Attachment 1 (reference: Question #1)

betacontrol

SERVICE MANUAL

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Remarks

The information contained in this manual is based on meticulous research and compilation. Nevertheless, we cannot accept any liability whatsoever for completeness or errors; we would, however, be grateful for your suggestions and proposals for improvement.

With the exception of intent or gross negligence, all claims for compensation shall be excluded.

We reserve the right to technical modifications which serve the improvement of the product without prior notification. It therefore cannot be assumed that subsequent product versions will feature the same properties as the previous versions.

Registered trademarks are the property of their manufacturers.

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1. SAFETY

1.1 RADIATION PROTECTION

Prior to commissioning a measurement system containing radioactive nuclides, careful attention must always be paid to the safety measures to avoid exposure of the operating personnel to any radiation hazard.

1.1.1 Gamma transmission measurement methods (Americium 241)

Providing the safety regulations are observed, the use of isotopic measuring equipment generally presents no greater danger than the handling of electrical apparatus.

betacontrol basis-weight measurement systems satisfy the usual requirements of radiological protection legislation. The level of radiation to which operating personnel is exposed falls well below the permissible tolerance limits. The following information is intended to draw your attention to possible hazards and their avoidance.

Injury may result from external or internal irradiation.

Normal use of these systems is only associated with external irradiation, with a natural distance existing between radiation source and body.
With **betacontrol** measurement systems, detectable physical injury from external irradiation will only occur as a result of negligent or consciously incorrect conduct.

Under German legislation, the following doses must not be exceeded for persons exposed to radiation at the workplace:

50 mSv/year for the overall body
300 mSv/year for skin

The above levels are 10 times lower for the general public or persons not directly exposed to radiation at the workplace.

The area exposed to a dose of 7.5 µSv/h or over is known as the «control area».
Any persons working in or frequently entering such areas must be monitored by a dosimeter and be at least 18 years of age.
In addition, regular examinations by a physician from the health authorities are prescribed.

Pregnant women, nursing mothers and children must not enter this area. The limits of this control area must be clearly signalised and marked.

The signs indicating the radiation source as well as the position of the shutter must always be in perfect condition - for the safety of operating personnel as well as for the safety of all.

1.1 RADIATION PROTECTION

1.1.1 Gamma transmission measurement methods (Americium 241)

Internal irradiation occurs if radioactive material penetrates the human body. This is considerably more dangerous since

- the duration of irradiation cannot be controlled (it is necessary to wait until the material has vacated the body or has been transformed into a non-radioactive material),
- no space exists between source and body,
- no additional screening measures can be taken.

However, radioactive material can only escape from its capsule and enter the environment or penetrate the human body if the capsule is damaged and radioactive material is additionally spread by means of dispersive influences (extinguishing water, wiping motion).

1.1.2 Description of source and source holder

The source comprises a cylindrical housing constructed of brass or stainless steel accomodating the radioactive Americium 241 in a ceramic state. This housing is sealed by soldered joints.

The source is installed in the source holder in such a way that it is protected from external damage.

The holder is protected from dust and moisture.

CAUTION! The source is fragile!

The weakest part of the holder is the radiation exit window, a plastic film with a thickness of 0.05 mm and aluminized on one side, which covers the collimator lens in the holder.

The source is located at a distance of 10 mm behind this cover film. When the unit is switched off or in the «Measuring off» mode, the source is screened by a lead shield.

The source is automatically screened in the event of power failure.

1.1 RADIATION PROTECTION

1.1.3 Protective measures

The following points must be observed to protect personnel from exposure to excessive irradiation:

- Under no circumstances must any work be carried out directly on the source holder.
- The illuminated signal display indicates the «Source closed» and «Attention radiation» modes by means of a limit switch. This limit switch is fitted in such a way that the «Source closed» signal is only activated in the absolute end position, with intermediate positions being signalised as «Attention radiation».
- When the calibration process is activated, the radiation shutter is automatically controlled by the system' electronics. The signal display must be observed. Additional switching status information is provided by an illuminated indicator on the front panel of the central system at illuminated key «Measuring I».

  Should the radiation shutter become damaged, the radiation exit port can also be closed by covering it with a 100 * 100 mm plate of

lead	3 mm thick
steel, brass	10 mm thick

- Do not look directly into the source of radiation.
- Persons working at the control area must wear a radiation dosimeter. The type of radiation dosimeter to be worn is prescribed by the supervisory authority (in general a film badge dosimeter). These film badges are evaluated each month by an official body, with the wearer being informed of the level of radiation to which he or she has been exposed.
- Never put your hands into the measurement gap.
- The dose-rate table shows the distribution of radiation around the sensor. The range within 25 µSv/h should always be avoided.

In normal operating conditions, however, direct exposure to radiation is not possible.

The geometric configuration of the sensor also contributes towards significantly reducing radiation. The amount of radiation actually occurring in the vicinity of the sensor is shown in the enclosed dose-rate table.

1.1 RADIATION PROTECTION

1.1.3 Protective measures

Americium 241 is a gamma source. Gamma radiation is weakened to $^1/_{10}$ of its intensity by

0.5 mm lead,
3 mm steel or brass,
30 mm aluminium or glass.

Double wall thickness weakens it to $^1/_{100}$ of its original intensity.

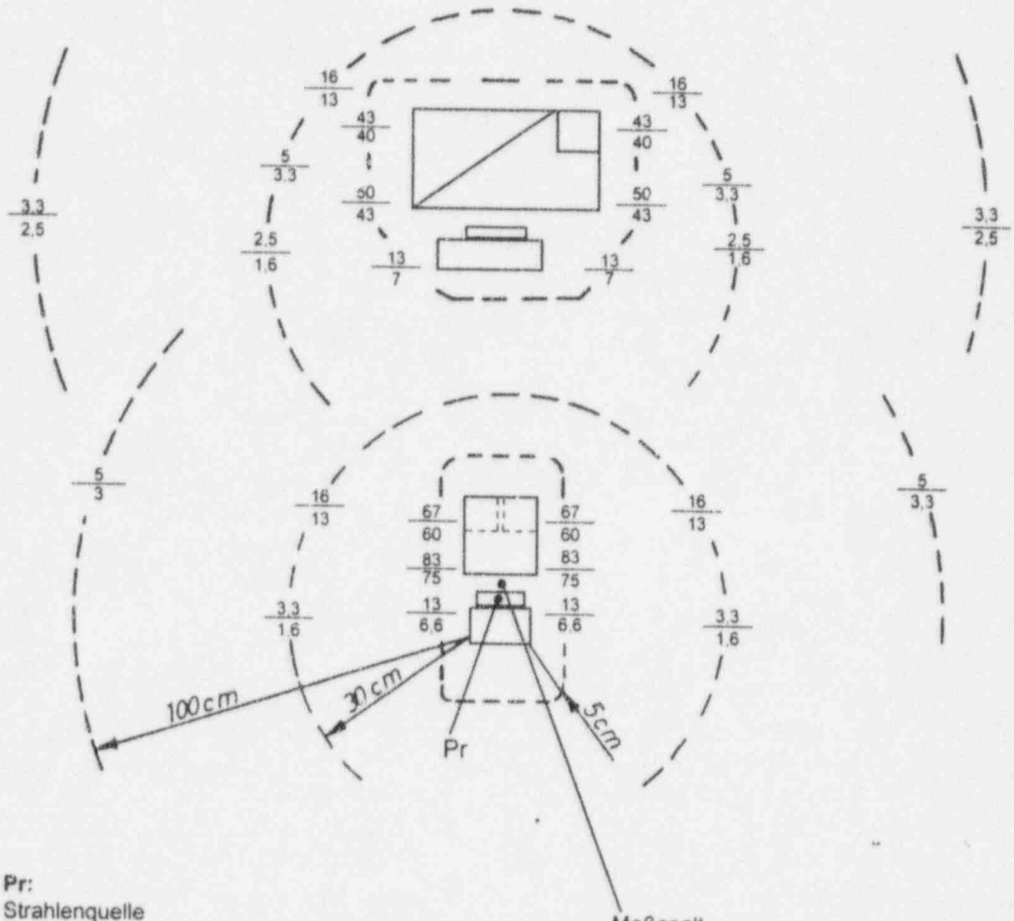
When «source screened», the dose rate at any point on the surface of the measuring sensor is less than 7 µSv/h.

The alpha radiation from Americium 241 generates a low radiation of high-speed neutrons in the emitter source enclosure.

The equivalent dose rate is:
3.2 µSv/h at a distance of 15 cm and
1 µSv/h at a distance of 25 cm.

