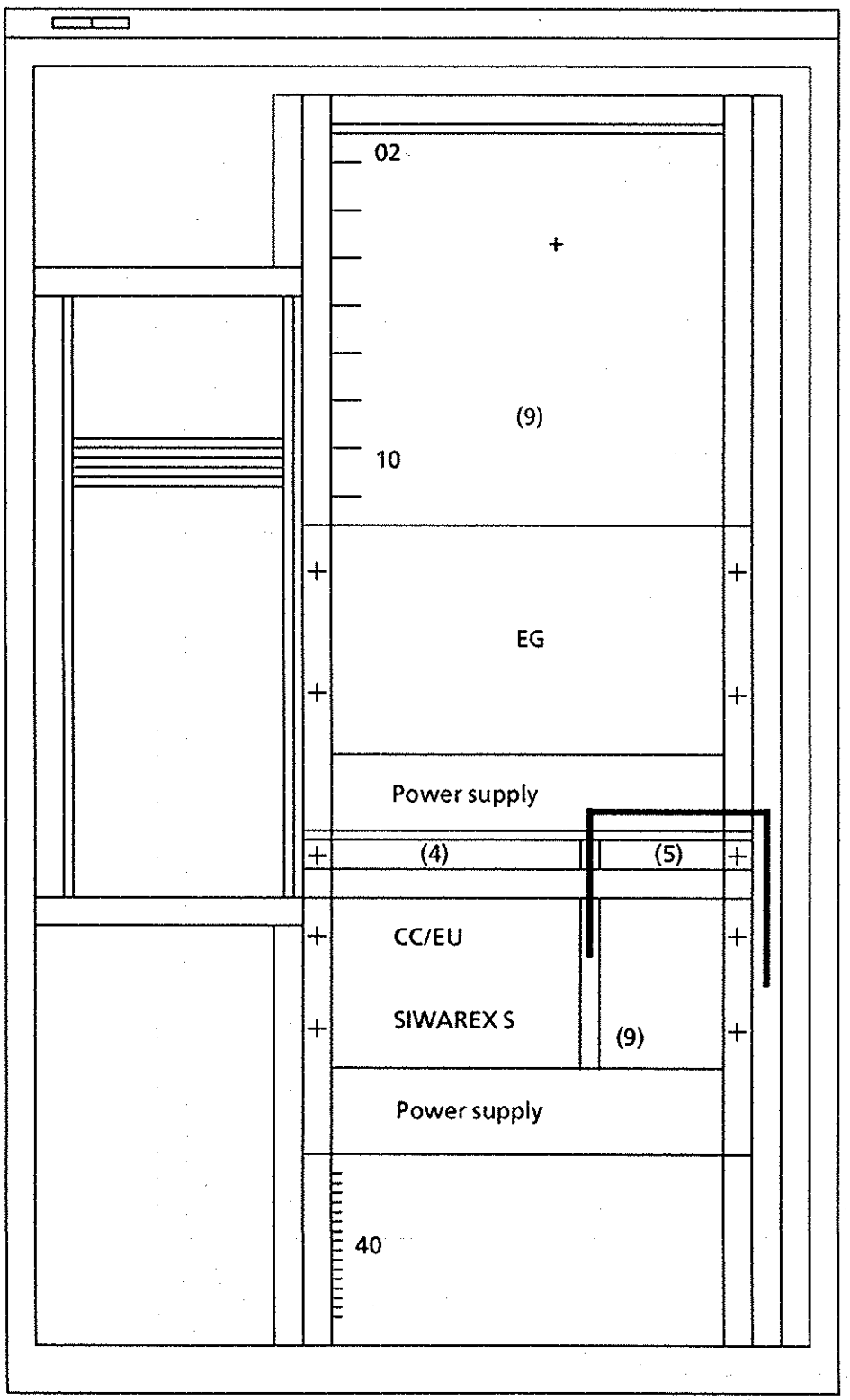


Figure 21: Construction Recommendations

1 Connection SIWAREX S to junction box
2 Layed open cable screen for 45mm
3 Layed open wire fitted with cable plugs wire end sleeves and led to the weighing processor on the shortest distance
4 Ground bar 6DS9906-8QA
5 Cable guide C79369-A3006-B10
6 Mounting with cable straps

* ground of the measuring cable screen

7 Cable in the wire guide channel or on cable clamps. Cable must be layed separately from signal supply cables. Spare at least 20 cm to be able to put the module on the adapter
8 to junction box
9 Weighing processor
10 Front plug
11 Locking bar
12 S5 support frame

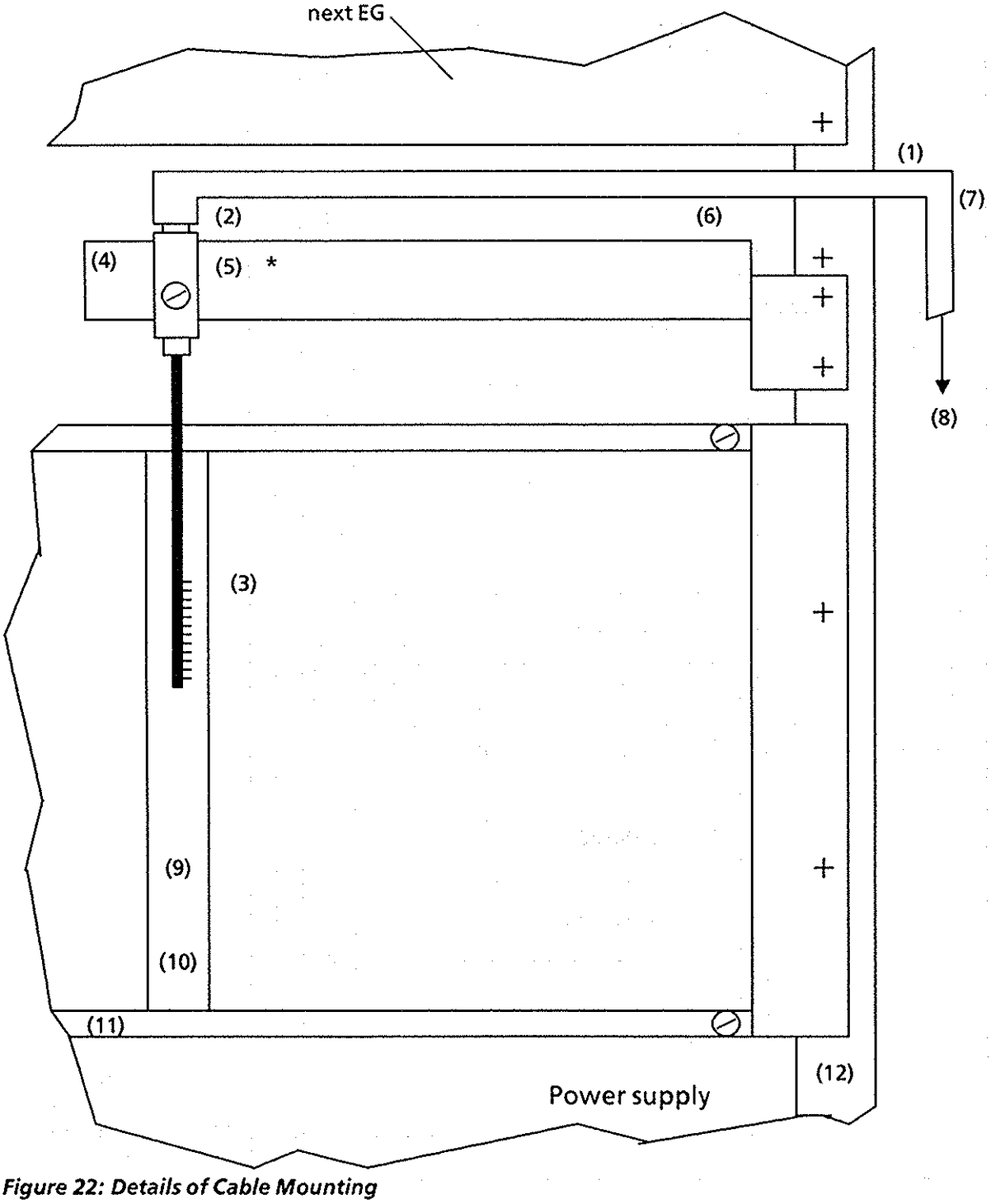


Figure 22: Details of Cable Mounting

3.3.5 Removing and Plugging-in the Weighing Processor

The weighing processor must not be removed before the supply voltage has been switched off.

The front connector should also be free of voltage before removing the weighing processor.

3.4 Technical Data

3.4.1 Technical Data Weighing Processor

- Temperature range	0 - 55 °C
- Storage temperature	– 40 to + 70 °C
- Protection class (for support mounting)	IP 00
- Current consumption 5 V ± 5 %	0,9 A max.
- Current consumption 24 V (20 to 30 V)	approx. 0,1 A to 0,3 A
- Isolation class (VDE 0100)	C
- Weight	530 g

3.4.2 Technical Data Data Acquisition (PCB 2)

- Internal resolution of measured value	up to 40.000 digits
- Step voltage (ex-works setting R_{43})	0,5 µV/d
- Linearity error regarding to the final value of meas. range	0,2 ‰
- Temperature error (– 10 to + 40 °C) without cable influences	
of Zero point	0,6 µV/K
of Gradient	0.01 ‰ VE/K
- Distance to junction box	1000 m max.
- Overall resistance of the load cells	50 Ω to 4010 Ω
- Pulse input (potential-free)	24V / 50 Hz
Input voltage	-3 to + 33V
Input voltage for signal 0	≤ 3 V
Input voltage for signal 1	≥ 18 V

3.4.3 Technical Data Data Processing (PCB1)

- Analog input (non-isolated)	
Input voltage range	0 to 5 V
Input current range	0 to 20 mA
Input resistance for current input	250 Ω
Resolution	8 Bit ± 1 LSB
Sampling rate	< 1 sec
- Interface to remote display	TTY (1.200 Baud) 20 mA current loop
- Relay outputs for coarse feed, fine feed and overcharge	60 V; 0,5 A, with spark arrester (see 3.5.2)

Attention: For inductive load use suppressor diodes.

3.5 Technical Details

3.5.1 External Power Supply

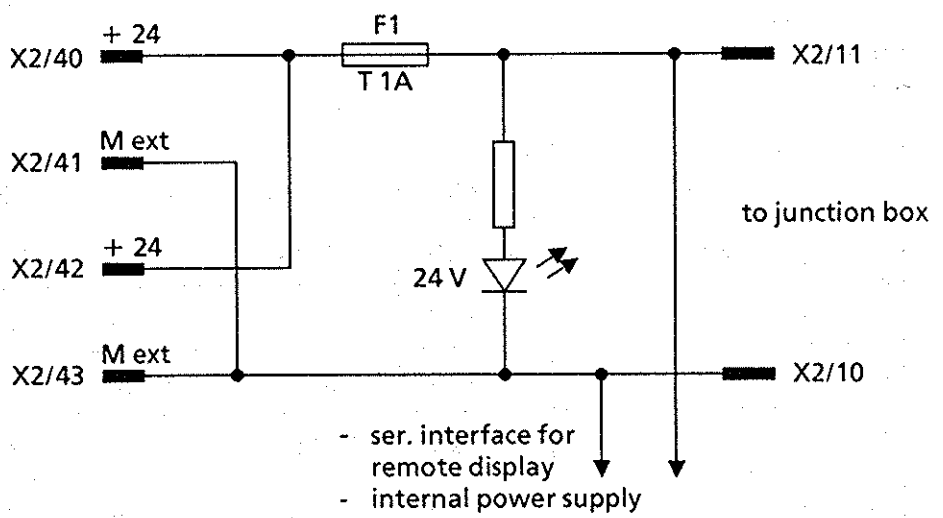


Figure 23

3.5.2 Relay Output with Spark Arrester

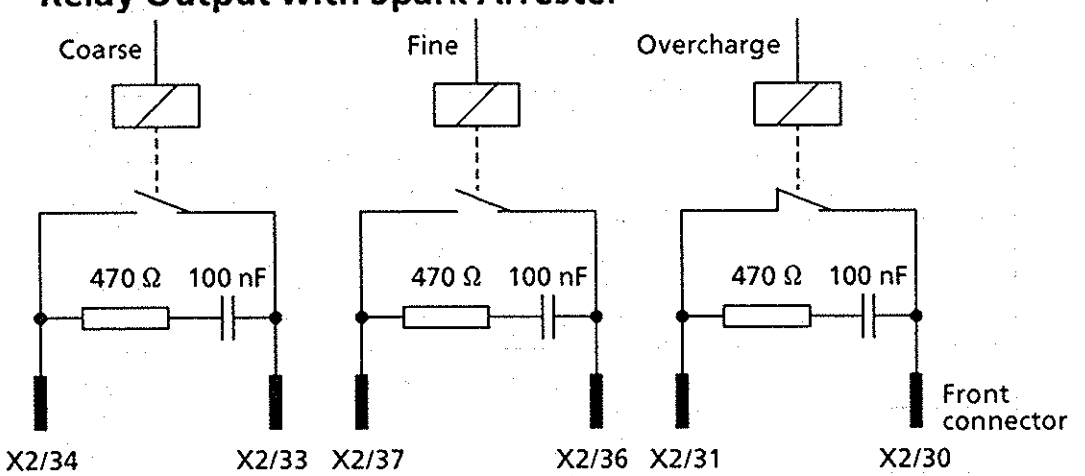


Figure 24

3.5.3 Serial Interface for Remote Display

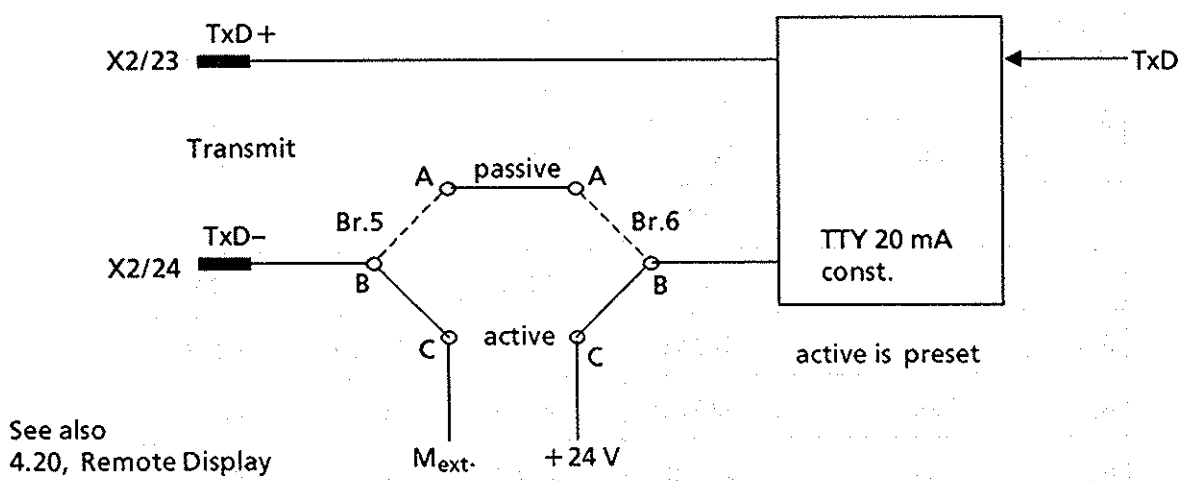


Figure 25

3.5.4 Tuning Resistors (24 E)

Load cell(s)		R_a 350 Ω		Nominal value 2 mV/V	
Number conn. in parallel		1	2	3	4
R_{tg}	R27	▬	▬	▬	▬
	R29	82 kΩ	43 kΩ	27 kΩ	20 kΩ
R_{tf}	R26	820 kΩ	430 kΩ	270 kΩ	200 kΩ
	R28	820 kΩ	430 kΩ	270 kΩ	200 kΩ
R_{vo}	R25	180 kΩ	91 kΩ	62 kΩ	43 kΩ
R_{vu}	R24	180 kΩ	91 kΩ	62 kΩ	43 kΩ
R_p	R23	91 kΩ	47 kΩ	30 kΩ	22 kΩ

▬ = soldering jumper

Load cell(s)		R_a 245 Ω		Nominal value 1,5 mV/V	
Number conn. in parallel		1	2	3	4
R_{tg}	R27	▬	▬	▬	▬
	R29	75 kΩ	39 kΩ	24 kΩ	18 kΩ
R_{tf}	R26	▬	390 kΩ	240 kΩ	▬
	R28	1,5 MΩ	390 kΩ	240 kΩ	360 kΩ
R_{vo}	R25	160 kΩ	82 kΩ	51 kΩ	39 kΩ
R_{vu}	R24	160 kΩ	82 kΩ	51 kΩ	39 kΩ
R_p	R23	82 kΩ	43 kΩ	27 kΩ	20 kΩ

Load cell(s)		R_a 600 Ω		Nominal value 1 mV/V	
Number conn. in parallel		1	2	3	4
R_{tg}	R27	▬	▬	▬	▬
	R29	300 kΩ	150 kΩ	100 kΩ	75 kΩ
R_{tf}	R26	3 MΩ	▬	▬	▬
	R28	3 MΩ	3 MΩ	2 MΩ	1,5 MΩ
R_{vo}	R25	620 kΩ	330 kΩ	220 kΩ	160 kΩ
R_{vu}	R24	620 kΩ	330 kΩ	220 kΩ	160 kΩ
R_p	R23	330 kΩ	160 kΩ	110 kΩ	82 kΩ

Load cell(s)		R_a 600 Ω			Nominal value 2 mV/V
Number conn. in parallel		1	2	3	4
R_{tg}	R27	H	H	H	H
	R29	140 kΩ	68 kΩ	47 kΩ	36 kΩ
R_{tf}	R26	1,4 MΩ	680 kΩ	470 kΩ	360 kΩ
	R28	1,4 MΩ	680 kΩ	470 kΩ	360 kΩ
R_{vo}	R25	330 kΩ	160 kΩ	110 kΩ	82 kΩ
R_{vu}	R24	330 kΩ	160 kΩ	110 kΩ	82 kΩ
R_p	R23	160 kΩ	82 kΩ	51 kΩ	39 kΩ

H = soldering jumper

Load cell(s)		R_a 1000 Ω			Nominal value 2 mV/V
Number conn. in parallel		1	2	3	4
R_{tg}	R27	H	H	H	H
	R29	240 kΩ	120 kΩ	82 kΩ	59 kΩ
R_{tf}	R26	2,4 MΩ	1,2 MΩ	820 kΩ	590 kΩ
	R28	2,4 MΩ	1,2 MΩ	820 kΩ	590 kΩ
R_{vo}	R25	510 kΩ	270 kΩ	180 kΩ	130 kΩ
R_{vu}	R24	510 kΩ	270 kΩ	180 kΩ	130 kΩ
R_p	R23	270 kΩ	130 kΩ	91 kΩ	68 kΩ

Load cell(s)		R_a 4010 Ω			Nominal value 2,85 mV/V
Number conn. in parallel		1	2	3	4
R_{tg}	R27	H	H	H	H
	R29	680 kΩ	330 kΩ	220 kΩ	160 kΩ
R_{tf}	R26	6,8 MΩ	3,3 MΩ	2,2 MΩ	1,6 MΩ
	R28	6,8 MΩ	3,3 MΩ	2,2 MΩ	1,6 MΩ
R_{vo}	R25	1,5 MΩ	750 kΩ	510 kΩ	360 kΩ
R_{vu}	R24	1,5 MΩ	750 kΩ	510 kΩ	360 kΩ
R_p	R23	750 kΩ	390 kΩ	240 kΩ	180 kΩ

3.6 PLC Interface

The interface between PLC (automation unit) and WP (weighing processor) is realized on the weighing processor with a FIFO memory.

For reading and writing separate memory areas with a depth of 16 byte each are available.

Data transfer is performed by transmitting complete data blocks of 16 byte length by the handling modules (PLC → WP) or, respectively, by the WP (WP → PLC).

1. byte:	message identification byte
2. byte:	data
.	.
.	.
.	.
.	.
15. byte:	data
16. byte:	end identifier

Synchronization trouble in data transfer can occur by errors during the call-up of the handling modules or by disturbances on the data bus.

If a synchronization error occurs several times, the weighing processor will perform a synchronization and issue the message 'Interface to PLC breakdown' (DW10, bit 14; DW 50, Bit 14).

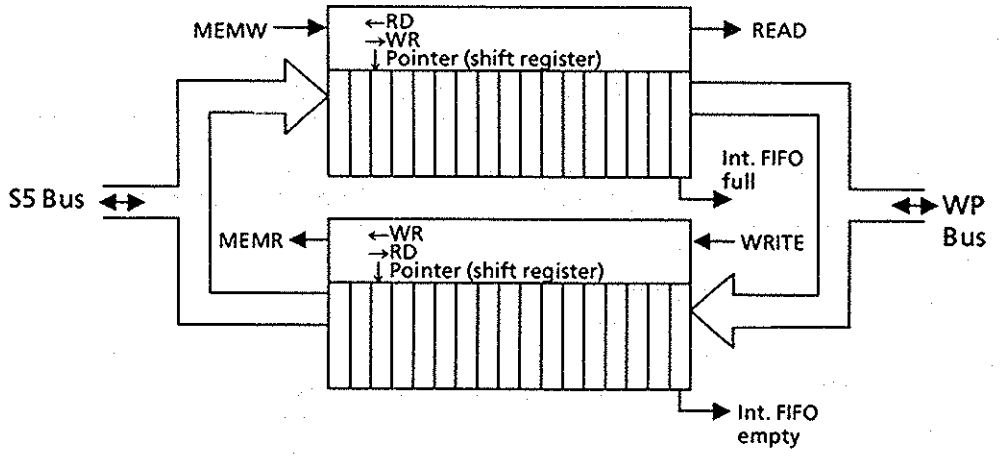
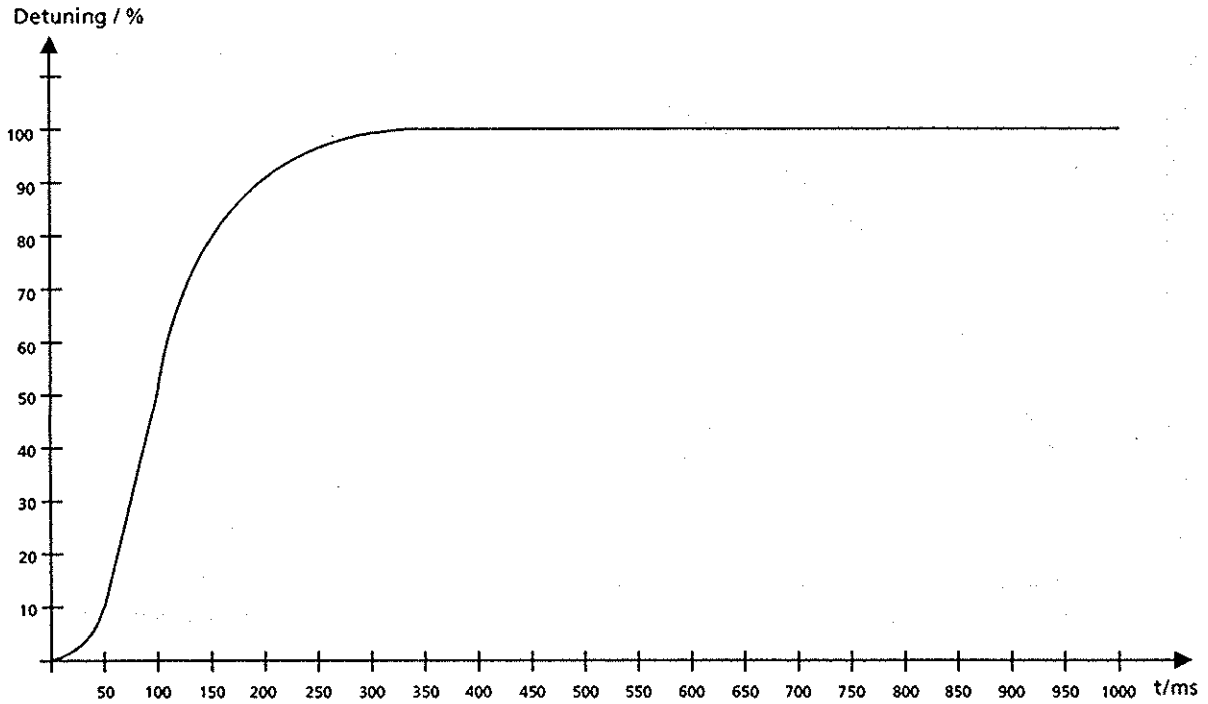


Figure 26

3.7 Characteristics, Step Response

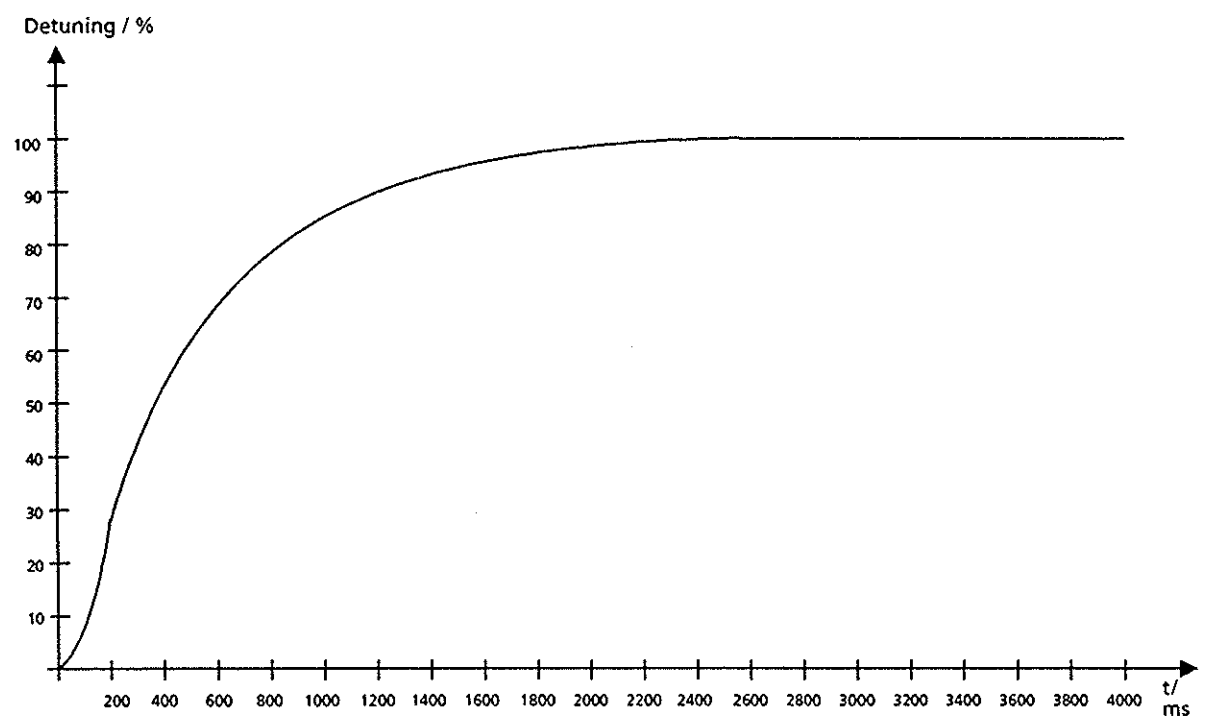
Conditions: (Standard case)

- Software dependent control amplifying ON (DW 52, bit 11 = 0)
- Potentiometer R_{43} set ex-works (2 mV/V adaptation)
- Damping capacitor C_{19} and C_{20} (ex-works mounted)

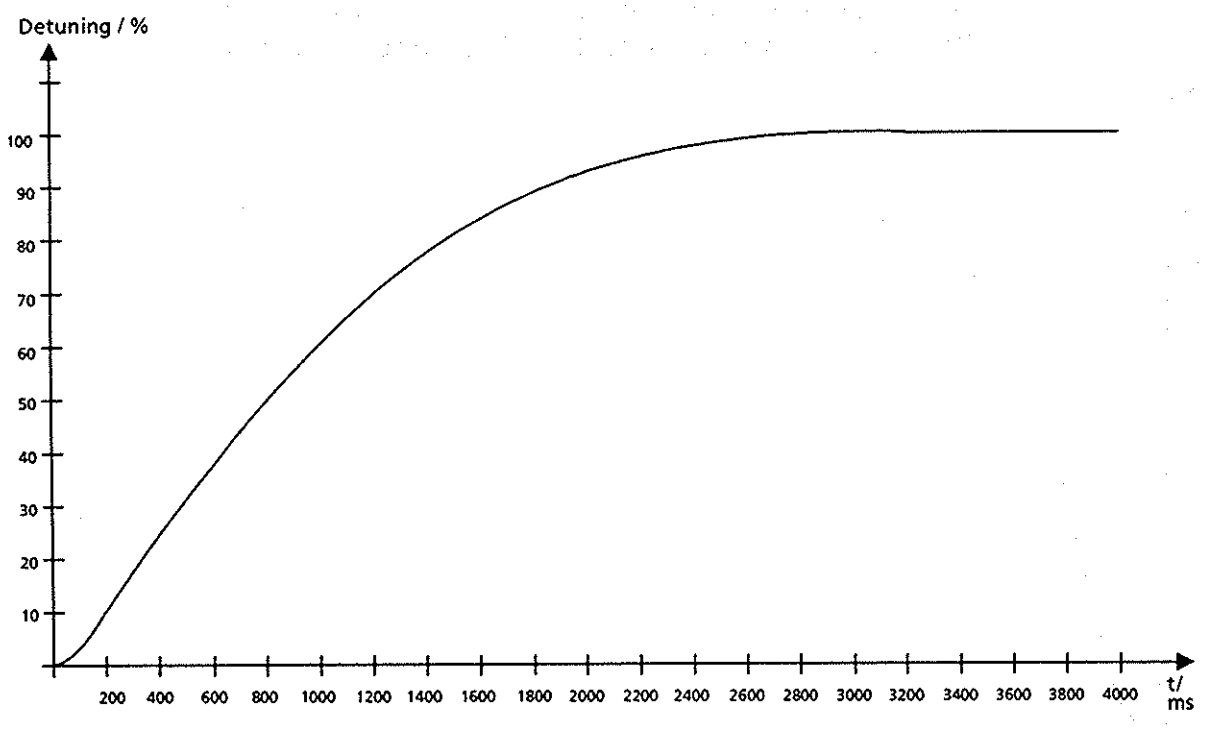


Conditions:

- Software dependent control amplifying OFF (DW 52, bit 11 = 1)
- Potentiometer R_{43} set ex-works (2 mV/V adaptation)
- Damping capacitor C_{19} and C_{20} (ex-works mounted)



Conditions:
- Software dependent control amplifying OFF (DW 52, bit 11 = 1)
- Potentiometer R_{43} set ex-works plus 3 turns right (lowering)
- Damping capacitor C_{19} and C_{20} (ex-works mounted) plus 4.7 µF for C_{21}



h4 Functions

4.1 Calibration

If a linear behaviour of the weighing mechanic is assumed, one calibration weight (known weight) is sufficient for calibration (according to calibration weight 1 (scale unloaded) and calibration weight 2 (first calibration weight)).

