WIEGAND

MACHINERY WORLD

File 2

WIEGAND

File 1

1 Operating Instructions Evaporation Plant
2 Erection Drawings No. 763/764/765/766-303-0
3 Flow-sheet No. 513 / 515 - 302 - 0
4 Maintenance Instructions SIHI Vacuum pump
5 Maintenance Instructions Hilge Centrifugle pumps
6 Maintenance Instructions Mono pump Nezch
7 Maintenance Instructions GEA Ahlborn heat exchangers
8 Maintenance Instructions Schiele Fan
9 Maintenance Instructions Alfa Laval LKM Valves

File 2

11 Installation, Assembly & commisioning of controls
12 Parts list of control systems
13 Drawings of control systems
14 Taylol
15 Keystone
16 Valmet
17 Samson
18 Fisher Gravitrol
19 Berthold

File 3

20 Maintenance Instructions for Foxboro Instruments

File 4

21 Maintenance Instructions Bran + Lubbe pump
22 Conductivity Controller Condensate tank SPIRAX
23 Hicon Conductivity Controller Rosemount
24 pH Controller Wiegand Evap Endress&Hauser Mypex
25 Pressure Transmitter 2088G Rosemount
26
27
28
29

11

WIEGAND Karlsruhe GmbH D-7505 Ettlingen	Erection, Installation and Commissioning of the Control System	

The erection, installation and commissioning of the control system is only part of the WIEGAND supply if this was explicitly mentioned in the confirmation of order. The same applies for all electric instruments as well as for the pump motors. If this was not especially agreed upon, it will belong to the customer's supply in any case.

A) GENERAL (Control Elements)

The control elements (control valves and control flaps) are mostly mounted together with the evaporating plant. In doing so, the following will have to be checked and observed:

a) correct installation, according to the flow direction marked on the outside,

b) nominal widths of flow of the pipings are mostly larger than those of the control elements

c) the control elements have to remain free from inside contamination

d) the piping will have to be supported such that the control elements can be installed and removed without problems

e) note the input section on the erection drawing if indicated by us

B) PRECISION CONTROL INSTRUMENTS

The installation of precision control instruments, such as transmitters, sensors, and controllers should only be started after completion of all construction, painting and rough locksmith works in the evaporator room and after removal of all scaffolds, in order to avoid damages.

I. Transmitters (measuring transducer) Sensors

In this connection, please note the indications on our drawings. The instruments will have to be installed free from vibrations close by the measuring section. The connection between measuring point and transmitter is called pulse line.

Important:

1. provide a syphon for the steam pressure transmitter
2. do not provide a syphon for the vacuum transmitter, install it 10 cm above the measuring point (pulse line being a copper tube of 12 mm length). Lay this tube with an inclination to the measuring point.

For both a.m. transmitters a shut-off cock will have to be mounted in the pulse line. Do not brace measuring point and transmitter with the pulse line. Leave some space for a later insulation.

3. Install the temperature transmitters, sensors in reverse current and dip them into the liquid flow in their total length.

4. Screw in the electric resistance thermometers with special care.

5. The flowmeter will have to be absolutely mounted with the fixings provided for and in accordance with our erection drawing. In any case, it has to be avoided that pre- or subsequently arranged tube sections are fixed at the flowmeter. If necessary, these tube sections have to be fixed separately. There must be the possibility to install and remove the flowmeters quickly and without problems, without impairing pre- or subsequently arranged tube sections.

6. Screw in and tighten the conductivity measuring cells in the tube bend as indicated.

   <u>Attention:</u> Do not turn the electric connecting head of the measuring point (danger of damaging it). Only use existing hexagon.

7. Density measuring instrument
   It is of particular importance that no vibrations are transmitted by the pump which is normally pre-arranged. If this is not possible, flexible connections will have to be provided for. Densitymeters will have to be fixed to a firm foundation. Compensators of oscillation are not allowed.

All places of installation of transmitters have to be checked on that

a) no impairment of the instruments can take place by dripping and splashing liquids or steam,

b) they are mounted outside areas which are frequented by public or the operating personal.

II. Control Panel

1. The control panel will have to be mounted on the foundation prepared by the customer. The control panel is to a large extent pre-assembled, pneumatically tubed and electrically wired.

2. The WIEGAND supply contains the following control instruments which, for reasons of transportation can only be mounted into the control panel on site:

   - compact indicator
   - compact controller
   - six-colour point printer
   - three-line recorder

3. These instruments will have to be inserted and clamped in the control panel with the aid of the control panel drawing. Make the connections between the indicators, controllers, six-colour-point printers and line recorders and the lines pre-assembled in the panel from the pneumatic and electric connecting block to the controllers. Use our drawings for this purpose.

C) AIR SUPPLY (Pneumatics)

1. Connection, compressor with supply air reducing station and filter station.

   A suitable, accessible space outside the control panel has to be chosen for the air reducing station. Please note that air will have to be conveyed directly from the supply air reducing station into the control panel and into the plant. The connection, compressor with supply air reducing station will have to be laid by the customer using a metal tube of 1/2 ".

2. Connection, air reducing station with the control panel will have to be carried out by the customer, using a metal tube of 1/2" or a plastic hose which is resistant to compression (10 atue).

3. Connections, air reducing station with air distributor for transmitters, change-over valves and positioner controllers at the controlling units have to be made as described under para. 2.

4. Connections of the pneumatic connecting block in the control panel with the control valves and transmitters as well as change-over valves

a) with small plants concerned, individual lines will have to be laid, see pneumatic diagram

b) with bigger plants concerned, the pneumatic multi-strand collective cable from the control panel to the individual air distributors in the plant will have to be used.

Note: We recommend to lay the spare circuits at the same time.

- supply air distributors (see para 3) and signal air distributors will have to be mounted on a protected spot in the plant and must be easily accessible.
- they should be arranged close by each other
- when chosing their location, one should take care that the connecting lines with the transmitters, change-over valves and control elements are as short as possible.

5. The connecting lines between supply air distributors (feed air for the transmitters) will have to be inserted, consisting of a plastic hose, 1/4" and 6 mm, of blue colour. At the same time, the signal lines between the transmitters and the signal air distributor will have to be inserted, consisting of a plastic hose, 1/4 " and 6 mm, of black colour.

6. Make the connections between signal air distributor and control elements (control valves, control flaps), change-over valves by means of a plastic hose of 1/4" and 6 mm, of red colour.

   At the same time, the feed air supply lines for the positioner controllers at the control elements will have to be laid. Here too, a plastic hose of 1/4" and 6 mm, of blue colour, will be used.

   a) If there is no supply air distributor for the positioner controllers in the plant, the air is directly taken from the air reducing station, see the pneumatic diagram for this purpose.

   b) If there are several positioner controllers, a separate supply air distribution is provided for (in addition to the two distributors mentioned under para 3 and 4b).

D) ERECTION OF THE ELECTRO PART

If not especially agreed upon, these works do not form part of our scope of supply

In particular, the following will have to be installed (according to the electric and pneumatic WIEGAND diagrams):

I. General

1. Connecting lines between the electric panel part (contactor panel) and the pump motors of the evaporating plant.
2. The connecting line between the electric panel part (contactor panel) and the fan motor of the cooling tower. Particularities of installation of the stator heating of the motor will have to be observed.
3. The connecting line from the electric panel part (contactor panel) to the cooling tower heating (for this purpose, please see our electric wiring diagram).
4. The connecting line from the electric panel part (contactor panel) to the bowl heating thermostat of the cooling tower and to the fan motor thermostat. The former will be fixed in the cooling tower bowl and prevents the cooling water from freezing, the latter should be fixed to an outside wall of the cooling tower building. The stator heating will be brought into action at an outside temperature of - 15 °C.
5. The control lines from the WIEGAND control panel to the electric panel part (contactor panel) for the pump motors.
6. The connecting line between water-flow detector after the sealing water tank and the control panel.
7. Connecting lines between control panel and damp proof distributor cap within the evaporating plant, connecting lines between distributor cap and illuminating hoods for the separator illumination.
8. The electric measuring lines of the resistance thermometers to the control panel. For this a copper wire, twined, 2 x 1,5 mm^2, will be required. The lines will have to be equalized (in this connection please see the operating instructions of the electric temperature recorder).