1.2 RADIATION DOSE RATES

Refer to drawing	700-100-219	Bl. 64,	page 6
	700-100-220	Bl. 64,	page 7



Pr:
Strahlenquelle
radiation source
source de rayonnement

Meßspalt
gap
fente de mesure : **400 mm**

Strahler
source : **Americium 241; 18,5 GBq**

Strahlerfenster
source window
fenêtre de la source : **offen / open / ouverte**

Meßgerät
survey meter
appareil de mesure : **Babyline 31**

Dosisleistung
dose rate
débit de dose : (µSv/h)

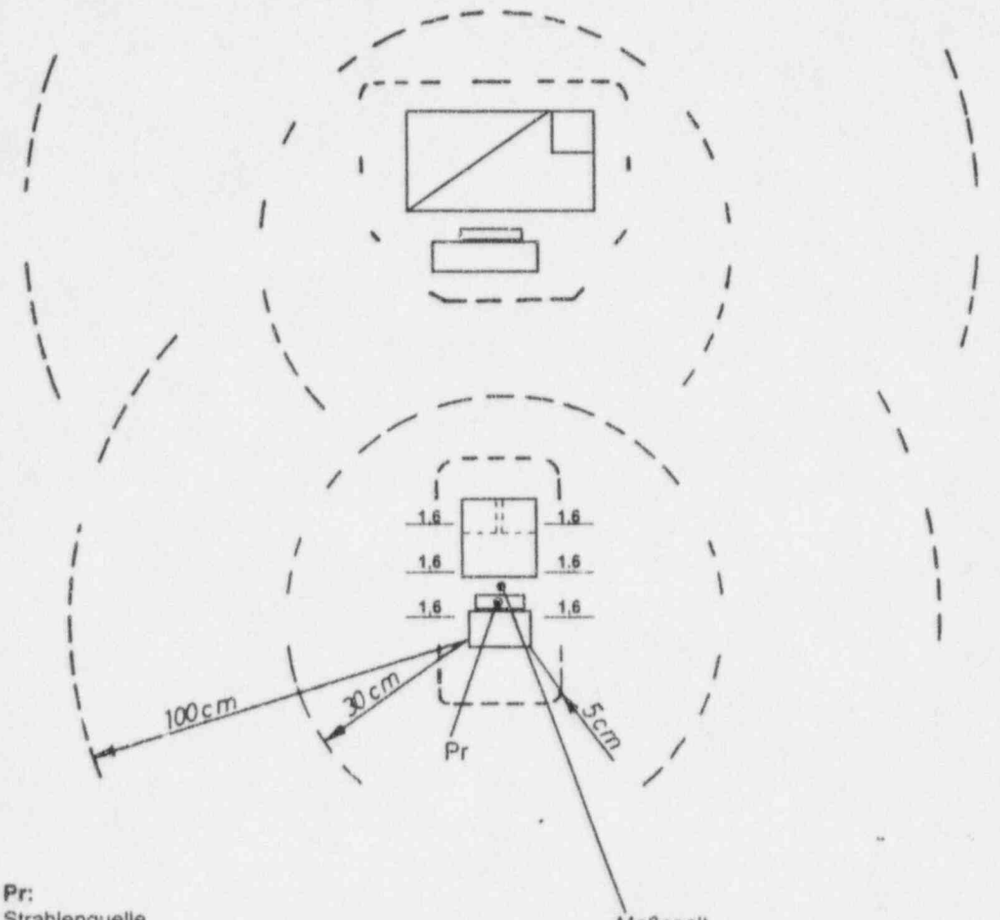
mit Absorber
with absorber
avec absorbeur : **7 mg/cm² / 300 mg/cm²**

Typ / type: X 97

	Datum	Name	Das Urheberrecht an dieser Zeichnung gehört uns. Laut Gesetz ist Vervielfältigung oder Mitteilung an dritte Personen unzulässig und strafbar.	betacontrol gmbh
Gezeichnet	31 05 1995	Lerch		meß- und regeltechnik, D-57258 Freudenberg
Geprüft	31 05 1995	Kray		

Strahlenbelastung
Radiation dose rates
Valeurs d'irradiation

700-103-219 Bl. 64



Pr:
Strahlenquelle
radiation source
source de rayonnement

Meßspalt
gap
fente de mesure : **400 mm**

Strahler
source : **Americium 241; 18,5 GBq**

Strahlerfenster
source window
fenêtre de la source : **geschlossen**
closed
fermée

Meßgerät
survey meter
appareil de mesure : **Babyline 31**

Dosisleistung
dose rate
débit de dose : (µSv/h)

mit Absorber
with absorber
avec absorbeur : $\frac{\textbf{7 mg/cm²}}{\textbf{300 mg/cm²}}$

Typ / type: X 97

	Datum	Name	Das Urheberrecht an dieser Zeichnung gehört uns. Laut Gesetz ist Vervielfältigung oder Mitteilung an dritte Personen unzulässig und strafbar	betacontrol gmbh meß- und regeltechnik, D-57258 Freudenberg
Gezeichnet	31.05.1995	Lerch		
Geprüft	31.05.1995	Kray		

Strahlenbelastung
Radiation dose rates
Valeurs d'irradiation

700-103-220 Bl. 64

Notes

2. Technical specifications and scope of delivery

2.1 USER-SPECIFIC DESCRIPTION OF THE **betacontrol** MEASUREMENT SYSTEM

The microprocessor-controlled basis weight and thickness measurement system TCS-MC 68 K02 has the purpose of measuring thickness and basis weight of ply wood. The cross profile is permanently recorded by means of 2 sensors mounted in a scanner, travelling back and forth across the material.

Sensor 1 (isotope sensor) measures the basis weight.

Sensor 2 (ultrasonic sensor) serves to measure the thickness.

The operator keyboard on the central electronics unit takes care of data preset and control of the system. A serial RS 232-interface is provided for connecting a printer.

A battery-backed memory for approximately 200 product data blocks is available.

The measuring values are processed by the microprocessor electronics for various histogram displays on a colour monitor.

2.2 TECHNICAL SPECIFICATIONS

Customer	:	Masonite, USA
Serial no.	:	700-549
Job no.	:	18/0683
Supply voltage	:	110 V; 60 Hz
Delivery date	:	04/96

Sensor 1 (S1 Isotope)

Measurement range	:	0 - 30000 g/m²
Measuring accuracy	:	± 0,5 % but not better than ± 50 g/m²
Measurement gap	:	125 mm
Isotope	:	Americium 241
Activity	:	18,5 GBq
Half life	:	458a
Isotope I. D. number	:	3460 LQ / X97
Measurement resistance	:	1 GΩ
Ionization chamber no. / type	:	XE 70174
Chamber voltage	:	- 613,2 V DC

Sensor 2 (S2 Ultrasonic)

Measurement range	:	0 - 15 mm
Measuring accuracy	:	± 40 µm
Measurement gap	:	ca. 125 mm

2.3 SCOPE OF DELIVERY

Qty	*Description*	*Type / no.*
1	sensor	BC - MK 1.0 Am 241
1	sensor	BC - UDM 2000
1	scanner	BC - TE 3.311
1	central system	BC - MC 68 K02.M
1	control desk	BC - P 80
1	colour monitor	BC - PM 14 C
1	printer	OKI 590 Elite
1	printer cabinet	700-16.103/3 I
1	set of cables cabinet - printer	5 m
1	set of cables cabinet - scanner I	150 m
1	light barriere for signal «board detected»	

Notes

3. Measuring principle and configuration

3.1 MEASUREMENT PRINCIPLE

The **betacontrol** measurement system is designed for the contactless measurement of basis weight (= thickness * specific weight) of foils, layers or tubes made of paper, rubber, plastic, metal, glass and other materials or also of coating layers on films and textiles as well as the quantity of dye and impregnating substances absorbed in textiles and other porous web-type materials.

In conjunction with appropriate signal processing, it is possible to determine the density of the material to be measured if the "thickness" parameter remains constant, and the thickness of the material to be measured if the «density» parameter remains constant.

The measurement system comprises a sensor (refer to «sensors») and evaluation electronics.

The electronic section of the measurement system comprises the power supply, signal processor, entry keyboard and output of measuring values.

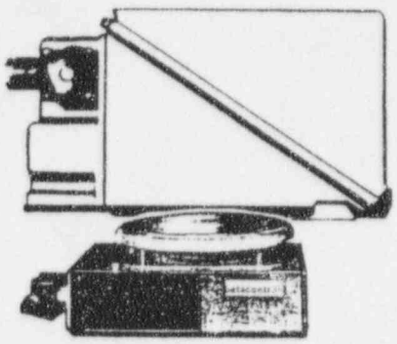
The sensor signal is coupled with a time constant adapted to the measurement task in hand and then fed to an analog/digital converter. The digitalized voltage values are then compared with the calibration curve by the operating program of the microprocessor electronics and displayed as a digital value.

The calibration curve is stored in an EPROM at the factory and cannot be altered by the customer.
At a selected correction value of 1.000, the display agrees with the values of the calibration curve.
This correction value makes, for example, allowance for the degree of radiation absorbed by the composition of the material to be measured.
In addition to correction values, it is also possible to enter target values and tolerance limits. In addition to general product data, it is also possible on request to include various customer-specific parameters in the product data package.

3.2 FUNCTION GROUPS

3.2.1 Sensors

3.2.1.1 Isotope sensor



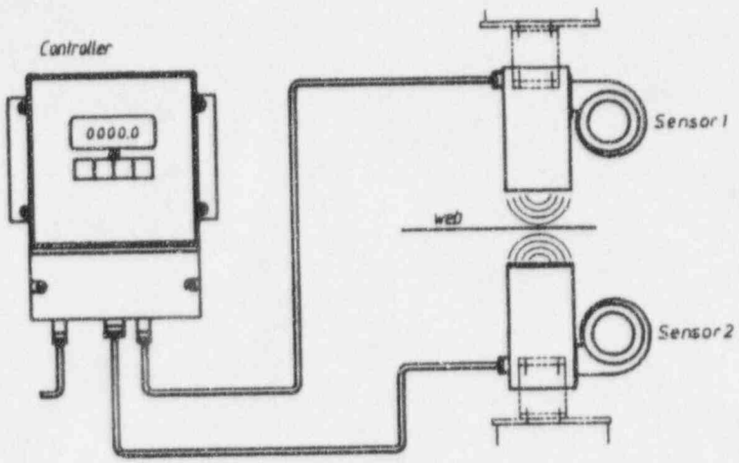
transmission sensor

The measurement facility comprises an emission and a receiving unit. The transmitter is a radioactive source (refer to «technical specifications»). This source is provided with a rotary magnet releasing the radiation only when energized.