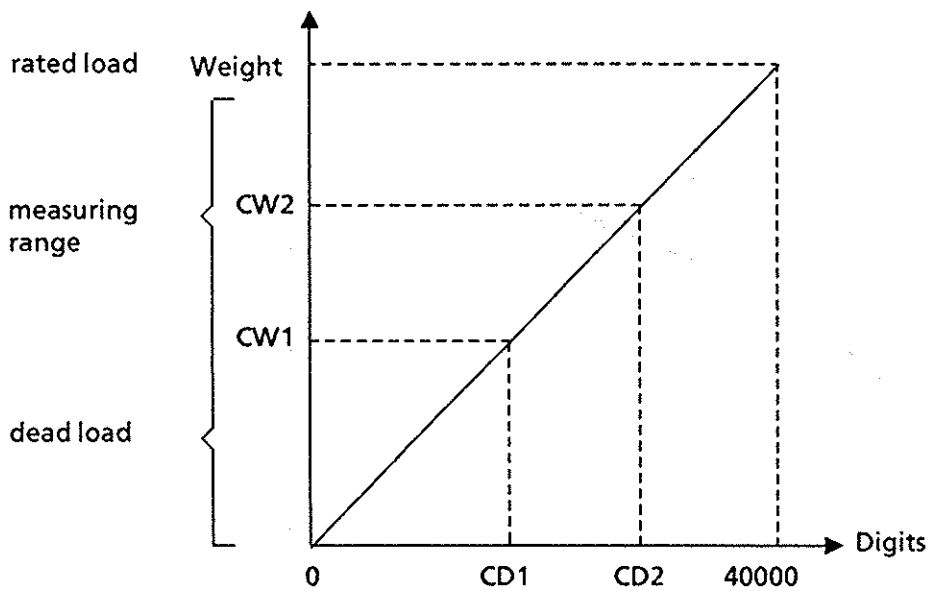


Figure 30: Linearization

The weighing processor breaks up the signal which is sent by the load cells at rated load in 40 000 parts (digits).

During calibration internal digits are calculated for the weight values. Calculation is performed by the following formula:

$$Weight\,per\,digit = \frac{CW2 - CW1}{CD2 - CD1}$$

This relationship is valid on the whole measuring range. Between CD1 and CD2 must be a minimum difference of 1000 digits, to achieve a sufficient accuracy.

The weighing processor is able to display the calculated digits instead of filling level in DW 38 during calibration. Therefore bit 10 in DW 51 must be set.

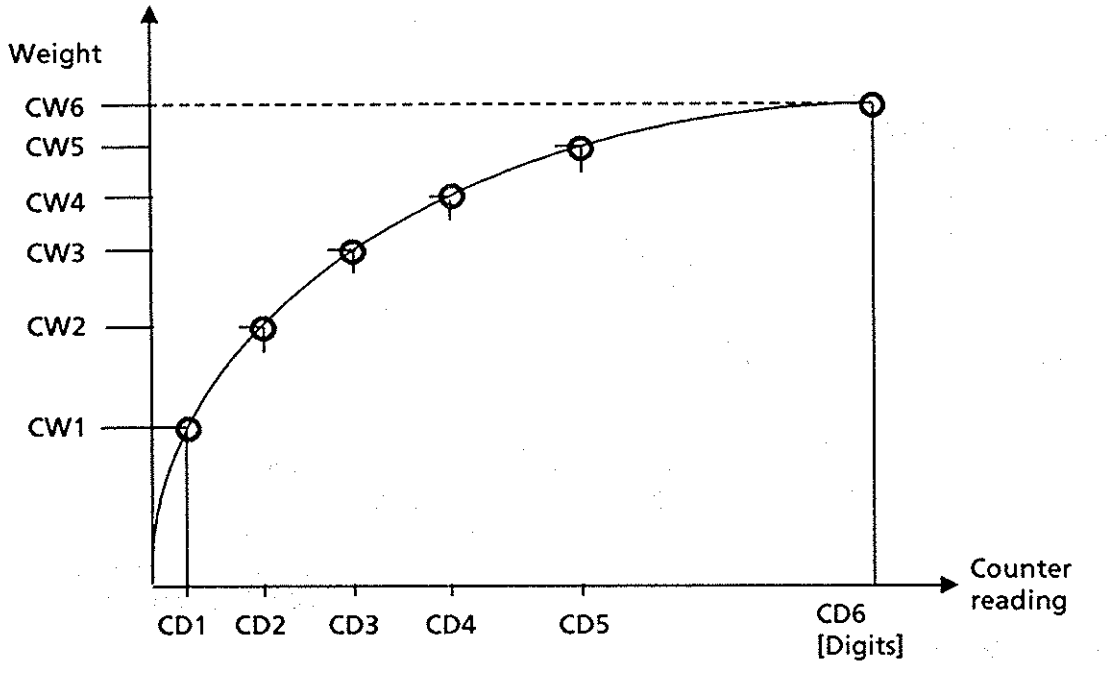
Note: 'Dead load' is generally understood as the sum of all movable masses of the mechanical system of a scale, that means the own dead mass of the mechanical parts of the scale.

See also section 5.1.1.

4.2 Linearization

The scale's mechanical construction can cause non-linearity over the measuring range.

As this is a reproducible behaviour, the weighing processor provides the possibility to linearize the weighing processor's sensitivity with 6 individual load values (calibration weights) (see Fig. 31). The pre-condition for that is that the measuring curve has no hysteresis.



CW = Calibration weight (g/kg/t) from DW 73 to 84
CD = Calibration digits from DW 85 to 96

Figure 31: Linearization of Characteristic Line

The non-linear function can be seen as composed of 6 individual linear subfunctions. To accomplish linearization 5 calibration weights have to be applied - distributed over the measuring range (CW1 = empty scale).

A detuning of a minimum of 1000 digits is necessary between the calibration weights.

The calibration value 1 (CD 1) results from calibration point 1 (scale unloaded; zero of scale). Calibration point 2 is determined by loading the scale with calibration weight 2. It corresponds with calibration digit 2 etc. A linearization factor which shows the ascent of the characteristic line is calculated on calibration points 1 to 5 (unit: weight/digit).

Outside the calibration points the calibration line is defined as straight line, linearly elongated between the 2 nearest calibration points.

Linearization factors which are corresponding to the function shape are determined as follows:

$$LIFAC_n = \frac{CW_{(n+1)} - CW_{(n)}}{CD_{(n+1)} - CD_{(n)}}$$

LIFAC	:	Linearization factor
CW	:	Calibration weight
CD	:	Calibration digit
n	:	Index (1<n<5)

The actual weight is determined:

$$Weight = CW_{(n)} + ((actual\,value_d - CD_n) \cdot LIFAC_n)$$

actual value$_d$ = actual weight in digits

The weighing processor remains switched on disturbance until it is calibrated.

The disturbance message will be reset if the adjustment of the last calibration weight is reached. (Not used calibration weights have to be preset with "zero").

The factors, weighing parameters and weights which have been determined at the linearization of the characteristic curve are placed in a voltage-failure protected RAM.

In order to avoid a manipulation of adjustment data the command 'ADJUSTMENT BLOCKED' was introduced. With the command 'ADJUSTMENT BLOCKED' which is done by setting the bit nb11 in DW51, one flag is set and placed in a voltage-failure protected RAM. This flag prevents a new linearization.

The RAM and thus the calibration flag can be cleared by switch S2/3 on the basic PC board - or by software command (data block for scale, DW 51, bit 9). Clearing via software will only be possible if S2/7 is closed.

4.3 Zeroing

As the scale's zero point can change by wear and tear etc., the level should be set to zero. You have to choose the command 'ZEROING' (DW 51, bit 0) for this. The command 'ZEROING' is possible in the range between the scale's absolute ZERO point (255 digits) and the calibration point 2.

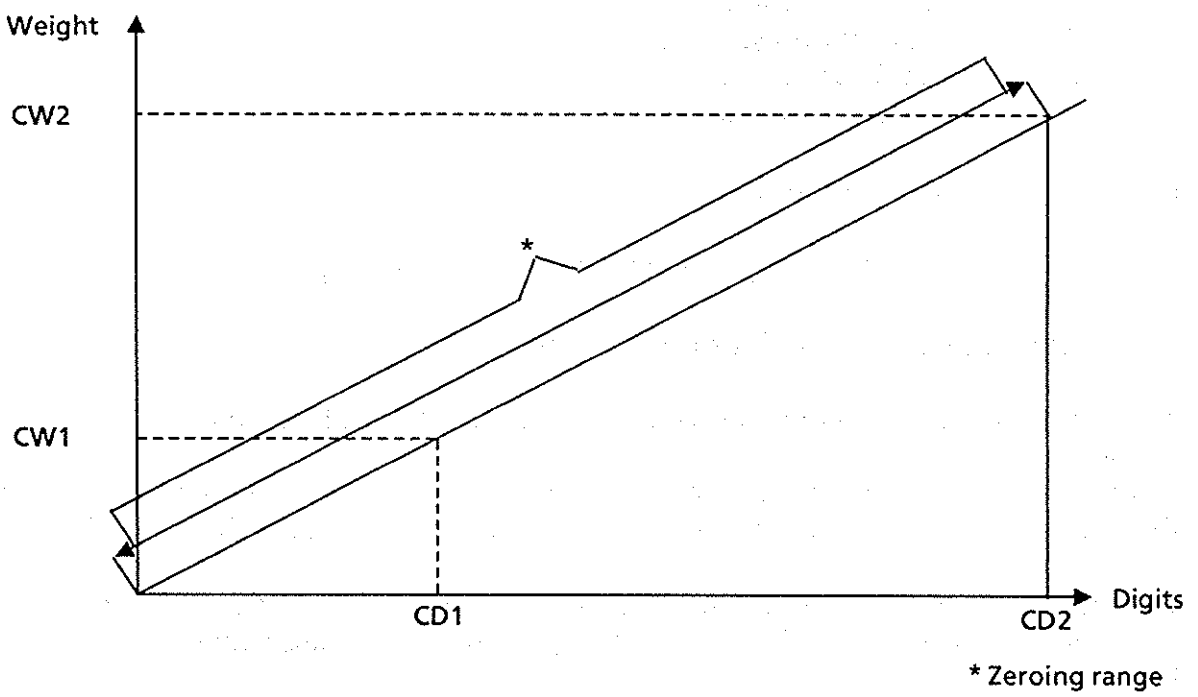


Figure 32: Zeroing Range

After zeroing the difference of the new 'zero' to calibration point 1 (digits) must be written into DW 53, 54 (= zeroing digits) with the command 'READ CALIBRATION DATA' (DW 51, bit 7). The 'zero' can be manipulated intentionally by changing DW 53, 54 and the following command 'TRANSMIT CALIBRATION DATA' (DW 51, bit 7). A plausibility check on the weighing processor is performed after transmitting the new zero. After a positive shape of the plausibility check the new zero is accepted, after a negative check the old zero remains. An error message will not be issued.

If you calibrate the scale for the first time, it is important to have written a '0' in zero value DW 53, 54.

Every time the command 'TRANSMIT CALIBRATION DATA' is sent, the zero value would also be transmitted to the weighing processor. To have no change of the zero it is necessary to give the command 'READ CALIBRATION DATA' after the command 'ZEROING'.

Note: **'ZEROING'** means generally resetting the scale's **level counter** to the zero value.This is also valid for all following weighings until zeroing is started again. Opposite to that, **'TARING'** will set the scale's ***batch weight counter*** to the zero value.

4.4 Batching Procedure

With every start of a batching procedure (DW 12, bit 7) the "standstill check" is executed and - in case of standstill - an automatic taring will be done. Taring means that the actual load value (DW37, 38) becomes the new zero. The relays 'coarse feed' and 'fine feed' will be energized (see Fig. 33). The batch weight counter rises from zero.

When the turn-off point for 'coarse feed turn off value' (= set value – pre signal – follow up) is reached, the coarse relay is de-energized.
When the 'fine feed turn off value' (= set value – follow up) is reached, the fine relay is de-energized.

Then the settling time (DW 21) is started. When the settling time is elapsed, the tolerance check is performed. Then the 'READY' signal (DW 36, bit 1) is provided.

If the standstill signal (DW 36, bit 14) is provided before the settling time (DW 21) is elapsed, the settling time will be interrupted at the same time as the standstill signal is sent, a tolerance check is performed and the 'READY' signal is provided.

That means a shortening of the batching procedure (batch time optimizing).

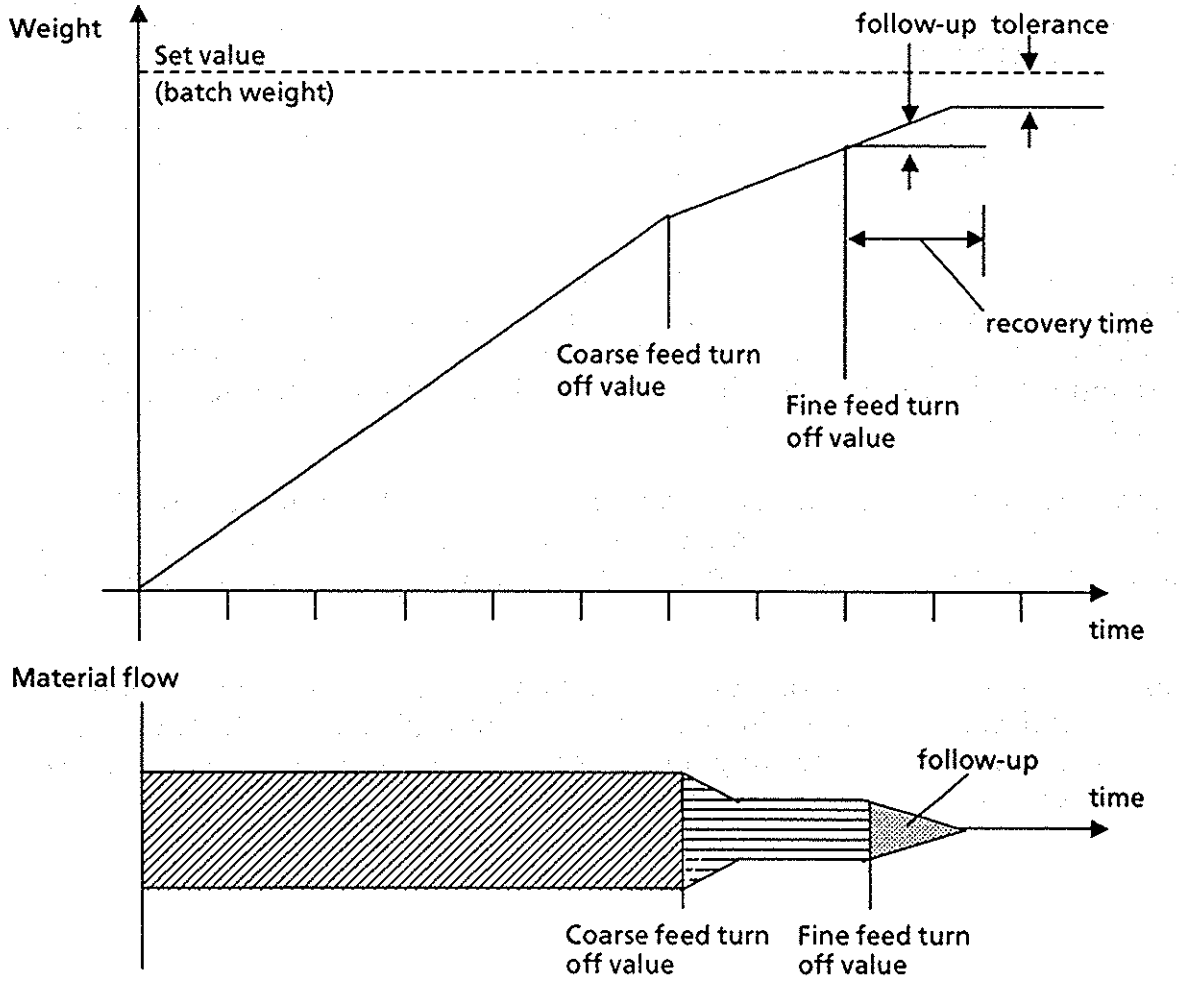


Figure 33: Batching Procedure

When the batching procedure was interrupted with the command 'STOP' (DW 12, bit 5), it will be possible to continue batching with the command 'INTERMEDIATE START' (DW 21, Bit 6). In this case the scale would not be tared.

If the switching-over from coarse feed to fine feed is done, switching back to coarse feed (within the running batching procedure) will not be performed in the case if the value is fallen below the switching point.

If a new set value (DW 13, 14) is transmitted to the weighing processor in the coarse feed or fine feed phase of a batching procedure, a plausibility check will be performed. If the plausibility check is negative, an error message will be issued (DW 10, bit 5).

In inching duty mode (see section 4.7) the plausibility check will always be performed independent of the phase of the running batching procedure.

If a new set value is transmitted only within the "follow-up phase" the batching procedure will be stopped immediately and the same error message will be issued. This is necessary to reach a regular finish of the batching procedure.

Automatic post batching at tolerance underranging

Besides of the 'automatic follow-up correction' there is another possibility to reach the set value exactly, means the automatic post batching at tolerance underranging.

When the 'automatic follow-up correction' is OFF (DW 52, bit 8 = 1) and the 'post batching at tolerance underranging' is ON (DW 52, bit 4 = 1), the weighing processor behaves as follows:

When batching, a tolerance check is performed after switching off the coarse feed and the fine feed signal. If an underflow of the tolerance is realized (DW 36, bit 2), the 'READY' message will not be issued and the fine feed signal will come as long as the tolerance minus limit is reached (DW 26, 27). After another tolerance check the 'READY' message will be issued now.

At 'post batching at tolerance underranging' (DW 52, bit 4 = 0) the 'READY' and the 'tolerance minus underflown' messages will be issued in the same procedure as above after processing the first tolerance check. A new fine feed signal will not be sent.

Note: The function 'automatic post batching at tolerance underranging' will be switched on or off in the range of the calibration data and, therefore, transmitted to the weighing processor with the FB SIW:JUST and disabled user program (FB SIW:SOLL and FB SIW:LESE).

4.5 Tolerance Check

A tolerance check is performed after any batching procedure.

If the batch weight is **lower** than the value "set value – batch load TOLMINUS", the message 'TOLMINUS underranged' will be issued.

If the batch weight is **higher** than the value "set value + batch load TOLPLUS", the message 'TOLPLUS overranged' will be issued.

The tolerance values are stated in the following data words:

Tolerance Plus	DW 24/25
Tolerance Minus	DW 26/27

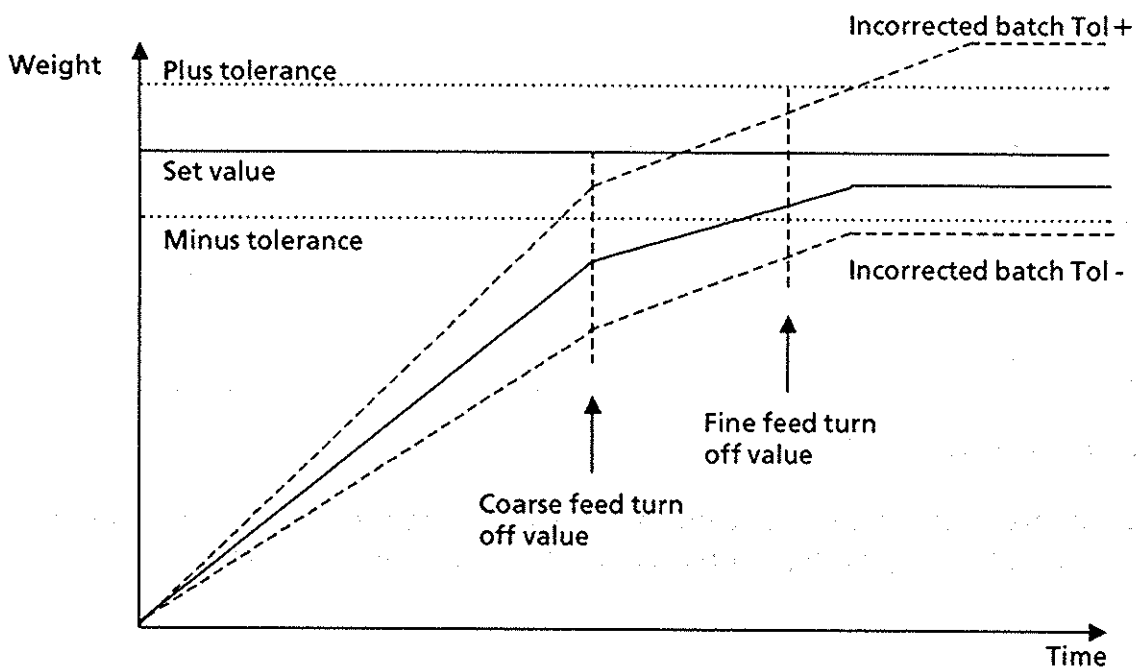


Figure 34: Tolerance Check

The tolerance limits TOLPLUS and TOLMINUS can be given as relative in ‰ of the set value or as absolute values (e. g. g, kg) dependent on bit 7 in DW 52 is parameterized (Calibration Data).

If the weighing processor realizes a tolerance underflow, the reaction depends on its parameterizing:

If bit 4 is set in DW 54 (1), the weighing processor executes 'AUTOMATIC POST BATCHING'.

If bit 4 is not set in DW 54 (0), 'INCHING DUTY' is programmed.

4.6 Automatic Post Batching

If bit 4 is set in DW 52 (Transmit Calibration Data), the weighing processor executes 'AUTOMATIC POST BATCHING'. After performing settling time (eventually shortened by a standstill signal) and an underflow of the tolerance minus (DW 26, 27) the output signal 'fine' is set again. 'Fine' is active until the tolerance minus limit will be reached.

Now 'Fine' is de-energized and the settling time is started. After settling time is over, or by the standstill signal, 'READY' will be set.

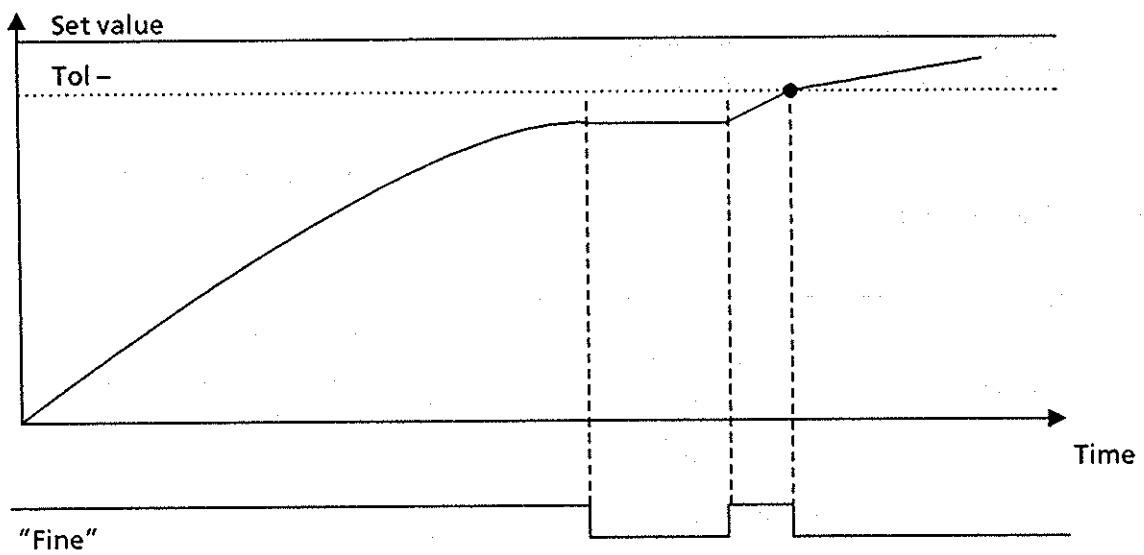


Figure 35: Automatic Post Batching

Caution: Overruns of the tolerance plus are possible when the follow up values (DW 17, 18) are very high (in this case work in the inching duty mode).

4.7 Inching Duty

Inching duty can be started with the command 'START INCHING DUTY' (DW 12, bit 15).

Inching duty means that the 'fine relay' is energized for a given period of time. The time pre-set in DW 32 is called 'inching time'. The inching time has to be given in multiples of 0.1 sec in DW 32. Therefore, very short inching times can be realized. After ending of the first inching duty the settling time is started and is operated independent of the standstill signal. After this a tolerance check is performed again. If the tolerance minus is underflown, the 'fine relay' is energized again for the period of the inching time.

If the batch weight overflows the tolerance minus limit, the inching duty eventually still running will be interrupted and the 'fine' signal will be switched off immediately. Inching duty cannot be started within the TOLMINUS borders.

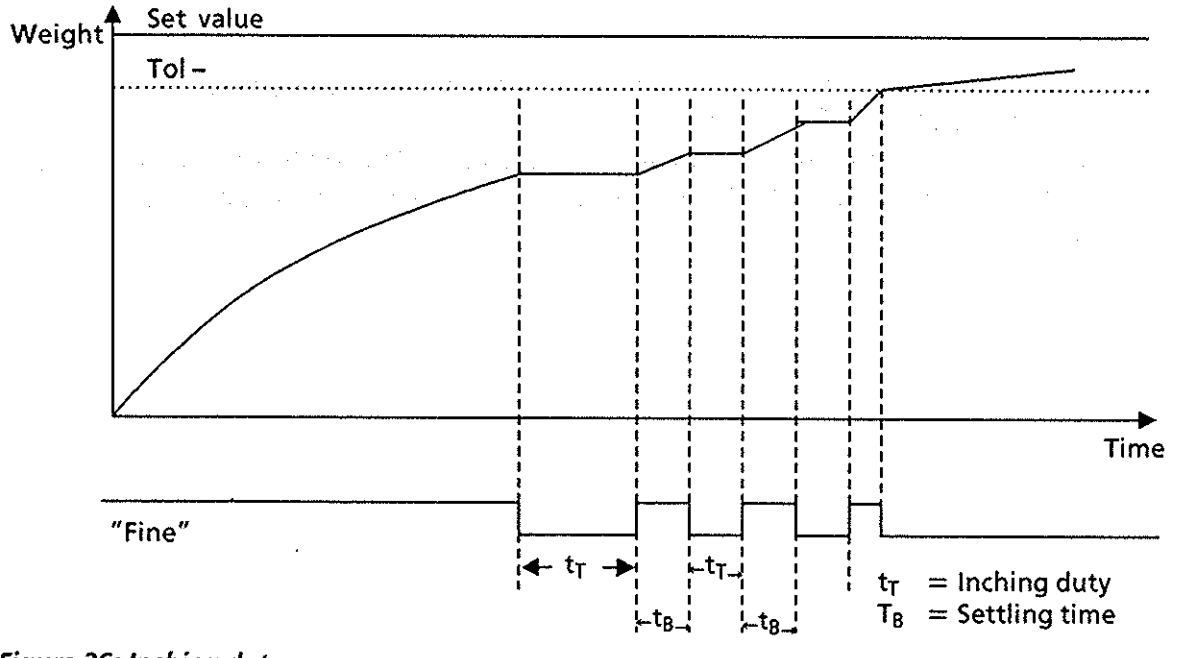


Figure 36: Inching duty

Note: If the batch weight overflows the tolerance minus limit, the 'READY' message will come after the settling time and not already with the 'standstill' message.

4.8 Taring the Scale

If the scale is loaded with an unknown weight which should not be displayed, the command 'TARING' (DW 12, bit 8) is to be taken. The batch weight (DW 39, 40) will be set to zero. In the filling level (DW 37, 38) the total weight is preserved.

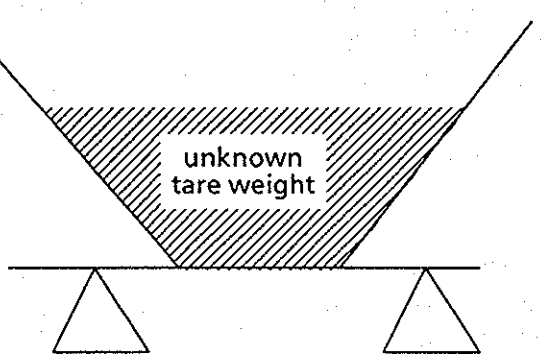


Figure 37: Taring (Tare unknown)

Note: **Taring** is generally understood as the **batch weight counter** of the scale is set to the value 0 for actual weighing.
Opposite to that, the **filling level counter** of the scale will be set to 0 at **zeroing**. This is also valid for all following weighing until zeroing is started again.

4.9 Preset Tare

In cases of filling or emptying containers of which the tare weight is known the content of the container, i. e. the net weight, can be displayed.

For that, the known tare weight is to be preset as 'preset tare' (DW 30, 31) in the data module of the scale before batching procedure is started. To transmit the 'preset tare' to the weighing processor, the command 'PRESET TARE VALID' (DW 12, bit 1) must be released in addition to the statement in the scale's data module (+ DW 11, bit 0 = 'transmit command word').

The command 'PRESET TARE VALID' (DW 12, bit 1) is active without 'START'.

After loading the scale (with the known tare weight + unknown net weight) and transmission of the command 'PRESET TARE VALID' (DW 12, bit 1), the value 'level – preset tare' (net weight) is indicated in the batch weight counter (DW 39, 40). (Preset tare, DW 30, 31.)

If the level is lower than 'preset tare – 5 %', a plausibility error message (DW 10, bit 15) will be issued.

After the command 'PRESET TARE VALID' has been accepted, the weighing processor is still in the upward batching mode because the net weight value must be correctly indicated in the batch weight counter (DW 39, 40).

The batch weight is to be calculated as follows:

batch weight = (level – preset tare)

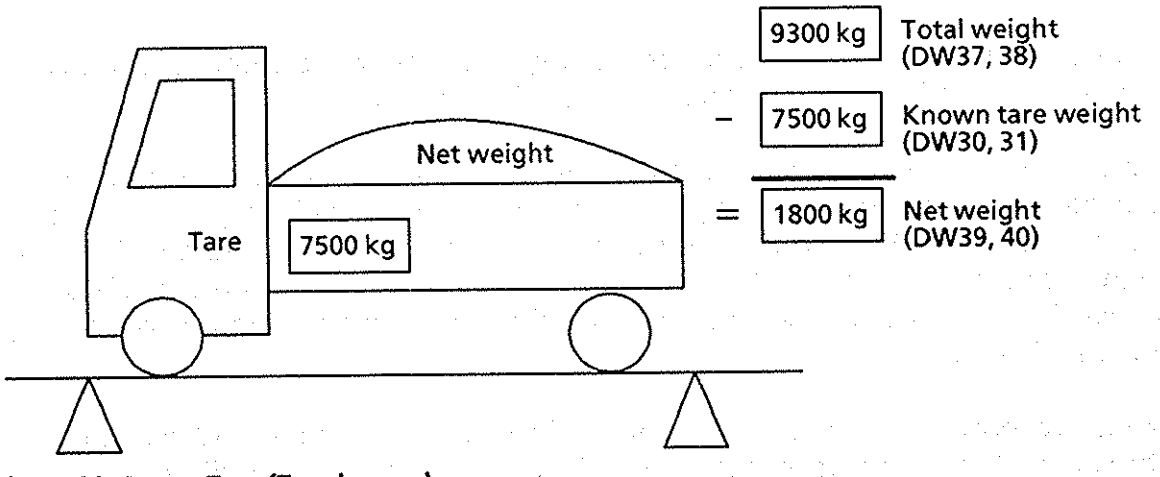


Figure 38: Preset Tare (Tare known)

Note: Before the scale will be loaded with the gross weight, the level must be zero, otherwise a wrong net weight would be computed (if required, set the level to 0 by zeroing).

4.10 Level Supervision

The level is supervised twice: the maximum load as well as the maximum volume are checked.

The following parameters are necessary for **load supervision**:

- MIN value (DW 61, 62)
- MAX value (DW 63, 64)
- Overcharge value (DW 65, 66)
- 'Empty' indication value (DW 55, 56) and
- 'Empty' indication delay (DW 57).