II. If provision is made for an electric control system

1. Lay the connections, transmitter with control panel by means of twined copper wire of 2 x 1,5 mm^2.

2. If pneumatic valves with electric positioner controllers are applied, twined copper wire, 2 x 1,5 mm^2, will have to be laid for each positioner controller from the connecting block in the control panel to the individual positioner controllers at the pneumatic valves.

3. Care has to be taken that the signal lines from the transmitters to the connecting block in the control panel and from the connecting block in the control panel to the valves are laid in steel-armoured conduit and that no power circuits are nearby which might cause inductive voltages.

4. If electric control valves are used a four-strand line will have to be laid in addition from the control panel to the control valves. This is a power circuit, the cross section of which will have to be selected according to the respective drive.

E COMMISSIONING

As soon as the erection of the measuring and control instruments as well as the supply air reducing station and the individual air distributors is completed and all connections are made, the commissioning will be started. The following sequence shall be kept to:

I. Checking of the Air Supply

1. The connections between the air reducing station and the control panel will be loosened at the air distributor in the control panel. The same is done with the individual connections at the air distributors in the plant.

2. Start the compressor and let the air blow for about 3 hours, so that the supply air piping will get clean.

   Attention: Avoid that oil containing air gets into the control instruments when you start the system. This would make necessary considerable repairing works.

3. Tighten the loosened unions again.

II. Adjustment of the Air Supply (Supply Air at the Air Reducing Station)

The individual instruments have to be supplied as described below:

1. Positioners at the control valves with 2.5 atm.g.
2. Change-over and spray cleaning valves with 4 atm.g.
3. Pressure, absolute pressure, and temperature transmitters, density measuring instrument, flowmeter, and controllers with 1.35 - 1.4 atm.g.

Attention: These values must individually be checked at the input of the respective instruments by means of a hand manometer (loosen the supply air line at the individual instruments).

III. Preparation of the Control System (Positioners, Transmitters, and Controllers) for the Start-up

1. Adjust all controllers to manual operation. Remove the transport safety devices in the controllers, transmitters, densitymeter, and flowmeters as described in the attached operating instructions.

2. By means of the manual controllers of the individual auto-manual stations at the controllers the respective valves are passed in the whole range. That means, a valve for steam has to be closed when the control capacity is 0 %, it has to be open by 50 % when the control capacity is 50 %. The control capacity is adjusted at the manual controller of the auto-manual station.

3. When the control elements are equipped with positioners the positioners must be checked according to the operating instructions attached and, if necessary, they must be re-adjusted. It has to be taken care, that the closing and opening velocities of the control elements with positioners are the same. This can be regulated at the spring tension for the control element.

4. When the controllers are adjusted to "manual", the valves must be checked as follows:

   a) Manual controllers at the controllers to 50 %. The valve must be opened by 50 %.

   b) Repetition at 0 % and 100 %. With 0 %, the valve must be closed and at 100 % it has to be completely open. This applies to the steam valve only. As far as the other valves are concerned, you will have to look at our drawings for the control technique where we stated the required safety positions of the valves; i.e. whether the valve has to be closed without pressure or opened without pressure.

5. If the values stated under item 3 cannot be repeated, please check:

   a) the control capacity output of the controller - this output must be measured directly before the valve.

   b) If a) is correct, check the control element.

F Start-up of the Plant

Now everything is ready to start the measuring and control system of the plant.

When you start up the plant, you have to take care that the rectifiers of the indicating instruments and the motors of the recorders are supplied with electricity and that all the controllers are switched on manual operation. Now the plant can be started on water. (see general operating instructions for the evaporator).

I With the manual controllers at the individual controllers the valves will be adjusted in such a way that the required values for steam, pressure, temperature, and feed are obtained. As soon as those values are obtained, and after a time of about 10 minutes, the set-point devices will be adjusted in such a way that the output signal of the controller equals the output signal of the manual controller is giving to the valves. Those figures will be indicated at the controller.

II. Criteria for the adjustment of the controllers

steam pressure control loop - proportional range = 80 %,
reset time: 0.2 min.

vacuum control loop - proportional range = 100 %,
reset time: 0.5 min.

temperature control loop - proportional range = 80 %,
reset time: 1.5 min.

feed control loop - proportional range = 100 %,
reset time: 0.3 min.

level control loop - proportional range = 50 %,
reset time: 1.0 min.

concentration control loop - proportional range = 400 %,
reset time: 6.0 min.

III After the adjustment of the approximate control parameters stated under II, the manual-automatic switches at the individual auto-manual stations will be manually switched over to automatic.

Attention: When it is switched over from manual to automatic, the actual values and the set-points must correspond; if they do not correspond, the direction of the action has to be changed. as described in the instructions for the specific instrument. If there are still differences between actual values and set-points with correct direction of the action, the zero points at the controllers must be changed as per oper operating instructions for the controllers.

IV When this has been done and when the temperatures in the plant have reached the values specified, the product feed can be opened and the plant is now run on product.

V The zero points for concentration and viscosity at the respective transmitters (measuring transducers) can only be adjusted during operation with product according to measurements in the laboratory. That means for instance for the concentration: a certain content of % TS will be determined with the help of a pocket refractometer. If this value corresponds to the value given by the indicator at the controller, it is momentarily not necessary to correct anything. If the controller indication, however, differs from the refractometer indication, it will be necessary to correct the zero point at the transmitter (measuring transducer) according to the instructions for the particular instrument.
Example: by means of the steam pressure the plant will be run in such a way that an outlet concentration of 45 % TS which had been indicated on the refractometer is obtained. After a period of about 10 minutes, the dry substance content in the product outlet shown on the indication is still 45 %. The indication at the controller itself, however, does only show 30 % TS. Now, it is necessary to correct the concentration with the zero-point screw at the transmitter (measuring transducer) as described in the instructions for the instrument, so that the indication at the controller does also state 45 % TS. This can only be done, when the controller is switched on manual operation.

The above-described correction can be repeated later, i.e. it can be improved by comparisons with laboratory measurements.

VI It is a precondition for a correct operation of the control system, that the optimum controller adjustments are found and realized during the first operation. (see enclosure).

VII Optimum Controller Adjustment

1. For the adjustment of the controller to the control section it is necessary that the preparations described in the instructions "Erection, Installation, and Commissioning of the Control System" are completed.

2. All the control instruments will be checked and calibrated by the different companies before they are supplied. The calibration is an optimum 95 % calibration. In most cases this is the best calibration possible, because the calibration is done on a production line. The calibration may afterwards be changed due to transport and weather conditions. The basic calibration is mostly sufficient, because the controller adjustment methods of today only give approximate values. As far as control sections for which the normal basic calibration is not sufficient are concerned,- these may be 4th class control sections.-, it is necessary to carry out a second optimum calibration. This has to be done as described in the operating instructions for the respective instrument.

3. Adjustment of the controller to the control section

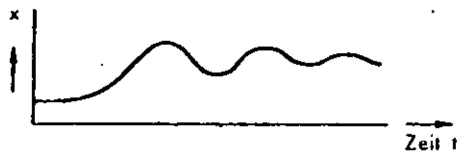
We know different methods of adjusting a controller to the control section. One of the most simple methods which is mostly used is the method found by Ziegler and Nichols. In the most cases, this method brings about the success required. All the methods known give approximate values only, guaranteeing an optimum 90 - 100 % adjustment. It may only be necessary to an unimportant correction not requiring any considerable adjustment. It is not possible to determine a 100 % adjustment of the controller.
When the class of the control section shall be determined, one has often to rely on assumptions, so that in practice there are only approximate reference points for the adjustment available. Even, if the data for similar sections are available, it may be necessary due to differences which cannot be seen from the outside to have different adjustments of control sections which are equal for the rest. The methods known up to now to adjust a controller to the control section have been

either been determined by calculation or by tests with certain control systems.