The receiving unit comprises an ionization chamber and a preamplifier. In the ionization chamber, a signal is generated which is proportional to the magnitude of incident radiation. The radiation is essentially a function of the mass of the material to be measured and the measurement current a function of the actual value of this mass. This signal is then fed to the preamplifier where it is boosted into an output signal of 0 - 10 V and transmitted to the evaluation electronics. (0 V = source closed; 10 V = source open and no material in measurement gap.)

3.2.1 Sensors

3.2.1.2 Ultrasonic sensor

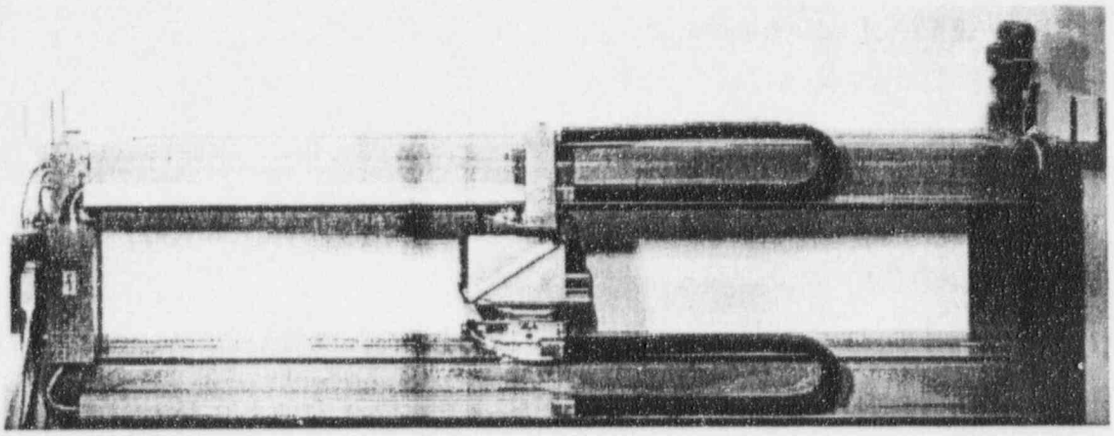


ultrasonic sensor

The ultrasonic thickness measuring equipment consists of 2 sensors and one evaluating device. The distance measuring values of the sensors are evaluated in the control unit and are transferred via a serial interface to the central electronic unit. (Details with respect to ultrasonic thickness measuring cf. «Operating Instructions Ultrasonic Thickness Measuring System UDM 2000».)

Notes

3.2.2 Scanner



The scanner incorporated in the **betacontrol** measurement system has the purpose of synchronously moving the transmitting and receiving unit of the sensor across the entire width of the material to be measured.

It is mainly used in production lines where basis weight or thickness are measured at various points on the web-type material, this information being used, for example, to adjust the flat-sheet die of an extruder or to control the calender rolls.

3.2.2 Scanner

3.2.2.1 Design features

The scanner essentially comprises two double cross members with side spacer supports and track rods mounted to the scanner members. The track rods have the purpose of guiding the detector and source carriages. Both carriages are moved forward by toothed belts driven by an electric motor on a common shaft. This arrangement permits synchronous carriage transport without backlash. For safety reasons, the toothed belts for the sensor carriages are driven via a friction clutch located between the motor shaft and carriage drive.
It is adjusted by the manufacturer in such a way that no slip occurs when the sensor is moved forward and that the power transmitted from the drive motor, which has a high step-down ratio, does not exceed a specific level.
Two M 16 threads are located on the outside of both scanner supports to mount the scanner.

3.2.2.2 Technical specifications

Scanner:

Operating voltage:	possible range	0 - 60 V DC
Power consumption:		5 A max
Direction of rotation:		forwards or backwards
Scanning speed:		
forwards	possible range	0 - 50 m/min
backwards		0 - 50 m/min

3.2.3 Central system

The central system, heart of any **betacontrol** measurement system, comprises the following 2 main components:

1. 19" rack accommodating the entire electronics

This comprises several function units in single or double Euroformat and is configured according to the requirements placed by the customer on each measurement system.

The individual function units, which are plugged onto a 16-bit VME bus, are controlled by a 32-bit processor. This configuration permits a rapid elimination of malfunctions since entire plug-in cards can be replaced.

2. A control panel with sealed keyboard

which can be geared to various customer requirements by the addition of keys and various schematic diagrams (on request). In its basic configuration, the sealed keyboard is designed for upgrading the measurement system to accommodate up to 5 measuring sensors.

It is resistant to plasticizers and therefore also suitable for application in an aggressive environment.

3.2.3 Central system

Customized central system configuration

a) Power supply			***stock no.:***
1 * power supply unit	+ 5 V, 14 A ; + 12 V, 2 A; - 12 V, 1 A		04 0558 03
1 * power supply unit	2 * 24 V, 1 A	stable	04 0104
1 * power supply unit	1 * 28 - 30 V, 1 A	unstable	04 0156

b) Cards on VME-Bus		
1 * VEC		04 0486 04B
1 * OPTOAD	optical coupler 32 input / 28 output 2 counter	04 0485 05
	analog 16 input / 2 output	

c) Cards in vacant plug-in slots

1 * NVZ, 1 channel version	04 0113 01

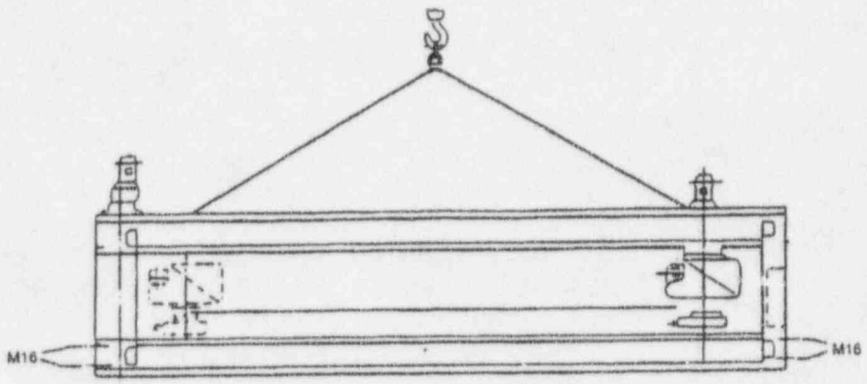
4. Installation instructions and handling

4.1 SCANNER

The scanner belongs to the category of measurement instruments and must therefore be treated with appropriate care. Handling and installation must therefore be carried out with utmost caution.

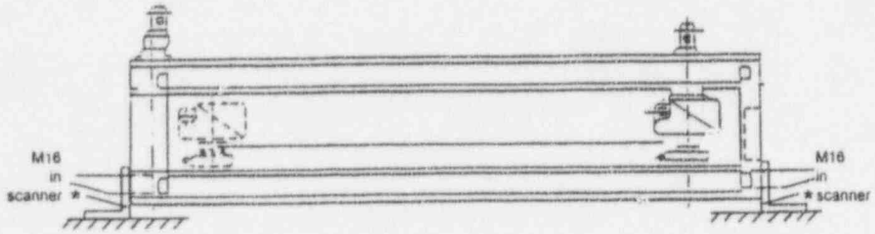
While being handled, the scanner should be suspended only. The suspending points on the scanner are marked accordingly.

Example:

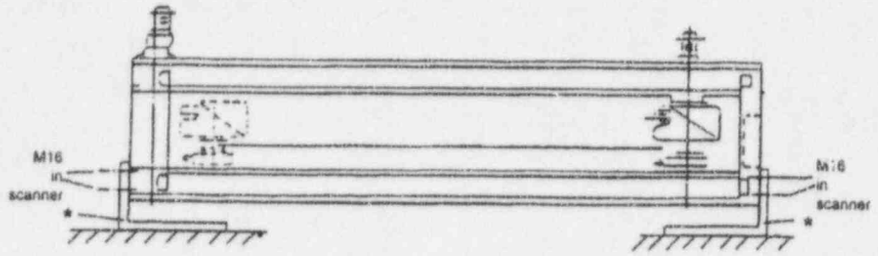


The scanner should also as far as possible be suspended for installation and with a clearance of at least 5 mm between the contact surface and scanner cross members. For this purpose, 2 threaded holes of size M16 are provided on each side of the scanner.