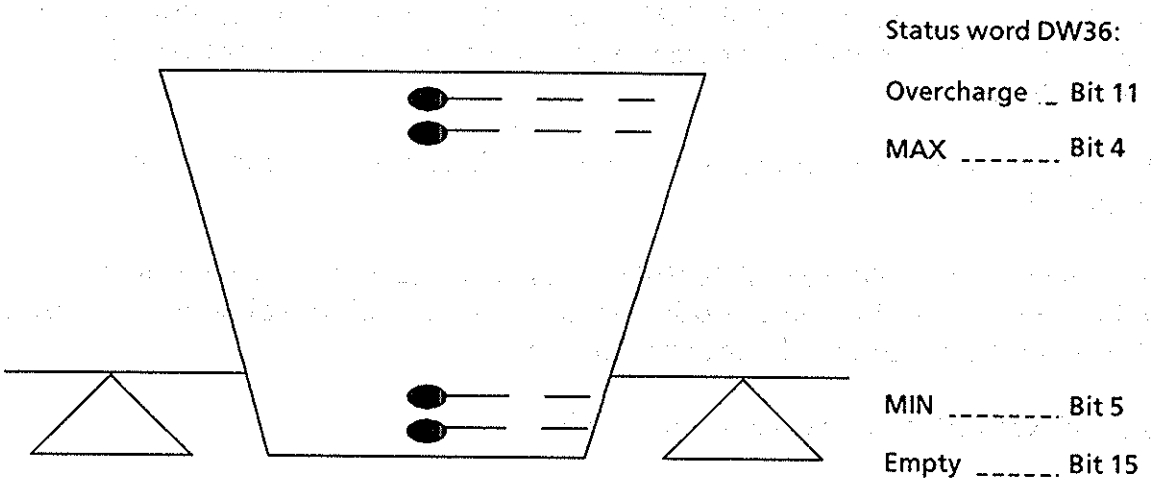


Figure 39: Level Supervision

The values MIN and MAX do not cause any reaction concerning the batching procedure. They are just transferred to the PLC via status word.

If the actual value rises over the MAX value and reaches the critical limit of the overcharge value (upward batching), the batching procedure is stopped, the relays 'fine' and 'coarse' (DW 36, bits 6 and 7) are de-energized immediately. Thus, the batching procedure is interrupted. The status is transferred to the PLC via status word (DW 36, bit 10) and the message 'overcharge' is given (Premise: overcharge value > MAX value).

In downward batching mode after overrunning the 'MIN value' and reaching the 'empty value', the batching procedure will not be stopped immediately. A delay time is started. If the delay time is elapsed, the actual value is compared with the 'empty' indication value again. If the actual value is still below the limit, the batching procedure is stopped as well and the 'empty' message will be issued (DW 36, Bit 15).

With the 'empty' message, the total volume will be simultaneously reset.

4.11 Volume Supervision

In addition to load supervision, the weighing processor is able to check the volume of the filled-in media according to the maximum volume of the weighing bin.

These parameters are necessary for **volume supervision**:

- Specific gravity	(DW 28, 29) in g/dm³
- Maximum volume	(DW 97, 98)
- Unit of volume	(DW 100)
- Unit of weight	(DW 101)
- (Overcharge limit value	(DW 65, 66))

The volume supervision is derived from the specific weight of the medium. The specific weight has no decimal point (DW 99) and is generally transferred to the weighing processor with the unit g/dm³.

The actual volume is calculated from the actual load divided by the media's specific weight. The calculated volume is permanently compared with the maximum volume. If the actual volume exceeds the limit, 'overcharge' (DW 36, bit 11) will be indicated and the batching procedure will be interrupted as well (DW 36, bit 10).

In order to switch off the volume supervision, the specific weight is to be set down to '0'.

For volume supervision in the upward batching mode the volume is to be calculated as follows:

$$V_{new} = V_{old} + BW / SW$$

V_{new} : new, actual volume (added from former components)
V_{old} : old volume
BW : batch weight
SW : specific weight in g/dm³

In the upward batching mode, V_{new} will only be cleared with the 'empty' message of the scale, that means after weighing a batch and emptying of the scale it must be made sure that the 'empty' message will come. Otherwise, at all following batching procedures the volume limit value would be passed and an overfilling message would be issued.

With the START command, the sum of the volume corresponding to the set value and the actual value is supervised as to the limit value 'maximum volume'. If the 'maximum volume' value is exceeded, start will be prevented and the message 'set value not plausible' (DW 10, bit 5) will be issued.

For multi-component weighing the components generally have different specific weights which are transferred to the weighing processor at 'taring' or 'start with automatic taring'. To be able to realize volume supervision in that case, V_{old} will be stored for 'taring' (DW 12, bit 8) or 'start with automatic taring' (DW 12, bit 7). This

makes sure that the total volume can be correctly calculated during the whole weighing process.

In the case of downward batching only (without taking into account the actual volume) the preset set-value will be checked with the limit value 'MAXIMUM VALUE'. Shifting the scales from downward to upward batching operation the old volume is calculated as

$$V_{new} = actual\ level / SG$$

A downward batching scale has no V_{old} because always the volume taken off at one weighing is calculated.

$$V_{new} = BW / SG$$

For entering the maximum volume (DW 97, 98) the volume resp. weight unit given in DW 100 and DW 101 must be taken care of.

$$Volume = \frac{batch\ weight}{specific\ weight} \cdot 10^{-EFCT}$$

EFCT = unit factor = volume unit + weight unit

Constants for computing the unit factor:

Volume unit		Weight unit	
DW 100 in ASCII format	EFCT	DW 101 in ASCII format	EFCT
MM	-6	GR	0
CM	-3	KG	-3
DM	0	TO	-6
ME	+3		

Example:

To be able to follow the function, the volume is stated at DW 41, 42 (setting DW 52, bit 2 = '0' and bit 15 = '1' (calibration data) to be transmitted to the weighing processor).

Volume unit (DW 100) = CM (cm^3 in KC format)
Weight unit (DW 101) = GR (grams in KC format)
Specific gravity (DW 28, 29) = 500 (g/dm^3)
Max. volume (DW 97, 98) = 18 000
Overfilling limit (DW 65, 66) = 10 000

Load the scale slowly (e. g. by the load cell phantom) and observe the batch weight (DW 39, 40) and the volume value (DW 41, 42). If the batch weight reaches the value 9 000 or, respectively, the volume value reaches 18 000 (see maximum volume) the message 'Overfilling limit value reached' (DW 36, bit 11) appears.

If during the same procedure the volume supervision is switched off at sending **'specific gravity = 0'**, the message 'Overfilling limit value reached' only appears at a batch weight of 10 000 (see overfilling limit value).

Volume unit (DW 100)	= DM (dm^3 in KC format)	
Weight unit (DW 101)	= KG (kilograms in KC format)	
Specific weight (DW 28, 29)	= 250 (g/dm^3)	= 250 (in KC format)
Max. volume (DW 97, 98)	= 3 m3	= 30 000 (in KF format)
Decimal point (DW 99)	= 1	= (in KF format)

Batch weight (DW 40)	= Volume (DW 98)	x spec. weight (DW 29)	x 10^{-EFCT}
7 500	= 30 000	x 250	x $10^{(0-3)}$

→ The overfilling message appears at 7 500

DW 40 = 7.500 (in KF) = 750,0 kg
DW 98 = 30.000 (in KF) = 3.000,00 dm^3
] decimal point, volume and weight unit are given

Note: If the scale runs in downward batching mode, the volume will be computed according to the formula:

$$Volume = \frac{batch\ weight}{specific\ weight}$$

That means that, after the start of batching, the volume is enlarged according to the above formula. If now a new specific weight is transmitted to the weighing processor, the indicated volume value changes immediately.

4.12 Batching Time Supervision

The batching time supervision can be switched on or off in the DW 52.

DW 52, bit 10 = '1'	batching time supervision OFF
DW 52, bit 10 = '0'	batching time supervision ON

The batching time supervision is started with the start of the batching procedure by the command 'Start'.

If batching is not finished within the given period of time (no 'READY' signal), the batching procedure will be stopped. This will be stated in the status word with 'batching stopped' (DW 36, bit 10). Furthermore, in the error word (DW 10, bit 7) 'batching time overflown' is issued.

In the same case, batching would not be stopped and the 'fine' and 'coarse' signal would remain if the batching time supervision had not been switched OFF.

Thus the batching supervision time can be adapted to the given set value by means of a batching factor which is highly dependent on the media to be batched.

The batching supervision time is calculated as follows:

BSP = TFU + DF * SV (seconds)

BSP: Batching supervision time (in seconds)
TFU: Settling time in seconds (DW 21)
BF: Batching factor (DW 22, 23) in seconds per weight unit
SV: Set value (in kg) (DW 13, 14)

A decimal point (DW 99) is also valid for the batching factor.

Example:

Given:	DW 21	settling time	5.0 sec	KF = +5
	DW 23	batching factor	0.5 sec/kg	KG = +50
	DW 14	set value	95.0 kg	KF = +9500
	DW 99	decimal point	2.0	KF = +2
	DW 101	weight unit	kg	KC = KG

Batching supervision time = 5 sec + (50*10-2) sec/kg * (9500 * 10^{-2}) kg
= 52.5 sec

Note: At an intermediate start, the batching supervision time (see above) will be re-started.

4.13 Supervising Functions

A watchdog supervision is implemented for the data processing (DP) system. The data acquisition (DA) is checked indirectly. If the DP does not receive a new telegram from DA after a certain period of time, the DA's microprocessor will be reset by the DP's microprocessor. Eventual disturbance is given out in the error word (DW 10 resp. DW 50).

Bit 2: EPROM error (A)
An EPROM error is indicated if any deviation between the stored checksum and the data in the EPROM is found out during initialization.

Bit 3: RAM error (A)
A RAM error is indicated if it is found out during initialization.
A RAM error is indicated if any deviation between the stored checksum and the checksum of the data stored in the RAM are found out during the cyclical checksum check.

Bit 4: Watchdog supervision response (A)
Watchdog error is issued when an error occurs in the cyclical program processing (firmware) of the data processing (DP).

Bit 11: Measuring circuit disturbed (A)
If the load on the scale does not change within approx. 5 seconds, an automatical check routine will be activated. If the check is negative (no reaction of the measuring circuit), the message 'measuring circuit disturbed' (DW 10, bit 11 resp. DW 50, bit 11) will be issued and an eventually running batching procedure will be stopped (not in pulse operation). The check of the measuring circuit itself waits for another 6 seconds until it will indicate the disturbance.

(A) = must be acknowledged

The above mentioned disturbances cause the lighting up of the red failure indication on the front panel and the setting of bit 0 in the status word (DW 36) (see also sections 5.1.2.2.3 and 5.1.2.2.4).

Automatic Function Test of the Data Acquisition (DA)

The data acquisition (DA) is able to check itself. For that, the DMS bridge will be selectively detuned by a check resistor (R_p). The weighing processor internally selects the direction of detuning dependent on the actual operation point. This function will be started by the command 'CHECK' (DW 12, bit 4). 'CHECK'ing takes approximately 10 seconds. During this time the load must not change. By this function, the accuracy of the measuring unit can be checked on one hand, on the other hand some hardware defects can be realized (see following pages). To perform the check, the test value must be ascertained by the command 'ascertain test value' (DW 12, bit 0). The difference of detuning is stored by that but not indicated. During 'CHECK'ing (DW 12, bit 4) later performed the difference of

detuning is also ascertained and compared to the formerly ascertained detuning value.

The difference of the two measurements must not overrange the given 'test value tolerance' (DW 67, 68).

The status word (DW 36) indicates by the messages 'test value out of tolerance' (bit 12) and 'test value within tolerance' (bit 13) if the test value is within or out of the test value tolerance.

Note: For this function, the scale should be in the same condition as for ascertaining the test value because the weighing processor must get the correct value for comparing.
It is also possible to ascertain the two comparing values already on 'ascertain test value' in order to be independent from the actual operation point. For that, the command 'ascertain test value' must be sent twice: once below 20 000 digits and once above 20 000 digits (see also section 4.25).

Caution: The test value tolerance shall be selected with regard to the check routine and does not correlate with the set value tolerances TOLPLUS and TOLMINUS.

Detuning upward / downward

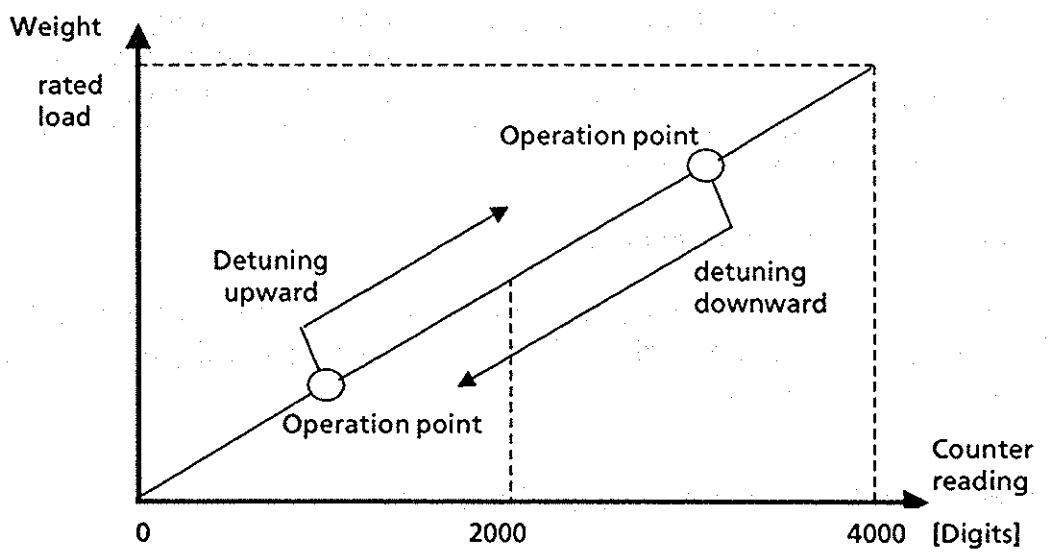


Figure 40: Detuning upward / downward

Detuning upward/downward serves for checking the limit values at appropriate times also during operation. For that, the function 'detuning upward' or 'detuning downward' must be started dependent on the actual operation point of the scale.

If the command 'detuning upward' (DW 12, bit 9) is sent to the weighing processor, the weight value in the level counter (DW 37, 38) will be increased of up to 19 740 digits depending from check resistor. This causes reaching e. g. the MAX value or the

overcharge value and issuing the corresponding message and, therefore, checking these values.

The command 'start detuning upward' is only active for the time division input (not for pulse input). By that, the test resistor is applied to and the scale is detuned in positive direction.

Opposite to 'CHECK', the level indication will always be updated during detuning and the bits 'test value within tolerance' (bit 13) and 'test value out of tolerance' (bit 12) in the status word (DW 36) remain unchanged.

If the command 'detuning downward' (DW 12, bit 10) is sent to the weighing processor, the weight value in the level counter (DW 37, 38) is diminished of up to 19 740 digits dependent on the test resistor. This causes reaching e. g. the MIN value and issuing the corresponding message and, therefore, checking it. The command 'start detuning downward' is only active for the time division input (not for pulse input).

By that, the test resistor is applied to and the scale is detuned in negative direction.

Opposite to 'CHECK', the level indication will always be updated during detuning and the bits 'test value within tolerance' (bit 13) and 'test value out of tolerance' (bit 12) in the status word (DW 36) remain unchanged (see also section 5.1.2.2.1).

Automatical test of the measuring circuit

For supervising the supply voltage of the weighing processor or, respectively, for ascertaining wiring interrupts within the cables between the connector, the PCB and the load cell junction box, a test of the measuring circuit is realized which can be enabled or disabled via bit 12 in the parameter word DW 52. (This function can be switched off by bit 12 = '1' in DW 52.)

In principle, two kinds of failures are ascertained:

1st kind of failure:
Are failures or disturbances which effect that the data acquisition (DA) does not react at all on load changes.

Reaction of the PCB:
If no changing of the load happens within 5 seconds, a test routine will be performed (6 seconds). When the test result is negative, an error message will be issued (LED 'Failure'; DW 36, bit 0; DW 10, bit 11 and DW 50, bit 11) and batching eventually running will be stopped.

Example:
- 24 V supply of the PCB is defective,
- internal ±15 V supply of the data acquisition is defective,
- internal hardware defects, e. g. opto-isolators are defective.

2nd kind of failure:
Are failures or disturbances causing that the data acquisition (DA) runs up to the upper (39 990 digits) or down to the lower (255 digits) final value of the measuring range.

Reaction of the PCB:
If the upper resp. lower final value of the measuring range of the data acquisition is reached, this will be indicated by bit 9 resp. bit 8 in the status word (DW 36) and an error message will be issued (LED 'Failure'; DW 36, bit 0; DW 10, bit 11 and DW 50, bit 11). Eventually started batching will be stopped.

Example:
- Removing the load cell cable from the connector,
- interrupt of measuring signal conductors,
- 10 V supply for the load cells is defective, e. g., by a defect of the DC/DC converter in the junction box.

Note: The error message 'measuring circuit disturbed' (DW 10, bit 11 resp. DW 50, bit 11) must be acknowledged.

The WP's reaction time for wiring interrupt (connection cable between WP and JB) can be seen in the following table.

Wiring interrupt check is only realized by the firmware and bases mostly on the function 'Test'. A wiring interrupt mostly causes exceeding of the measuring range limits. Exact times cannot be given, as this depends on the actual load of the load cells. The function 'Test', however, allows exact failure ascertaining.

Wire	Reaction of the Weighing Processor
1=VRT+	Time dependent on the load
2=MRT+	Time dependent on the load (D 36.0, D 36.9, D 10.11 and D 36.11 are set)
3=VRT-	Time according to the load
4=MW-	Time dependent on the load (D 36.0, D 36.8 and D 10.11 are set)
5=MW+	Time dependent on the load (D 36.0, D 36.8 and D 10.11 are set)
6=MRP	(only required for the function 'Test')
10=M_{ext}	Time dependent on the load (D 36.0, D 36.8 and D 10.11 are set)
11=P_{24}	Time dependent on the load (D 36.0, D 36.8 and D 10.11 are set)
42=+24V	6 to 11sec (D 36.0 und D 10.11 are set)
43=M_{ext}	6 to 11sec (D 36.0 und D 10.11 are set)

Measuring range limit supervising

The upper and the lower measuring range limits are currently supervised by the firmware. The supervising function gets active when the cable to the junction box or to the load cell or even single wires are interrupted (except wires 1 and 3; see also above) or the 10 V load cell voltage supply in the junction box is missing.

An interrupt of wire 1 causes differences in the measured value of up to + 50 %. An interrupt of wire 3 causes differences in the measured value of up to – 50 %. In both cases, however, no overranging or underranging of the corresponding measuring range limit dependent on the actual load condition is reached.

4.14 Standstill Signal

The standstill signal is determined by the parameters 'STANDSTILL VALUE' and 'STANDSTILL TIME'.

Standstill value (DW 58, 59) (weight unit)
Standstill time (DW 60) (seconds).

The standstill value is performing a "window" together with the standstill time around the actual filling level. After leaving this window the standstill signal (DW 36, bit 14) will be reset and stand still time will be started again.

After duration of the standstill time the standstill signal will be reset if the weight value is within the range of the window. If the weight value lies out of this window, the standstill time will be started again and the window will be transferred.

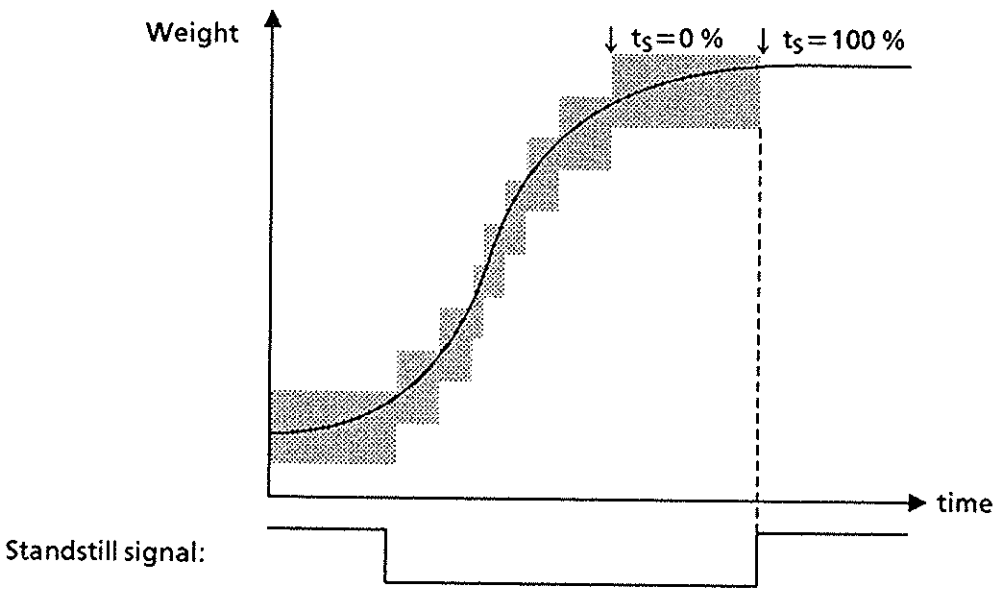


Figure 41: Standstill signal (DW 36, bit 14)

Sv = Standstill value (DW 58, 59)
t_S = Standstill time (DW 60; in seconds)

Note: If the standstill signal does not come, e. g. because of scale vibrations, the 'READY' message will be set after the settling time is over (DW 21).
If the standstill signal comes before the settling time is over, the 'READY' message will be issued and the settling time will be stopped.

The check of leaving the window will be performed every 10 msec (interrupt routine).

4.15 Follow-up Weight Correction

The weighing processor has the possibility of correcting the follow-up value (DW 17, 18) to reach the given set value more accurately at more succeeding dosings of the same material.

The adaption is being calculated as follows:

$$FV_{new} = FV_{old} - (\text{set point} - \text{batch weight})/2$$

FV_{new}: new, corrected follow-up weight
FV_{old}: old follow-up weight

The automatic follow-up correction can be switched off with bit 8 in the parametric word DW 52. Then the weighing processor works currently with the value stated as follow-up correction.

Parameter word DW 52:
Bit 8 = '1' without automatical follow-up correction
Bit 8 = '0' with automatical follow-up correction

When the automatical follow-up correction is used, the corrected follow-up value will be written back into the AG (data module DW 17, 18) before the 'READY' signal will be sent by the weighing processor.

Example of a batching procedure	1	2	3	4
Set value	100	100	100	100
Follow-up	10	7	6	5
Actual follow-up	4	4	4	4
'Fine' switch-off	90	93	94	95
Batch weight	94	97	98	99
Batch error	6	3	2	1
Follow-up correction	$10 - \frac{6}{2} = 7$	$7 - \frac{3}{2} = 6$	$6 - \frac{2}{2} = 5$	$5 - \frac{1}{1} = 4$

The digits behind the decimal point remain unconsidered.

As above example of a batching procedure shows, the set value will be reached more and more exactly by using the follow-up correction.

4.16 Analog Input

The weighing processor offers, besides the strain gauge bridge acquisition (respectively pulse input), an analog input which consists of an A/D converter with 8 bits (without sign). The analog input serves e. g. for calculating of humidity correction which influences the set point of the batching medium.

The calculation of correction is performed in the automation system.

The input of the A/D converter consists of a differential amplifier with an input voltage range from 0 to 5 volts. For processing currents from 0 to 20 mA or 4 to 20 mA (life zero), the resistance R_{24} on the basic P.C. board must be 250 ohms.

The measuring result is acquired:

AV = ((FAV-ZAV)/255 * ADCV) + ZAV at 0 to 20 mA, or, respectively,
AV = ((FAV-ZAV)/204 * ADCV – 51) + ZAV at 4 to 20 mA

AV:	Analog value in cyclic telegram	(DW 41, 42)
FAV:	Final analog value	(DW 71, 72)
ZAV:	Zero analog value	(DW 69, 70)
ADCV:	Analog/digital change value	

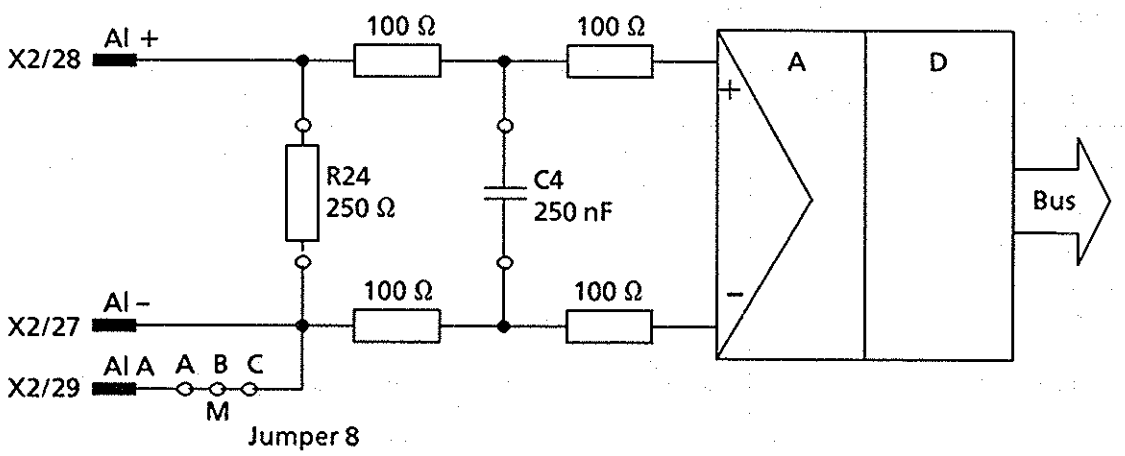


Figure 42: Analog Input, Function Diagram

According to the current consumption the external ground has to be connected to the internal ground of the weighing processor. The connection on jumper 8 is made as follows:

Jumper 8: A to B: (–) of the current source connected to int. ground (always required for non-isolated transmitters)
B to C: Pin X2/29 connected to ground (e. g. for external shielding)

Note: If 'with analog value transmission' (DW 52, bit 2) and 'analog value with life zero' (DW 52, bit 1) is selected in the parameter word, a wire interrupt message (DW 10, bit 10; in adjustment operation DW 50, bit 10) is issued in the case of a voltage underranging of 0.4 V or, respectively, a current

underranging of 1.5 mA. In this case, 'zero' will be output in DW 41, 42 (analog value).

Instead of the analog value the flow value or the volume value can be indicated in DW 41, 42. For that, the following settings must be done in DW 52:

DW 52, bit 2 = 1	DW 52, bit 15 = X	analog value indication
DW 52, bit 2 = 0	DW 52, bit 15 = 1	volume indication
DW 52, bit 2 = 0	DW 52, bit 15 = 0	flow indication

The flow value can be calculated according to the following algorithm:

$$Flow\ value = \frac{weight\ value}{200\ msec}$$

The processor updates this value every 200 msec. However, care must be taken of the fact that the reading (FB SIW:LESE) depends on the cycle time of the user program and, therefore, DW 41, 42 will be updated according to the running time of the program.

The volume value is calculated according to the following algorithm:

$$Volume\ value = \frac{weight\ value}{specific\ weight}$$

Specific weight in grams per dm^3.
For the weight value observe the weight unit (g, kg, etc.).

4.17 Pulse Operation

During pulse operation, the scale does not have to be adjusted. The corresponding data words (DW 73 to DW 96), however, should be fed in with zero if generally only pulse operation is applied.

If the pulse mode is selected, the load is determined as follows:

$$LOAD = n_j * L_{pi}$$

n_j: number of pulses
L_{pi}: load per pulse (DW 19, 20)

The pulse batch weight (DW 39, 40) is deleted with the command 'TARING' (DW 12, bit 8) or with 'START AUTOMATIC TARING' (DW 12, bit 7) or with giving a new "Weight/Pulse" (DW 19, 20; DW 11, bit 3). The weight scaled up to now, however, is saved as pulse level (DW 37, 38). If, for the following component, a new 'weight per pulse' is given, then this is multiplied by the number of pulses, indicated in the pulse batching weight and at the same time added to the still valid pulse level.

The stored value is then added as follows:

$$LOAD = LTI + n_j * L_{pi}$$

L_{TI}: tared pulse weight

The values necessary for determining the pulse weight are restored in a power-failure protected RAM. Thus after power failure or changing parameters to time counter and following roll back to pulse input the actual pulse filling level is restored.

In the case of a power failure (mains failure) you have to take into consideration that arriving pulses are not counted because of the follow-up of the batching material. The result can be a measuring error.

The command 'RESET PULSE COUNTER' (DW 12, bit 14) enables to erase the pulse filling level (DW 37, 38) and the pulse batch weight (DW 39, 40). It makes sense to take this command only after the whole batching procedure (single-component or multi-component batching) is closed and the scale is empty again.

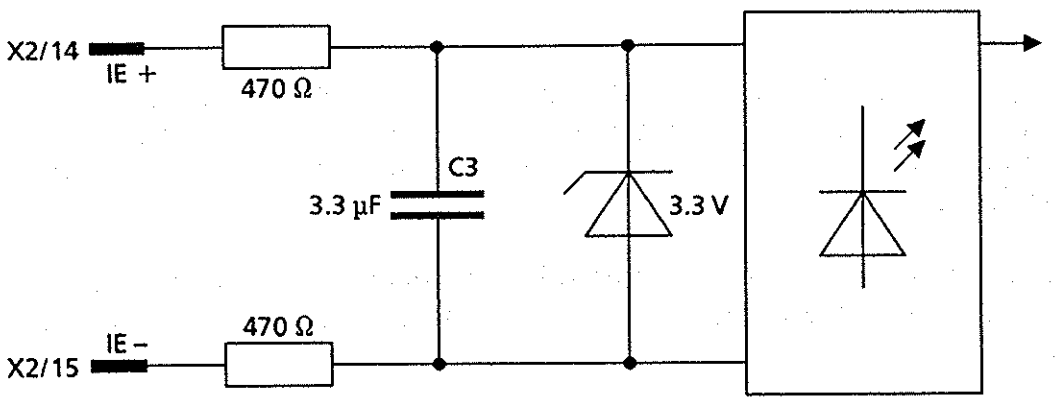


Figure 43: Function Diagram

4.18 Filling Weighing

In the upward batching mode the batching counter (DW 39, 40) runs upward under load. This is generally valid, means at single- and multi-component weighing the batching counter runs upward from zero after each 'Start with automatic taring' as long as the scale is loaded.

When bit 2 in DW 12 is set, the scale is in the upward batching mode, means filling weighing. When bit 2 in DW 12 is not set, the scale is in the downward batching mode.

If a scale is operated as upward batching scale, bit 2 **must** be set for each command, like e. g. 'Stop' or 'Taring'. In general, it is recommended not to set single bits but to transfer the corresponding data word as a bit pattern (data format KM) to get a survey of the selected functions.

Example:

```
L KM 00000000 10000100      for upward batching + start with automatic batching
T DW 12                     Command word of the scale
L KM 00000000 00000001      for command word transmission
T DW 11                     Telegram selection word
.
.
SPB FB202                   SOLL
SIW:SOLL
.
.
```

See also section 5.1.2.2.1.

4.19 Downward Batching

In the downward batching mode, the batching counter (DW 39, 40) runs upwards under unloading. This is generally valid, means at single- and multi-component weighing the batching counter runs upwards from zero after each 'start with automatic taring' as long as the scale is unloaded.

When bit 2 in DW 12 is not set, the scale is in the downward batching mode. When bit 2 in DW is set, the scale is in the upward batching mode, means filling weighing.

If a scale is operated as upward batching scale, bit 2 **must not** be set for each command, e. g. 'Stop' or 'Taring'. In general, it is recommended not to set single bits but to transfer the corresponding data word as a bit pattern (data format KM) for to get a survey of the selected functions.