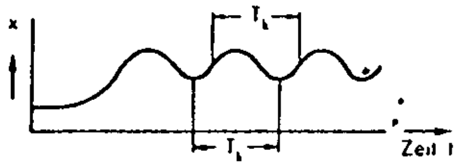
4. Method of Adjusting the Controller

The controller must function as a pure P-controller. For that purpose, the Tn-throttle (integral action) has to be closed and the Tv-throttle (derivative action) has to be opened. If the derivative action is not existing, it is not necessary to open the Tv-throttle. Subsequently you adjust a larger P-range (proportional) of approximately 500 %. With this position of the controller, you now have to cause a sudden disturbance by changing the set-point. As a result of this action, the control value (actual value) which has to be seen on the recorder, will change. Shown in a sketch, this will presumably look like figure "a".

a)



b)



Then, the proportional band will be changed in a downward direction and a disturbance is repeatedly caused by changing the set-point until the recorder fig. "b" shows the control value. Now, the critical P-range Xpk is reached. This critical P-range can be read at the P-range adjustment of the controller. The value resulting will be multiplied by two and , thus, the P-range to be adjusted is determined.

The whole time for the curve Tk as shown on fig. "b" will be multiplied by 0.85, thus, determining the reset time Tn. To find out the D-action (derivative time), Tk will be multiplied by 0.5.

The above-described method should lead to a good adjustment of the controllers.

H) ASSEMBLY AND ADJUSTMENT OF POSITIONER CONTROLLERS

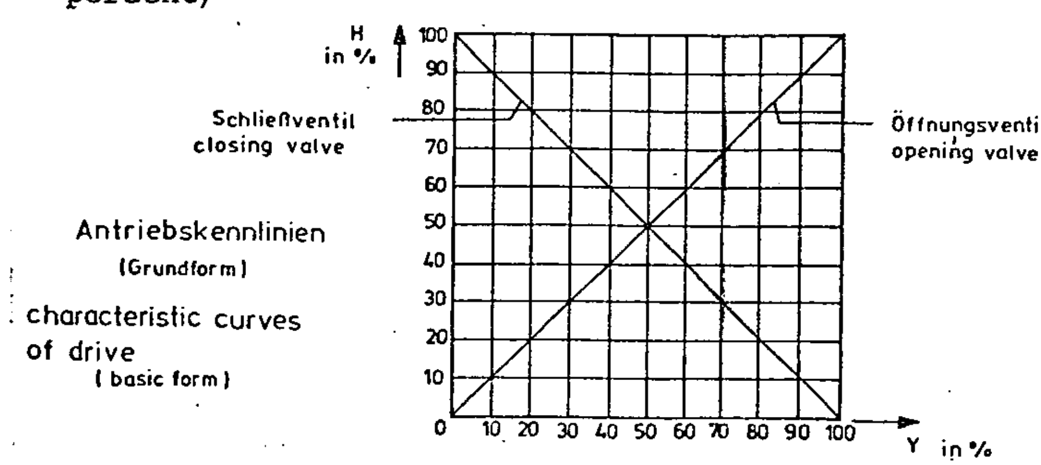
The positioner controller is a proportional follow-up controller. The output signal of the process controller is the input signal of the positioner and thus it can at the same time be considered the nominal value for the follow-up control loop - in our case the positioner controller.

The positioner controller shall be installed as described in the assembly instructions attached. The assembly instructions always refer to a certain make. When the positioner controller is installed at the correcting element, it will have to be adjusted. Please follow the below stated sequence.

1. Open the supply air valve and check the air pressure. The correct supply air pressure can be taken from the type plate of the respective instrument. If the pressure is not stated, choose a pressure of 4 bar g.

2. The action type of the positioner controller depends on the required safety position of the correcting element.

3) The input signal for the positioner can either be an electric or a pneumatic signal - depending on the controller make installed. By means of the range and zero point devices the positioner must be adjusted such that the correcting element is closed or opened - depending on the action chosen - by 25 % when the input signal is 25 %. With an input signal of 50 %, the correcting element must be opened by 50 %. With an input signal of 75 %, the correcting element must either be opened or closed by 75 % - depending on the type of action chosen. When the instrument is adjusted, check all fastening elements once again and control the correcting range. (For a better understanding, please see the explanation to the diagram. H = lift of the correcting element, y = input value for the positioner. H + y indicated in percent)



G) ASSEMBLY OF SHUT-OFF AND CONTROL FLAPS

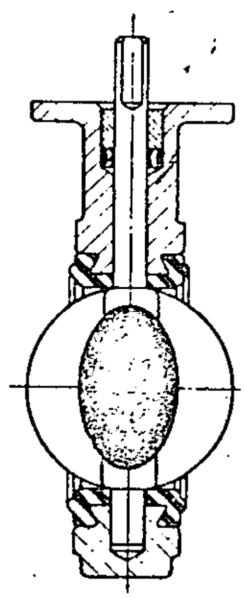
General

Flaps will be installed between the tube flanges. As the flap disc is centrically located, the flaps can be installed independently from the throughput direction. Total solids containing media form exceptions. For those media we recommend to install the flap with horizontal shaft with the lower half of the flap opening in the throughput direction.

If the seat ring of the flap is provided with a sealing lip, which is simultaneously forming a flange joint, it is not permitted to use additional flange gaskets.

Installation

The flap will be shifted inbetween the flanges; at this time the flap is almost closed (30°). The flanges should be drawn asunder so that the flap can easily be installed with clearance. Afterwards, the flange screws will be inserted and the flap centered as well as adjusted. After a test switching the screws will be tightened. At new plants the screws will have to be tightened by hand and the flange pinchwelded. The flap will then be dismantled again and the flange weld completed. Only after the flange has cooled down, will the flap be assembled again between the flanges. Before the flange screws are equally tightened, a test switching shall guarantee that the flap disc can move in the connection flange. Orientation means are key surfaces and the feather nut of the flap shaft resp., they must always lie in parallel to the flap disc.



Einbaudarstellung — Klappe 30° geöffnet   view of installation — flap 30° opened

12

Benennung: description: Meß _ und Regelstückliste piece list for measuring and control equipment	WIEGAND Karlsruhe GmbH D-7505 Ettlingen
	Kom. 2590-75-83.01 Job No. 520-83-83.01 Maelor
	Blatt: page: 1 von: of:

Proj. Ing.	Bearbeiter responsible:	Datum: date	Zeich. Nr. drwg. no.
Engelhardt	Hellmuth	7/11/84	157-393-4

Schrankausführung: execution of the panel:	L: Wiegand Lager B: bestellt — Index unter Bemerkung
Steuerspannung: control voltage:	Fließbild: mimic diagram: Zeichnung Nr.: drawing no.: ~~-383-0-~~
Betriebsspannung: operation voltage:	Elektr. Bedienungselemente: electr. switches and buttons:
Zuluft: inlet air:	Besonderheiten: particularities:

Änderung alteration	Datum date	Kommission Job No.	Bearbeiter responsible	Blatt page

Pos. item	Stück quty	Benennung description	Blatt page	Zeichnung drawing	Lieferung supply
		PIC 1 main steam control			
		FIC 2 feed control			
		TIC 3 temperature control			
		TIC 4 temperature control			
		PIC 5 vacuum control			
		DIC 6 concentration control			
		LIC 7 level control Peeco J			
		float balance tank			
		TR 8 temperature recording			

Benennung description **Meß. und Regelstückliste** piece list for measuring and control equipment	WIEGAND Karlsruhe GmbH D-7505 Ettlingen Kom. 2590-75-83.01 Job No. 520-83-83.01 Maelor Blatt page 2

Proj.Ing.	Bearbeiter responsible	Datum date	Zeichn. Nr. drwg. no.
Engelhardt	Hellmuth	7/11/84	157-393-4

Pos. item	Stück quty	Benennung description	Blatt page	Zeichnung drawing	Lieferung supply
		CISA 9 condensate supervision			
		HS 10 control (gating)			
		LSA 11 level supervision			
		TIA 12 temperature supervision			
		XIAS 12 vibration control (fan)			
		LS 13 supervision of service water			
		PIC 1[illegible] steam control (sealing steam/fan)			
		FIC 15 feed control			
		TIC 16 temperature control			
		PIC 17 vacuum control			
		DIC 18 control of the concentration (high-concentrator)			

Benennung description		WIEGAND Karlsruhe GmbH D-7505 Ettlingen
Meß. und Regelstückliste piece list for measuring and control equipment		Kom. Job No. 2590-75-83.01 520-83-83.01 Maelor
		Blatt page 3
Proj. Ing. Engelhardt	Bearbeiter responsible Hellmuth	Datum date 7/11/84	Zeichn. Nr. drwg. no. 157-393-4