Installation recommendations:



1. Fastening brackets projecting on either side
* Fastening brackets do not belong to the scope of delivery



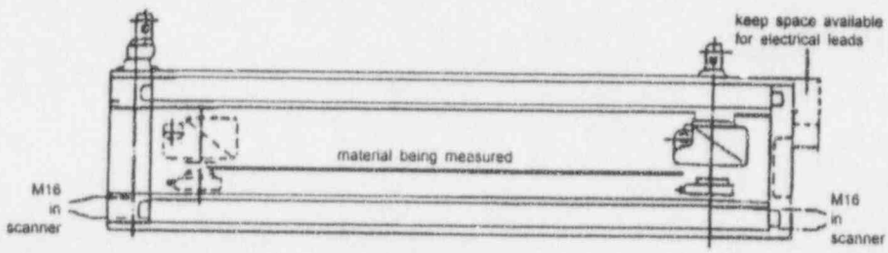
2. Fastening brackets pointing inwards
* Fastening brackets do not belong to the scope of delivery

If installation is not possible as illustrated above, baseplates can be factory fitted. Baseplates of this type must not be retrofitted by the customer since after they are installed the scanner must be realigned.

4.2. OPERATION CONDITIONS FOR SCANNER / SENSOR

The ambient temperature of an uncooled sensor must not exceed 50° centigrade.

The scanner must not be exposed to severe shock or vibration. In case of systems without pass line error compensation, the material to be measured must over the whole scanning width be fed through the sensor gap without flapping and at a constant distance to the source (see dimensioned drawing of scanner, dimension «e»); if necessary, guiding elements are to be fitted to control the material feed. If these instructions are not adhered to, faulty measurements may occur!



The detector and radiation windows must be kept clean of dirt and depositions. If necessary, they must be protected by means of a cross-flowing air barrier since deposits of this type may critically impair the measurement result.

If the material to be measured is subject to electrostatic charging, ionizing electrodes must be fitted upstream of the sensor to discharge such material. Installation in rooms subject to explosion hazard must be carried out in accordance with the special safety regulations.

4.3 CONTROL CONSOLES / CABINETS

If possible, control consoles and control cabinets must be handled and stored in an upright position. They should be set up in a dry place free from vibration. Depending on place of operation, additional air condition may be necessary.

The control console and control cabinets must be bolted in position. Control cabinets must be easily accessible from the front, control consoles from the front and back.

Attention! **Pay attention to cable entries during installation!**

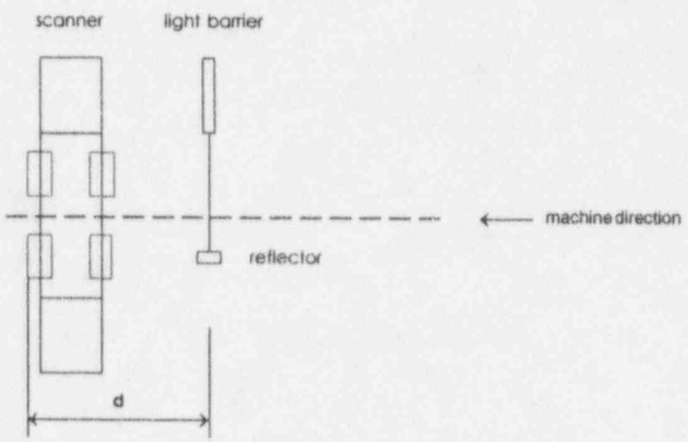
4.4 ELECTRICAL INSTALLATION

Refer to wiring diagram identified in the iist of drawings.

Attention! **Leads carrying signals must be laid separately from power cables. If necessary, use screened leads for transferring signals (refer to wiring diagram).**

4.4.1 Light barrier for signal «board detected»

The **betacontrol** system usually includes a reflection light barrier fixed at right angles to the material web, at a distance of approximately 150 mm. (For installation refer to the drawing.)



The dimension "d" ist to be entered in system parameters line 317

4.5 STORAGE

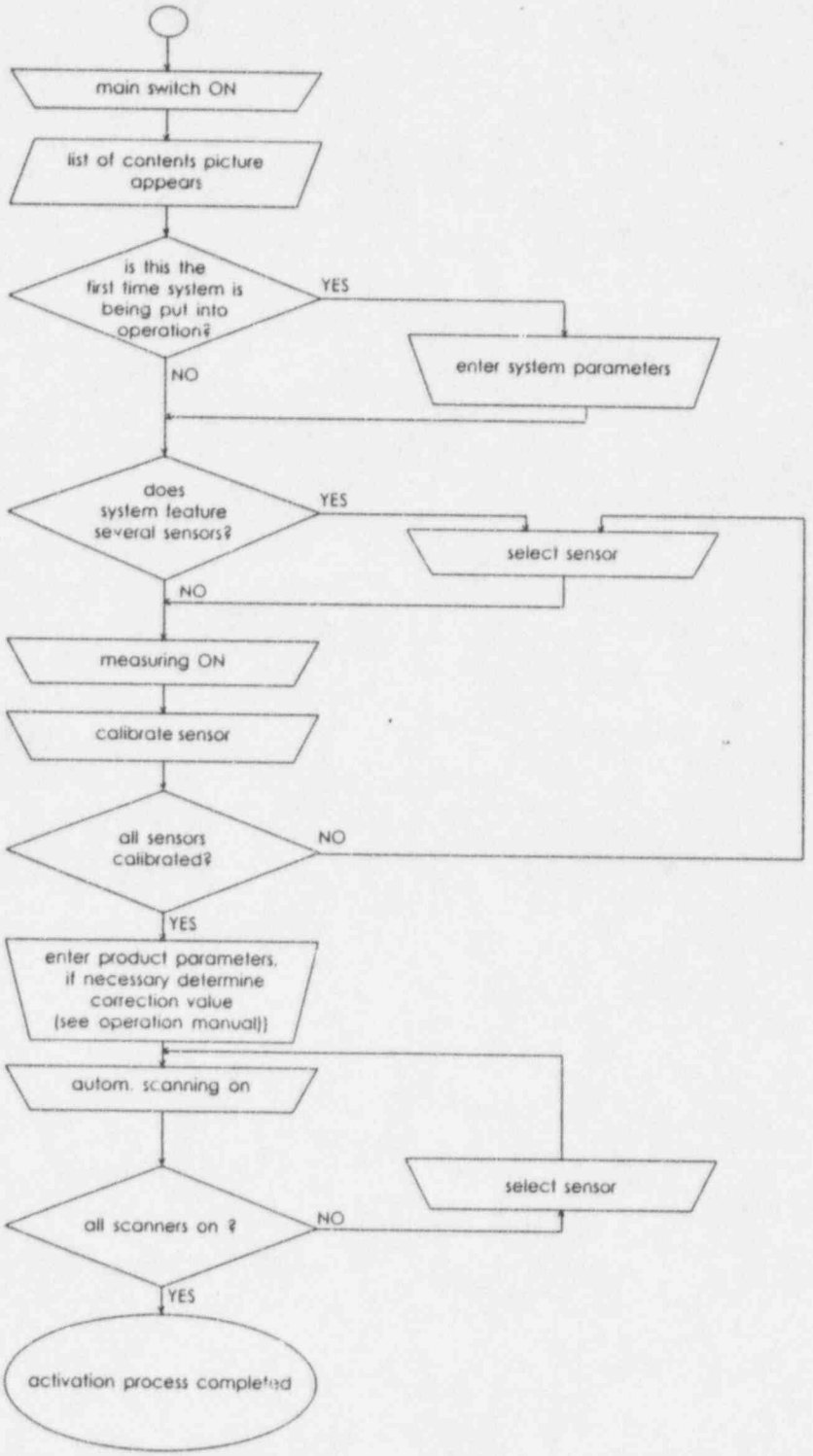
Upon delivery, the units must not be stored in a place exposed to weathering. Storage temperatures should not be subject to severe fluctuation. The storage temperature should remain constant within the range from approx. 10° to 40° centigrade.

5. Start-up / adjustments

5.1 REMOVING THE LOCKING AND PROTECTION DEVICE

After assembling and installing the **betacontrol** measurement system and before commencing the measurement process, remove the protective covers fitted prior to shipment to the transmitting source and receiving unit.

5.2 SWITCHING ON



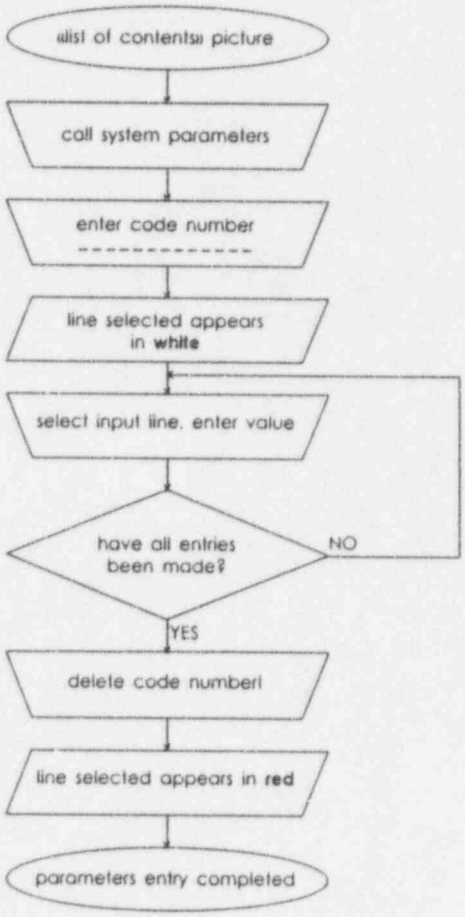
5.3 SYSTEM SETTINGS

The first time the **betacontrol** measurement system is put into operation, it must be adapted to the production line, i. e. optimized. The system parameters belonging to the measurement system serve this purpose. On comprehensive systems, several picture pages may be necessary to enter all relevant parameters. As described above, these pages may be selected using the picture control keys.