Example:

```
L KM 00000000 10000000     for downward batching + start with automatic taring
T DW 12                    Command word of the scale
L KM 00000000 00000001     for command word transmission
T DW 11                    Telegram selection word
.
.
.
SPB FB202                  SOLL
SIW:SOLL
.
.
```

See also section 5.1.2.2.1.

4.20 Serial Interface for Remote Display

A serial interface (TTY) is provided with the weighing processor to allow the connection of a remote display. The transmission speed (baud rate) can be adapted by the switch S2/4, 5, 6 from 110 up to 19 200 Bd.

The baud rate is set ex works to 1 200 Bd and should not be changed.

To display the weight values, an intelligent external display is provided:

Type 7MH3504-8AA	Dimensions: 144mm x 72mm
Type 7MH3504-8AB	Dimensions: 96mm x 48mm

According to jumper setting on the connector of the remote display the values for

- level	total
- batch weight	net
- set weight	

can be displayed.

The level as well as the batch weight are displayed on the remote display with the step width selected in DW 102. The set weight indication is not influenced by the step width.

Furthermore, an automatic floating-point for display overflow is realized.

In the telegram for remote display only one decimal point for all weight values is available. Therefore, if one of the three values causes an overflow, the decimal point for the two other values will also be shifted. Shifting the decimal point of one digit causes also the least significant digit to be no longer displayed. This is valid for each other shifting, too.

Two succeeding overflows may occur. More overflows following each other are indicated by a 'running decimal point' (decimal point runs from one possible position to the others) on the remote display.

Note: The step width set in DW 102 in the KF data format is only active for the remote display.

A serial connection of three or more displays is possible.

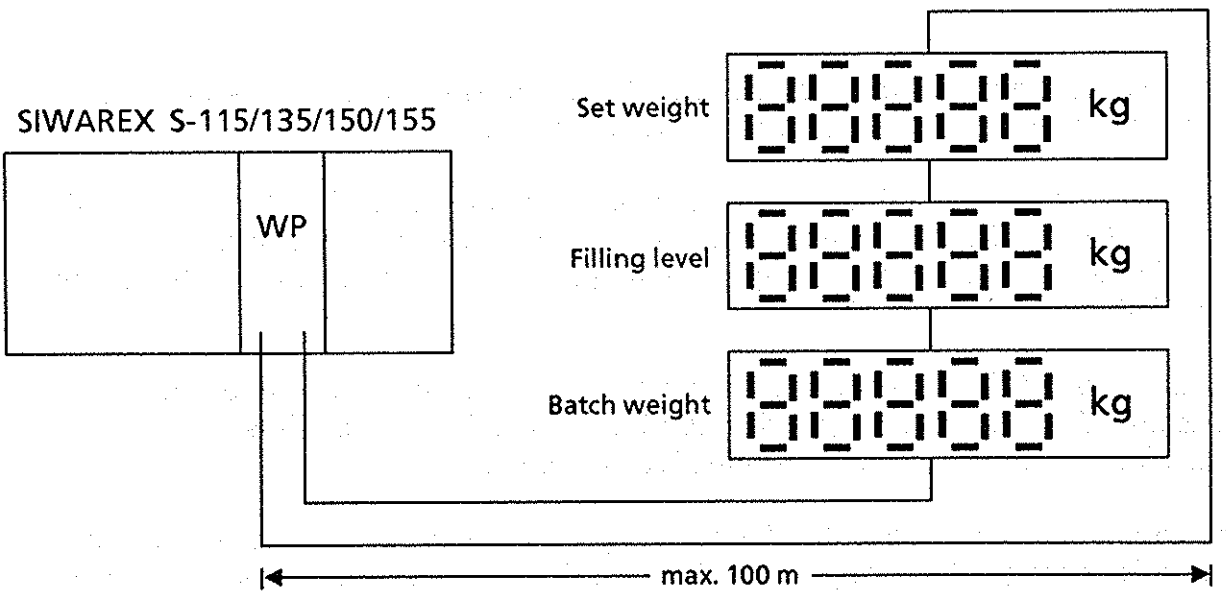


Figure 44: Serial Connection of Remote Displays

See as well section 3.5.4.

Example:

If a value shall be indicated which is higher than the one possible by the set decimal point (DW 99), the position of the decimal point of the remote display will be automatically shifted by one digit to the right for the three indicated values (set value, actual value, batch value), and the least significant decade of the value to be displayed is cut off. If the decimal point is already in the rightmost position of the remote display, this will be indicated by the 'running decimal point'. The displayed value contains only the five most significant decades.

Decimal point : 2
Format: KG

Representation:

Set value in kg	Value in D 13	value on the remote display
123,450	+1234500+05	+ 1 2 3 . 4 5
1234,500	+1234500+06	+ 1 2 3 4 . 5
12345,000	+1234500+07	+ 1 2 3 4 5 .
123450,000	+1234500+08	+ 1 . 2 . 3 . 4 . 5 .

If the value in above example falls below the limit $1 \cdot 10^8$, the running decimal point will stop.

4.21 Mains Failure

The factors, scale parameters and weights ascertained during characteristic line linearization are stored in a power-failure protected RAM.

The values for ascertaining the pulse weight are also stored in the power-failure protected RAM. Therefore, after a mains failure or changing the parameters to the time-division input and following switching-back to the pulse input, the last valid pulse filling level is still available.

On each 'empty' message, the actual volume, the set value, and the tare are transmitted to the data acquisition (DA) and stored in the buffered RAM. After a mains failure the correct volume value is available again.

The command 'block calibration', which is generated by opening the switch S2/7 on the basic board (PCB 1) or by setting bit 11 in DW 51 causes setting a flag which will be stored in the power-failure protected RAM. This flag prevents performing a new calibration.

For mains failure it is to be considered that, in pulse operation mode, incoming pulses (e. g. by follow-up) cannot be counted. This can cause an error.

The calibration values and the setting values at last transmitted remain kept in the battery-buffered RAM on the data acquisition (DA).

If the weighing processor has been inserted into an expansion unit and the mains failure occurs only on the central unit, a data loss can occur in particular cases (CPKL = '0' by ZG-EG connection; see 3.1.4). This will be indicated after initialization by 'EPROM error' or 'RAM' and 'Interface 8031 error' (DW 10, bit 2 or 3 and 6; DW50, bit 2 or 3 and 6).

4.22 Analog Value

The weighing processor is equipped with an analog input besides of the DMS acquisition (resp. pulse input) which consists of an A/D converter with a resolution of 8 bits without sign.

The analog value available in DW 41, 42 can be used e. g. for pressure or humidity corrections within the STEP5 user program. For that, bit 2 in DW 52 must be set.

If 'with analog value transmission' (DW 52, bit 2) and 'analog value with life zero' (DW 52, bit 1) has been set, a wire interrupt message (DW50, bit 10; DW10, bit 10) will be issued on voltage underranging of 0.4 V or, respectively, current underranging of 1.5 mA.

4.23 Flow Value

Instead of the analog value, the flow value can also be indicated in DW 41, 42. For that, the following setting in DW 52 must be made:

DW 52, Bit 2 = '0' DW 52, Bit 15 = '0' Flow indication

The flow value can be calculated as follows:

$$Flow\ value = \frac{Filling\ level_{new} - Filling\ level_{old}}{200\ msec}$$

This value is updated every 200 msec by the weighing processor. By that, the content of DW41, 42 will be updated every 200 ms. (If the cycle time of the user program is >200 ms, it is to be considered that DW 41, 42 will be evaluated after the corresponding time.)

The flow value can be positive (increasing filling level) as well as negative (decreasing filling level).

4.24 Volume Value

Instead of the analog value the volume value can be indicated in DW 41, 42. For that, the following setting must be madein DW 52:

DW 52, bit 2 = '0' DW 52, bit 15 = '1' Volume indication

The volume value can be calculated as follows:

$$Volume\,value = \frac{weight\,value}{specific\,weight}$$

Specific weight in grams/dm³.
For the weight value observe the weight unit (g, kg etc.).

4.25 Test

For checking the data acquisition, the DMS bridge is detuned by a test resistor (R_p; see also 3.1.2). Detuning must be between 9 000 and 19 740 digits.

To perform the test, the test value must be ascertained by the control command 'ascertain test value' (DW 12, bit 0). The difference of detuning is stored. When the test value is within the permitted range from 9 000 to 19 740 digits, the bits 'test value in tolerance' and 'test value out of tolerance' in the status word (DW 36, bit 13; DW 36, bit 12) will be set. In the other case, the message 'test value ascertaining error' (DW 10, bit 8) is issued and the two bits are reset (see 4.25).

For 'ascertain test value', the scale should be loaded as for 'test' performed later, or 'ascertain test value' will be performed twice for to be independent from the actual load: once in the range of <20 000 digits and once in the range of >20 000 digits. The digits in the filling level counter (DW 37, 38) can be output for to realize in which range the scale is (DW 51, bit 10; see 5.1.1.2).

For 'test' (DW 12, bit 4) the difference of detuning is ascertained again and compared to the formerly ascertained detuning. The difference of the two measurements must not be higher than the 'test value tolerance' pre-set in DW 67, 68. On testing, the weighing processor realizes if it is above or below 20 000 digits at that moment and uses the corresponding comparing value. If the value is not stored in the comparator store the message 'test value ascertaining error' (DW 10, bit 8) will be issued.

The output of the actual value is inhibited while testing.

By the command 'test', the messages 'test value in tolerance' and 'test value out of tolerance' are reset. After testing has been performed, one of the two messages will be set again.

In the status word (DW 36) it is indicated if the test value is in or out of tolerance (DW 36, bit 13 = 'test value in tolerance'; DW 36, bit 12 = 'test value out of tolerance').

'Test' takes totally approx. 10 seconds. Five seconds are needed to apply the test resistor, and five seconds take the settling time before the weight value is updated again. By that, the function is guaranteed also for damped measuring equipment.

The command 'test' is only active when the DMS input is used (not for pulse input).

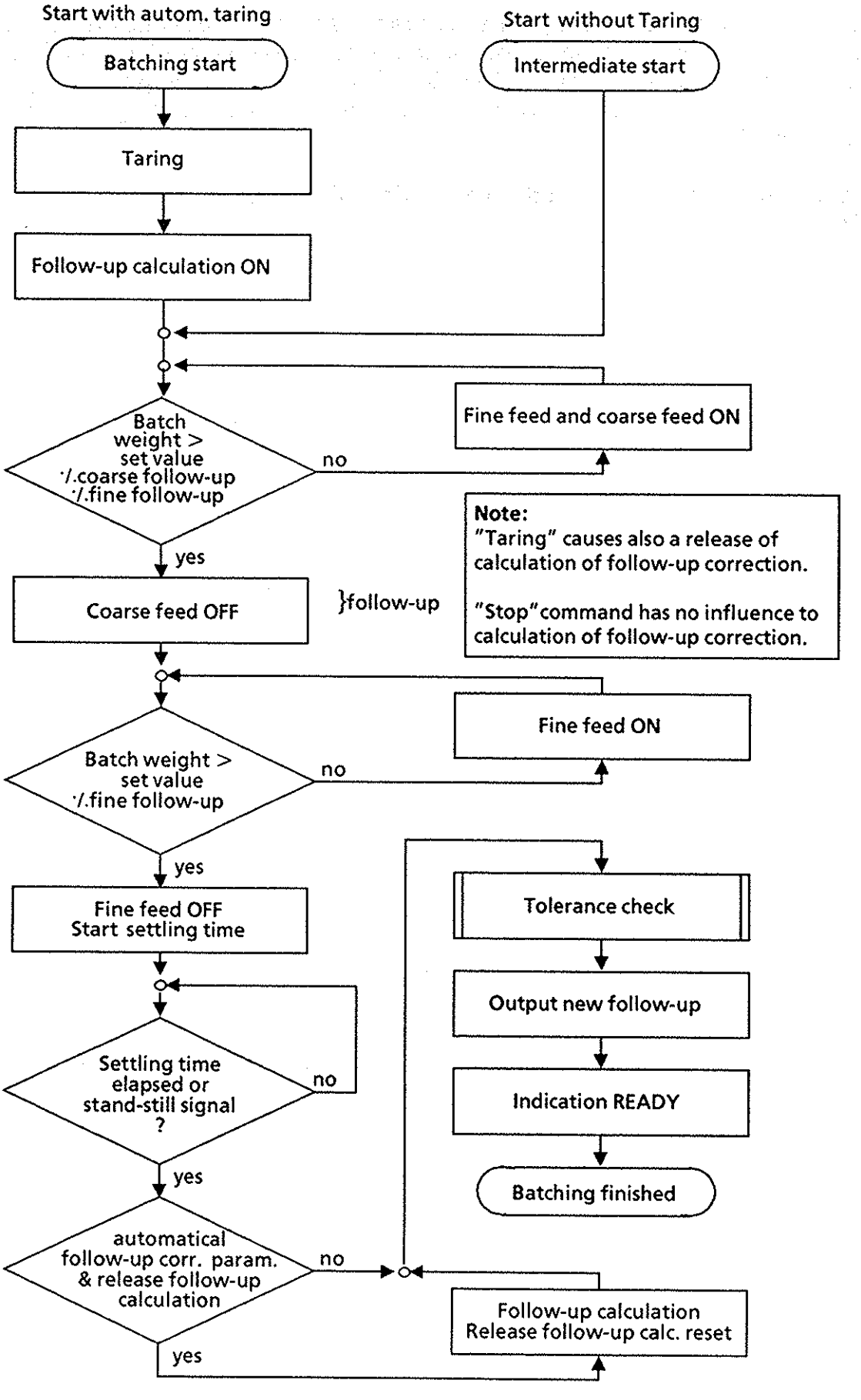
4.26 Empty Message

By means of the empty message, the user can easily realize at which time the scale became empty. The weighing processor compares currently its filling level (DW 37, 38) to the empty message value (DW 55, 56) and issues the empty message after reaching resp. underranging this value and after the empty message delay time is elapsed (DW 57).

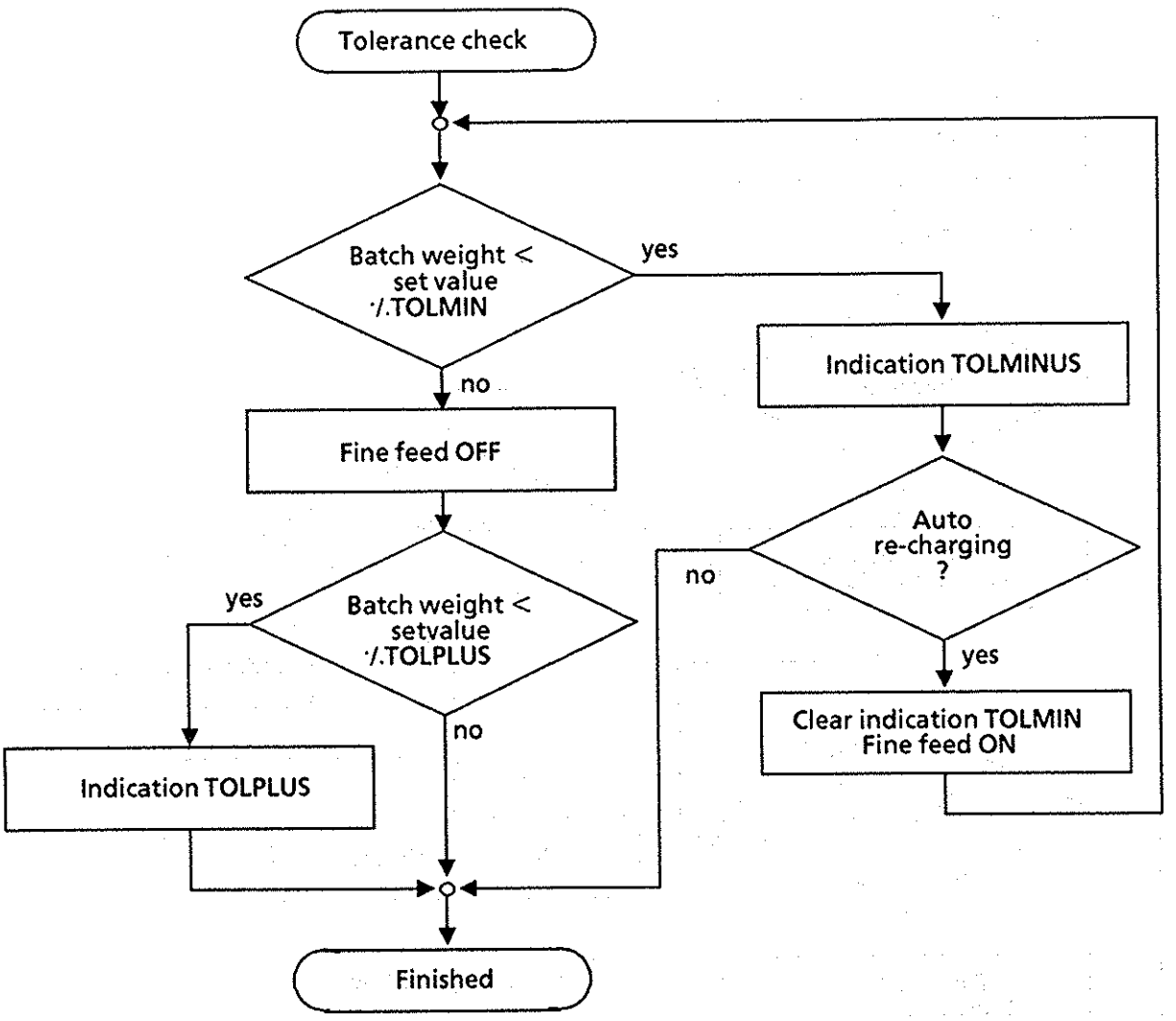
The empty message is often used in connection with the stand-still message (DW 36, bit 14).

4.27 Flow Charts

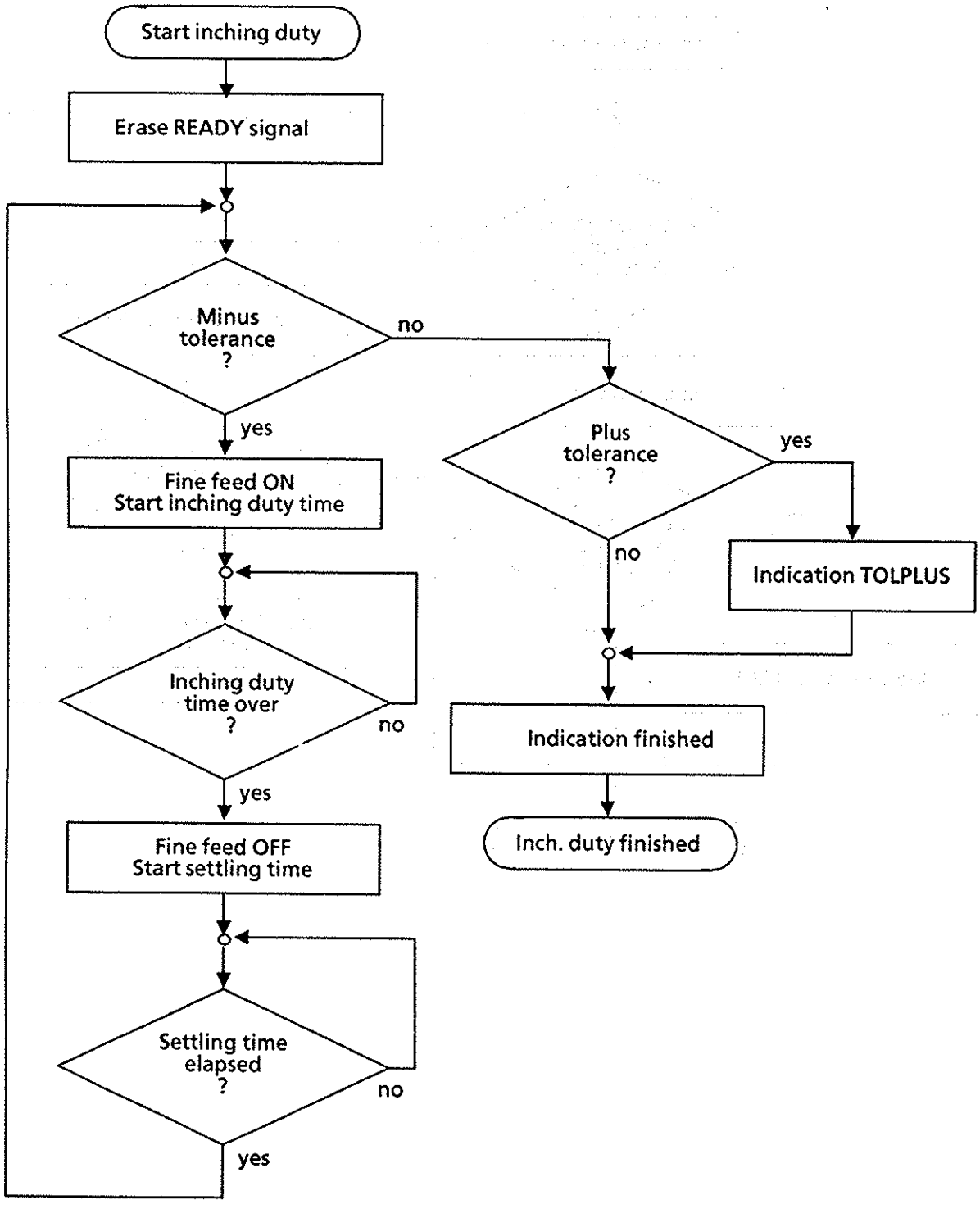
4.27.1 Flow Chart 'Batching Procedure'



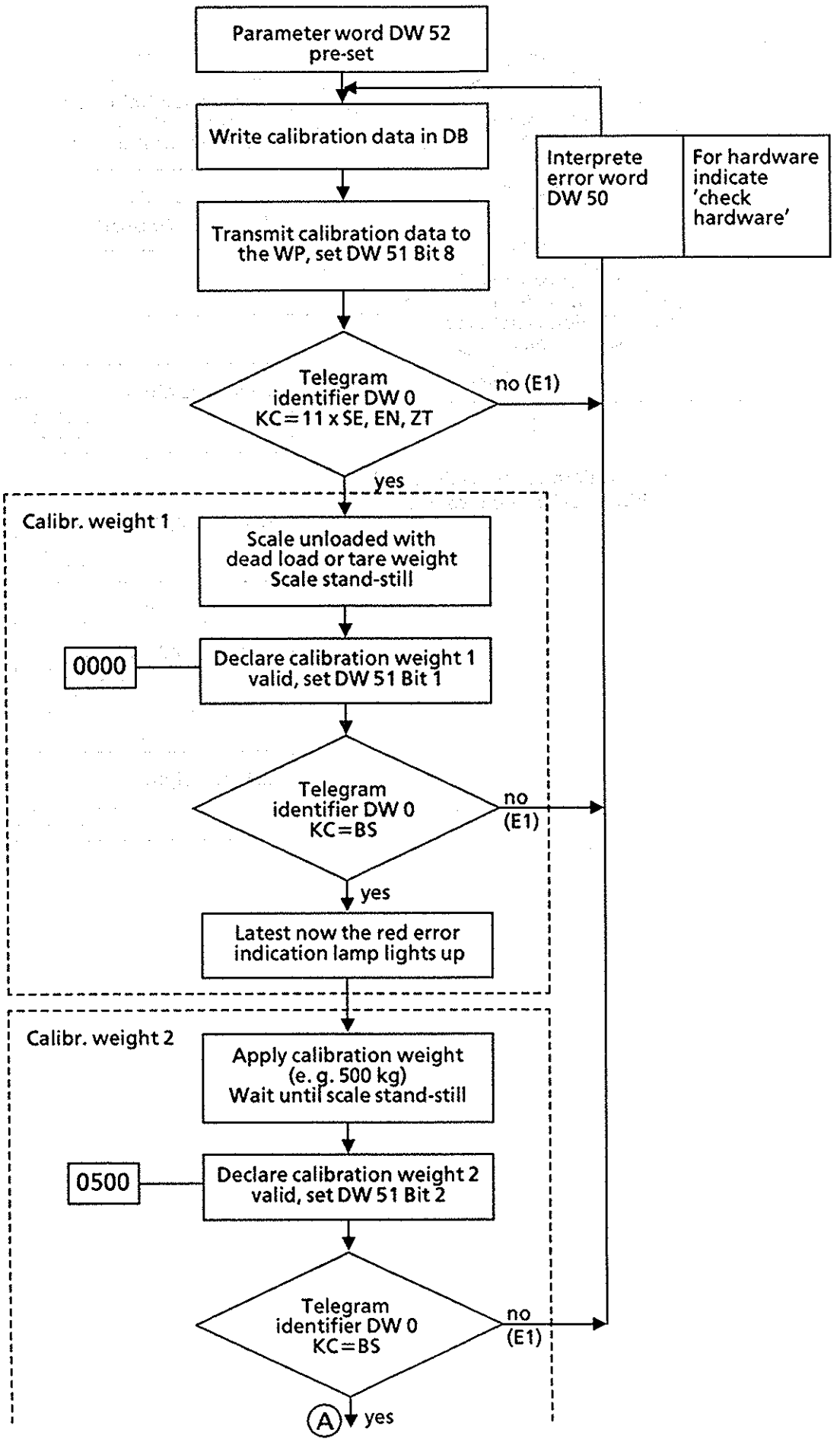
4.27.2 Flow Chart 'Tolerance Check'

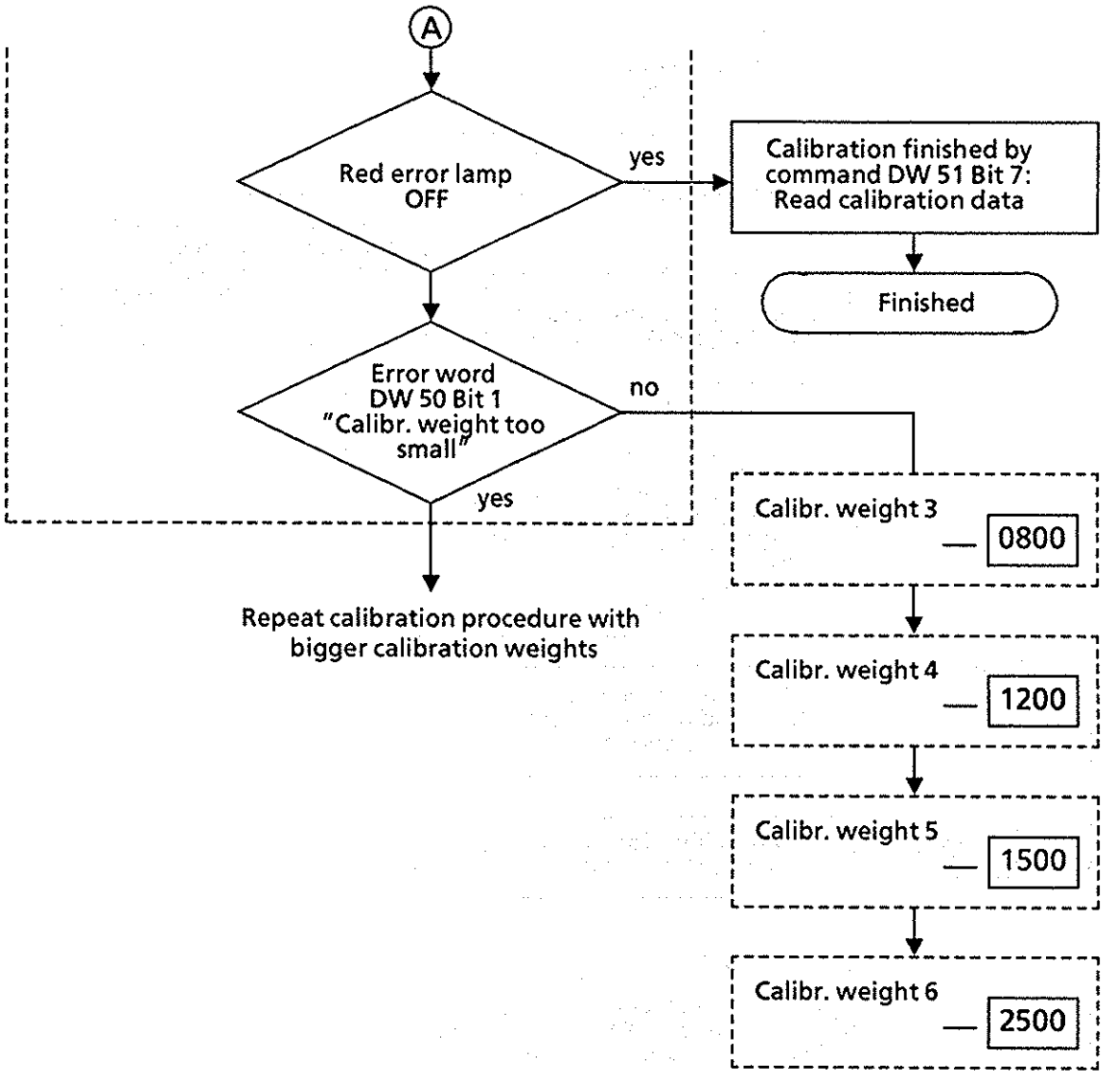


4.27.3 Flow Chart 'Inching Duty'



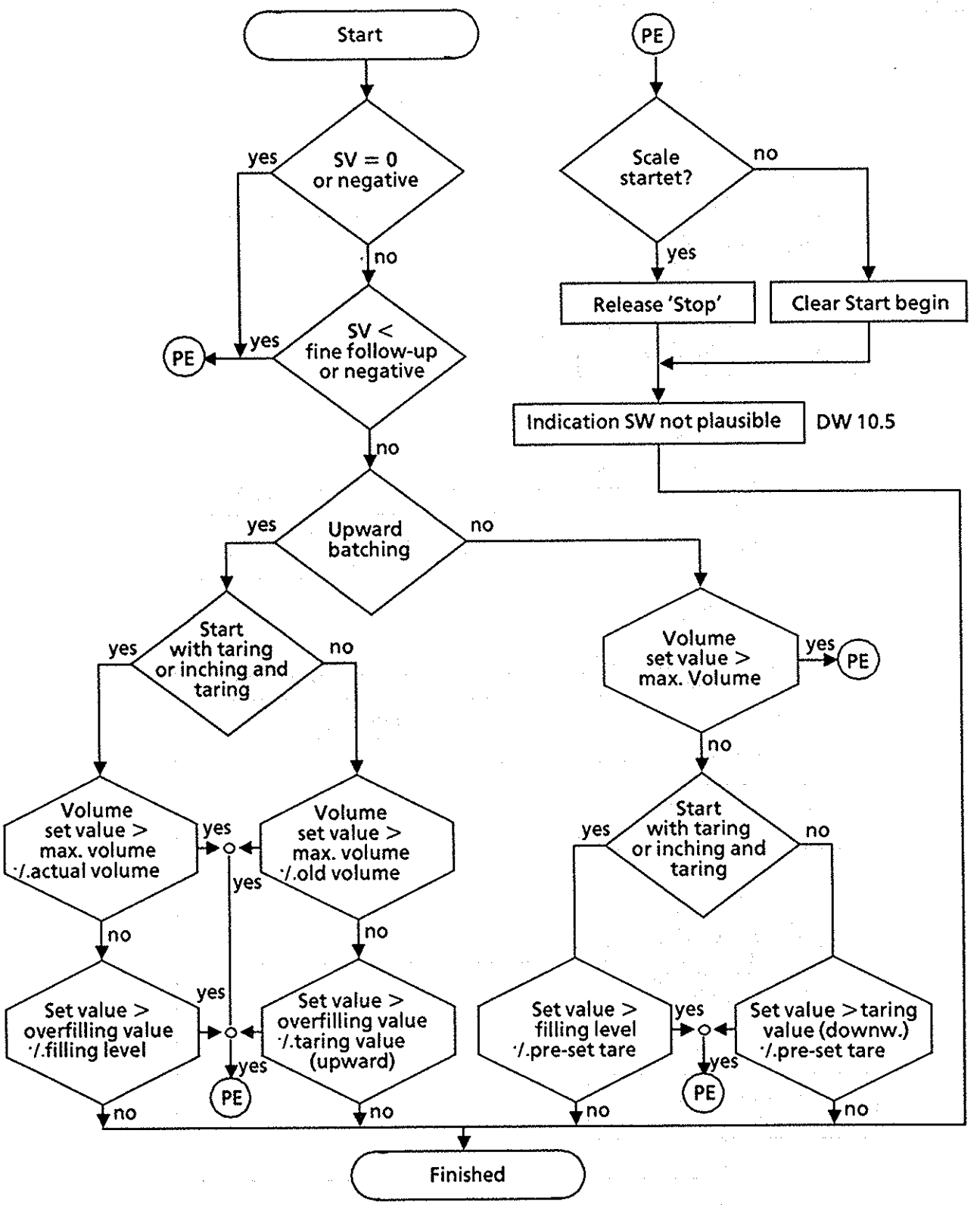
4.27.4 Flow Chart 'Calibration'