Pos. item	Stück quty	Benennung description	Blatt page	Zeichnung drawing	Lieferung supply
		LIC 19 level control Hicoj			
		(float balance tank)			
		LIC 20 level control			
		LIC 21 level control			
		TR 22 temperature recording			
		CISA 23 condensate supervision			
		HS 24 Control			
		26 - supply air reducing station			
		list of materials for assembly			
		LI 28 - level control float balance tank			
		29 - control panel			

Benennung description		Kom. 2590-75-83.01 Job No. 520-83-83.01 MAELOR
Meß- und Regelstückliste piece list for measuring and control equipment		Blatt page 4
Proj. Ing. Engelhardt	Bearbeiter responsible Hellmuth / Datum date 7/11/84	Zeichn Nr drwg no 157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
		PIC 1 main steam control			
1.01	1	meas. transducer for pressure	Foxboro		
		meas. range: 0 - 10 bar			
		output: 4 - 20 mA			
		type: 821GM-IK1NM2			
		connection: R 1/2"			
1.04	1	I/P transformer	Foxboro		
		input: 4 - 20 mA			
		output: 0,2 - 1,0 bar			
		aux. energy: 1,4 bar			
		type: E69R-J2/CS-E/FN-A			
1.05	1	diaphragm control valve DN 80,	Samson	241	
		PN 16			
		Kvs			
1.06	1	positioner	Samson	765	
		input: 0,2 - 1 bar			
		supply air: 4 bar			
		at input 0,2 bar: valve closed			

Benennung / description		
Meß- und Regelstückliste	WIEGAND	
piece list for measuring and control equipment	Kom. / Job No. 2590-75-83.01 / 520-83-83.01	MAELOR
	Blatt / page 5	

Proj. Ing.	Bearbeiter / responsible	Datum / date	Zeichn Nr / drwg no
Engelhardt	Hellmuth	7/11/84	157-393-4

Pos / item	Stück / quty	Benennung / description	Fabrikat / make	Type / type	Bemerkung / remarks
		FIC 2 feed control			
2.01	1	flow pick-up DN 50, PN	Foxboro		
		meas. range: 0 - 40 m³/hr			
		aux. energy: 110 V, 50 cycles			
		model: 2802-SAZD-TSF-G			
2.02	1	meas. transducer	Foxboro		
		meas. range: 0 - 40 m³/hr			
		aux. energy: 110 V, 50 cycles			
		model: 896-SA-AE/ with pulse			
		output : 1 pulse / 100 l			
2.03	10m	signal cable			
2.04	1	I/P transformer	Foxboro		
		input: 4 - 20 mA			
		output: 0,2 - 1 bar			
		aux. energy: 1,4 bar			
		type: identical to item 1.04			

Benennung description		Meß- und Regelstückliste piece list for measuring and control equipment	WIEGAND		
			Kom. 2590-75-83.01 Job No. 520-83-83.01	MAELOR	
			Blatt page 6		
Proj. Ing. Engelhardt		Bearbeiter responsible Hellmuth / Datum date 7/11/84	Zeichn Nr drwg no 157-393-4		

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
2.05	1	control flap DN 65, PN 16	Keystone	fig. 9-18	
		coating: EPDM			
		drive: 790-018			
		with mechanical closing limitation			
2.06	1	positioner	Keystone		
		input: 0,2 - 1 bar			
		flap opened at input 1 bar			
		aux. energy: 4 bar			
		order no. 43-101-002			
		item 2.06 mounted to item 2.05			

Benennung
description

Meß- und Regelstückliste

piece list for measuring and control equipment

Kom. 2590-75-83.01 MAELOR
Job No. 520-83-83.01

Blatt
page 7

Proj. Ing.	Bearbeiter responsible	Datum date	Zeichn Nr drwg no
Engelhardt	Hellmuth	7/11/84	157-393-4

Pos item	Stück qnty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
		TIC 3 - temperature control			
3.01	1	resistance thermometer	Degussa	PT 100	
		connection R 1/2"			
3.02	1	R/I transformer	Foxboro		
		measuring range: 0 - 40 °C			
		aux. energy: 110 V, 50 cycles			
		output: 4 - 20 mA			
		type: E94G64B			
3.04	1	I/P transformer	Foxboro		
		input: 4 - 20 mA			
		output: 0,2 - 1 bar			
		aux. energy: 1,4 bar			
		type: identical to item 1.04			
3.05	1	diaphragm control valve DN 32,	Samson	241	
		PN 16			
		Kvs 16			
3.06	1	positioner	Samson	765	
		input: 0,2 - 1 bar			
		supply air: 4 bar			
		at input 0,2 bar: valve opened			

Benennung description		WIEGAND
Meß- und Regelstückliste piece list for measuring and control equipment		Kom. 2590-75-83.01 Job No. 520-83-83.01 MAELOR
		Blatt page 8
Proj. Ing. Engelhardt	Bearbeiter responsible Hellmuth	Datum date 7/11/84
		Zeichn Nr drwg no 157-393-4

Pos item	Stück qnty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
		TIC 4 temperature control			
4.01	1	resistance thermometer	Degussa	PT 100	
		connection R 1/2"			
4.02	1	R/I transformer	Foxboro		
		meas. range: 0 - 100 °C			
		aux. energy: 110 V, 50 cycles			
		output: 4 - 20 mA			
		type: identical to item 3.02			
4.04	1	I/P transformer	Foxboro		
		input: 4 - 20 mA			
		output: 0,2 - 1 bar			
		aux. energy: 1,4 bar			
		type: identical to item 1.04			
4.05	1	diaphragm control valve DN	Samson	241	
		PN			
		Kvs			
4.06	1	positioner	Samson	765	
		input: 0,2 - 1 bar			
		supply air: 4 bar			
		at input 0,2 bar: valve closed			

Benennung description		WIEGAND
Meß- und Regelstückliste piece list for measuring and control equipment		Kom. 2590-75-83.01 Job No. 520-83-83.01 MAELOR
		Blatt page 9
Proj. Ing. Engelhardt	Bearbeiter responsible Hellmuth	Datum date 7/11/84	Zeichn Nr drwg no 157-393-4

Pos item	Stück qnty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
		PIC 5 vacuum control			
5.01	1	abs. pressure meas. transducer	Foxboro		
		meas. range: 0 - 300 mbar			
		output: 4 - 20 mA			
		connection: R 1/2"			
		type: 821ALIK1NM2			
5.04	1	I/P transformer	Foxboro		
		input: 4 - 20 mA			
		output: 0,2 - 1 bar			
		aux. energy: 1,4 bar			
		type: identical to item 1.04			
5.05	1	control flap DN 150, PN 10	Keystone	fig.9-18	
		drive: 790-036			
		coating: EPDM			
5.06	1	positioner	Keystone	43101002	
		input: 0,2 - 0,6 bar			
		aux. energy: 4 bar			
		at input 0,6 bar: flap closed			
5.07	1	like item 5.05 DN 50			
		drive: 790-012			
5.08	1	like item 5.06 input 0,6 - 1,0 bar output at 1,0 bar			

Benennung description					WIEGAND
Meß- und Regelstückliste					Kom. / Job No. 2590-75-83.01 / 520-83-83.01 MAELOR
piece list for measuring and control equipment					Blatt / page 10
Proj. Ing. Engelhardt	Bearbeiter / responsible Hellmuth		Datum / date 7/11/84		Zeichn Nr / drwg no 157-393-4

Pos item	Stück qty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
		DIC 6 - control of the			
		concentration			
6.01	1	densitymeter	Fisher		
		type: Gravitrol Mark V			
		meas. range: 1,05 - 1,2 kg/l			
		aux. energy: 1,4 bar			
		output: 0,2 - 1 bar			
		process connection: flange 1"			
6.02	1	P/I transformer	Foxboro		
		input: 0,2 - 1,0 bar			
		output: 4 - 20 mA			
		aux. energy: 110 V, 50 cycles			
		type: E92-RFN 6I			