Attention! **After the system parameters have been entered / updated, press either the main switch or the «reset button» on the VEC in the 19" module in order to accept the new values.**

To prevent unauthorized access to the system parameters, always delete code number after the parameters have been entered!

5.3.1 Flow diagram for system parameters entry



5.3.2 «system parameters» picture

This picture contains a list of all lines available for entering parameters of relevance to the measurement system.

bc p. 12 **system parameters** tu 23.04.1996 16:06:56

3		code system parameters	??????
269	BW	max. line speed (in 0.1 fpm)	3020
280	BW	distance line center - park position (in 0.1 inch)	616
281	BW	profile reflection : 0=none,1=scale+profile,2=scale,3=profile	0
282	BW	interchange notations drive side / operating side (0/1)	0
283	BW	averaging over x scans (max 20)	4
284	BW	no. of pixels for bar width in trend diagram	2
285	BW	no. of pixels for bar spacing in trend diagram	2
317	BW	distance board sensor - scanner (in 0.1 inch)	0
472	BW	measured value smoothing : 0 = off, 1 = range-dependent, 2 = constant	1
473	BW	factor x for sigma for threshold determination (entry : x * 10)	40
474	BW	sigma for range-independent smoothing	110
514		set value for scanner error compensation (in 0.1 mils)	770
544	TH	set value for calibration sample (in 0.1 mils)	1215
564	TH	averaging over x scans (max 20)	4
636	TH	scanner error comp. : starting point (in 0.1 inch) after park pos.	25
637	TH	scanner error comp. : end point (in 0.1 inch) after park pos.	1225
638	TH	scanner error comp. : start = "1" + enter	0
639	TH	scanner error comp. : clear = "1" + enter	0
640	TH	scanner error comp. : number of scans	4

5.3.3 System parameters (general)

Line 3 : «code system parameters»

The code number must be entered in this line to make an update or entry in one of the system parameter lines. Correct entry is indicated by the selected input line changing from red to white.

Line 269 : «BW max. line speed (in 0.1 fpm)»

End value of maximum line speed.
This value is assigned to the speed-sensitive output voltage 5 V = x fpm of the line speed roller.

Line 280 : «BW distance line cente - park po n (in 0.1 inch)»

Entry of the distance in 0,1 inch between park position and machine center.

Line 281 : «BW profile reflection: 0=none, 1=scale+profile, 2=scale, 3=profile»

Entry «0»: no profile reflection (histogram)
Entry «1»: scale and profile reflected
Entry «2»: scale reflected only
Entry «3»: profile reflected only

Line 282 : «BW interchange notations drive side / operating side (0/1)»

Enter «1» to interchange the drive / operating side on the monitor. This serves the purpose of machine alignment.

Line 283 : «BW averaging over x scans (max. 20)»

Average value formed from x scans, a maximum of 20 being possible. Display in the «averages» picture.

Line 284 : «BW no. of pixels for bar width in trend diagram»

Bar width in trend diagram.

Line 285 : «BW no. of pixels for bar spacing in trend diagram»

Distance between individual bars of the trend diagram in «averages» picture. With a bar width of 1 (line 284), it is possible to display a maximum of 400 scans values.

Line 317 : «BW distance board sensor - scanner (in 0.1 inch)»

Entry of distance between light barrier and scanner.

5.3.3 System parameters (general)

Line 472 : «BW measured value smoothing: 0 = off, 1 = range-dependent, 2 = constant»

Each new measured value (LS) entered from a/d converter is now further processed by means of the smoothing algorithm as follows:

$$LM\ (new) = LM\ (old) - \frac{LM\ (old) - LS}{N}$$

LM (new) = measured value indicated in the profile pictures.

LM (old) = measured value previously indicated in the profile pictures.

LS = measured value entered from the a/d converter.

N = divisor

The divisor (N) differs in accordance with the range in which the entered values lies.

N = 8 for all measured values (LS) within the range $\pm \frac{(sigma * factor\ X)}{2}$

N = 2 for all measured values (LS) within the range ± sigma * factor X.

N = 1 for all measured values (LS) outside the range ± sigma * factor X.

factor X = entry in line 473 of the system parameters.

Entry «0» : Smoothing algorithm off. Measured values are further processed without smoothing.

Entry «1» : Smoothing varying with measured value. The measuring range is divided into 10 equal ranges each of which being assigned a sigma value (factory-set). For smoothing, then is used the sigma of the range in which the measured values lies (with correction factor 1) (see test picture page 200).

Entry «2» : Constant smoothing over the entire measuring range. If the smoothing is to be made equally over the entire measuring range, proceed as follows:

1. Insert material to be measured in the measurement gap using the foil holder. The sensor must not scan!
2. Release the measurement process and select test picture page 200.
3. After approximately 1 minute, the amount of the standard deviation is displayed (sigma = ...).
4. Enter the indicated value in line 474 of system parameters.

5.3.3 System parameters (general)

Line 473 : «BW factor x for sigma for threshold determination (entry: x * 10)»

Is put in the equation for smoothing algorithm as described under line 472. The factor applies to both range-dependent and independent measured value smoothing.

Line 474 : «BW sigma for range-independent smoothing»

Only if «2» has been entered in system parameters line 472. Here, the sigma determined as described under line 472 (entry «2») is entered.

Line 514 : «set value for scanner error compensation (in 0.1 mils)»

En..ry of thickness of the sample which is used for scanner error compensation.

Line 544 : «TH set value for calibration sample (in 0.1 mils)»

Entry of thickness of the calibration sample. This value is used to calibrate the ultrasonic sensors.

Line 564 : «TH averaging over x scans (max 20)»

See line 283.

Line 636 : «TH scanner error comp.: starting point (in 0.1 inch) after park pos.»

Determines, at which distance from the standard position the scanner error compensation shall be started with.

Line 637 : «TH scanner error comp.: end point (in 0.1 inch) after park pos.»

Determines up to which distance from the standard position the scanner error compensation is to be effected.

Line 638 : «TH scanner error comp.: start = "1" + enter»

In case in this line a «1» is entered and if this is confirmed by pressing the key «enter», the scanner error compensation is started.

Line 639 : «TH scanner error comp.: clear = "1" + enter»

After entering a «1» and finishing by «enter» all correction values are deleted.

Line 640 : «S2 scanner error comp.: number of scans»

Here the number of scans for the scanning error compensation is fixed. A suitable number of scans lies within the range 2 till 5.

When starting the scanning error compensation one additional scanning is effected per direction, the result of which is not represented in the picture «scanner error», which is, however, necessary for establishing the parameters of the system.

Notes

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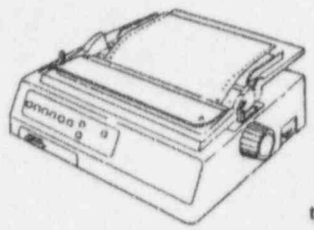
5.3.4 Printer settings



type: OKI 590 Elite

Printer Control	Emulation Mode	EPSON LQ
Font	Print Mode	Utility
Font	Pitch	10 CPI
Font	Proportional Spacing	No
Font	Style	Normal
Font	Size	Single
Symbol Sets	Character Set	Set II
Symbol Sets	Language Set	German
Symbol Sets	Zero Character	Slashed
Symbol Sets	Code Page	USA
Symbol Sets	Slashed Letter O	No
Rear Feed	Line Spacing	6 LPI
Rear Feed	Form Tear-Off	500ms
Rear Feed	Skip Over Perforation	Yes
Rear Feed	Page Length	12 "
Rear Feed	Gap Control	Auto Gap
Bottom Feed	Line Spacing	6 LPI
Bottom Feed	Form Tear-Off	2 sec
Bottom Feed	Skip Over Perforation	Yes
Bottom Feed	Page Length	12 "
Bottom Feed	Gap Control	Auto Gap
Top Feed	Line Spacing	6 LPI
Top Feed	Bottom Margin	Valid
Top Feed	Page Length	12 "
Top Feed	Gap Control	Auto Gap
Top Feed	Wait Time	1 sec
Top Feed	Page Length Control	by MENU Setting
Set-Up	Graphics	Bi-directional
Set-Up	Receive Buffer Size	64K
Set-Up	Paper Out Override	No
Set-Up	Print Registration	0
(FWD) (REV)		
Set-Up	Operator Panel Function	Limited Operation
Set-Up	Reset Inhibit	No
Set-Up	Print Suppress Effective	Yes
Set-Up	Auto LF	No
Set-Up	Time Out Print	Valid
Set-Up	Auto Select	Yes
Set-Up	Ribbon Selection	Black
Set-Up	Printhead Gap Adjust	0
Set-Up	Graphics Speed	High
Set-Up	Centering Position	DEFAULT
Parallel I/F	I-Prime	Buffer Print
Parallel I/F	Pin 18	+5v
Parallel I/F	Auto Feed XT	Invalid
Serial I/F	Parity	None
Serial I/F	Serial Data 7/8 Bits	8 Bits
Serial I/F	Protocol	Ready/Busy
Serial I/F	Diagnostic Test	No
Serial I/F	Busy Line	DTR
Serial I/F	Baud Rate	9600 BPS
Serial I/F	DSR Signal	Valid
Serial I/F	DTR Signal	Ready on Power UP
Serial I/F	Busy Time	200 ms

Printer Control Emulation Mode EPSON LQ

Notes

6. SERVICE

6.1 BALANCING THE PREAMPLIFIER

In general, it is not necessary to balance the preamplifier, since it is factory-adjusted. The original adjustment may shift as a result of radioactive source disintegration, dust deposit on the measuring window as well as amplifier drift.
Automatic compensation is made for this error by initiating the «calibration process».