A
Red error lamp OFF
yes
Calibration finished by command DW 51 Bit 7: Read calibration data
Finished
Error word DW 50 Bit 1 "Calibr. weight too small"
no
yes
Repeat calibration procedure with bigger calibration weights
Calibr. weight 3
0800
Calibr. weight 4
1200
Calibr. weight 5
1500
Calibr. weight 6
2500

4.27.5 Flow Chart 'Plausibility Check'

Plausibility Check of Set Value

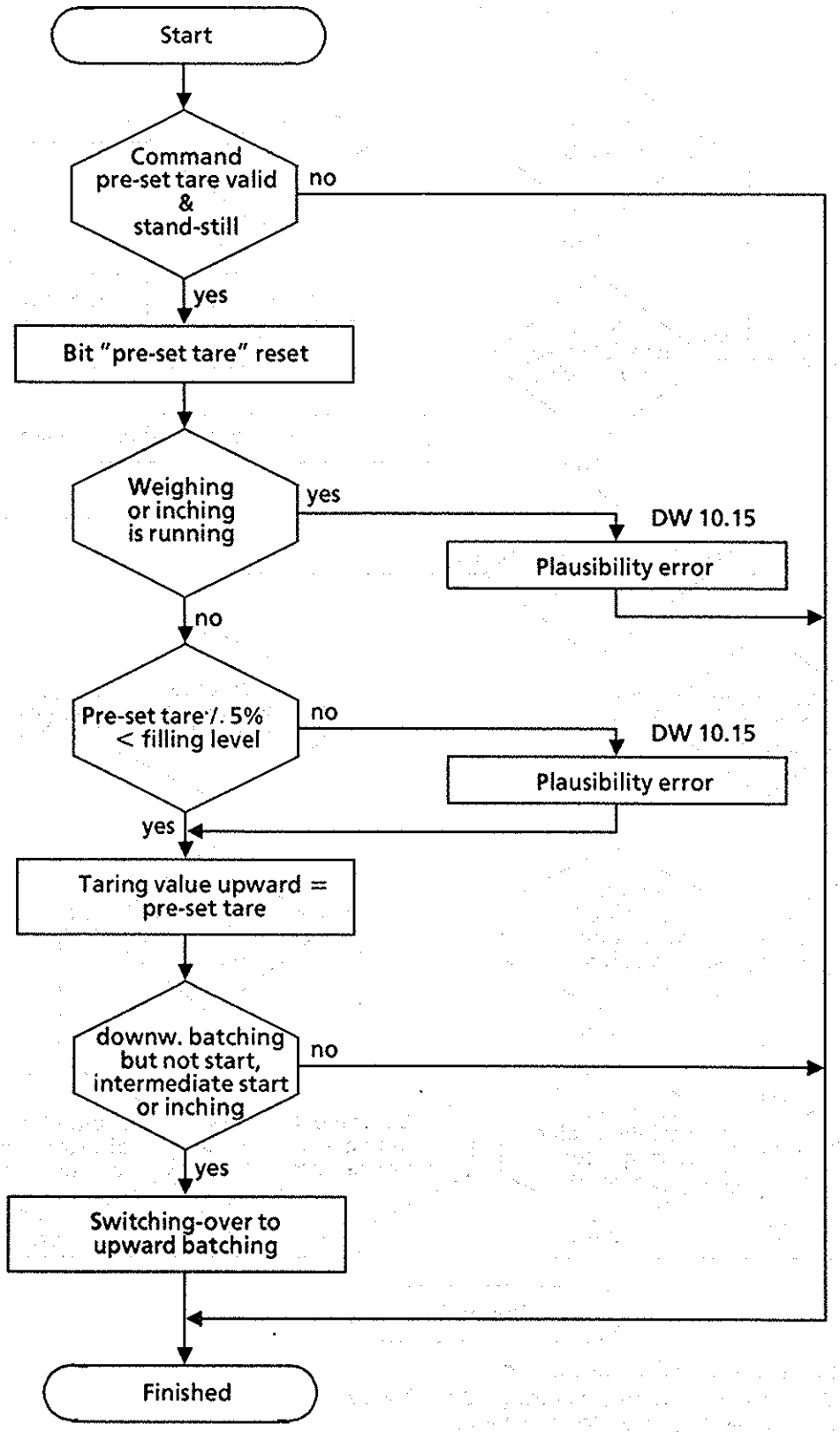


The plausibility check 'Set value' will be performed

1. at command 'Start with automatical taring' (DW 12, Bit 7)
2. at command 'Intermediate start' (DW 12, Bit 6)
3. at transmission of a new set-value during weighing in the COARSE / FINE phase
4. at command 'Start inching duty' (DW 12, Bit 15)

4.27.6 Flow Chart 'Pre-set Tare'

Command 'Pre-set Tare valid' (DW 12, Bit 1)



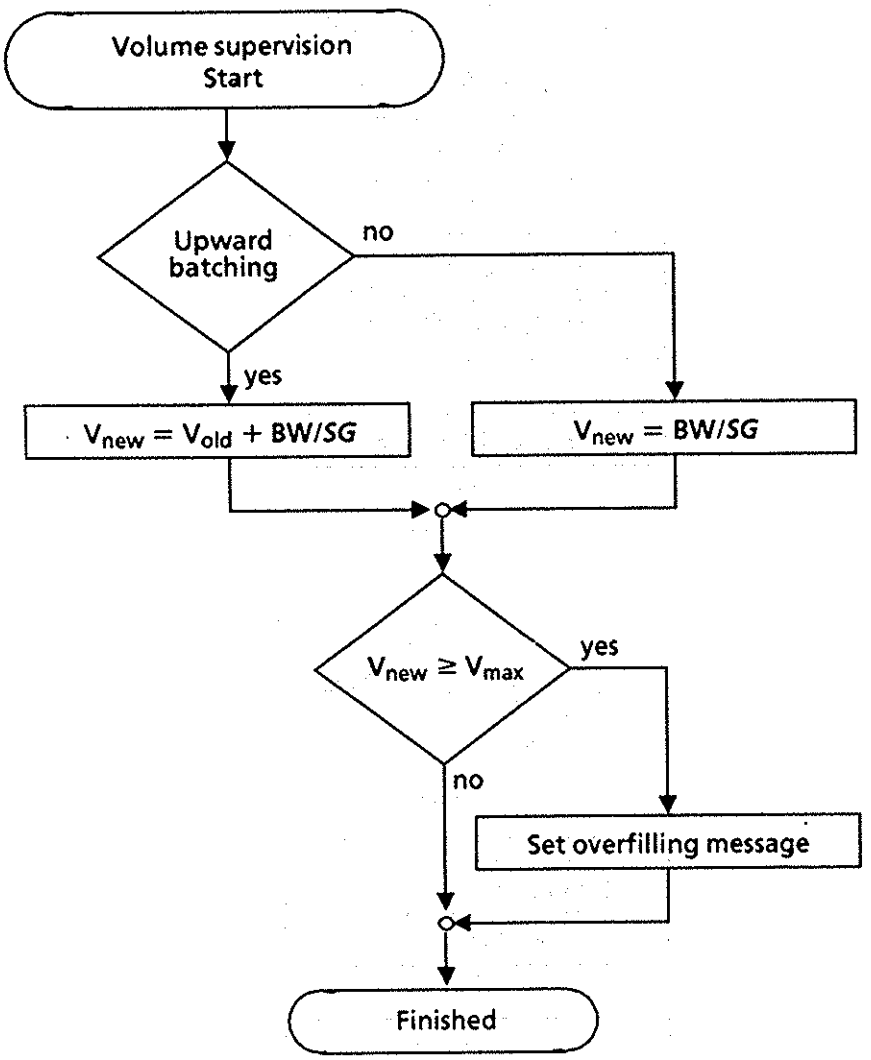
4.27.7 Flow Chart 'Volume Supervision'

Hint:

At 'Taring': $V_{old} = V_{new}$

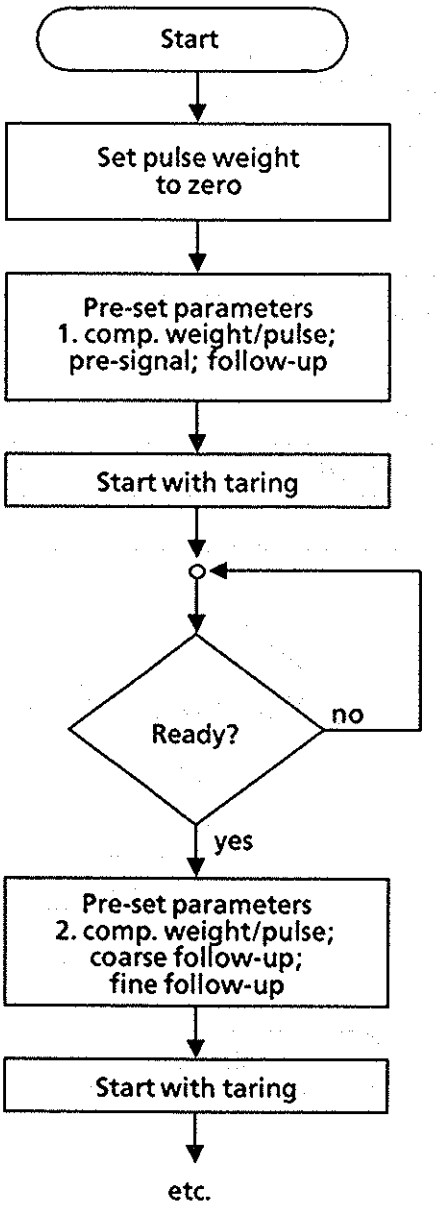
At switching-over from downward to upward batching: $V_{old} = 0$; V_{new} = filling level/set weight

At switching-over from upward to downward batching: $V_{old} = 0$



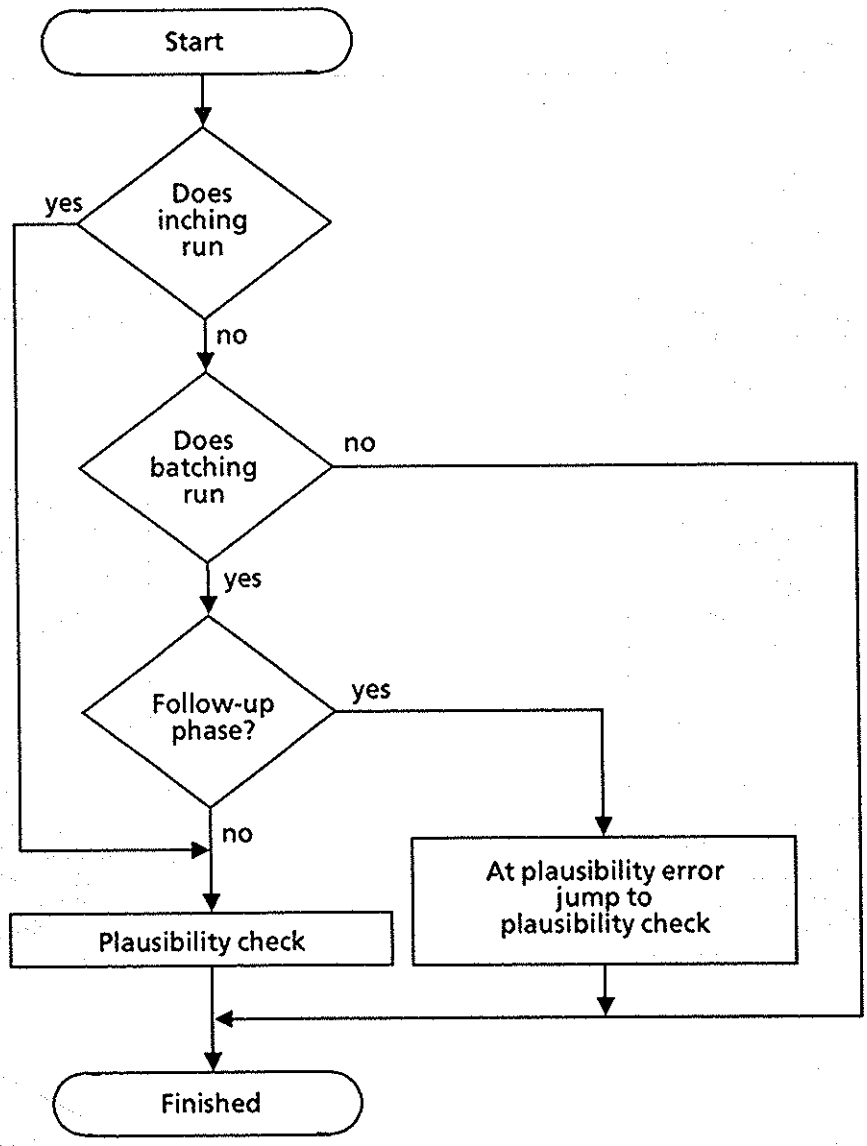
4.27.8 Flow Chart 'Multi-component Processing at Pulse Operation'

If a new weight/pulse value is pre-set (DW 19, 20) or at 'Taring' (DW 12, bit 8) the filling level weighed up to this point of time will be stored as tared pulse weight W_{tp} (see 4.17).



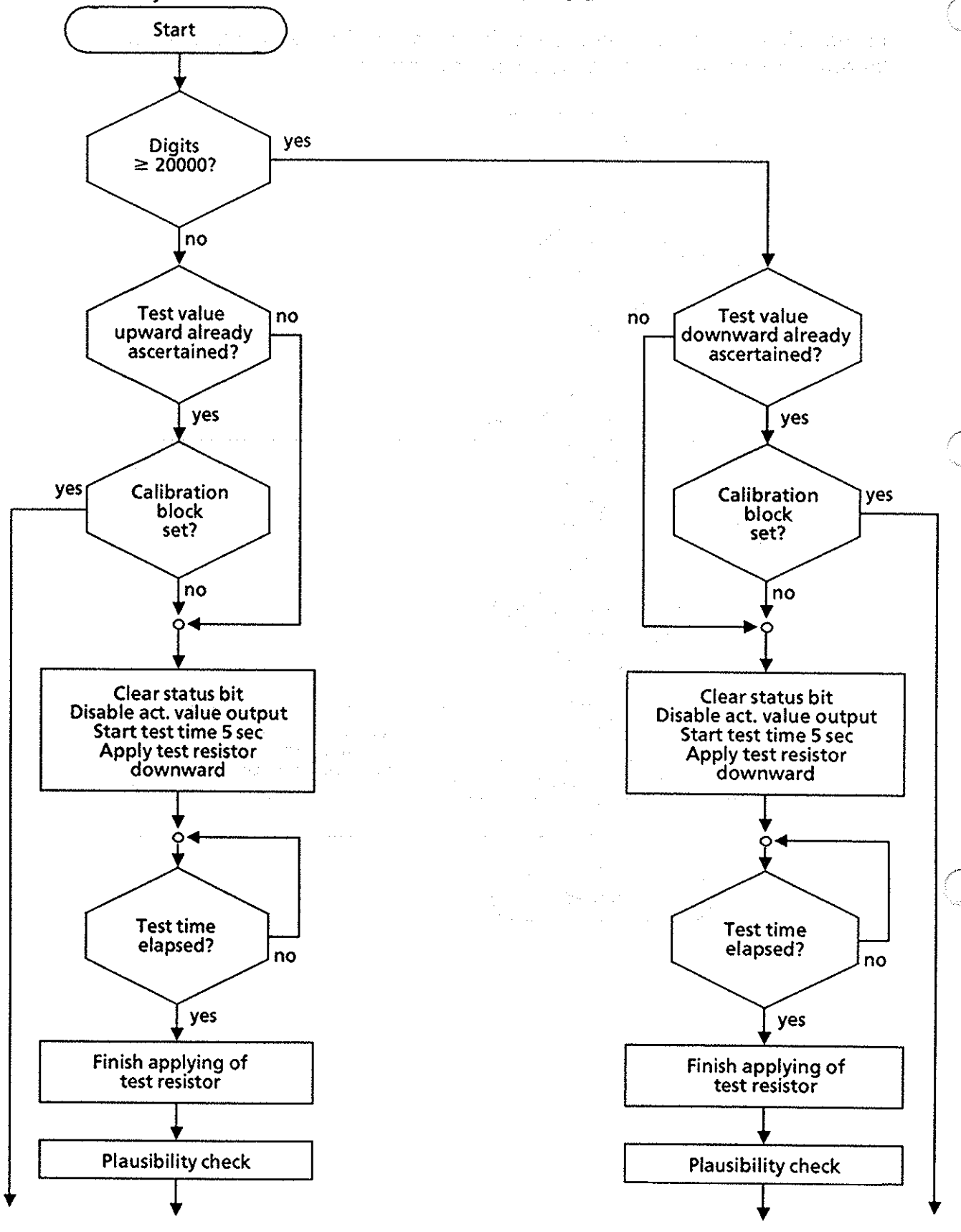
4.27.9 Flow Chart 'Pre-set Set Value'

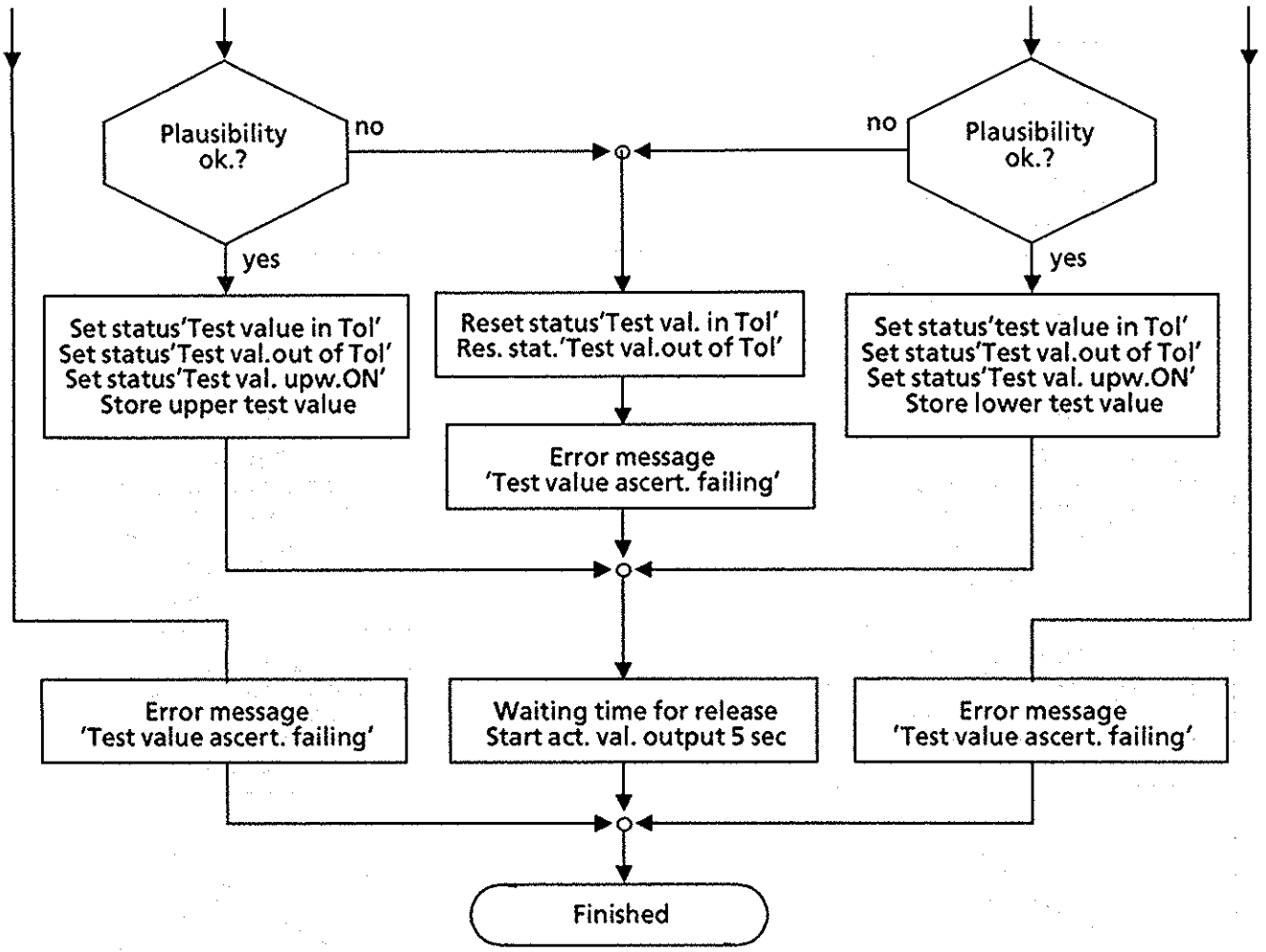
In the follow-up phase a new set value must not be transmitted because then the 'automatical follow-up correction' will be corrupted.



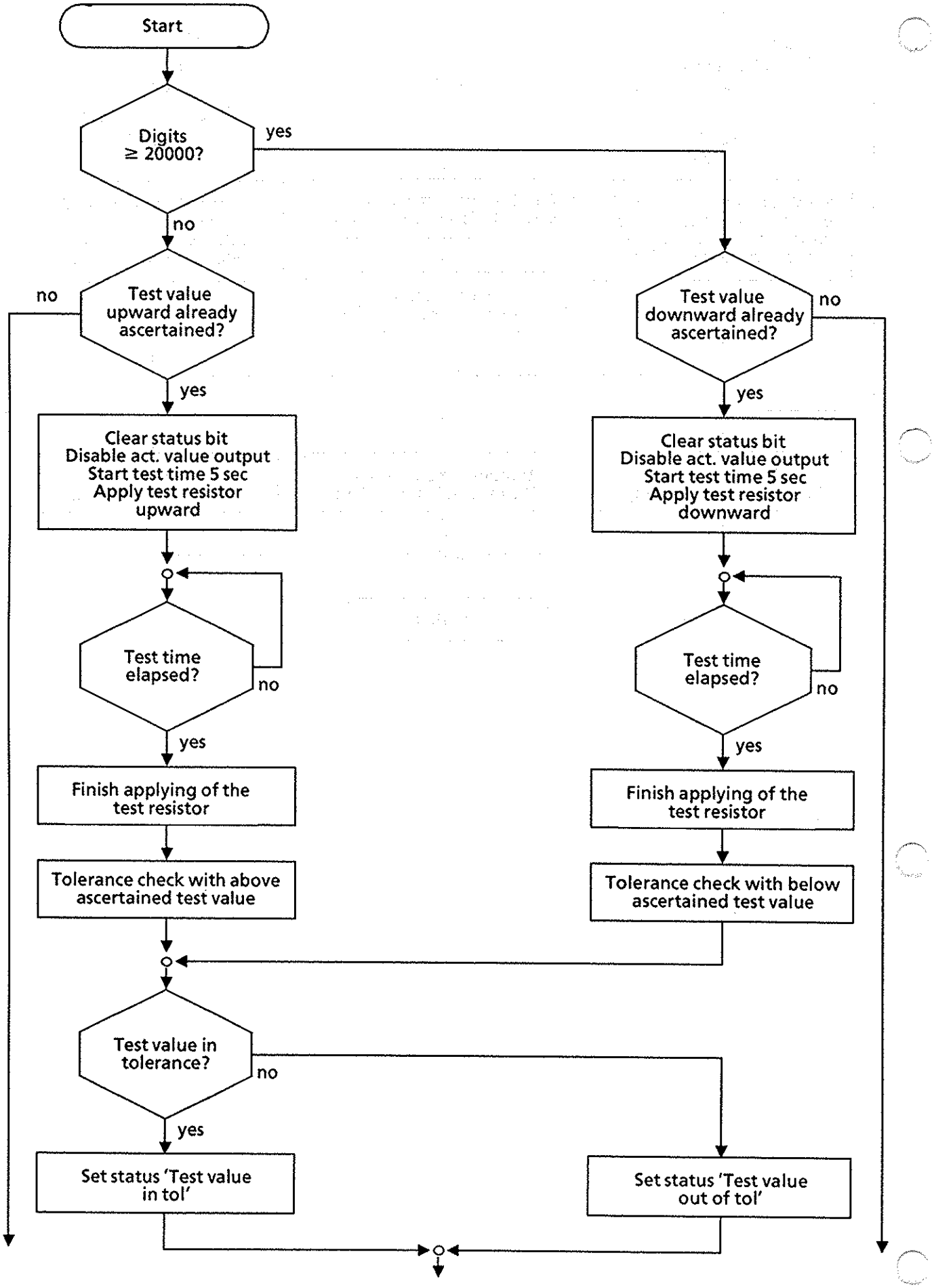
4.27.10 Flow Chart 'Determine Test Value'

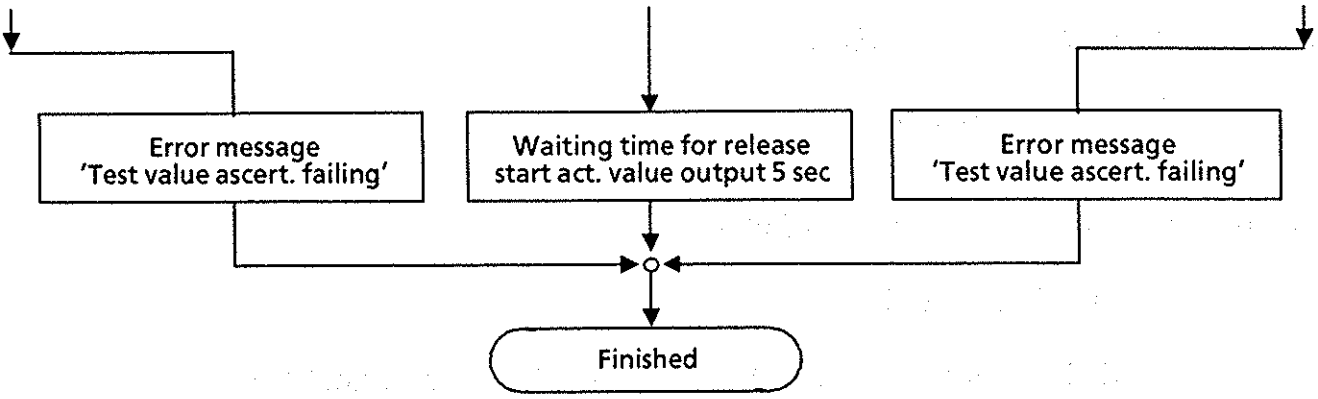
Hint: Plausibility check = 9.000d < test value < 19.740 d




Plausibility ok.?
no
yes
Plausibility ok.?
no
yes
Set status'Test value in Tol'
Set status'Test val.out of Tol'
Set status'Test val. upw.ON'
Store upper test value
Reset status'Test val. in Tol'
Res. stat.'Test val.out of Tol'
Error message
'Test value ascert. failing'
Set status'test value in Tol'
Set status'Test val.out of Tol'
Set status'Test val. upw.ON'
Store lower test value
Error message
'Test value ascert. failing'
Waiting time for release
Start act. val. output 5 sec
Error message
'Test value ascert. failing'
Finished

4.27.11 Flow Chart 'Test'




Error message
'Test value ascert. failing'
Waiting time for release
start act. value output 5 sec
Error message
'Test value ascert. failing'
Finished

5 Software Description

5.1 Function Modules

The function modules are named as follows:

- handling modules

Calibration:	FB 200	SIW:JUST	Libr. No. 51186
Read data:	FB 201	SIW:LESE	Libr. No. 51186
Given set value: (Transfer data)	FB 202	SIW:SOLL	Libr. No. 51186

For identification of release status each FB receives a library number (Libr. No.).

- Initialization OBs 20, 21, 22

Initialization:	FB 254	SIW:ANLF
Time delay	FB 255	SIW:5s

- Supply program for calibrating the scale

FB 203	SIW:ANW:JUST

A demonstration program FB 231 and one Data Module DB 231 (in KF) exist on the floppy disk which make able to load a cold booting program. With this program first steps can be performed successfully.

5.1.1 FB SIW:JUST 'Calibration' (FB 200)

The FB 'SIW:JUST' is necessary for the calibration of the scales. It transferres calibration values recorded in DB from DW 52 to DW 102 to the weighing processor WP (see table 1).

After calibration of the scale the actual calibration data including the calibration digits now ascertained can be read again from the WP and transmitted to the data module by means of FB 'SIW:JUST'.

It is imperative to block FB 201 (SIW:LESE) and FB 202 (SIW:SOLL) during the calibration procedure as these two handling modules would read false bytes.

To supply the FB 'SIW:JUST' with parameters the command word DW 51 and parameter word DW 52 are available. The FB 'SIW:JUST' has to be cyclically processed from AG during the calibration procedure.

If errors occur at calibration, they will be loaded back into the error word (DW 50) for the **period of 1 cycle only** (see also sections 5.2.5 and 5.2.6).

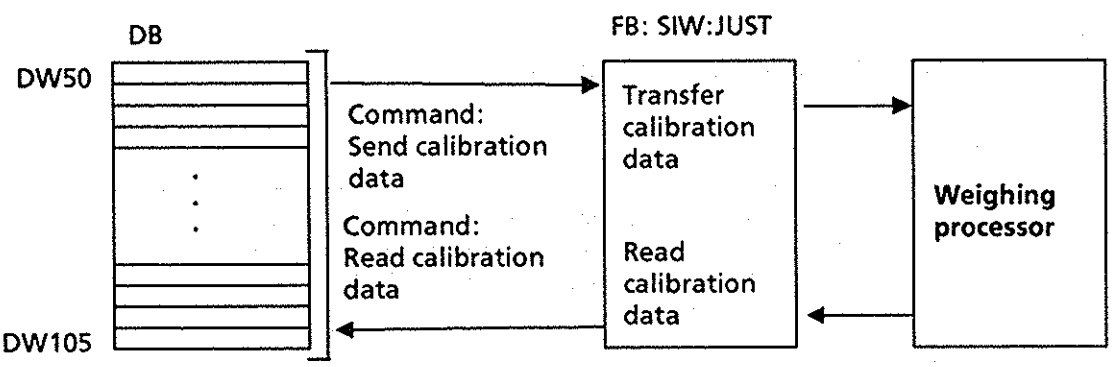


Figure 45: Data Flow During Calibration

5.1.1.1 Contents Parameter Word

DW 52	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Bit 0 : 0 = SIWAREX S-115, -135; 1 = SIWAREX S-150, -155
Bit 1 : 1 = analog value with 'life zero' (4-20mA)
Bit 2 : 1 = with analog value transfer
Bit 3 : 1 = time division electronics; 0 = evaluate pulse input
Bit 4 : 1 = autom. post dosing at tolerance underranging (TOLMINUS)
Bit 5 : 1 = BCD representation
Bit 6 : 1 = fixed point; 0 = floating point representation
Bit 7 : 1 = tolerance in per mil; 0 = tolerance absolute (e. g. in kg)
Bit 8 : 1 = without automatical follow-up correction;
0 = with automatical follow-up correction
Bit 9 : 0 = internal (must be 0)
Bit 10 : 1 = without dosing time supervision
Bit 11 : 1 = Software control amplifying OFF
Bit 12 : 1 = without automatical check of measuring circuit
Bit 13 :
Bit 14 :
Bit 15 : volume / flow value (see below)

Bit	2	15	
	1	x	analog value indication in DW 41, 42
	0	1	volume value indication in DW 41, 42
	0	0	flow value indication in DW 41, 42

x = '1' or '0'

Bit 0 Setting of the AG type

Bit 1 Setting of the analog value with life zero

Bit 2 Analog value transfer to the DB of the scale

Bit 3 Time division or pulse input setting
By this bit, switching-over is performed between time division and pulse input. The pre-condition for that is that the corresponding pins on the front connector (see 3.3.1) are connected. To inform the weighing processor of the change of setting, the function 'transfer calibration data' (DW 51, bit 8) must additionally be released.