Benennung description				WIEGAND
Meß- und Regelstückliste piece list for measuring and control equipment				Kom. / Job No. 2590-75-83.01 / 520-83-83.01 MAELOR; Blatt / page 11
Proj. Ing. Engelhardt	Bearbeiter responsible Hellmuth	Datum date 7/11/84		Zeichn Nr drwg no 157-393-4

Pos item	Stück qnty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
		LIC 7 level control			
		float balance tank			
7.01	1	level transmitter	Valmet		
		meas. range: 0 - 2,5 m WG			
		supply air: 1,4 bar			
		output signal: 0,2 - 1 bar			
		DN 80, PN 16			
7.02	1	P/I transformer	Foxboro		
		input: 0,2 - 1,0 bar			
		output: 4 - 20 mA			
		aux. energy: 110 V, 50 cycles			
		type: identical to item 6.02			
7.04	1	I/P transformer	Foxboro		
		input: 4 - 20 mA			
		output: 0,2 - 1 bar			
		aux. energy: 1,4 bar			
		type: identical to item 1.04			
7.05	1	control flap (condensate)	Keystone	fig.9-18	
		DN 65; PN 10			
		drive: 790-018			
		coating: EPDM			

Benennung description		Meß- und Regelstückliste piece list for measuring and control equipment	WIEGAND
			Kom. 2590-75-83.01 MAELOR Job No. 520-83-83.01
			Blatt page 12

Proj. Ing.	Bearbeiter responsible	Datum date	Zeichn Nr drwg no
Engelhardt	Hellmuth	7/11/84	157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
7.06	1	positioner	Keystone		
		input: 0,2 - 0,6 bar			
		aux. energy: 4 bar			
		at input 0,6 bar: flap closed			
7.07	1	I/P transformer	Foxboro		
		input: 4 - 20 mA			
		output: 0,2 - 1 bar			
		aux. energy: 1,4 bar			
		type: identical to item 1.04			
7.08	1	control flap (product)	Keystone	fig.9-18	
		DN 65, PN 10			
		drive: 790-018			
		lining : EPDM			
7.09	1	positioner	Keystone	43101002	
		input: 0,6 - 1,0 bar			
		aux. energy: 4 bar			
		at input 1,0 bar: flap closed			

Benennung description	Kom. Job No.	2590-75-83.01 520-83-83.01 MAELOR
# Meß- und Regelstückliste piece list for measuring and control equipment	Blatt page	13

Proj. Ing.	Bearbeiter responsible	Datum date	Zeichn Nr drwg no
Engelhardt	Hellmuth	7/11/84	157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
		TR 8 - temperature recording			
8.01-	8	resistance thermometers	Degussa		
8.08		PT 100			
8.09	1	resistance thermometer	Degussa		
		PT 100			
8.10	1	R/J transducer for rack mounting	Foxboro		
		model _E94G 64B			
		0 - 100 °C			
		output: 4 - 20 mA			
8.11	1	like item 8.10			
8.12	1	" " "			
8.13	1	" " "			
8.14	1	" " "			
8.15	1	" " "			
8.16	1	" " "			
8.17	1	" " "			
8.18	1	" " "			

Benennung description	Meß- und Regelstückliste piece list for measuring and control equipment	WIEGAND
		Kom. / Job No. 2590-75-83.01 / 520-83-83.01 MAELOR
		Blatt / page 14

Proj. Ing.	Bearbeiter responsible	Datum date	Zeichn Nr drwg no
Engelhardt	Hellmuth	7/11/84	157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
		CISA 9 condensate supervision			
9.01	1	conductivity measuring cell	Foxboro		
		temperature: 10 - 80 °C			
		model: 871CC-A2			
9.02	1	conductivity meas. trandsducer	Foxboro		
		measuring range: 0 - 100 µS			
		aux. energy: 110 V, 50 cycles			
		output: 4 - 20 mA			
		type: 870CC-10-P			
9.03	3	4-way solenoid valve	Bürkert	420G	
		gating: 24 V DC			
		with mounting plate			
9.05	1	on/off flap			
		gating air/air			
		DN 50			
		with acknowledgement at position			
		open and closed			
		approximation initiators	Turk		
		type: BJ-5-S18-AP-6-X			
		with 6 m connecting cable			

Benennung description			Meß- und Regelstückliste piece list for measuring and control equipment	WIEGAND Karlsruhe GmbH		
				Kom. Job No. 2590-75-83.01 520-83-83.01 MAELOI	Blatt page 15	
Proj. Ing. Engelhardt	Bearbeiter responsible Hellmuth		Datum date 7/11/84	Zeichn Nr drwg no 157-393-4		

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
9.06	1	on/off flap			
		gating air/air			
		DN 50			
		with acknowledgement at position			
		open and closed			
		approximation initiators	Türk		
		type: BJ-5-S18-AP-6-X			
		with 6 m connecting cable			
9.07	1	on/off flap			
		gating air/air			
		DN 50			
		with acknowledgement at position			
		open and closed			
		approximation initiators	Turk		
		type: BJ-5-S18-AP-6-X			
		with 6 m connecting cable			

Benennung
description

Meß- und Regelstückliste

piece list for measuring and control equipment

WIEGAND

Kom. / Job No.	2590-75-83.01 / 520-83-83.01	MAELOR
Blatt / page	16	

Proj. Ing.	Bearbeiter / responsible	Datum / date	Zeichn Nr / drwg no
Engelhardt	Hellmuth	7/11/84	157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
9.08	1	on/off flap			
		gating air/air			
		DN 25			
		with acknowledgement at			
		position open and closed			
		approximation initiators	Turk		
		type: BJ-5-S18-AP-6-X			
		with 6 m connecting cable			

Benennung description		Kom. 2590-75-83.01 Job No. 520-83-83.01 MAELOR
Meß- und Regelstückliste piece list for measuring and control equipment		Blatt page 17
Proj. Ing. Engelhardt	Bearbeiter responsible Hellmuth; Datum date 7/11/84	Zeichn Nr drwg no 157-393-4

Pos item	Stück qnty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
		HS 10 - Control			
10.01	1	inclined seat valve	Bürkert		
		casing VA, DN 3/4"			
		spring: opening			
10.01.2	1	4-way solenoid valve	Bürkert	420G	
		gating: 24 V DC			
		with mounting plate			
10.02	1	inclined seat valve	Bürkert		
		casing VA, DN R 3/4"			
		spring: opening			
10.02.2	1	4-way solenoid valve	Bürkert	420 G	
		gating: 24 V DC			
		with mounting plate			
10.03	1	inclined seat valve	Bürkert		
		casing VA, DN R 1/2"			
		spring: opening			
10.03.2	1	4-way solenoid valve	Bürkert	420 G	
		gating: 24 V DC			
		with mounting plate			

Benennung description	Meß- und Regelstückliste piece list for measuring and control equipment		WIEGAND
			Kom. Job No. 2590-75-83.01 520-83-83.01 MAELOR
			Blatt page 18
Proj. Ing. Engelhardt	Bearbeiter responsible Hellmuth	Datum date 7/11/84	Zeichn Nr drwg no 157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
10.04.2	1	4-way solenoid valve	Bürkert	420G	
		gating: 24 V DC			
		with mounting plate			
10.04	1	on/off flap			
		gating: air/air			
		DN 40			
		with acknowledgement at			
		position open and closed			
		approximation initiators	Turk		
		type: BJ-5-S18-AP-6-X			
		with 6 m connecting cable			

Benennung description		Meß- und Regelstückliste piece list for measuring and control equipment	WIEGAND		
Proj. Ing. Engelhardt	Bearbeiter responsible Hellmuth	Datum date 7/11/84	Kom. Job No. 2590-75-83.01 520-83-83.01 MAELOR	Blatt page 19	Zeichn Nr drwg no 157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
10.05.2	1	4-way solenoid valve	Bürkert	420 G	
		gating: 24 V DC			
		with mounting plate			
10.05	1	on/off flap			
		gating: air/air			
		DN 40			
		with acknowledgement at			
		position open and closed			
		approximation initiators	Turk		
		type: BJ-5-S18-AP-6-X			
		with 6 m connecting cable			

Benennung description		Meß- und Regelstückliste piece list for measuring and control equipment	WIEGAND	
			Kom. Job No. 2590-75-83.01 520-83-83.01	MAELOR
			Blatt page 20	