Only initiate calibration process in measurement mode. (Key «measuring on» activated.)

The calibration process must be repeated whenever the system is switched on.

If necessary, or in the case of systems without automatic calibration process, proceed as follows:

Adjustment should be performed at the earliest one hour after switching the system on and only under the ambient conditions prevailing during production.

1. Carefully and thoroughly clean protective film in measurement gap.
2. Switch on system.
3. Test points on printed-circuit board NVZ (at the 19"-Rack) are -

1st	channel	b1	(+)	and b4	(0 V)
2nd	channel	b11	(+)	and b14	(0 V)
3rd	channel	b21	(+)	and b24	(0 V)
4th	channel	b31	(+)	and b34	(0 V)

4. Switch off source (key «measuring off»)
5. Connect voltmeter to the test points - as described in point 3.
6. The voltage measured must not be less than 0 V.
7. Press key «measuring on». (Source is open, radiation in the vacant measurement gap.)
8. The voltage measured must not be greater than + 5 V.
9. With following potentiometers, adjust to + 4.9 V:
   for channel 1 with P2
   for channel 2 with P5
   for channel 3 with P8
   for channel 4 with P11

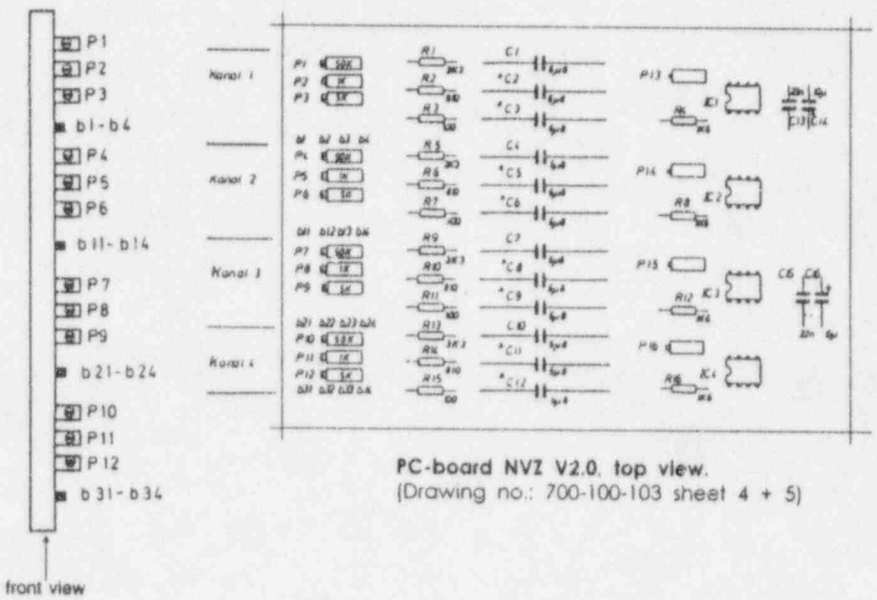
6.1 BALANCING THE PREAMPLIFIER

10. The following potentiometers determine the time constant superimposed on the measurement signal:
for channel 1 with P1
for channel 2 with P4
for channel 3 with P7
for channel 4 with P10

The time constant is calculated as follows:

T channel 1	=	(R1 + P1) *	(C1 + C2 + C3)
T channel 2	=	(R5 + P4) *	(C4 + C5 + C6)
T channel 3	=	(R9 + P7) *	(C7 + C8 + C9)
T channel 4	=	(R13 + P10)*	(C10 + C11 + C12)

11. Seal potentiometer with varnish.

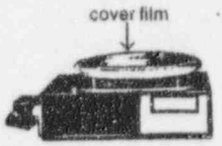


PC-board NVZ V2.0, top view.
(Drawing no.: 700-100-103 sheet 4 + 5)

6.2 REPLACING THE COVER FILM

Location of persons performing work:
around the measuring head at a distance of 0.2 m

1. Replacing the cover film on the source unit



a) Switch off «Mains» push-button.

b) Loosen cable connection.

c) Unscrew the source unit from the scanner (3 allen screws M6).

d) Unscrew the four allen screws (M4) from the yellow ring on the source unit.

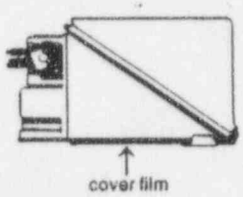
e) Lift off ring and remove defective film.

f) Fit new film with aluminized coating facing downwards so that it evenly projects over the O-ring diameter on all sides. (The aluminium coating can be measured with the aid of an ohmmeter.)

g) Weigh down film with a round piece of iron approx. 120 mm in diameter. (Anyone unfamiliar with replacing film will hardly avoid creases without using a fixing weight.)

h) Fully depress ring and uniformly tighten screws.

2. Replacing the cover film on the detector unit



a) Switch off «Mains» push-button.

b) Loosen cable connections.

c) Unscrew the detector unit from the scanner (4 hexagon head cap screws M8) and unhinge it.

d) Lift off film mounting frame using two screwdrivers.

e) At a location well away from the measuring head, turn over film mounting frame, unscrew the now visible screws, remove upper film ring, sealing ring and defective film.

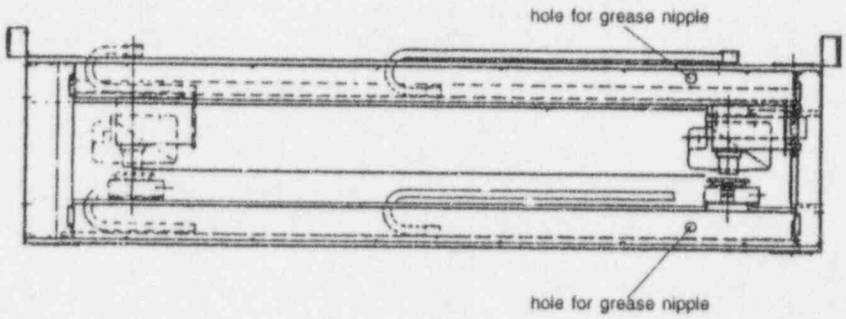
f) Fit new aluminized film so that the electrically nonconductive side points towards the material to be measured.
Fit film ring so that holes are aligned with lower film mounting frame.

g) Mount the film mounting frame by uniformly tightening the fixing screws.

h) Place sealing ring around film mounting frame, lubricating it slightly turn the mounting frame and fit it into the detector housing by applying uniform pressure to the outer ring.

6.3 LUBRICATING OF CARRIAGES

- To avoid wear of the ball bearing mounted carriages, they must be serviced once a month when used continuously or otherwise every 3 months.
- The grease nipples (two per carriage) are located on the opposite side of the cable drag chain. They are accessible through holes in the cover plate when the carriages are moved in this position. All grease nipples are protected from the effects of dirt by red cover plates.
- The lubricants K2K in accordance with DIN 51825 are recommended.



6.4 ADJUSTING SAFETY FRICTION CLUTCH ON SCANNER

The friction clutch is located within the clutch housing between the motor shaft and the toothed disk. If has been adjusted by the manufacturer in such a way that no slip occurs when the measuring head is moved forward and the power transmission from the stepdown motors does not exceed a specific limit.

Normally, clutch friction should untergo no change. However, should it be necessary to adjust friction when performing inspection work, proceed as follows:

Adjustment:

1. Remove side cover plate from clutch housing.
2. Unlock adjusting nut (1) by slackening off setscrew (2).
3. Tighten or screw back adjusting nut (1). This will increase or reduce torque
4. Lock adjusting nut (1) by tightening setsrew (2).
5. Check whether the required slip torque is transferred. If not, repeat process.

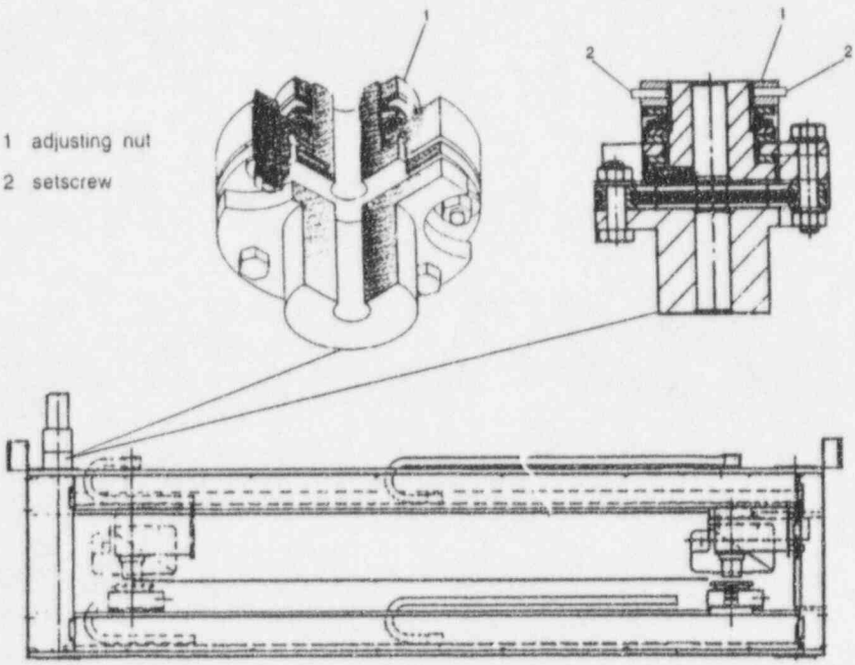
Maintance:

The friction clutch is maintenace-free.