Bit 4 Automatical post-dosing at tolerance underranging
When 'post-dosing at tolerance underranging' (bit 4 = '1') is ON, the weighing processor behaves as follows:
After switching OFF the coarse feed and the fine feed signal, a tolerance check is performed. If during this process a tolerance underranging is ascertained (DW 36, bit 2), the 'READY' message will not be issued and the

fine feed signal will come again until the TOLMINUS limit (DW 26, 27) is reached. The 'READY' message comes after a new tolerance check.
If 'post-dosing at tolerance underranging' (bit 4 = '0') would be OFF, after the first tolerance check performed as above the 'READY' and 'TOLMINUS underranged' messages (but no new fine feed signal) would be issued.

Bit 5 BCD representation

Bit 6 Fixed point or floating point representation

Bit 7 Tolerance in per mil / tolerance absolute

Bit 8 Without / with automatical follow-up correction (see also 4.15)
The weighing processor has the possibility to correct the follow-up value (DW 17, 18) to reach the pre-set set value more exactly at several succeeding dosing procedures of the same medium. If the 'automatical follow-up correction' is OFF, the weighing processor works currently with the value accepted as follow-up value.
If the 'automatical follow-up correction' is ON, the corrected follow-up value will be written back by the weighing processor into the PLC (data module DW 17, 18) before the 'READY' message is reached.

Bit 9 Internally assigned (must be '0')

Bit 10 Dosing time supervision (see also 4.12)
The dosing time supervision is started with the 'Start' command.
If the dosing process is not finished after the pre-set dosing supervision time has been elapsed (no READY message), the dosing process will be interrupted and this mentioned with 'weighing interrupted' in the status word (DW 36, bit 10). Furthermore 'dosing time overflow' (DW 10, bit 7) is issued in the error word.
When the 'dosing time supervision' would be OFF, dosing would not be interrupted in the same case and the fine feed and/or the coarse feed signal would remain.
By the dosing factor dependent on the medium which is a measure for the speed of dosing, the dosing supervision time can thus be optimally adapted to the corresponding set value.

Bit 11 Software control amplifying OFF
By this bit, the software control amplifying can be switched OFF which causes a simple adaptation to agitating measuring equipment. (For jump-loading of the scale and control amplifying ON, the internal setting time of the weighing processor will be shortened to approx. $^1/_3$)
(Nevertheless, inserting an additional damping capacitor can be required.)

Bit 12 Automatical check of measuring circuit
When the 24 V supply or the internal 15 V supply of the weighing processor fails or any wires of the load cell cable (not wire 1, 3, and 6) or the whole load cell cable are interrupted, the messages 'measuring circuit interrupted' (DW 10, bit 11 resp. DW 50, bit 11) and 'failure' (DW 36, bit 0) are issued after a measuring circuit test routine. An evtl. started dosing will be stopped. This function can be switched off by setting bit 12 = '1'.

Bit 15 Volume or flow value setting in DW 41, 42 instead of the analog value.
As shown in above table, the volume value or the flow value can optionally be indicated in DW 41, 42 instead of the analog value. The flow value is calculated in weight value/200 msec and will be updated every 200 msec on the weighing processor (see also 4.13).

5.1.1.2 Contents Command Word (Calibration)

DW 51	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Bit 0 : Zeroing
Bit 1 : Calibration weight 1 valid
Bit 2 : Calibration weight 2 valid
Bit 3 : Calibration weight 3 valid
Bit 4 : Calibration weight 4 valid
Bit 5 : Calibration weight 5 valid
Bit 6 : Calibration weight 6 valid
Bit 7 : Read calibration data
Bit 8 : Transmit calibration data
Bit 9 : Clear RAM
Bit 10 : Output digits on filling level
Bit 11 : Block calibration
Bit 12 :
Bit 13 :
Bit 14 :
Bit 15 : Calibration data have been read

▸ **The bits set in DW 51 are only set for one cycle**

Bit 0 Zeroing
This control command must be transferred to the weighing processor if the scale has to be reset after calibration. For that, the filling level counter (DW 37, 38) will be set to '0'. If the function 'read calibration data' is released after the function 'zeroing', the deviation from the adjusted zero can be read in DW 54 (zeroing digits) in digits.

Bits 1 to 6 Calibration weight 1 to 6 valid
On control command 'calibration weight valid' the scale must be at standstill. The corresponding linearization point will be acquired and the linearization factor ascertained.

Bit 7 Read calibration data
All data are transferred from the weighing processor to the AG.

Bit 8 Transmit calibration data
All calibration data of the data modules (DW 52 to DW 102) are transferred from the AG to the weighing processor. If the function 'clear RAM' has been performed before that, the 'failure' LED on the weighing processor will get OFF after the command 'transfer calibration data' (with correct data). The batch weight, the volume and the pulse weight calculated at last as well as the ascertained check numbers will get lost.

Bit 9 Clear RAM
All data in the weighing processor will be cleared. An eventually active 'failure' signal, however, will not be reset.

The function 'clear RAM' should be generally released after replacing a weighing processor before the command 'transmit calibration data' is sent. This is also required before new weighing processors will be adjusted. After releasing the function 'clear RAM', the filling level counter in DW 37, 38 goes to '0' and the 'failure' LED on the weighing processor lights up.

Bit 10 Output digits on filling level (test feature for servicing)
Instead of the filling level, absolute value digits wil be output in DW 37, 38. To switch back to filling level indication, release the command 'read calibration data'.

Bit 11 Block calibration
A calibration flag will be set which prevents overwriting of calibration weights and calibration digits and ascertaining of the check number. This operation mode can only be left by 'clear RAM'.

Bit 15 Calibration data have been read
This bit will be set by the FB SIW:JUST after all calibration data have been transferred from the weighing processor into the PLC.

5.1.1.3 Contents Error Word (Calibration)

DW 50	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Bit 0 :
Bit 1 : Calibration error
Bit 2 : EPROM error
Bit 3 : RAM error
Bit 4 : Watchdog supervision responded
Bit 5 :
Bit 6 : Interface 8031 disturbed (hardware error)
Bit 7 :
Bit 8 :
Bit 9 :
Bit 10 : Wire interrupt of the analog input (for life zero operation)
Bit 11 : Measuring circuit disturbed
Bit 12 : Buffer battery empty
Bit 13 : Data invalid
Bit 14 : Interface to the PLC disturbed
Bit 15 : Plausibility error

▸ **The bits in DW 50 are only set for one cycle**

Bit 1 Calibration error
'Calibration error' is indicated when the difference between the calibration values 'n' and 'n + 1' is not at least 1000 digits or if the calibration commands are entered in the wrong order or if the upper limit of the measuring range is overranged (≥ 39.990 digits) resp. the lower limit of the measuring range is underranged (≤255 Digits).

Bit 2 EPROM error (A)
'EPROM error' is indicated when a deviation is realized between the check sum stored in the RAM and the data in the EPROM during initialization.

Bit 3 RAM error (A)
'RAM error' is indicated when a RAM error is realized during initialization. 'RAM error' is indicated when deviations occur during the cyclical check sum check between the stored check sum and the check sum of the data stored in the RAM.

Bit 4 Watchdog supervision responded (A)
Watchdog error' is indicated by the data processing when an error occurs in the cyclical program processing (firmware DP).

Bit 6 Interface 8031 disturbed (hardware error) (A)
This message will be issued if the DP does not receive an updated filling level telegram from the DA during the supervision time or no check number is indicated during 'test'. If this error occurs while a weighing process is running, the process will be stopped. (This message comes additionally on EPROM error or RAM error.)

Bit 10 Wire interrupt on the analog input (for life zero operation)
The 'wire interrupt' message will be issued if in the parameter word 'with analog value transfer' (DW 52, bit 2) and 'analog value with life zero' (DW 52, bit 1) are set and a voltage of 0.4 V or a current of 1.5 mA are underranged.

Bit 11 Measuring circuit disturbed (A)
If the load on the scale does not change within approximately 5 seconds, an automatical test routine will be started. If the test is negative, means the measuring circuit does not react, the message 'measuring circuit disturbed' will be issued and an evtually running dosing process will be stopped.
Or: If the data acquisition (DA) reaches the upper or lower limit value of the measuring range or if the 24 V supply or the internal 15 V supply are failing, the message 'measuring circuit disturbed' will be issued (not for pulse operation).

Bit 12 Buffer battery empty (A)
'Buffer battery empty' is issued when the battery of the buffered RAM on the absolute measuring method (DA) is empty.

Bit 13 Data invalid
'Data invalid' is issued when the FB 200 or the FB 201 have been interrupted by a mains failure.

Bit 14 Interface to the PLC disturbed
After repeating a telegram to the PLC three times a cyclical telegram will be transferred to prevent blocking of the FIFO interface. If more synchronization errors between WP and PLC occur after that, the message 'interface to the PLC disturbed' will be issued and a synchronization will be performed. In addition to that, the 'failure' message will be issued (DW 36, bit 0).
The periphery byte to which the WP is addressed must not be interrogated in the user program.

Bit 15 Plausibility error
A 'plausibility error' occurs, when

a) MIN MAX has been preset,
b) unallowed step width has been set. Preset allowed are: 1, 2, 5, 10, 20, and 50.
c) Analog zero value > analog final value has been preset in the case of the analog value is parameterized,
d) not allowed volume or weight unit has been preset,
e) linearization weight CW (n + 1) < CW(n).

(A) = message to be acknowledged by setting bit 3 in DW 12.

5.1.1.4 Calibration of Scales

- Prior to calibrating the RAM can be erased. However, this is only imperative for first start-up procedure.
  Erasement of RAM is executed through voltage activation with open switch S2/3 (see hardware operating instructions) or by means of setting bit 9 in DW 51. To erase RAM (software), switch S2/7 must be closed.

- The calibration data have to be recorded in data module segment 'calibration data' (see 5.2, 'Numerical Representation').

- The user has to provide now that FB 200 (SIW:JUST) is called-up and runs through cyclically (see program example). For that, FB 201 (SIW:LESE) and FB 202 (SIW:SOLL) must not be executed.

- By setting bit 8 in DW 51 the transfer of the calibration data to the weighing processor is activated.

- Now FB 200 transmits in 11 cycles one telegram with a part of calibration data per each cycle. In DW 0 each sending of a telegram is indicated by 'SE' (send).

- During the last run the addressed FB 200 recognizes that all telegrams were transmitted and reacts with the entry 'EN' (end of transmission) in DW 0 for one cycle.

- The scale is unloaded, means loaded only with its own weight (dead load).

- The calibration weight 1 (DW73, 74) must always be zero (scale empty).

- Set bit 1 in DW 51. With that calibration weight 1 is declared valid.

- By the command 'calibration weight 1 valid' an internal calculation process is started. The result is 'calibration digit 1' which will be stored on the weighing processor.

- DW 37, 38 (filling level) now presents the value of calibration weight 1 (pre-condition: DW 53, 54 = 0). If there is an indicator connected to the serial interface and if it is set to show the filling level, the calibration weight 1 will be displayed. If calibration weight 1 = 0, '0000' will be displayed.

- The 'failure' lamp lights up on the weighing processor.

- The first calibration weight (calibration weight 2) will be placed on the scale.

- Wait for stand-still of the scale.

- Declare calibration weight 2 valid (set DW 51, bit 2).

- By the command 'calibration weight 2 valid' an internal calculation process is started. The result is the value 'calibration digit 2' which will be stored on the weighing processor.

- DW 37, 38 (filling level) now presents the value of calibration weight 2. If there is an indicator connected to the serial interface and if it is set to show the filling level, the calibration weight 2 will be displayed.

- If necessary, the second calibration weight according to calibration weight 3 will be placed on the scale.

- Declare calibration weight 3 valid (set DW 51, bit 3).

- Further steps of calibration up to 'calibration weight 6' must be done according to the above described procedure.

- When all calibration data have correctly been transmitted and when they have correctly been interpreted by the weighing processor, no bit is set in the error word (DW 50).

- When during calibration the last calibration weight is reached, the scale will be regarded calibrated. The 'failure' lamp will go OFF.

- The weighing processor will check the correct sequence of calibration commands, i. e., it checks that command 'n' is followed by command 'n + 1'. If this is not being considered the calibration has to be re-started with the command 'calibration weight 1 valid'.

- To calibrate the weighing processor, at least two linearization points are necessary (dead load and 1st calibration weight corresponding to calibration weight 1 and/plus calibration weight 2).

5.1.1.5 Read and Transmit Calibration Data

With this command all calibration data are being transmitted from the weighing processor (WP) to the AG (scale DB) resp. from the AG to the WP. With 'read calibration data' the same data as with 'transmit calibration data' are transmitted but in addition to that also the calibration digits calculated by the weighing processor during the calibration procedure and, if necessary, the zero value.

After the 'read calibration data' all scale specific data including the calibration digits calculated by the weighing processor and the zeroing value are available in the AG and can be stored on a floppy disk. After replacement of a WP the entire calibration data can be transmitted from the floppy disk to the WP. A new calibrat-ion is not necessary, however, the zero point should be adapted by the command 'zeroing' (DW 51, bit 0) as well as the test value should be ascertained (if required) by the command 'ascertain test value (DW 12, bit 0).

During the transmission of the calibration data to the WP, a check sum is formed automatically. The calibration data in the buffered RAM are cyclically compared to the check sum In the case of an error the messages 'RAM error' (DW 36, bit 3) and 'failure' (DW 36, bit 0) are issued.

When the calibration data have been read, the identifier 'EL' (end of reading) will be set in DW 0 for one cycle.

It is imperative to wait for the identifier 'EL' before new commands will be transmitted to the WP resp. FB 201 or 202 will be called-up.

Note: **When replacing a weighing processor (WP) attention has to be given that the adaptation resistors on the data acquisition board are the same as on the "old" board.**

Display for user:

DW 0	= BS	:	Command word was sent
	= E1	:	Look at error word
	= TW	:	Telegram was repeated
	= ZT	:	Cyclical telegram was read (not stored)
	= E2	:	Marker byte not known (when reading)
	= KA	:	No order bit set
	= EN	:	End of transferring calibration data
	= SE	:	Transferring calibration data
	= LE	:	Read calibration data
	= EL	:	Calibration data have been read

5.1.2 Weighing

5.1.2.1 FB SIW:LESE 'Read Data' (FB 201)

Call-up:
FB SIW:LESE ('read data') will be bounded into the cyclical part of the user program. That means that it will be executed once in each cycle.

While the FB 201 (SIW:LESE; 'read data') is running, it is imperative to block the FB 200 (SIW:JUST) because the handling module would deliver wrong marker bytes.

Function:
- It transfers the weight values (DW 37 to DW 40) and the analog value (DW 41, 42) from the weighing processor into the AG.
- It updates the scale status in the AG (status word DW 36).
- It transfers the set values (after initializing via FB SIW:SOLL) from the AG to the weighing processor.

Note: **FB 202 (SIW:SOLL) works only in conjunction with FB 201 (SIW:LESE). If one of the FBs described hereafter is called up, the scale DB has to be prepared in the AG before and has to to be called up in the supply program (e. g. A DB xxx).**

Display for user:

DW 0 = F1 : Look at error word
= TW : Telegram was repeated
= F2 : Marker byte unknown
= ZT : Cyclical telegram was read
= KA : No order available
= SU : Setting value was transferred

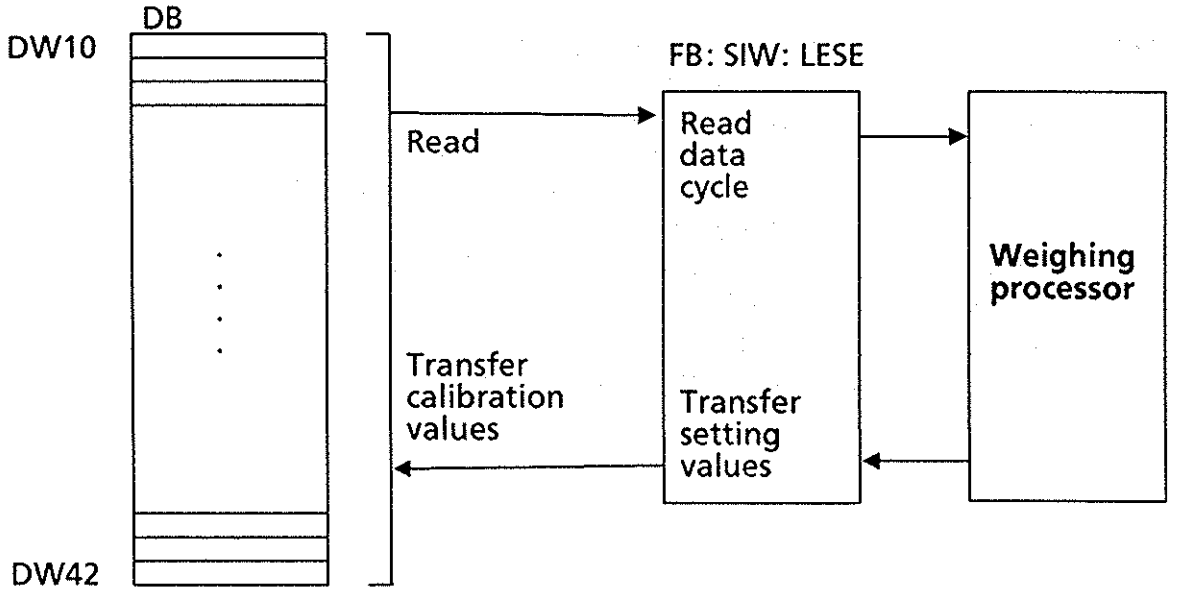


Figure 46: Data Flow while Reading

5.1.2.2 FB "SIW:SOLL" "Set ValueTransfer Initializing" (FB 202)

Call-up:

FB SIW:SOLL (transfer initializing) will be conditionally (start, stop, etc.) called up in the user program **via an edge** (see program example).

While FB 202 (SIW:SOLL) is running, it is imperative to block FB 200 (SIW:JUST) because this handling module would deliver wrong marker bytes.

Function:

- Transfer of set values, pre-signals, follow-up values etc. or control commands like 'start', 'stop' etc. is **prepared**. The actual transfer to the weighing processor is executed via FB SIW:LESE.

- The values that have to be transferred must be entered before in the DB under 'set values' (DW 13 to DW 42). DW 11 (telegram selection) has to determine which data have to be transmitted.

- If bit 0 is set in DW 11 the complete command word DW 12 is prepared for transmission.

- If there are set several bits at a time in DW 11 by the user, the orders are executed according to the following priority list:

  1) Set value
  2) Coarse follow-up/fine follow-up
  3) Weight / pulse, setting time, batching time factor
  4) TOLPLUS value, TOLMINUS value
  5) specific gravity, tare weight, inching time
  6) Command word

Notes: **The set bits in data words 11 and 12 are not being erased by FB SIW:SOLL.**

FB 202 (SIW:SOLL) works only in conjunction with FB 201 (SIW:LESE).

If one of the FBs described hereafter is called up, the scale DB has to be prepared in the AG before and has to to be called up in the supply program (e. g. A DB xxx).

5.1.2.2.1 Contents Command Word

DW 12	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Bit 0 : Determine test value
Bit 1 : Tare value valid
Bit 2 : 1 = upward; 0 = downward batching mode
Bit 3 : Error acknowledge
Bit 4 : Test
Bit 5 : Stop
Bit 6 : Intermediate start
Bit 7 : Start with automatic taring
Bit 8 : Taring
Bit 9 : Initialize test detuning upward
Bit 10 : Initialize test detuning downward
Bit 11 :
Bit 12 :
Bit 13 :
Bit 14 : Set pulse weight to zero
Bit 15 : Start inching duty

Bit 0 Determine test value
By this command, a specific test value comparing constant (see status word) is ascertained. Ascertaining of the test value will take approx. 10 seconds. After the test value has correctly been ascertained, bits 12 and 13 in the status word (DW 36) will be set (see also 4.25, 'Test').

Bit 1 Tare value valid
The set tare value is being accepted. This command is also effective without start.

Bit 2 Upward / downward batching mode
When the bit is set, the scale is in an upward batching mode, i. e. fill weighing. When the bit is not set, the scale is in a downward batching mode, i. e. deduct weighing.
If the scale operates in upward batching mode, bit 2 must be set for each command as e. g. 'stop' or 'tare'. Generally is to be recommended not to set only single bits but to transfer the complete DW as a bit pattern (data format KM) to get a better survey of the functions to be used.
(e. g. L KM 00000000 10000100 for upward batching + start with automatical taring)
(T DW 12 command word of the scale).

Bit 3 Error acknowledge
Acknowledgement bit for malfunctions which have to be acknowledged (marked with (A)). Any hardware malfunction has to be acknowledged.

Bit 4 Test
The control command 'Test' is only effective when the time division electronics (DMS input) is selected as signal input (instead of the pulse input). The test resistor is being connected, and after the end of the test the status bits are set within or out of tolerance. Prior to this the test value has to be ascertained. 'Test' will take approx. 10 seconds (see also 4.25, 'Test').

Bit 5 Stop
The batching procedure is being terminated immediately. The status bit 'weighing terminated' is being set.
If the 'stop' command has been released during the post-dosing procedure, attention must be given to the fact that the follow-up value will not be transmitted to the WP again on an eventually following 'intermediate start' + 'automatic follow-up correction'. Only at the next start the follow-up value will be transmitted again.

Bit 6 Intermediate start
With this command an interrupted batching procedure can be sustained (e. g. after mains failure or 'stop'). No automatic taring is executed.
If the 'stop' command has been released during the post-dosing procedure, attention must be given to the fact that the follow-up value will not be transmitted to the WP on an eventually following 'intermediate start' + 'automatic follow-up correction'. Only at the next start the follow-up value will be transmitted again.

Bit 7 Start with automatic taring
The batching procedure will be started when the weighing processor is at stand-still and the data acquisition electronics is not in a check status. The batch weight (DW39, 40) is set to zero.

Bit 8 Taring
The batch weight is set to zero. No start is executed.
In case of pulse operation, the pulse counter is set to zero.

Bit 9 Initialize test detuning upward
If the command 'test detuning upward' (DW 12, bit 9) is sent to the weighing processor, the weight value in the filling level counter (DW37, 38) increases of up to 19 740 digits dependent on the test resistor (not for pulse input; see also 4.13).

Bit 10 Initialize test detuning downward
If the command 'test detuning downward' (DW 12, bit 10) is sent to the weighing processor, the weight value in the filling level counter (DW37, 38) decreases by up to 19 740 digits dependent on the test resistor (not for pulse input; see also 4.13).

Bit 14 Set pulse weight to zero
After this command the filling level (DW 52, bit 3) is set to zero in the pulse operation mode. This bit can also be set together with the start bit for dosing with only one medium.

Bit 15 Start inching duty

The fine feed relay is energized for a determinated period of time (inching time, DW 32). Now, the inching is repeated by the weighing processor until the TOLMINUS limit will no longer be underranged. If dosing has been finished, the command 'start inching duty' causes no action.

If the TOLMINUS limit is underranged while the inching time is running, the inching time will be terminated immediately and the fine feed signal (DW36, bit 6) will be cut off.

Between the inching pulses the settling time (DW 21) elapses.

5.1.2.2.2 Contents Telegram Selection

DW 11	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Bit 0 : Command word
Bit 1 : Set value
Bit 2 : Coarse follow-up/fine follow-up
Bit 3 : Weight per pulse, settling time, dosing time factor
Bit 4 : TOLPLUS value, TOLMINUS value
Bit 5 : Specific gravity, pre-set tare
Bit 6 :
Bit 7 :
Bit 8 :
Bit 9 :
Bit 10 :
Bit 11 :
Bit 12 :
Bit 13 :
Bit 14 :
Bit 15 :

Bit 0 Command word
By this bit, the transmission of the command word (DW 12) to the weighing processor will be initialized. If this bit has not been set, DW 12 is not transferred to the weighing processor and thus the last transmitted values continue to be valid.

Bit 1 Set value
By this bit, the transmission of the set value (DW13, 14) to the weighing processor is initialized.

Bit 2 Coarse follow-up/fine follow-up
By this bit, the transmission of the coarse follow-up value (DW 15, 16) and the fine follow-up value (DW 17, 18) to the weighing processor is initialized.

Bit 3 Weight per pulse, settling time, dosing time factor
By this bit, the transmission of the value for 'weight per pulse' (DW 19, 20), the value of the 'settling time' (DW 21), and the dosing time factor (DW 22, 23) to the weighing processor is initialized.

Bit 4 TOLPLUS value, TOLMINUS value
By this bit, the transmission of the TOLPLUS value (DW 24, 25) and the TOLMINUS value (DW 26, 27) to the weighing processor is initialized.
Setting the tolerance to 'per mil' or 'absolute' can be done in the calibration data range (DW 52, bit 7).

Bit 5 Specific weight, pre-set tare
By this bit, the transmission of the specific weight (DW 28, 29) and the pre-set tare (DW 30, 31) to the weighing processor is initialized.

5.1.2.2.3 Contents Status Word

DW 36	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Bit 0 : Malfunction
Bit 1 : READY
Bit 2 : TOLMINUS underflow
Bit 3 : TOLPLUS exceeded
Bit 4 : MAX exceeded
Bit 5 : MIN underflow
Bit 6 : Fine feed
Bit 7 : Coarse feed
Bit 8 : Low measuring range limit reached
Bit 9 : High measuring range limit reached
Bit 10 : Weighing terminated
Bit 11 : Overfill limit value reached
Bit 12 : Test value outside tolerance
Bit 13 : Test value within tolerance
Bit 14 : Stand-still
Bit 15 : Empty message

Bit 0 Malfunction
'Malfunction' is indicated when one or several of the following conditions are fulfilled:

- Measuring circuit disturbed (A)
- Interface DA - DP disturbed (A)
- Watchdog has responsed (A)
- RAM error (A)
- EPROM error (A)
- Buffer battery RAM empty (A)
- Weighing processor not yet calibrated
- Low or high measuring range limit exceeded (A)

(A) = has to be acknowledged

Bit 1 READY
'READY' is indicated when the batching procedure is finished.
(If neither TOLPLUS (bit 3) nor TOLMINUS (bit 2) have been set, the actual value is within the given tolerances.)

Bit 2 TOLMINUS underflow
'TOLMINUS underflow' is indicated when after the finished batching procedure the actual value < set value – pre-set tolerance (TOLMINUS DW 26, 27). During a batching procedure neither TOLPLUS (bit 3) nor TOLMINUS (bit 2) have been set. (During post-batching TOLMINUS is set.)

Bit 3 TOLPLUS exceeded
'TOLPLUS exceeded' is indicated when, after finishing the batching procedure, the actual value > set value + pre-set tolerance (TOLPLUS DW 24, 25). During a batching procedure neither TOLPLUS (bit 3) nor TOLMINUS (bit 2) have been set.

Bit 4 MAX exceeded
'MAX' is indicated when the filling level (DW 37, 38) has reached the pre-set maximum weight value (DW 63, 64).

Bit 5 MIN underflow
'MIN' is indicated when the filling level (DW 37, 38) has reached respect. exceeded the pre-set minimum weight value (DW 61, 62).

Bit 6 Fine feed
'FINE' is indicated when the fine feed relay is energized (see also 4.4, 'Batching').
'FINE' is indicated during a batching procedure until the set value/follow-up value limit is reached. After the settling time is elapsed, resp. after the stand-still message, the READY message (bit 1) will be issued.

Bit 7 Coarse feed
'COARSE' is indicated when the coarse feed relay is energized (see also 4.4, 'Batching').
'COARSE' is indicated during a batching procedure until the set value/ follow-up value limit is reached. After that only 'FINE' (bit 6) is still indicated.

Bit 8 Low measuring range limit reached
'Low measuring range limit reached' is indicated when the internal counter reading is ≤255 digits.

Bit 9 High measuring range limit reached
'High measuring range limit reached' is indicated when the internal counter reading is ≥39 990 digits.

Bit 10 Weighing terminated
Bit 10 'Weighing terminated' is indicated when

- the stop command has been released
- batching has been terminated because of overcharge
- batching has been terminated because of a failure message
- batching has been terminated because of dosing time exceeded

Bit 11 Overcharge limit value reached
'Overcharge limit value reached' is indicated when the overcharge limit value (DW 65, 66) has been reached resp. exceeded. If the volume supervision has been switched off by setting 'specific weight = 0' (DW 28, 29) the overfill value is only a weight limit value.
If the volume supervision has been switched ON by setting 'specific weight >< 0' (DW 28, 29), the overcharge value also represents a volume limit value.

Bit 12 Test value outside tolerance
'Test value outside tolerance' is indicated when the difference between the measured test value and the according reference value (value ascertained by the command 'determine test value' (DW 12, bit 0)) is higher than the given test value tolerance (DW 67, 68).

Bit 13 Test value within tolerance
'Test value within tolerance' is indicated when the difference between the measured test value and the according reference value (value ascertained by the command 'determine test value' (DW 12, bit 0)) is lower than the given test value tolerance (DW 67, 68).

Bit 14 Stand-still
'Stand-still' is indicated when the filling level (DW 37, 38) is within the given stand-still value ((DW 58, 59) during the given stand-still time (DW 60).

Bit 15 Empty message
'Empty message' is indicated when the filling level (DW37, 38) has fallen under the given empty message value (DW 55, 56) and the empty message delay time (DW 57) has elapsed.

5.1.2.2.4 Contents Error Word (Adjustment Values)

DW 10	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Bit 0 : Overrun pulse weight
Bit 1 :
Bit 2 : EPROM error
Bit 3 : RAM error
Bit 4 : Watchdog responded
Bit 5 : Set-value not plausible
Bit 6 : Interface 8031 disturbed (hardware error)
Bit 7 : Batching supervision time elapsed
Bit 8 : Test value determining error
Bit 9 :
Bit 10 : Wire interrupt of analog input
Bit 11 : Measuring circuit disturbed
Bit 12 : Buffer battery empty
Bit 13 :
Bit 14 : Interface to the AG disturbed
Bit 15 : Plausibility error

▸ **The given bits in DW 10 are valid only for one cycle.**

Bit 0 Overrun pulse weight
'Overrun pulse weight' is indicated when the pulse counter reaches 65535, or when the pulse weight (that means the filling level (parameterized pulse input)) exceeds 10^7 (for BCD) resp. 32 767 (for fixed point). The filling level counter (DW 37, 38) will be counted up beginning from 0. The error message will further be indicated and must be cleared after evaluating in the user program.