Proj. Ing.	Bearbeiter responsible	Datum date	Zeichn Nr drwg no
Engelhardt	Hellmuth	7/11/84	157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
10.06.2	1	4-way solenoid valve	Bürkert	420 G	
		gating: 24 V DC			
		with mounting plate			
10.06	1	on/off flap			
		gating air/air			
		DN 40			
		with acknowledgement at			
		position open and closed			
		approximation initiators	Turk		
		type: BJ-5-S18-AP-6-X			
		with 6 m connecting cable			

Benennung
description

Meß- und Regelstückliste

piece list for measuring and control equipment

WIEGAND

Kom. 2590-75-83.01
Job No. 520-83-83.01 MAELOR

Blatt / page 21

Proj.Ing. Engelhardt

Bearbeiter / responsible Hellmuth

Datum / date 7/11/84

Zeichn Nr / drwg no 157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
10.08.2	1	4-way solenoid valve	Bürkert	420 G	
		gating: 24 V DC			
		with mounting plate			
[illegible]0.08	1	on/off flap			
		gating air/air			
		DN 40			
		with acknowledgement at			
		position open and closed			
		approximation initiators	Türk		
		type: BJ-5-S18-AP-6-X			
		with 6 m connecting cable			

Benennung
description

Meß- und Regelstückliste

piece list for measuring and control equipment

WIEGAND

Kom. 2590-75-83.01
Job No. 520-83-83.01 MAELOR

Blatt
page 22

Proj.Ing. Engelhardt | Bearbeiter responsible Hellmuth | Datum date 7/11/84

Zeichn Nr
drwg no 157-393-4

Pos item	Stück qnty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
10.09.2	1	4-way solenoid valve	Bürkert	420 G	
		gating: 24 V DC			
		with mounting plate			
10.09	1	on/off flap			
		gating air/air			
		DN 40			
		with acknowledgement at			
		position open and closed			
		approximation initiators	Türk		
		type: BJ-5-S18-AP-6-X			
		with 6 m connecting cable			

Benennung description		
Meß- und Regelstückliste piece list for measuring and control equipment	WIEGAND	
	Kom. Job No.	2590-75-83.01 520-83-83.01 MAELOR
	Blatt page	23

Proj. Ing.	Bearbeiter responsible	Datum date	Zeichn Nr drwg no
Engelhardt	Hellmuth	7/11/84	157-393-4

Pos item	Stück qty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
10.10.2	1	4-way solenoid valve	Bürkert	420 G	
		gating: 24 V DC			
		with mounting plate			
[illegible].10	1	on/off flap			
		gating air/air			
		DN 40			
		with acknowledgement at			
		positions open and closed			
		approximation initiators	Turk		
		type: BJ-5-S18-AP-6-X			
		with 6 m connecting cable			

Benennung description		WIEGAND
Meß- und Regelstückliste piece list for measuring and control equipment		Kom. 2590-75-83.01 Job No. 520-83-83.01 MAELOR
		Blatt page 24
Proj. Ing. Engelhardt	Bearbeiter responsible Hellmuth	Datum date 7/11/84	Zeichn Nr. drwg no 157-393-4.

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
10.11.2	1	4 way solenoid valve	Bürkert	420 G	
		gating: 24 V DC			
		with mounting plate			
10.11	1	on/off angle valve	Alfa Laval		
		gating: opening by air			
		DN 40			
		with acknowledgement at positions			
		open and closed			
		approximation initiators	Turk		
		type: BJ-5-S18-AP-6-X			
		with 6m connecting cable			

Benennung description		Kom. Job No.	2590-75-83.01 520-83-83.01 MAELOR
Meß- und Regelstückliste piece list for measuring and control equipment		Blatt page	25
Proj. Ing. Engelhardt	Bearbeiter responsible Hellmuth	Datum date 7/11/84	Zeichn Nr drwg no 157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
10.12	1	on/off angle valve	Alfa Laval		
		gating: opening by air			
		DN 40			
		with acknowledgement at			
		positions on and off			
		approximation initiators	Turk		
		typ: BJ-5-S18-AP-6X			
		with 6 m connecting cable			

Benennung description	WIEGAND
Meß- und Regelstückliste piece list for measuring and control equipment	Kom. 2590-75-83.01 MAELOR Job No. 520-83-83.01
	Blatt page 26
Proj. Ing. Engelhardt / Bearbeiter responsible Hellmuth / Datum date 7/11/84	Zeichn Nr drwg no 157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
10.13	1	on/off angle valve	Alfa Laval		
		gating: opening by air			
		DN 40			
		with acknowledgement at			
		positions on and off			
		approximation initiators	Turk		
		typ: BJ-5-S18-AP-6-X			
		with 6 m connecting cable			

Benennung description					WIEGAND
Meß- und Regelstückliste					Kom. 2590-75-83.01 MAELOR
piece list for measuring and control equipment					Job No. 520-83-83.01
					Blatt page 27
Proj. Ing. Engelhardt	Bearbeiter responsible Hellmuth	Datum date 7/11/84			Zeichn Nr drwg no 157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
10.14.2	1	4-way solenoid valve	Bürkert	420 G	
		gating: 24 V D.C.			
		with mounting plate			
10.14	1	on/off angle valve	Alfa Laval		
		gating: opening by air			
		DN 40			
		with acknowledgement at			
		positions on and off			
		approximation initiators	Turk		
		type: BJ-5-S18-AP-6-X			
		with 6 m connecting cable			

Benennung description			
Meß- und Regelstückliste piece list for measuring and control equipment		WIEGAND	
		Kom. Job No.	2590-75-83.01 520-83-83.01 MAELOR
		Blatt page	28
Proj. Ing. Engelhardt	Bearbeiter responsible Hellmuth	Datum date 7/11/84	Zeichn Nr drwg no 157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
10.15.2	1	4-way solenoid valve	Bürkert	420 G	
		gating: 24 V D.C.			
		with mounting plate			
10.15	1	on/off flap			
		gating: air/air			
		DN 25			
		with acknowledgement at			
		positions on and off			
		approximation initiators	Turk		
		type: BJ-5-S18-AP-6-X			
		with 6.m connecting cable			

Benennung description	Meß- und Regelstückliste measuring control piece list		WEIGAND Karlsruhe GmbH D-7505 Ettlingen
			Kom 2590-75-83.01 520-83-83.01
			Blatt page 28a von of
Proj. Ing. Engelhardt	Bearbeiter responsible Hellmut	Datum date 7/11/84	Zeichn Nr drwg no 157-393-4

Pos item	Stück piece	Benennung description	Fabrikat make	Type type	Bemerkung note
10.20.2	1	4-way solenoid valve	Bürkert	420 G	
		gating: 24 V D.C.			
		with mounting plate			
10.20	1	on/off (inclined seat) valve	Bürkert		
		VA DN R 1"			
		opening by air			

Benennung
description

Meß- und Regelstückliste

piece list for measuring and control equipment

WIEGAND

Kom. 2590-75-83.01
Job No. 520-83-83.01 MAELOR

Blatt 29
page

Proj.Ing. Engelhardt | Bearbeiter responsible Hellmuth | Datum date 7/11/84 | Zeichn Nr drwg no 157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
10.21.2	1	4-way solenoid valve	Bürkert	420 G	
		gating: 24 V D.C.			
		with mounting plate			
10.21	1	on/off flap			
		gating: air/air			
		DN 50			
		with acknowledgement at			
		positions on and off			
		approximation initiators	Turk		
		type: BJ-5-S18-AP-6-X			
		with 6 m connecting cable			

Benennung description	Meß- und Regelstückliste piece list for measuring and control equipment	WIEGAND Kom. 2590-75-83.01 Job No. 520-83-83.01 MAELOR Blatt page 30
Proj. Ing. Engelhardt	Bearbeiter responsible Hellmuth | Datum date 7/11/84	Zeichn Nr drwg no 157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
10.22.2	1	4-way solenoid valve	Bürkert	420 G	
		gating: 24 V D.C.			
		with mounting plate			
10.22	1	on/off flap			
		gating: air/air			
		DN 40			
		with acknowledgement at			
		positions on and off			
		approximation initiators	Turk		
		type: BJ-5-S18-AP-6-X			
		with 6 m connecting cable			