However, recommended to check function and condition at specific intervals. Sign of wear will become apparent when the friction clutch is subject to frequent (unintended) slip. In this case, perform adjustment as described in points 1 - 5.

1 adjusting nut

2 setscrew

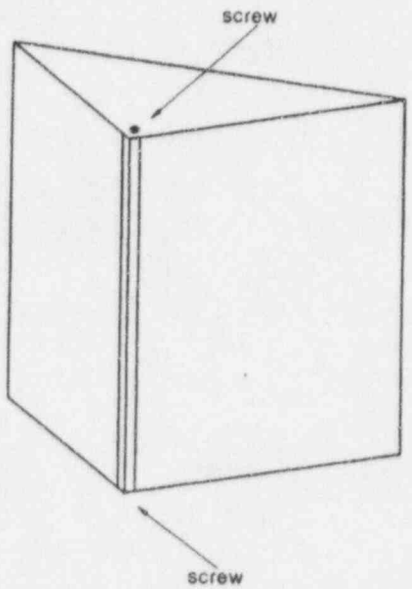


6.5 EXCHANGE OF THE INCANDESCENT LAMPS IN THE WARNING PANELS

The warning panels signalling the state of the source (open / closed) always have to be in a perfect condition in order to ensure the safety of the operating personnel.

In case a signal lamp fails, it has to be exchanged as soon as possible. You should proceed as follows:

1. remove the two recessed head screws (cf. picture) serving for fixing the supporting bracket of the plexiglass sheets and take out the supporting bracket.



2. pull out the plexiglass sheets.
3. replace the defective incandescent lamp (spare part no. 15 0300).
4. re-assemble the warning panel in reverse order.

Notes

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7. Service interruptions

7.1 TEST PICTURES

The **betacontrol** measurement system features a series of test pictures to assist service personnel in troubleshooting and commissioning activities. These test pictures may either be selected directly via page number - starting at 200 - or by cursor selection in the «list of contents» picture in conjunction with the «page up» and «page down» keys.

7.1 TEST PICTURES

Test picture page 200

```
bc p. 200                    measurement          tu 23.04.1996 16:07:14
          scanner no.1 : measuring range-dependent smoothing

range      from          to        sigma     factor    threshold value
           lbs/1000ft2
1          0       -     614       110       4.0       440
2          615     -     1229      107       4.0       428
3          1230    -     1843      104       4.0       416
4          1844    -     2458      102       4.0       408
5          2459    -     3072      100       4.0       400
6          3073    -     3686      98        4.0       392
7          3687    -     4301      96        4.0       384
8          4302    -     4915      94        4.0       376
9          4916    -     5530      92        4.0       368
10         5531    -     6144      90        4.0       360

updating of the following values after each full minute
values void as source was closed during last minute! Please wait!
sigma                  :    58938
no. of measurements    :    2004
average                :    8751    lbs/1000ft2
maximum                :    8751    lbs/1000ft2
minimum                :    1046    lbs/1000ft2
```

This test picture shows the threshold values for the range-dependent measured value smoothing as well as the sigma for threshold calculation for a constant smoothing over the entire measuring range.

The header of this picture indicates the respective mode in which the smoothing is made.

Are displayed in detail:

range : sectioning of the measuring range.

sigma : relevant standard deviation with correction factor 1 (updated values with allowance for source decay).

factor : factor for sigma for threshold determination (see description of system parameters line 472).

threshold value : threshold value for smoothing algorithm.

7.1 TEST PICTURES

Test picture page 200

Moreover, are indicated:

sigma	:	calculated standard deviation (to be entered in the system parameters with constant smoothing)
number of measurements	:	total of single measurements
average	:	averaged measured value in lbs/1000ft².
maximum	:	maximum single measured value in lbs/1000ft².
minimum	:	minimum single measured value in lbs/1000ft².

7.1 TEST PICTURES

Test picture page 201

betacontrol p.201 **calibration curve** tu 12.10.1993 09:29:39

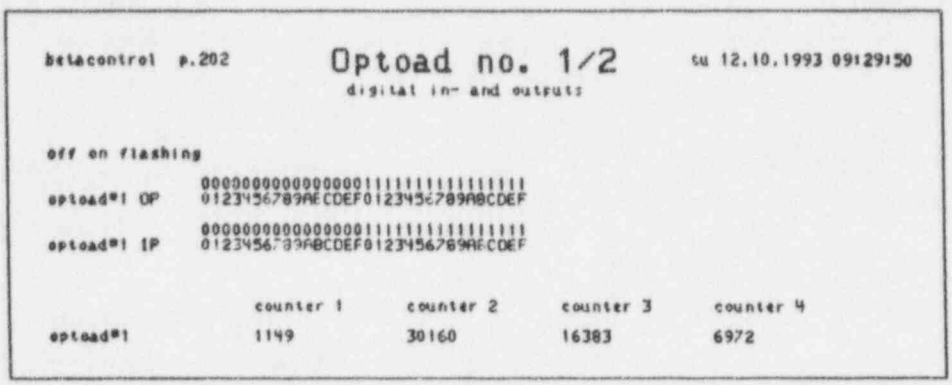
The 32 highest and lowest values of the calibration curve

no. 0	21888	no. 1	21888	no. 2	21888	no. 3	21888
no. 4	16579	no. 5	13897	no. 6	12649	no. 7	11841
no. 8	11241	no. 9	10737	no. 10	10315	no. 11	9954
no. 12	9633	no. 13	9343	no. 14	9084	no. 15	8848
no. 16	8629	no. 17	8424	no. 18	8230	no. 19	8046
no. 20	7873	no. 21	7710	no. 22	7556	no. 23	7410
no. 24	7275	no. 25	7146	no. 26	7022	no. 27	6903
no. 28	6788	no. 29	6677	no. 30	6569	no. 31	6463
no. 225	306	no. 226	29	no. 227	285	no. 228	274
no. 229	263	no. 230	253	no. 231	242	no. 232	231
no. 233	219	no. 234	208	no. 235	196	no. 236	185
no. 237	174	no. 238	164	no. 239	153	no. 240	142
no. 241	132	no. 242	122	no. 243	112	no. 244	102
no. 245	92	no. 246	82	no. 247	73	no. 248	63
no. 249	54	no. 250	44	no. 251	35	no. 252	26
no. 253	17	no. 254	8	no. 255	0		

This test picture shows the 32 highest and lowest values of the calibration curve in decimal form.

7.1 TEST PICTURES

Test picture page 202



This test picture is used to check the digital inputs and outputs of all I/O cards «Optoad» in the system, identified by the designation «Optoad # n» where «n» stands for the consecutive number of the I/O card. The inputs and outputs are arranged in tabular form, their relevant status is indicated by colour code.

Colour significance:

green = not set, low level
red = set, high level
violet = input / output alternates between low and high level

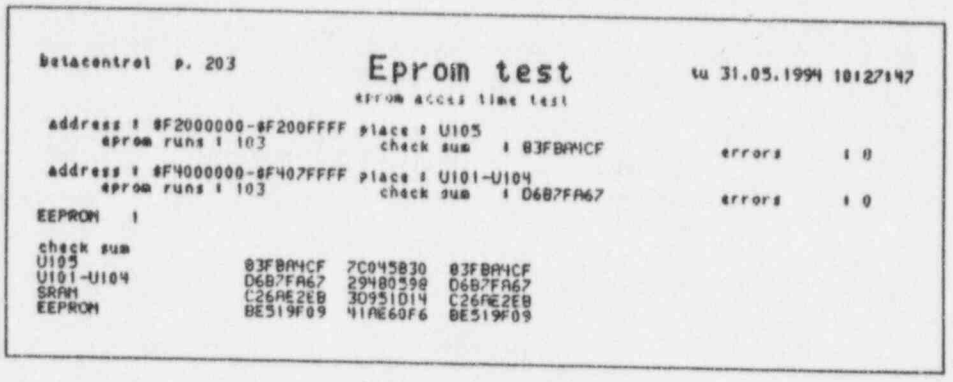
Analog identification of the inputs and outputs in the test picture and in the circuit diagrams facilitates fast function testing.

Example:
Optoad # 1 IP 1F = red → input 1F of the optoad no. 1 ist set, it carries high level.

In addition to the displays of the inputs and outputs, the existing counters and their readings are also indicated in this picture. The values of the counter readings are specified in decimal form and therefore represent the sum of all pulses since the last «reset pulse». Counter 1 and 3 are incremental counters and counters 2 and 4 summation counters.