Bit 2 EPROM error (A)
'EPROM error' is indicated when a deviation is determined during initialization between the check sum stored in the RAM and the data in the EPROM.

Bit 3 RAM error (A)
'RAM error' is indicated when a RAM error is determined during the initialization.
'RAM error' is indicated when a deviation is determined during the cyclic check sum test between the stored check sum and the check sum of the data stored in the RAM (A).

Bit 4 Watchdog error (A)
'Watchdog responded' is indicated when a firmware error has been realized during the cyclic program processing.

Bit 5 Set-value not plausible (A)
'Set-value not plausible' is indicated when

- Set-value > filling level (for downward batching)
- Set-value > (overcharge value – filling level) (for upward batching)
- Volume set-value > volume (maximum volume for downward batching)
- Volume set-value > volume (maximum volume – actual volume for downward batching)
- Set-value = 0
- Set-value < fine follow-up value

If the given set-value is too high during weighing, weighing will be terminated.

Bit 6 Interface 8031 disturbed (A)
'Interface 8031 disturbed' is indicated when the DP does not receive an updated filling level telegram during the supervision time or when no test value is answered during testing. If this error occurs while a weighing process is running, weighing will be terminated (when RAM or EPROM error is indicated, 'Interface 8031 disturbed' will additionally be indicated).

Bit 7 Batching supervision time elapsed
The batching is not finished during the given supervision time. The messages 'batching supervision time exceeded' and 'weighing interrupted' (DW 36, bit 10) will be issued.

Bit 8 Test value determining error
This message will be issued when

- it is realized during 'determine test value' that 'calibration blocked' has been set,
- a plausibility error is realized during the internal test,
- it is realized during testing that the corresponding reference store has not been set for 'determine test value' (see section 4.25),
- detuning by R_p is not in the range between 9 000 and 19 740 digits.

Bit 10 Wire interrupt analog input
If 'with analog value transfer' and 'analog value with life zero' has been set in the parameter word, a wire interrupt message will be issued at a voltage underranging below 0.4 V resp. a current underranging below 1.5 mA.

Bit 11 Measuring circuit disturbed (A)
If no change of the load occurs on a scale for more than 5 seconds, an automatical test routine will be activated. When the reaction of the measuring circuit is negative, a failure message which has to be acknowledged will be issued and an evtl. running batching process will be terminated.
Or: If the data acquisition (DA) reaches the upper or lower final limit value or if the 24 V supply of the weighing processor or the internal voltage supply of the data acquisition fails, the message 'measuring circuit disturbed' will be issued (not for pulse operation (A)).

Bit 12 Buffer battery empty (A)
This message will be issued when the battery of the buffered RAM on the DA board is empty.

Bit 14 Interface to the AG disturbed
After a telegram to the AG has been repeated three times, a cyclical telegram is transmitted to avoid blocking of the FIFO interface. If more synchronizing errors occur after that, an error message will be issued and a synchronization will be performed. An additional 'failure' message will be issued (DW 36, bit 0).
The periphery byte onto which the weighing processor has been addressed must not be interrogated any longer in the user program.

Bit 15 Plausibility error (A)
Filling level < pre-set tare – 5 %

(A) = to be acknowledged

5.2 Data Module

For each weighing processor a data module in the AG is reserved in which the data following described again are stored.

The weighing processor can be parameterized for the following data formats:

Fixed-point representation	(KF)
BCD representation	(KH)
Floating-point representation	(KG)

The board address in DW 1 must always be pre-set in KF format and **must** correspond to the hardware address (DIL switch resp. threding switch) of the corresponding weighing processor board.

The decimal point to be set in the KF format in **DW 99** is important for the remote display as well as for the following data:

DW 13, 14	Set-value
DW 15, 16	Coarse follow-up
DW 17, 18	Fine follow-up
DW 24, 25	Tolerance plus
DW 26, 27	Tolerance minus
DW 30, 31	Pre-set tare
DW 37, 38	Filling level
DW 39, 40	Batch weight
DW 55, 56	Empty message value
DW 58, 59	Stand-still value
DW 61, 62	MIN value
DW 63, 64	MAX value
DW 65, 66	Overcharge value
DW 73, 74	Calibration weight 1
DW 75, 76	Calibration weight 2
DW 77, 78	Calibration weight 3
DW 79, 80	Calibration weight 4
DW 81, 82	Calibration weight 5
DW 83, 84	Calibration weight 6

Example: A filling level value of 2 000 with decimal point 1 means 200.0.

All data words **not** mentioned up to incl. DW 105 are internally used. The data words from DW 106 upwards can be freely assigned by the user.

5.2.1 Numerical Representation

The numerical representation is parameterized in DW 52 in bit 5 or 6.

Fix-point Representation

Data word with Bit No.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Valency	VZ	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}

Data word m, left byte (DL) Byte n

Data word m, right byte (DR) Byte n+1

VZ = sign (0 = positive; 1 = negative)

Number range: $Z_{min} = -32.768 = 8000_H$
$Z_{max} = +32.767 = 7FFF_H$

Example:

DW 73 KF = +0000 irrelevant
DW 74 KF = +0500 Calibration weight 1

Note: If you work with the fix-point representation, the first data word is always irrelevant

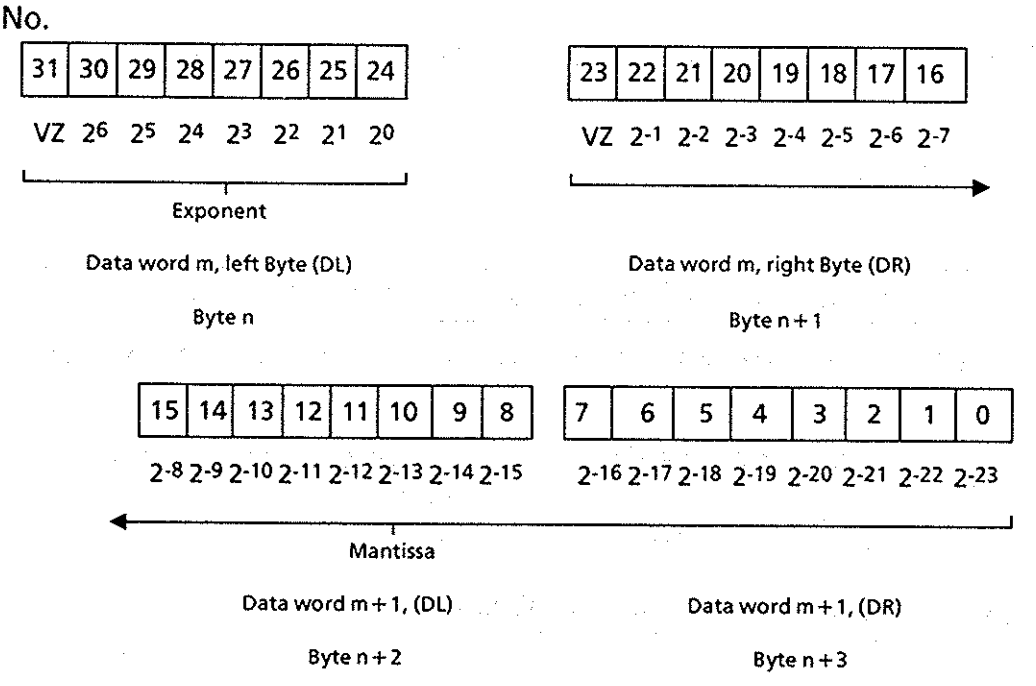
When applying data format KF, according to the resolution the worst case is a measuring range of 40 000 because the range limit value of a fix-point number is 32 000 and the measuring range must be selected smaller by a power of ten (i. e. 4 000).

The resolution is:

$$\frac{1}{4\,000} = 0{,}25\,‰$$

The resolution of a common load cell is approx. 1 ‰. Therefore, the resolution of the weighing processor is still four times better than the resolution of the load cell in this worst case.

Floating-point Representation



VZ = sign (0 = positive; 1 = negative)

Representation: $Z = (\text{Mantissa}) * 2^{(\text{Exponent})}$

Number range: $Z_{min} = -1.7 \times 10^{38}$
$Z_{max} = +1.7 \times 10^{38}$

Because of internal processing, a floating-point number must not exceed 10^7.

Example: DD 73 KG = +5500000 +03 Linearization weight 1
= $+0{,}55 \times 10^3 = 550$ g (or kg or t)

Note: The weighing processor always calculates internally with a 32 bit fix-point number, that means, if in the AG the data module is programmed in the floating-point format, the digits after the decimal point will not be considered.

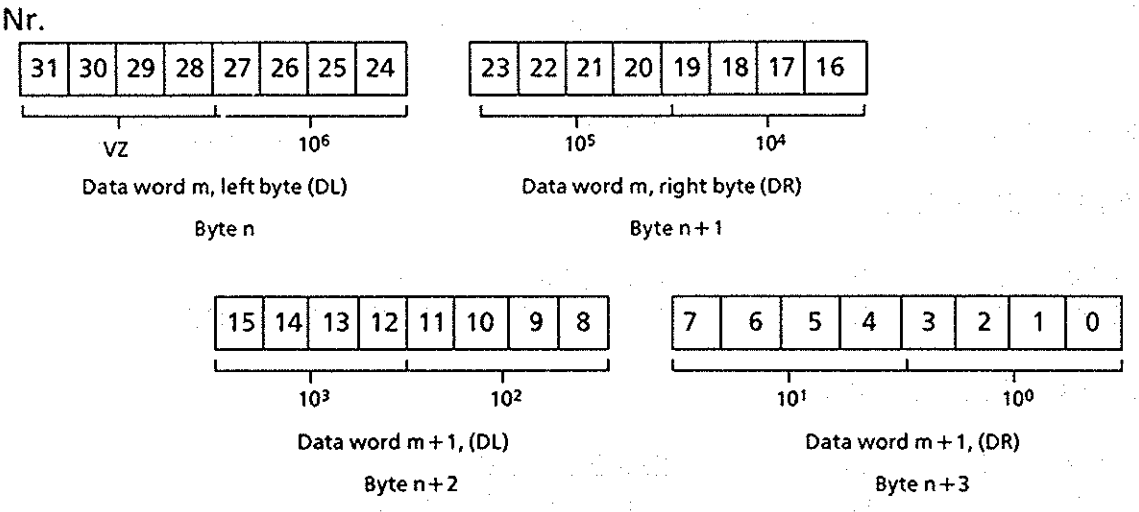
Example: KG = +1234000 +02
Z = 12,34

In this example, the weighing processor works only with the digits before of the decimal point, i. e. 12.

To be able to transmit the value Z = 12.34, the value in KG = +1234000+04 with decimal point 2 can be transferred to the weighing processor.

Time values are pre-set in the data format KF.

BCD Representation



VZ = sign (0 = positive; 1 = negative)

Number range: Z_{min} = -9'999.999
Z_{max} = +9'999.999

Example:

Z = +550
DD 73 KH = 00000550

(i.e. DW 73 = KH = 0000
DW 74 = KH = 0500)

Z = -550
DD 73 KH = F0000550

(i.e. DW 73 = KH = F000
DW 74 = KH = 0500)

5.2.2 Data Module Organization

5.2.2.1 Organization of the Data Module in KF

Scale Data Module **Data Format KF (Fix-point Representation)**

DATA MODULE HEAD:

DW	0	KC	TELEGRAM SIGNAL
DW	1	KF	ADDRESS WEIGHING PROCESSOR

CYCLIC COMMUNICATION:

DW	10	KM	ERROR WORD
DW	11	KM	TELEGRAM SELECTION
DW	12	KM	COMMAND WORD

SET VALUES:

DW	14	KF	SET-VALUE
DW	16	KF	COARSE FOLLOW-UP
DW	18	KF	FINE FOLLOW-UP
DW	20	KF	WEIGHT PER PULSE
DW	21	KF	SETTLING TIME (seconds)
DW	23	KF	BATCHING TIME FACTOR (seconds/weight unit)
DW	25	KF	TOLERANCE PLUS
DW	27	KF	TOLERANCE MINUS
DW	29	KF	SPECIFIC GRAVITY (g / dm^3)
DW	31	KF	PRE-SET TARE
DW	32	KF	INCHING TIME (value * 0.1 seconds)

CYCLIC INFORMATIONS:

DW	36	KM	STATUS WORD
DW	38	KF	FILLING LEVEL
DW	40	KF	BATCH WEIGHT
DW	42	KF	ANALOG VALUE, FLOW VALUE, VOLUME VALUE

CALIBRATION DATA:

DW	50	KM	ERROR WORD CALIBRATION
DW	51	KM	COMMAND WORD CALIBRATION
DW	52	KM	PARAMETER WORD CALIBRATION
DW	54	KF	ZEROING DIGITS
DW	56	KF	EMPTY INDICATION VALUE
DW	57	KF	EMPTY INDICATION DELAY (seconds)
DW	59	KF	STAND-STILL VALUE
DW	60	KF	STAND-STILL TIME (seconds)
DW	62	KF	MIN WEIGHT LIMIT VALUE
DW	64	KF	MAX WEIGHT LIMIT VALUE
DW	66	KF	OVERCHARGE VALUE (weight value)

DW	68	KF	TEST VALUE TOLERANCE (digits)
DW	70	KF	ANALOG ZERO VALUE (0 mA resp. 4 mA)
DW	72	KF	ANALOG FINAL VALUE (20 mA)
DW	74	KF	CALIBRATION WEIGHT 1 (zero; scale empty)
DW	76	KF	CALIBRATION WEIGHT 2 (1. weight)
DW	78	KF	CALIBRATION WEIGHT 3 (2. weight)
DW	80	KF	CALIBRATION WEIGHT 4 (3. weight)
DW	82	KF	CALIBRATION WEIGHT 5 (4. weight)
DW	84	KF	CALIBRATION WEIGHT 6 (5. weight; 0.<1.<2.<3.<4. <5.)
DW	86	KF	CALIBRATION DIGIT 1
DW	88	KF	CALIBRATION DIGIT 2
DW	90	KF	CALIBRATION DIGIT 3
DW	92	KF	CALIBRATION DIGIT 4
DW	94	KF	CALIBRATION DIGIT 5
DW	96	KF	CALIBRATION DIGIT 6
DW	98	KF	MAXIMUM VOLUME LIMIT VALUE
DW	99	KF	DECIMAL POINT POSITION (0, 1, 2, 3 for remote display)
DW	100	KC	VOLUME UNIT (MM, CM, DM, ME; see 4.11)
DW	101	KC	WEIGHT UNIT (GR, KG, TO; see 4.11)
DW	102	KF	STEP WIDTH (for remote display; 1, 2, 5, 10, 20, 50)

Parameterizing Example for the Scale Data Module

Data Format KF (Fix Point Representation)

DATA MODULE HEAD

DW	0	KC=ZT	TELEGRAM SIGNAL
DW	1	KF= 128	ADDRESS WEIGHING PROCESSOR

CYCLIC COMMUNICATION

DW	10	KM=00000000 00000000	ERROR WORD
DW	11	KM=00000000 00000000	TELEGRAM SELECTION
DW	12	KM=00000000 00000000	COMMAND WORD

SET VALUES

DW	14	KF=+1000	SET-VALUE (100,0 kg)
DW	16	KF=+200	COARSE FOLLOW-UP (20,0 kg)
DW	18	KF=+50	FINE FOLLOW-UP (5,0 kg)
DW	20	KF=+0	WEIGHT PER PULSE
DW	21	KF=+10	SETTLING TIME (10 seconds)
DW	23	KF=+0	BATCHING TIME FACTOR (seconds/weight unit)
DW	25	KF=+50	TOLERANCE PLUS (5,0 kg)
DW	27	KF=+50	TOLERANCE MINUS (5,0 kg)
DW	29	KF=+0	SPECIFIC WEIGHT (g/dm^3)
DW	31	KF = +0	PRE-SET TARE
DW	32	KF = +0	INCHING TIME (value x 0.1 seconds)

CYCLIC INFORMATIONS

DW	36	KM = 00000000 00000000	STATUS WORD
DW	38	KF = +0	FILLING LEVEL
DW	40	KF = +0	BATCH WEIGHT
DW	42	KF = +0	ANALOG VALUE, FLOW VALUE, VOLUME VALUE

CALIBRATION DATA

DW	50	KM = 00000000 00000000	ERROR WORD CALIBRATION
DW	51	KM = 00000000 00000000	COMMAND WORD CALIBRATION
DW	52	KM = 00000000 00000000	PARAMETER WORD CALIBRATION
DW	54	KF = +0	ZEROING DIGITS
DW	56	KF = +10	EMPTY INDICATION VALUE (1,0 kg)
DW	57	KF = +5	EMPTY INDICATION DELAY (5 seconds)
DW	59	KF = +20	STAND-STILL VALUE (2,0 kg)
DW	60	KF = +2	STAND-STILL TIME (2 seconds)
DW	62	KF = +50	MIN WEIGHT LIMIT VALUE (5,0 kg)
DW	64	KF = +1500	MAX WEIGHT LIMIT VALUE (150,0 kg)
DW	66	KF = +1700	OVERCHARGE VALUE (170,0 kg)
DW	68	KF = +30	TEST VALUE TOLERANCE (30 digits)
DW	70	KF = +0	ANALOG ZERO VALUE (0 mA resp. 4 mA)

DW	72	KF = +0	ANALOG FINAL VALUE (20 mA)
DW	74	KF = +0	CALIBRATION WEIGHT 1 (zero; scale empty, 0 kg)
DW	76	KF = +500	CALIBRATION WEIGHT 2 (1. weight = 50,0 kg)
DW	78	KF = +0	CALIBRATION WEIGHT 3 (2. weight = 0 kg)
DW	80	KF = +0	CALIBRATION WEIGHT 4 (3. weight = 0 kg)
DW	82	KF = +0	CALIBRATION WEIGHT 5 (4. weight = 0 kg)
DW	84	KF = +0	CALIBRATION WEIGHT 6 (5. weight = 0 kg)
DW	86	KF = +4856	CALIBRATION DIGIT 1 (4.856 digits)
DW	88	KF = +24689	CALIBRATION DIGIT 2 (24.689 digits)
DW	90	KF = +0	CALIBRATION DIGIT 3 (0 digits)
DW	92	KF = +0	CALIBRATION DIGIT 4 (0 digits)
DW	94	KF = +0	CALIBRATION DIGIT 5 (0 digits)
DW	96	KF = +0	CALIBRATION DIGIT 6 (0 digits)
DW	98	KF = +0	MAXIMUM VOLUME LIMIT VALUE
DW	99	KF = +1	DECIMAL POINT POSITION (= 1 for remote display)
DW	100	KC = DM	VOLUME UNIT (DM; see 4.11)
DW	101	KC = KG	WEIGHT UNIT (KG; see 4.11)
DW	102	KF = +1	STEP WIDTH (for remote display; 1)

5.2.2.2 Data Module in KH (BCD)

Scale Data Module			Data Format KH (BCD Representation)
DATA MODULE HEAD			
DW	0	KC	TELEGRAM SIGNAL
DW	1	KF	ADDRESS WEIGHING PROCESSOR
CYCLIC COMMUNICATION			
DW	10	KM	ERROR WORD
DW	11	KM	TELEGRAM SELECTION
DW	12	KM	COMMAND WORD
SET VALUES			
DD	13	KH	SET-VALUE
DD	15	KH	COARSE FOLLOW-UP
DD	17	KH	FINE FOLLOW-UP
DD	19	KH	WEIGHT PER PULSE
DW	21	KH	SETTLING TIME (seconds)
DD	22	KH	BATCHING TIME FACTOR (seconds/weight unit)
DD	24	KH	TOLERANCE PLUS
DD	26	KH	TOLERANCE MINUS
DD	28	KH	SPECIFIC WEIGHT (g / dm^3)
DD	30	KH	PRE-SET TARE
DW	32	KH	INCHING TIME (value x 0.1 seconds)
CYCLIC INFORMATIONS			
DW	36	KM	STATUS WORD
DD	37	KH	FILLING LEVEL
DD	39	KH	BATCH WEIGHT
DD	41	KH	ANALOG VALUE, FLOW VALUE, VOLUME VALUE
CALIBRATION DATA			
DW	50	KM	ERROR WORD CALIBRATION
DW	51	KM	COMMAND WORD CALIBRATION
DW	52	KM	PARAMETER WORD CALIBRATION
DD	53	KH	ZEROING DIGITS
DD	55	KH	EMPTY INDICATION VALUE (weight value for empty message)
DW	57	KH	EMPTY INDICATION DELAY (seconds)
DD	58	KH	STAND-STILL VALUE (weight value for stand-still message)
DW	60	KH	STAND-STILL TIME (seconds)
DD	61	KH	MINIMUM WEIGHT LIMIT VALUE
DD	63	KH	MAXIMUM WEIGHT LIMIT VALUE
DD	65	KH	OVERCHARGE VALUE (weight value)

DD	67	KH	TEST VALUE TOLERANCE (digits)
DD	69	KH	ANALOG ZERO VALUE (0 mA resp. 4 mA)
DD	71	KH	ANALOG FINAL VALUE (20 mA)
DD	73	KH	CALIBRATION WEIGHT 1 (zero; scale empty)
DD	75	KH	CALIBRATION WEIGHT 2 (1. weight)
DD	77	KH	CALIBRATION WEIGHT 3 (2. weight)
DD	79	KH	CALIBRATION WEIGHT 4 (3. weight)
DD	81	KH	CALIBRATION WEIGHT 5 (4. weight)
DD	83	KH	CALIBRATION WEIGHT 6 (5. weight; 0.<1.<2.<3. <4.<5.)
DD	85	KH	CALIBRATION DIGIT 1
DD	87	KH	CALIBRATION DIGIT 2
DD	89	KH	CALIBRATION DIGIT 3
DD	91	KH	CALIBRATION DIGIT 4
DD	93	KH	CALIBRATION DIGIT 5
DD	95	KH	CALIBRATION DIGIT 6
DD	97	KH	MAXIMUM VOLUME LIMIT VALUE
DW	99	KH	DECIMAL POINT (0, 1, 2, 3 for remote display)
DW	100	KC	VOLUME UNIT (MM, CM, DM, ME; see 4.11)
DW	101	KC	WEIGHT UNIT (GR, KG, TO; see 4.11)
DW	102	KH	STEP WIDTH (for remote display; 1, 2, 5, 10, 20, 50)

Parameterizing Example for the Scale Data Module

Data Format KH (BCD Representation)

DATA MODULE HEAD

DW	0	KC=ZT	TELEGRAM SIGNAL
DW	1	KF=+128	ADDRESS WEIGHING PROCESSOR

CYCLIC COMMUNICATION

DW	10	KM=00000000 00000000	ERROR WORD
DW	11	KM=00000000 00000000	TELEGRAM SELECTION
DW	12	KM=00000000 00000000	COMMAND WORD

SET VALUES

DD	13	KH=0000 1000	SET-VALUE (100,0 kg)
DD	15	KH=0000 0200	COARSE FOLLOW-UP (20,0 kg)
DD	17	KH=0000 0050	FINE FOLLOW-UP (5,0 kg)
DD	19	KH=0000 0000	WEIGHT PER PULSE
DW	21	KH=0010	SETTLING TIME (10 seconds)
DD	22	KH=0000 0000	BATCHING TIME FACTOR (seconds/weight unit)
DD	24	KH=0000 0050	TOLERANCE PLUS (5,0 kg)
DD	26	KH=0000 0050	TOLERANCE MINUS (5,0 kg)
DD	28	KH=0000 0000	SPECIFIC WEIGHT (g/dm³)
DD	30	KH = 0000 0000	PRE-SET TARE
DW	32	KH = 0000	INCHING TIME (value * 0.1 seconds)

CYCLIC INFORMATIONS

DW	36	KM = 00000000 00000000	STATUS WORD
DW	37	KH = 0000 0000	FILLING LEVEL
DD	39	KH = 0000 0000	BATCH WEIGHT
DD	41	KH = 0000 0000	ANALOG VALUE, FLOW VALUE, VOLUME VALUE

CALIBRATION DATA

DW	50	KM = 00000000 00000000	ERROR WORD CALIBRATION
DW	51	KM = 00000000 00000000	COMMAND WORD CALIBRATION
DW	52	KM = 00000000 00000000	PARAMETER WORD CALIBRATION
DD	53	KH = 0000 0000	ZEROING DIGITS
DD	55	KH = 0000 0010	EMPTY INDICATION VALUE (1,0 kg)
DW	57	KH = 0005	EMPTY INDICATION DELAY (5 seconds)
DD	58	KH = 0000 0020	STAND-STILL VALUE (2,0 kg)
DW	60	KH = 0002	STAND-STILL TIME (2 seconds)
DD	61	KH = 0000 0050	MIN WEIGHT LIMIT VALUE (5,0 kg)
DD	63	KH = 0000 1500	MAX WEIGHT LIMIT VALUE (1.500kg)
DD	65	KH = 0000 1700	OVERCHARGE LIMIT VALUE (170,0 kg)

DD	67	KH = 0000 0030	TEST VALUE TOLERANCE (30 digits)
DD	69	KH = 0000 0000	ANALOG ZERO VALUE (0 mA resp. 4 mA)
DD	71	KH = 0000 0000	ANALOG FINAL VALUE (20 mA)
DD	73	KH = 0000 0000	CALIBRATION WEIGHT 1 (zero; scale empty; 0 kg)
DD	75	KH = 0000 0500	CALIBRATION WEIGHT 2 (1. weight = 50,0 kg)
DD	77	KH = 0000 0000	CALIBRATION WEIGHT 3 (2. weight = 0 kg)
DD	79	KH = 0000 0000	CALIBRATION WEIGHT 4 (3. weight = 0 kg)
DD	81	KH = 0000 0000	CALIBRATION WEIGHT 5 (4. weight = 0 kg)
DD	83	KH = 0000 0000	CALIBRATION WEIGHT 6 (5. weight = 0 kg)
DD	85	KH = 0000 4856	CALIBRATION DIGIT 1 (4 856 digits)
DD	87	KH = 0002 4689	CALIBRATION DIGIT 2 (24 689 digits)
DD	89	KH = 0000 0000	CALIBRATION DIGIT 3 (0 digits)
DD	91	KH = 0000 0000	CALIBRATION DIGIT 4 (0 digits)
DD	93	KH = 0000 0000	CALIBRATION DIGIT 5 (0 digits)
DD	95	KH = 0000 0000	CALIBRATION DIGIT 6 (0 digits)
DD	97	KH = 0000 0000	MAXIMUM VOLUME LIMIT VALUE
DW	99	KH = 0001	DECIMAL POINT POSITION (= 1 for remote display)
DW	100	KC = DM	VOLUME UNIT (DM; see 4.11)
DW	101	KC = KG	WEIGHT UNIT (KG; see 4.11)
DW	102	KH = 0001	STEP WIDTH (for remote display; 1)

5.2.2.3 Data Module in KG

Note: The range of numbers is restricted for operating the weighing processor in floating-point format. Only integers can be processed, that means that all digits behind the decimal point remain unconsidered.

Scale Data Module			**Format KG (Floating-point Representation)**
DATA MODULE HEAD			
DW	0	KC	TELEGRAM SIGNAL
DW	1	KF	ADDRESS WEIGHING PROCESSOR
CYCLIC COMMUNICATION			
DW	10	KM	ERROR WORD
DW	11	KM	TELEGRAM SELECTION
DW	12	KM	COMMAND WORD
SET VALUES			
DD	13	KG	SET-VALUE
DD	15	KG	COARSE FOLLOW-UP
DD	17	KG	FINE FOLLOW-UP
DD	19	KG	WEIGHT PER PULSE
DW	21	KF	SETTLING TIME (seconds)
DD	22	KG	BATCHING TIME FACTOR (seconds/weight unit)
DD	24	KG	TOLERANCE PLUS
DD	26	KG	TOLERANCE MINUS
DD	28	KG	SPECIFIC WEIGHT (g / dm^3)
DD	30	KG	PRE-SET TARE
DW	32	KF	INCHING TIME (value x 0.1 seconds)
CYCLIC INFORMATIONS			
DW	36	KM	STATUS WORD
DD	37	KG	FILLING LEVEL
DD	39	KG	BATCH WEIGHT
DD	41	KG	ANALOG VALUE, FLOW VALUE, VOLUME VALUE
CALIBRATION DATA			
DW	50	KM	ERROR WORD CALIBRATION
DW	51	KM	COMMAND WORD CALIBRATION
DW	52	KM	PARAMETER WORD CALIBRATION
DD	53	KG	ZEROING DIGITS
DD	55	KG	EMPTY INDICATION VALUE
DW	57	KF	EMPTY INDICATION DELAY (seconds)
DD	58	KG	STAND-STILL VALUE

DW	60	KF	STAND-STILL TIME (seconds)
DD	61	KG	MIN WEIGHT LIMIT VALUE
DD	63	KG	MAX WEIGHT LIMIT VALUE
DD	65	KG	OVERCHARGE VALUE
DD	67	KG	TEST VALUE TOLERANCE (digits)
DD	69	KG	ANALOG ZERO VALUE (0 mA resp. 4 mA)
DD	71	KG	ANALOG FINAL VALUE (20 mA)
DD	73	KG	CALIBRATION WEIGHT 1 (zero; scale empty)
DD	75	KG	CALIBRATION WEIGHT 2 (1. weight)
DD	77	KG	CALIBRATION WEIGHT 3 (2. weight)
DD	79	KG	CALIBRATION WEIGHT 4 (3. weight)
DD	81	KG	CALIBRATION WEIGHT 5 (4. weight)
DD	83	KG	CALIBRATION WEIGHT 6 (5. weight; 0.<1.<2.<3. <4.<5.)
DD	85	KG	CALIBRATION DIGIT 1
DD	87	KG	CALIBRATION DIGIT 2
DD	89	KG	CALIBRATION DIGIT 3
DD	91	KG	CALIBRATION DIGIT 4
DD	93	KG	CALIBRATION DIGIT 5
DD	95	KG	CALIBRATION DIGIT 6
DD	97	KG	MAXIMUM VOLUME LIMIT VALUE
DW	99	KF	DECIMAL POINT POSITION (0, 1, 2, 3 for remote display)
DW	100	KC	VOLUME UNIT (MM, CM, DM, ME; see 4.11)
DW	101	KC	WEIGHT UNIT (GR, KG, TO; see 4.11)
DW	102	KF	STEP WIDTH (for remote display; 1, 2, 5, 10, 20, 50)

Parameterizing Example for the Scale Data Module

Data Format KG (Floating-point Representation)

DATA MODULE HEAD

DW	0	KC=ZT	TELEGRAM SIGNAL
DW	1	KF=+128	ADDRESS WEIGHING PROCESSOR

CYCLIC COMMUNICATION

DW	10	KM=00000000 00000000	ERROR WORD
DW	11	KM=00000000 00000000	TELEGRAM SELECTION
DW	12	KM=00000000 00000000	COMMAND WORD

SET VALUES

DD	13	KG=+1000000+04	SET-VALUE (100,0 kg)
DD	15	KG=+2000000+03	COARSE FOLLOW-UP (20,0 kg)
DD	17	KG=+5000000+02	FINE FOLLOW-UP (5,0 kg)
DD	19	KG=+0000000+00	WEIGHT PER PULSE
DW	21	KF=+10	SETTLING TIME (10 seconds)
DD	22	KG=+0000000+00	BATCHING TIME FACTOR (seconds/weight unit)
DD	24	KG=+5000000+02	TOLERANCE PLUS (5,0 kg)
DD	26	KG=+5000000+02	TOLERANCE MINUS (5,0 kg)
DD	28	KG=+0000000+00	SPECIFIC WEIGHT (g/dm³)
DD	30	KG=+0000000+00	PRE-SET TARE
DW	32	KF=+10	INCHING TIME (value x 0.1 seconds)

CYCLIC INFORMATIONS

DW	36	KM=00000000 00000000	STATUS WORD
DD	37	KG=+0000000+00	FILLING LEVEL
DD	39	KG=+0000000+00	BATCH WEIGHT
DD	41	KG=+0000000+00	ANALOG VALUE, FLOW VALUE, VOLUME VALUE

CALIBRATION DATA

DW	50	KM=00000000 00000000	ERROR WORD CALIBRATION
DW	51	KM=00000000 00000000	COMMAND WORD CALIBRATION
DW	52	KM=00000000 00000000	PARAMETER WORD CALIBRATION
DD	53	KG=+0000000+00	ZEROING DIGITS
DD	55	KG=+1000000+02	EMPTY INDICATION VALUE (1,0 kg)
DW	57	KF=+5	EMPTY INDICATION DELAY (5 seconds)
DD	58	KG=+2000000+02	STAND-STILL VALUE (2,0 kg)
DW	60	KF=+2	STAND-STILL TIME (2 seconds)
DD	61	KG=+5000000+02	MIN WEIGHT LIMIT VALUE (5,0 kg)
DD	63	KG=+1500000+04	MAX WEIGHT LIMIT VALUE (150.0kg)
DD	65	KG=+1700000+04	OVERCHARGE LIMIT VALUE (170.0 kg)

DD	67	KG = +3000000 +02	TEST VALUE TOLERANCE (30 digits)
DD	69	KG = +0000000 +00	ANALOG ZERO VALUE (0 mA resp. 4 mA)
DD	71	KG = +0000000 +00	ANALOG FINAL VALUE (20 mA)
DD	73	KG = +0000000 +00	CALIBRATION WEIGHT 1 (zero point; scale empty; 0 kg)
DD	75	KG = +5000000 +04	CALIBRATION WEIGHT 2 (1. weight = 50,0 kg)
DD	77	KG = +0000000 +00	CALIBRATION WEIGHT 3 (2. weight = 0 kg)
DD	79	KG = +0000000 +00	CALIBRATION WEIGHT 4 (3. weight = 0 kg)
DD	81	KG = +0000000 +00	CALIBRATION WEIGHT 5 (4. weight = 0 kg)
DD	83	KG = +0000000 +00	CALIBRATION WEIGHT 6 (5. weight = 0 kg)
DD	85	KG = +4856000 +04	CALIBRATION DIGIT 1 (4 856 digits)
DD	87	KG = +2468900 +05	CALIBRATION DIGIT 2 (24 689 digits)
DD	89	KG = +0000000 +00	CALIBRATION DIGIT 3 (0 digits)
DD	91	KG = +0000000 +00	CALIBRATION DIGIT 4 (0 digits)
DD	93	KG = +0000000 +00	CALIBRATION DIGIT 5 (0 digits)
DD	95	KG = +0000000 +00	CALIBRATION DIGIT 6 (0 digits)
DD	97	KG = +0000000 +00	MAXIMUM VOLUME LIMIT VALUE
DW	99	KF = +1	DECIMAL POINT POSITION (= 1 for remote display)
DW	100	KC = DM	VOLUME UNIT (DM; see 4.11)
DW	101	KC = KG	WEIGHT UNIT (KG; see 4.11)
DW	102	KF = +1	STEP WIDTH (for remote display; 1)

5.2.3 Entering Data

To be able to work with the weighing processor, it is imperative to enter some specific data. In the following there are all basic data to be entered listed in ***italic and bold*** marked with ***'xxxx'***.