Benennung
description

Meß- und Regelstückliste

piece list for measuring and control equipment

WIEGAND

Kom. 2590-75-83.01 MAELOR
Job No. 520-83-83.01

Blatt 31
page

Proj. Ing.	Bearbeiter responsible	Datum date	Zeichn Nr drwg no
Engelhardt	Hellmuth	7/11/84	157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
10.23.2	1	4-way solenoid valve	Bürkert	420 G	
		gating: 24 V D.C.			
		with mounting plate			
10.23	1	on/off valve (inclined seat valve)	Bürkert		
		VA DN R 1"			
		opening by air			

Benennung
description

Meß- und Regelstückliste

piece list for measuring and control equipment

WIEGAND

Kom. / Job No.	2590-75-83.01 / 520-83-83.01 MAELOR
Blatt / page	32
Zeichn Nr / drwg no	157-393-4

Proj. Ing.	Bearbeiter / responsible	Datum / date
Engelhardt	Hellmuth	7/11/84

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
10.24.2	1	4-way solenoid valve	Bürkert	420 G	
		gating: 24 V D.C.			
		with mounting plate			

Benennung description	Meß- und Regelstückliste / piece list for measuring and control equipment	WIEGAND	Kom. / Job No. 2590-75-83.01 / 520-83-83.01 MAELOP
			Blatt / page 33
Proj. Ing. Engelhardt	Bearbeiter / responsible Hellmuth	Datum / date 7/11/84	Zeichn Nr / drwg no 157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
10.24	1	on/off valve	Samson	241	
		DN 50, PN 16, Kvs max.			
		casing: grey cast			
		drive: 240 cm^2			
		closing by spring towards 10 bar			

Benennung
description

Meß- und Regelstückliste

piece list for measuring and control equipment

WIEGAND

Kom. 2590-75-83.01 MAELOR
Job No. 520-83-83.01

Blatt page 34

Proj. Ing. Engelhardt | Bearbeiter responsible Hellmuth | Datum date 7/11/84 | Zeichn Nr drwg no 157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
10.25	1	hand flap with acknowledgement			
		at position, closed			
		approximation initiator			
		type: BJ - 5 - s18 - AP-6-X	Turk		
		with 6 m connecting cable			

Benennung description						
Meß- und Regelstückliste				WIEGAND		
piece list for measuring and control equipment				Kom. 2590-75-83.01 / Job No. 520-83-83.01	MAELOR	
				Blatt page 35		
Proj. Ing. Engelhardt	Bearbeiter responsible Hellmuth	Datum date 7/11/84		Zeichn Nr drwg no 157-393-4		

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
		LSA 11 Level Control			
11.01	1	Level switch	Alfa Laval		

Benennung description		Meß- und Regelstückliste piece list for measuring and control equipment	WIEGAND		
			Kom. 2590-75-83.01 MAELOR Job No. 520-83-83.01		
			Blatt page 36		
Proj. Ing. Engelhardt		Bearbeiter responsible Hellmuth / Datum date 7/11/84	Zeichn Nr drvg no 157-393-4		

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
		TIA 12 Temperature Supervision			
		XIAS 12 Vibration Control			
		(Fan)			
12.01	1	resistance thermometer	Degussa		
		identical to item 8.01			
12.02	1	R/J transducer identical to	Foxboro		
		item 8.10			
12.03	1	resistance thermometer	Degussa		
		identical to item 8.01			
12.04	1	R/J transducer	Foxboro		
		identical to item 8.10			
12.05	1	vibration control	Schenk		delivery by fan
					supplier
		relay K 1206 shut-off			

Benennung description	Meß- und Regelstückliste piece list for measuring and control equipment	WIEGAND	
		Kom. / Job No.	2590-75-83.01 / 520-83-83.01 MAELOR
		Blatt / page	37

Proj. Ing.	Bearbeiter responsible	Datum date	Zeichn Nr drwg no
Engelhardt	Hellmuth	7/11/84	157-393-4

Pos item	Stück qnty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
		LS 13 Supervision of the			
		Service Water			
13.01	1	electrode	RUF	HR-611111	
		connection: R 1/2"			
13.02	1	electrode relay	EXNER	ER3a5kOHM	
		auxiliary energy: 24 V/A.C.			
		output: relay			
13.03	1	identical to item 13.01			
13.04	1	identical to item 13.02			
13.05	1	identical to item 13.01			
13.06	1	identical to item 13.02			
13.07	1	identical to item 13.01			
13.08	1	identical to item 13.02			
13.02.1	1	tension supply unit			

Benennung description		Kom. / Job No.	
Meß- und Regelstückliste piece list for measuring and control equipment		2590-75-83.01 / 520-83-83.01	MAELOR
		Blatt page	38
Proj. Ing. Engelhardt	Bearbeiter responsible Hellmuth	Datum date 7/11/84	Zeichn Nr drwg no 157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
		PIC 14 Steam Control			
		(Sealing Steam/Fan)			
14.01	1	measuring transducer for	FOXBORO		
		pressure			
		meas. range: 0 - 10 bar			
		output: 4 - 20 mA			
		type: 821GM-IK1NM2			
		connection: R 1/2"			
14.04	1	I/P transformer	FOXBORO		
		input: 4 - 20 mA			
		output: 0.2 - 1.0 bar			
		auxiliary energy: 1.4 bar			
		type: identical to item 1.04			
14.05	1	diaphragm control valve DN 25,	SAMSON	241	
		PN 16, Kvs			
14.06	1	positioner	SAMSON	765	
		input: 0.2 - 1 bar			
		supply air: 4 bar			
		at an input of 0,2 bar the			
		valve is closed			

Benennung description		Kom. 2590-75-83.01 MAELOR
Meß- und Regelstückliste piece list for measuring and control equipment		Job No. 520-83-83.01
		Blatt page 39
Proj. Ing. Engelhardt	Bearbeiter responsible Hellmuth	Datum date 7/11/84
		Zeichn Nr drwg no 157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
		FIC 15 Feed Control			
15.01	1	flow receiver DN 25; PN 10	FOXBORO		
		meas. range: 0 - 8 m³/hr			
		aux. energy: 110 V, 50 cycles			
		model: 2801-SAZD-TSF-G			
15.02	1	meas. transducer	FOXBORO		
		meas. range 0 - 8 m³/hr			
		aux. energy : 110 V, 50 cycles			
		model: 896-SA-AE			
15.03	10m	signal cable			
15.04	1	I/P transformer	FOXBORO		
		input: 4 - 20 mA			
		aux. energy: 1.4 bar			
		output: 0.2 - 1 bar			
		type: identical to Item 1.04			
15.05	1	diaphragm control valve DN 40	Max v.Rohr		
		PN 16			
		Kvs sanitary			

Benennung description Meß- und Regelstückliste piece list for measuring and control equipment			WIEGAND Kom. 2590-75-83.01 Job No. 520-83-83.01 MAELOR Blatt page 40
Proj. Ing. Engelhardt	Bearbeiter responsible Hellmuth	Datum date 7/11/84	Zeichn Nr drwg no 157-393-4

Pos item	Stück qnty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
15.06	1	positioner			
		input: 0.2 - 1 bar			
		supply air: 4 bar			
		at an input of 0.2 bar the valve			
		is open			

Benennung description			
Meß- und Regelstückliste piece list for measuring and control equipment	WIEGAND		
	Kom. / Job No.	2590-75-83.01 / 520-83-83.01	MAELOR
	Blatt / page	41	
Proj. Ing. Engelhardt	Bearbeiter / responsible: Hellmuth	Datum / date: 7/11/84	Zeichn Nr / drwg no: 157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
		TIC 16 Temperature Control			
16.01	1	resistance thermometer	Degussa	PT 100	
		connection R 1/2"			
16.02	1	R/I transformer	FOXBORO		
		meas. range: 0 - 50 °C			
		aux. energy: 110 V, 50 cycles			
		output: 4 - 20 mA			
		type: identical to item 8.10			
16.0 4	1	I/P transformer	FOXBORO		
		input: 4 - 20 mA			
		output: 0.2 - 1 bar			
		aux. energy: 1.4 bar			
		type: identical to item 1.04			
16.05	1	control flap DN 125, PN 16	Keystone	Fig.9-18	
		lining : EPDM			
		drive: 790 - 018			
		with mechanical closing limita-			
		tion			