7.1 TEST PICTURES

Test picture page 203



EPROM acess time test

address : Address range in hex code.

place : EPROM plug-in slot on the VEC card, (VEC = abbreviation for processor card).

eprom runs : Total number of EPROM runs.

check sum : Check sum of EPROM in hex code.

errors : Indicates the number of run and check sum errors. The check sum and number of errors will be deleted in the event of «Mains off».

7.1 TEST PICTURES

test picture page 204

betacontrol p. 204 **analog inputs** fr 04.11.1994 10:42:24

upload no. 1

ad counter	18735			
ad error	0			
ad irq/sec	41			
calibrations	61			
		hex	dec	mV
ad channel	1	00020EC5	183101	2176
ad channel	2	00020185	184581	2041
ad channel	3	00000000	0	-5000
ad channel	4	00000000	0	-5000
ad channel	5	00000000	0	-5000
ad channel	6	00000000	0	-5000
ad channel	7	00000000	0	-5000
ad channel	8	00000000	0	-5000
ad channel	9	00000000	0	-5000
ad channel	10	00000000	0	-5000
ad channel	11	00000000	0	-5000
ad channel	12	00000000	0	-5000
ad channel	13	00000000	0	-5000
ad channel	14	00000000	0	-5000
ad channel	15	00000000	0	-5000
ad channel	16	00000000	0	-5000

This test picture is used for testing all available a/d input and output voltages.

ad counter : counter for a/d interrupts, goes to -32 768 when it reaches 32 767.

ad error : counter for missing a/d interrupts; should always be 0.

ad irq/sec : number of interrupts per second.

calibrations : number of a/d converter calibrations.

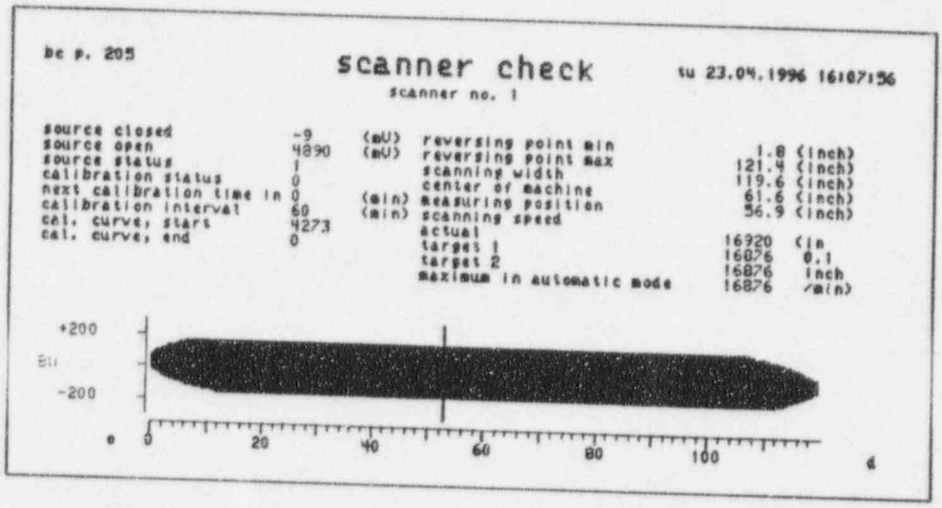
ad channel 1 : value last read in from a/d channel 1.

.
.
.

ad channel 16 : **see ad channel 1**
This a/d card has available max. 16 analog input channels.

7.1 TEST PICTURES

test picture page 205



This test picture is used to check data sampling and speed calculation for the scanner control. The graph shows the function of the scanner control with start- and brake ramp, a pointer marking the sensor position.

source closed : voltage in mV for closed source.

source open : voltage in mV for open source.

source status : target status of source: 1 = open, 2 = closed.

calibration status : ***Current status upon calibration:***

0 = calibration not activated.
1 = measuring head travels in manual mode towards min.
2 = is skipped (not used).
3 = measuring head travels towards min. until calibration switch is operated.
4 = is skipped.
5 = source is closed and after 7 seconds assumes status number 6.
6 = sum-up set to 0.
7 = waits 7 seconds and sums up.
8 = saves values and opens source.
9 = waits 7 seconds after opening source.
10 = sets sum-up to = 0.
11 = sums up for 7 seconds.
12 = is skipped.
13 = saves result in CMOS-RAM; extinguishes calibration lamp and goes into auto mode if activated, otherwise measuring head remains stationary.
14 = waits until measuring head is moved from calibration position and then sets status indicator to 0.

7.1 TEST PICTURES

Test picture page 205

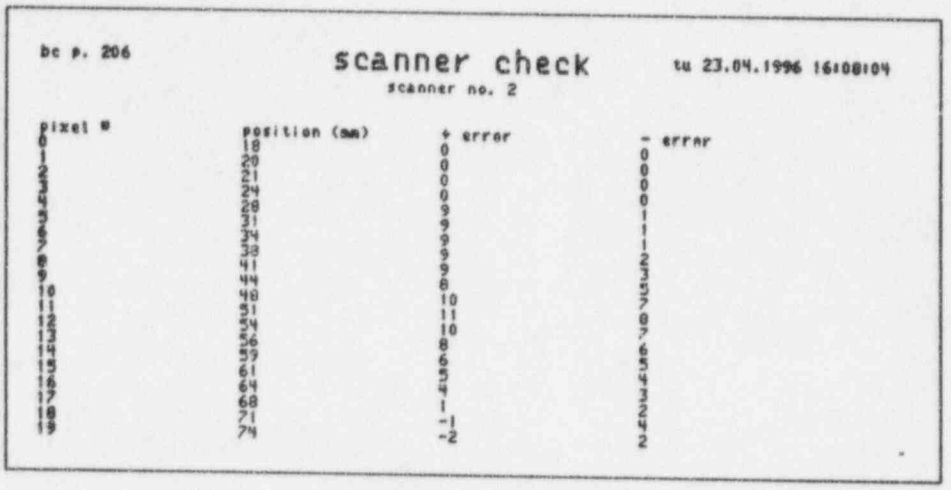
calibration intervall	:	time between two calibrations.
next calibration time in	:	the calibration time will starts on expiry of this time.
cal. curve start	:	start value of calibration curve (decimal).
cal. curve end	:	end value of calibration curve (decimal).
reversing point min	:	min. reversing point for autoscan in mm, measured from park position.
reversing point max	:	max. reversing point for autoscan in mm, measured from park position.
scanning width	:	scanning width in mm.
center of machine	:	selected machine center in mm, measured from park position.
measuring position	:	current measuring head position in mm, measured from park position.

scanning speed:

actual	:	actual value for scanning speed.
target 1	:	target value for scanning speed.
target 2	:	target value of scanning speed not allowing for the maximum admissible acceleration.
maximum in automatic mode	:	max. possible scanning speed in automatic mode.

7.1 TEST PICTURES

Test picture page 206



This test picture can be paged using the cursor function («cursor up» and «cursor down» keys).

It displays the values stored for scanning error correction.

pixel : pixel displayed in the graph on the monitor.

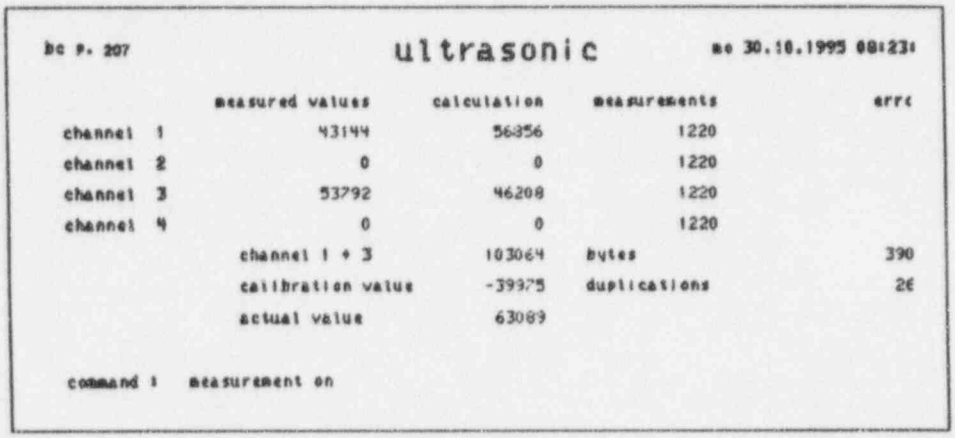
position (in 0,1 inch) : position of the displayed pixels in relation to the measuring head position.

+ error : error recorded in the positive scanning direction, i. e. away from the calibration position.

- error : error recorded in the negative scanning direction, i. e. towards the calibration position.

7.1 TEST PICTURES

Test picture page 207



This picture is used for adjustment and surveillance of the ultrasonic measuring system.

Are displayed in detail:

channel 1 - 4 : output channels of the ultrasonic measuring system
channel 1 = sensor 1;
channel 3 = sensor 2;
channel 2 and 4 = not used.

measured values : actual measuring value.

calculation : calculated value (100 000 - channel x).

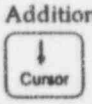
measurements : number of measurements / minute.

errors : error counter.

bytes : number of received bytes / minte.

duplications : number of memory reading cycles in which no actual measuring value was found.

Additionally commands appear on the bottom of the picture after pressing the 

or 

keys. For carrying out press the «enter» key.

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