Scale Data Module			**Data Format KF (Fix-point Representation)**
DATA MODULE HEAD			
DW	0	KC = xx	TELEGRAM SIGNAL (Output field)
DW	***1***	***KF = +xxxx***	***ADDRESS WEIGHING PROCESSOR***
DW	2	KH = 0000	INTERNAL
DW	3	KH = 0000	INTERNAL
DW	4	KH = 0000	INTERNAL
DW	5	KH = 0000	INTERNAL
DW	6	KH = 0000	INTERNAL
DW	7	KH = 0000	INTERNAL
DW	8	KH = 0000	INTERNAL
DW	9	KH = 0000	INTERNAL
DW	10	KM = 00000000 00000000	ERROR WORD (Output field)
DW	11	KM = 00000000 00000000	TELEGRAM SELECTION
DW	12	KM = 00000000 00000000	COMMAND WORD
DW	13	KH = 0000	
DW	***14***	***KF = +xxxx***	***SET VALUE***
DW	15	KH = 0000	
DW	***16***	***KF = +xxxx***	***COARSE FOLLOW-UP***
DW	17	KH = 0000	
DW	***18***	***KF = +xxxx***	***FINE FOLLOW-UP***
DW	19	KH = 0000	
DW	20	KF = +0	WEIGHT PER PULSE
DW	***21***	***KF = +xxxx***	***SETTLING TIME (seconds)***
DW	22	KH = 0000	
DW	23	KF = +0	BATCHING TIME FACTOR (seconds/weight unit)
DW	24	KH = 0000	
DW	***25***	***KF = +xxxx***	***TOLERANCE PLUS***
DW	26	KH = 0000	
DW	***27***	***KF = +xxxx***	***TOLERANCE MINUS***
DW	28	KH = 0000	
DW	29	KF = +0	SPECIFIC WEIGHT (g/dm³)
DW	30	KH = 0000	
DW	31	KF = +0	PRE-SET TARE
DW	32	KF = +0	INCHING TIME (value x 0.1 seconds)
DW	33	KH = 0000	INTERNAL
DW	34	KH = 0000	INTERNAL
DW	35	KH = 0000	INTERNAL
DW	36	KM = 00000000 00000000	STATUS WORD (Output field)
DW	37	KH = 0000	

DW	38	KF = +0	FILLING LEVEL (Output field)
DW	39	KH = 0000	
DW	40	KF = +0	BATCH WEIGHT (Output field)
DW	41	KH = 0000	
DW	42	KF = +0	ANALOG, FLOW, VOLUME VALUE (Output field)
DW	43	KH = 0000	INTERNAL
DW	44	KH = 0000	INTERNAL
DW	45	KH = 0000	INTERNAL
DW	46	KH = 0000	INTERNAL
DW	47	KH = 0000	INTERNAL
DW	48	KH = 0000	INTERNAL
DW	49	KH = 0000	INTERNAL
DW	50	KM = 00000000 00000000	ERROR WORD CALIBRATION (Output field)
DW	51	KM = 00000000 00000000	COMMAND WORD CALIBRATION
DW	52	KM = 00000000 00000000	PARAMETER WORD CALIBRATION
DW	53	KH = 0000	
DW	54	KF = +0	ZEROING DIGITS (Output field)
DW	55	KH = 0000	
DW	***56***	***KF = +xxxx***	***EMPTY INDICATION VALUE***
DW	***57***	***KF = +xxxx***	***EMPTY INDICATION DELAY***
DW	58	KH = 0000	
DW	***59***	***KF = +xxxx***	***STAND-STILL VALUE***
DW	***60***	***KF = +xxxx***	***STAND-STILL TIME***
DW	61	KH = 0000	
DW	***62***	***KF = +xxxx***	***MIN WEIGHT LIMIT VALUE***
DW	63	KH = 0000	
DW	***64***	***KF = +xxxx***	***MAX WEIGHT LIMIT VALUE***
DW	65	KH = 0000	
DW	***66***	***KF = +xxxx***	***OVERCHARGE VALUE***
DW	67	KH = 0000	
DW	***68***	***KF = +xxxx***	***TEST VALUE TOLERANCE***
DW	69	KH = 0000	
DW	70	KF = +0	ANALOG ZERO (0 mA resp. 4 mA)
DW	71	KH = 0000	
DW	72	KF = +0	ANALOG FINAL VALUE (20 mA)
DW	73	KH = 0000	
DW	***74***	***KF = +xxxx***	***CALIBRATION WEIGHT 1 (zero; scale empty)***
DW	75	KH = 0000	
DW	***76***	***KF = +xxxx***	***CALIBRATION WEIGHT 2 (1. weight)***
DW	77	KH = 0000	
DW	78	KF = +0	CALIBRATION WEIGHT 3 (2. weight)
DW	79	KH = 0000	
DW	80	KF = +0	CALIBRATION WEIGHT 4 (3. weight)
DW	81	KH = 0000	
DW	82	KF = +0	CALIBRATION WEIGHT 5 (4. weight)
DW	83	KH = 0000	
DW	84	KF = +0	CALIBRATION WEIGHT 6 (5. weight)
DW	85	KH = 0000	

DW	86	KF = +0	CALIBRATION DIGIT 1 (digits; output field)
DW	87	KH = 0000	
DW	88	KF = +0	CALIBRATION DIGIT 2 (digits; output field)
DW	89	KH = 0000	
DW	90	KF = +0	CALIBRATION DIGIT 3 (digits; output field)
DW	91	KH = 0000	
DW	92	KF = +0	CALIBRATION DIGIT 4 (digits; output field)
DW	93	KH = 0000	
DW	94K	F = +0	CALIBRATION DIGIT 5 (digits; output field)
DW	95	KH = 0000	
DW	96	KF = +0	CALIBRATION DIGIT 6 (digits; output field)
DW	97	KH = 0000	
DW	98	KF = +0	MAXIMUM VOLUME LIMIT VALUE
DW	***99***	***KF = +xxxx***	***DECIMAL POINT (for remote display)***
DW	***100***	***KC = xx***	***VOLUME UNIT (see 4.11)***
DW	***101***	***KC = xx***	***WEIGHT UNIT (see 4.11)***
DW	***102***	***KF = +xxxx***	***STEP WIDTH (for remote display)***
DW	103	KH = 0000	INTERNAL
DW	104	KH = 0000	INTERNAL
DW	105	KH = 0000	INTERNAL

5.2.4 Indications (DW 0)

DW 0 in KC for calibration

DW 0	= BS :	Command word has been sent
	= E1 :	Look at error word
	= E2 :	Identifying byte unknown for reading
	= EL :	All calibration data have been read
	= EN :	End of transmission of calibration data
	= KA :	No order bit has been set
	= LE :	Calibration data are read
	= SE :	Calibration data are transmitted
	= TW :	Telegram has been repeated
	= ZT :	Cyclic telegram has been read

DW 0 in KC for weighing

DW 0	= F1 :	Look at error word
	= F2 :	Identifying byte unknown
	= KA :	No order bit has been set
	= SU :	Set-value has been transmitted
	= TW :	Telegram has been repeated
	= ZT :	Cyclic telegram has been read

5.2.5 Error Localization

Continuous indication E2 or F2

Telegram communication between AG and WP interrupted.
Possible reason:

- Wrong address for the PC board has been set
- Hardware defect (AG or WP)

Occasional indication E2 or F2 or TW

Possible reason:

- Invalid (old) release of the EG - ZG interface
- FB (FB 200, 201) has been called-up several times in one OB1 cycle
- At 150 / 155U Bit 0 (AG type) has not been set in parameter word (DW 52)

Indication KA (only in 1. cycle)

- No order bit has been set in the parameter word (DW 11) when FB 202 (SIW:SOLL) was called-up

No indication in DW 0 (see 5.2.4)

- FB 201 (SIW:LESE) resp. FB 200 (SIW:JUST) is not processed
- AG in stop

5.2.6 Error Evaluation

24 V LED on the front panel does not light up

- Fuse on the WP defective
- 24 V supply voltage of the WP is missing

Failure indication lamp does not go OFF after initialization

- WP has not been calibrated
- Calibration data have not been sent yet
- Wrong connection with the junction box
- Adaptation resistors on the DA board are missing or wrong
- Hardware defect (check error word DW 10, 50 and status word DW 36)

Analog input delivers irregular measuring values

- Jumper 8 B-C not soldered in when using a potential-free transmitter (AI pin 27 not externally grounded)

Overcharge message continuously indicated

- Total volume cannot be reset because the empty value has not been reached

Pulse LED on the front panel is ON continuously

- WP not accelerated after RESET (hardware defect)

Scale does not start working

- Stand-still message is not generated
- Failure message is indicated
- Pre-set values are wrong (Plausibility error DW 10)

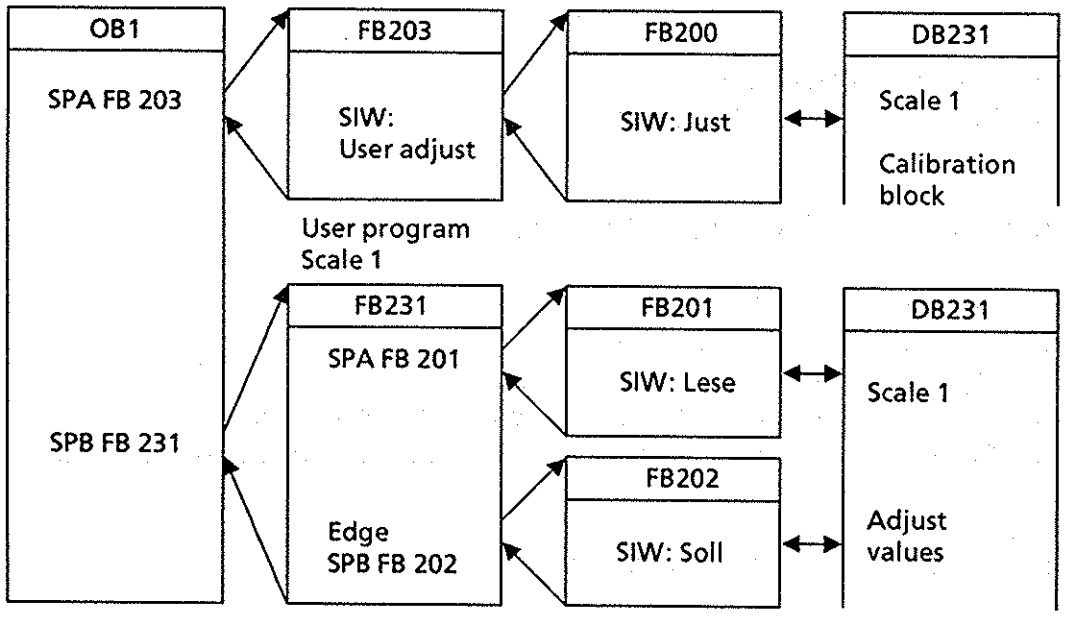
Batch weight does not accelerate at load change

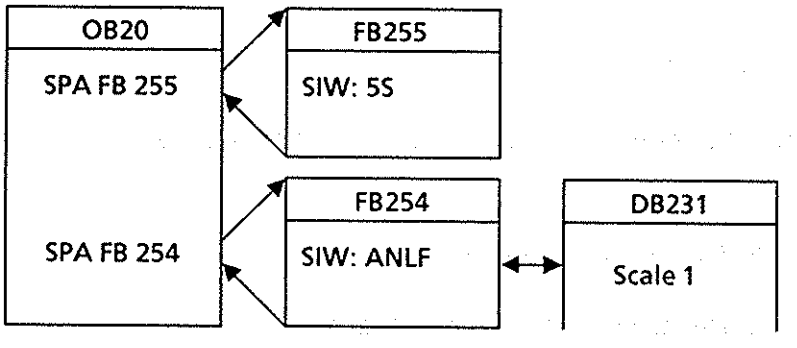
- Batching mode DW 12, bit 2 (upward/downward) has been incorrectly set
- Not tared before load change

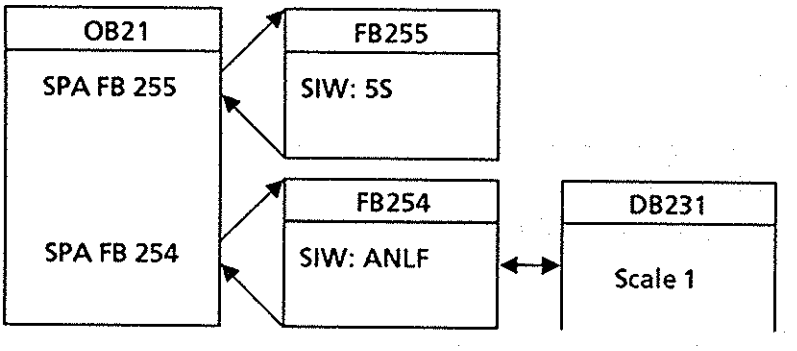
The read data have completely wrong values

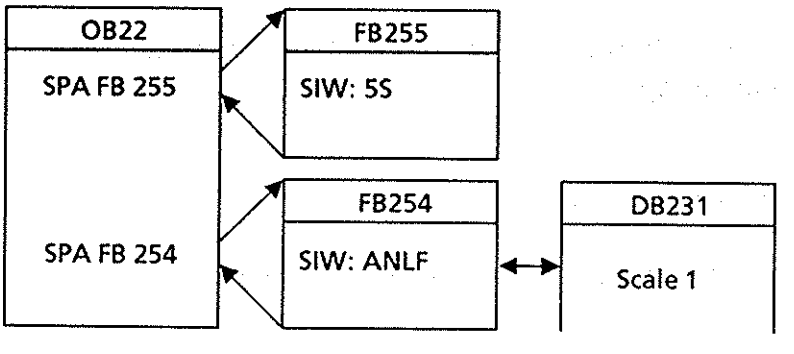
- Number representation format is wrong or has not been set

5.3 Program Organization









5.4 Program Example

```
OB1                    SPRM-A          LEN=24          ABS
                                                       PAGE 1
SEGMENT 1

0000          :    SPA FB203       USER CALIBRATION
0001  NAME    :    ANW: JUST
0002  DBNR    :         DB231      SCALE DB
0003  FRGJ    :         M 8.7      RELEASE FLAG: 1=CALIBRATION
0004  FEHL    :         MW20       ERROR WORD MEMORY
0005  SLOK    :         M 18.0     CHECK FLAG
0006          :
0007          :    UN M 8.7        RELEASE FLAG: 0=CYCLIC
0008          :    SPB FB231       CYCLIC SCALE PROGRAM
0009  NAME    :    DEMO
000A  STRT    :    M 8.0           COMMAND:  START WITH TARING
000B  STOP    :    M 8.1                     STOP
000C  TARI    :    M 8.2                     TARING
000D  ZWST    :    M 8.3                     INTERMEDIATE START
000E  QUIT    :    M 8.4                     QUIT
000F  PRER    :    M 8.5                     DETERMINE TEST VALUE
0010  PRUE    :    M 8.6                     TEST
0011          :
0012          :    BE
```

```
OB20                   SPRM-A          LEN=14          ABS
                                                       PAGE 1
SEGMENT 1

0000          :    SPA FB255       START-UP DELAY 5 SEC.
0001  NAME    :    SIW: 5 S
0002  TIME    :         T 100
0003          :
0004          :    SPA FB254       START-UP SCALE
0005  NAME    :    SIW: ANLF
0006  DBNR    :         DB231      SCALE DB
0007          :
0008          :    BE
```

```
OB21                    SPRM-A          LEN=14          ABS
                                                        PAGE 1
SEGMENT 1

0000          :     SPA FB255       START-UP DELAY 5 SEC.
0001  NAME    :     SIW: 5 S
0002  TIME    :          T 100
0003          :
0004          :     SPA FB254       START-UP SCALE
0005  NAME    :     SIW: ANLF
0006  DBNR    :          DB231      SCALE DB
0007          :
0008          :     BE
```

```
OB22                    SPRM-A          LEN=14          ABS
                                                        PAGE 1
SEGMENT 1

0000          :     SPA FB255       START-UP DELAY 5 SEC.
0001  NAME    :     SIW: 5 S
0002  TIME    :          T 100
0003          :
0004          :     SPA FB254       START-UP SCALE
0005  NAME    :     SIW: ANLF
0006  DBNR    :          DB231      SCALE DB
0007          :
0008          :     BE
```

SEGMENT 1 REALIZATION OF SCALE FUNCTIONS

Demonstration program

In this DB the most important scale functions are realized for example.

The following parameters are used:

STRT	**Start weighing**
STOP	**Stop weighing**
TARI	**Tare scale**
ZWST	**Scale intermediate start**
QUIT	**Acknowledge**
PRER	**Determine test value**
PRUE	**Test**

```
001A          :    ***
SEGMENT       2
001B          :    A      DB236     SCALE DB
001C  NAME    :    SPA    FB201     READ HANDLING MODULE
001D          :    SIW:   LESE
001E          :    0      =STRT     COMMAND  START+FILL TARING
001F          :    0      =STOP               STOP
0020          :    0      =TARI               TARING
0021          :    0      =ZWST               INTERMEDIATE START
0022          :    0      =QUIT               ACKNOWLEDGE
0023          :    0      =PRER               DETERMINE TEST VALUE
0024          :    0      =PRUE               TEST
0025          :    =      M 50.0
0026          :    UN     M 50.1
0027          :    R      M 51.0    POSITIVE EDGE MEMORY
0028          :    ON     M 50.0
0029          :    O      M 51.0
002A          :    SPB    =M001
002B          :                     THIS PROGRAM PART IS RUN THROUGH AT
002C          :                     POSITIVE EDGE
002D          :    S      M51.0     EDGE MEMORY
002E          :    L      KB0
002F          :    T      DW12      CLEAR COMMAND WORD
0030          :    T      MW20      CLEAR ERROR WORD
0031          :    S      M 28.0    COMMAND WORD
0032          :    S      M 28.1    SET-VALUE
0033          :    S      M 28.2    COARSE FOLLOW-UP, FINE FOLLOW-UP
0034          :    S      M 28.3    WEIGHT PER PULSE. SETTLING TIME, BATCHING
                                     FACTOR
0035          :
0036          :    S      M 28.4    TOLERANCE PLUS/MINUS
0037          :    S      M 28.5    SPECIFIC WEIGHT TARA INCHING TIME
0038          :    L      MB28      DW11 TELEGRAM SELECTION
```

```
0039          :    T     DR11
003A          :    U     =STRT   START+TARING
003B          :    =     M 31.7
003C          :    U     =STOP   STOP
003D          :    =     M 31.5
003E          :    U     =TARI   TARING
003F          :    =     M 30.0
0040          :    U     =ZWST   INTERMEDIATE  START
0041          :    =     M 31.6
0042          :    0     =STRT   START+TARING
0043          :    0     =ZWST   INTERMEDIATE START
0044          :    =     M 31.2
0045          :    U     =QUIT   QUIT
0046          :    =     M 31.3
0047          :    U     =PRER   DETERMINE TEST VALUE
0048          :    =     M 31.0
0049          :    U     =PRUE   TEST
004A          :    =     M 31.4
004B          :    L     MW30
004C          :    T     DW12    COMMAND WORD ADJUST DATA
004D          :    SPA   FB202   HANDLING MODULE SOLL
004E  NAME    :    SIW:SOLL
004F          :    L     KBO     ERASE
0050          :    T     DW11    TELEGRAM SELECTION
0051  M001    :    BE            END
```

SEGMENT 1

This module controls the handling module FB:SIW:JUST (FB200). The FB203 can be connected with the user program with a different FB number.
Parameters:
DBNR : According scale DB
FRGJ : Release calibration
FEHL : Error word memory
SLOK : Send/read O.K. bit="1":Sending resp. reading process ended without error

```
NAME :    NW:JUST
BEZ  :    DBNR        E/A/D/B/T/Z: B
BEZ  :    FRGJ        E/A/D/B/T/Z: E    BI/BY/W/D: BI
BEZ  :    FEHL        E/A/D/B/T/Z: E    BI/BY/W/D: W
BEZ  :    SLOK        E/A/D/B/T/Z: E    BI/BY/W/D: BI

0011      :    UN=FRGJ          RELEASE TO CALIBRATE SCALE X
0012      :    BEB
0013      :    B=DBNR           CALL-UP SCALE DB
0014      :    L DW51           COMMAND WORD CALIBRATION DATA
0015      :    T MW200          INTERMEDIATE FLAG
0016      :    OM 200.0         BIT: SEND CALIBR. DATA
0017      :    OM 201.7         BIT: READ CALIBR. DATA
0018      :    RB=SLOK          RESET CHECK FLAG
0019      :
001A      :    SPA FB200        FB200 CALIBRATION
001B NAME:     SIW:JUST
001C      :
001D      :    L KCE1           E1=LOOK AT ERROR WORD
001E      :
001F      :    L DW0            DW0=TELEGRAM INDICATION
0020      :    ><F
0021      :    SPB=M001         YES GO TO M001
0022      :    L DW50           ERROR WORD IN SCALE DB
0023      :    L=FEHL
0024      :    OW
0025      :    T=FEHL           ERROR WORD MEMORY
0026      :    BEA              END
0027 M001 :    L DW0
0028      :    L KCEN           EN=ALL CALIBRATION DATA SENT
002A      :    !=F
002B      :    0(               OR
002C      :    L DW0    01
002D      :    L KCEL   01      EL=ALL CALIBRATION DATA READ
002F      :    !=F      01
0030      :    )        01
0031      :    S=SLOK           SET CHECK FLAG
0032      :    BE               END
```

FB254 SPRM-A BIB60988 LEN=28 ABS
BLATT 1

SEGMENT 1

The FB:SIW.START-UP (FB254) is used for erasing of internally used data words.

```
NAME    :   SIW:ANLF    INITIALIZING IN SCALE DB
BEZ     :   DBNR        E/A/D/B/T/Z: B

0008    :   B=DBNR      CALL-UP DATA MODULE
0009    :   L KB0
000A    :   T DW50      CALIBR. ERROR WORD RESET
000B    :   T DW51      CALIBR. ERROR WORD RESET
000C    :   T DW103     CALIBR. POINTER 1 RESET
000D    :   T DW104     CALIBR. POINTER 2 RESET
000E    :   T DW105     CALIBR. POINTER 3 RESET
000F    :   T DW10      SET. ERROR WORD RESET
0010    :   T DW11      SET. COMMAND WORD RESET
0011    :   T DW12      SET. TELEGRAM WORD RESET
0012    :   T DW33      SET. POINTER 1 RESET
0013    :   T DW34      SET. POINTER 2 RESET
0014    :   T DW35      SET. POINTER 3 RESET
0015    :   BE          END**********************
```

FB255 SPRM-A BIB=60988 LEN=28 ABS
PAGE 1

SEGMENT 1 START-UP SIWAREX

The FB:SIW:5S (FB255) is used for start-up delay for OB20, OB21, OB22.

```
NAME    :    SIW:5S              START-UP FOR SIWAREX PROCESSOR
BEZ     :    TIMEE/A/D/B/T/Z: T

0008    :        UN=TIME
0009    :        L KT005.2
000A    :        SVZ=TIME        START-UP TIMER, 5 SECS.
000B    :        UN=TIME
000C    :        SVZ=TIME
000D    :        U=TIME          TIME OUT?
000E    :        SPB=M001        NO => GO TO M001
000F    :        U=TIME          DEFINED RESET WITH VKE=ZERO
0010    :        SVZ=TIME
0011    :        BE              END**************************
```

5.5 Survey of the Bit Contents (DW 10, 11, 12, 36, 50, 51, 52)

DW 10 Error word

Bit 0 : Pulse weight overflow
Bit 1 :
Bit 2 : EPROM error
Bit 3 : RAM error
Bit 4 : Watchdog responded
Bit 5 : Set-value not plausible
Bit 6 : Interface 8031 disturbed (Hardware error)
Bit 7 : Batching time elapsed
Bit 8 : Test value determination error
Bit 9:
Bit 10 : Wire interrupt analog input
Bit 11 : Measuring circuit disturbed
Bit 12 : Buffer battery empty
Bit 13 :
Bit 14 : Interface to AG disturbed
Bit 15 : Plausibility error

DW 11 Telegram selection

Bit 0 : Command word
Bit 1 : Set-value
Bit 2 : Coarse follow-up, fine follow-up
Bit 3 : Weight per pulse, settling time, batching time factor
Bit 4 : TOLPLUS value, TOLMINUS value
Bit 5 : specific gravity, pre-tare
Bit 6 :
Bit 7 :
Bit 8 :
Bit 9 :
Bit 10 :
Bit 11 :
Bit 12 :
Bit 13 :
Bit 14 :
Bit 15 :

DW 12 Command word

Bit 0 : Determine test value
Bit 1 : Pre-tare valid
Bit 2 : 1 = upward, 0 = downward batching
Bit 3 : Error acknowledgement
Bit 4 : Test
Bit 5 : Stop
Bit 6 : Intermediate start
Bit 7 : Start with automatic taring
Bit 8 : Taring
Bit 9 : Start detuning upward
Bit 10 : Start detuning downward
Bit 11 :
Bit 12 :
Bit 13 :
Bit 14 : Zero digits pulse weight
Bit 15 : Start inching

DW 36 Status word

Bit 0 : Failure
Bit 1 : READY message
Bit 2 : TOLMINUS underranged
Bit 3 : TOLPLUS overranged
Bit 4 : MAX overranged
Bit 5 : MIN underranged
Bit 6 : Fine feed
Bit 7 : Coarse feed
Bit 8 : Low measuring range limit reached
Bit 9 : Upper measuring range limit reached
Bit 10 : Weighing terminated
Bit 11 : Overcharge limit value reached
Bit 12 : Test value outside tolerance
Bit 13 : Test value within tolerance
Bit 14 : Stand-still
Bit 15 : Empty message

DW 50 Error word (Calibration)

Bit 0 :
Bit 1 : Calibration error
Bit 2 : EPROM error
Bit 3 : RAM error
Bit 4 : Watchdog responded
Bit 5 :
Bit 6 : Interface 8031 disturbed (Hardware error)
Bit 7 :
Bit 8 :
Bit 9 :
Bit 10 : Wire interrupt at analog input (for life zero operation)
Bit 11 : Measuring circuit disturbed
Bit 12 : Buffer battery empty
Bit 13 : Data invalid
Bit 14 : Interface to the AG disturbed
Bit 15 : Plausibility error

DW 51 Command word (Calibration)

Bit 0 : Zeroing
Bit 1 : Calibration weight 1 valid
Bit 2 : Calibration weight 2 valid
Bit 3 : Calibration weight 3 valid
Bit 4 : Calibration weight 4 valid
Bit 5 : Calibration weight 5 valid
Bit 6 : Calibration weight 6 valid
Bit 7 : Read calibration data
Bit 8 : Transmit calibration data
Bit 9 : Clear RAM
Bit 10 : Output digits on filling level
Bit 11 : Block calibration
Bit 12 :
Bit 13 :
Bit 14 :
Bit 15 : Calibration data have been read

DW 52 Parameter word (Calibration)

Bit 0 : 0 = SIWAREX S-115, -1351; 1 = SIWAREX S-150, -155
Bit 1 : 1 = Analog value with 'Life Zero' (4 to 20mA)
Bit 2 : 1 = with analog value transfer
Bit 3 : 1 = time division, 0 = evaluate pulse input
Bit 4 : 1 = autom. post-batching at tolerance underranging (TOLMINUS)
Bit 5 : 1 = BCD representation
Bit 6 : 1 = Fix-point, 0 = Floating-point representation
Bit 7 : 1 = Tolerance in per mille, 0 = Tolerance absolute (e. g. in kg)
Bit 8 : 1 = without, 0 = with autom. follow-up correction
Bit 9 : 0 internally assigned (must be 0)
Bit 10 : 1 = Batching time supervision OFF
Bit 11 : 1 = Software control amplifying OFF
Bit 12 : 1 = without automatical test of measuring circuit
Bit 13 :
Bit 14 :
Bit 15 : Volume / Flow value (see below)

Bit	2	15	
	1	x	Analog value indication in DW 41, 42
	0	1	Volume value indication in DW 41, 42
	0	0	Flow value indication in DW 41, 42

6 Index

To:

SIEMENS AG

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Propositions
Corrections

For instructions or manual:

Weighing and Dosing System
SIWAREX S
7MH3305-1AB

Order No. C71000-B5976-C42-1
Release: 05/90

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