Benennung description				WIEGAND	
Meß- und Regelstückliste				Kom. 2590-75-83.01 Job No. 520-83-83.01	MAELOR
piece list for measuring and control equipment				Blatt page 42	
Proj. Ing. Engelhardt	Bearbeiter responsible Hellmuth	Datum date 7/11/84		Zeichn Nr drwg no 157-393-4	

Pos item	Stück qnty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
16.06	1	positioner	Keystone		
		input: 0.2 - 1,0 bar			
		at an input of 1,0 bar the flap			
		is closed			
		aux. energy: 4 bar			
		serial no. 43-101-002			
		item 16.06 attached to item 16.05			

Benennung description					WIEGAND
Meß- und Regelstückliste					Kom. 2590-75-83.01 MAELOR
piece list for measuring and control equipment					Job No. 520-83-83.01
					Blatt page 43
Proj. Ing. Engelhardt	Bearbeiter responsible Hellmuth	Datum date 7/11/84			Zeichn Nr drwg no 157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
		PIC 17 Vacuum Control			
17.01	1	abs. pressure meas. transducer	Foxboro		
		meas. range: 0 - 300 mbar			
		output: 4 - 20 mA			
		connection: R 1/2"			
		type: 821AL-IK1NM2			
17.04	1	I/P transformer	Foxboro		
		input: 4 - 20 mA			
		output: 0.2 - 1 bar			
		aux. energy: 1.4 bar			
		type: identical to item 1.04			
17.05	1	control flap DN 100, PN 10	Keystone	Fig.9-18	
		drive: 790 - 018			
		lining : EPDM			
17.06	1	positioner	Keystone	43101002	
		input: 0.2 - 0.6 bar			
		aux. energy: 4 bar			
		at an input of 0.6 bar the flap			
		is closed			

Benennung description		Kom. / Job No.	
Meß- und Regelstückliste piece list for measuring and control equipment		2590-75-83.01 / 520-83-83.01	MAELOR
		Blatt / page	44
Proj. Ing. Engelhardt	Bearbeiter / responsible Hellmuth	Datum / date 7/11/84	Zeichn Nr / drwg no 157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
17.07	1	control flap DN 80, PN 10	Keystone	Fig.9-18	
		drive: 790 - 018			
		lining : EPDM			
17.08	1	positioner	Keystone	43101002	
		input: 0.6 - 1 bar			
		aux. energy: 4 bar			
		at an input of 1.0 bar the flap is			
		closed			

Benennung description		Kom. 2590-75-83.01 MAELOR
Meß- und Regelstückliste piece list for measuring and control equipment		Job No. 520-83-83.01
		Blatt page 45
Proj. Ing. Engelhardt	Bearbeiter responsible Hellmuth	Datum date 7/11/84	Zeichn Nr. drwg no 157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
		DIC 18 Concentrate Control			
		(High-Concentrator)			
18.01	1	isotope measuring section DN 65	Berthold	LB379	
18.02	1	meas. amplifier 110 V, 50 cycles	Berthold	LB 379	
		meas. range: 50 - 90 % TS, whey			
		output: 4 - 20 mA			
		with temperature compensation			
		and linearization			
18.04	1	I/P transformer	Foxboro		
		input: 4 - 20 mA			
		output: 0.2 - 1 bar			
		aux. energy: 1.4 bar			
		type identical to 1.04			
18.05	1	diaphragm control valve DN	Samson	241	
		PN Kvs			
18.06	1	positioner, input: 0.2 - 1 bar	Samson	765	
		supply air: 4 bar			
		at an input of 0.2 bar the valve			
		is closed			

Benennung description		
Meß- und Regelstückliste piece list for measuring and control equipment	WIEGAND	Kom. 2590-75-83.01 Job No. 520-83-83.01 MAELOR; Blatt page 46
Proj. Ing. Engelhardt	Bearbeiter responsible Hellmuth	Datum date 7/11/84
Zeichn Nr drwg no 157-393-4		

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
		LIC 19 Level Control			
		Float Balance Tank			
19.01	1	level transmitter	Valmet		
		meas. range: 0 - 2.5 m WG			
		supply air: 1.4 bar			
		output signal: 0.2 - 1 bar			
		DN 80, PN 16			
19.02	1	P/I transformer	Foxboro		
		input: 0.2 - 1 bar			
		output: 4 - 20 mA			
		aux. energy: 110 volts, 50 cycles			
		type: identical to item 6.02			
19.04	1	I/P transformer	Foxboro		
		input: 4 - 20 mA			
		output: 0.2 - 1 bar			
		aux. energy: 1.4 bar			
		type: identical to item 1.04			

Benennung description		Kom. Job No.	2590-75-83.01 520-83-83.01	MAELOR
Meß- und Regelstückliste		Blatt page	47	
piece list for measuring and control equipment				
Proj. Ing. Engelhardt	Bearbeiter responsible Hellmuth	Datum date 7/11/84	Zeichn Nr drwg no	157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
		Hi Con Bagge Tank.			
19.05	1	control flap DN 40, PN 16	Keystone	Fig. 9-18	
		lining : EPDM			
		drive: ~~790-018~~ 024	Actuator.	£370	
		790-024			
19.06	1	positioner	Keystone		
		input: 0.2 - 0.6 bar			
		at an input of 0.6 bar, the flap			
		is closed	Condensate		
		aux. energy: 4 bar			
		serial no. 43-101-002			
		item 19.06 is attached to item			
		19.05 .			
19.07	1	I/P transformer	Foxboro		
		input: 4 - 20 mA			
		output: 0.2 - 1 bar			
		aux. energy: 1.4 bar			

Benennung
description

Meß- und Regelstückliste

piece list for measuring and control equipment

WIEGAND

Kom. 2590-75-83.01 MAELOR
Job No. 520-83-83.01

Blatt
page 48

Proj. Ing.	Bearbeiter responsible	Datum date	Zeichn Nr drwg no
Engelhardt	Hellmuth	7/11/84	157-393-4

Pos item	Stück qnty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
19.08	1	control flap DN 40, PN 16	Keystone	Fig.9-18	
		lining : EPDM			
		drive: 790-018			
		with mechanical closing limitation			
19.09	1	positioner	Keystone		
		input: 0.6 - 1.0 bar			
		at an input of 1 bar the flap			
		is closed	PRODUCT		
		aux. energy: 4 bar			
		serial no. 43-101-002			
		item 19.09 attached to item 19.08			

Benennung description	WIEGAND
Meß- und Regelstückliste piece list for measuring and control equipment	Kom. Job No. 2590-75-83.01 520-83-83.01 MAELOR Blatt page 49

Proj. Ing.	Bearbeiter responsible	Datum date	Zeichn Nr drwg no
Engelhardt	Hellmuth	7/11/84	157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
		LIC 20 Level Control			
20.01	1	measuring transducer for differen-	Taylor		
		tial pressure			
		with attached pressure transmitter			
		DN 80			
		capillary length between meas.			
		transducer and pressure transmitter			
		3 m each			
		diaphragm of the transmitter			
		meas. range: 0 - 300 mm WG			
		aux. energy: 4 - 20 mA			
		output: 4 - 20 mA			
		type: 3423TD10763-01-10-146-DC702			

Benennung description		Kom. Job No.	2590-75-83.01 520-83-83.01	MAELOR
Meß- und Regelstückliste piece list for measuring and control equipment		Blatt page	50	

Proj. Ing.	Bearbeiter responsible	Datum date	Zeichn Nr drwg no
Engelhardt	Hellmuth	7/11/84	157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
		LIC 21 Level Control			
21.01	1	meas. transducer for differential	Taylor		
		pressure			
		with attached pressure transmitter			
		DN 80			
		capillary length between measuring			
		transducer and pressure transmitter			
		3 m each			
		diaphragm of the pressure trans-			
		mitter			
		meas. range: 0 - 300 mm WG			
		aux. energy: 24 V, D.C.			
		output: 4 - 20 mA			
		type: 3423TD10763-01-10-146-DC702			

Benennung description	WIEGAND
Meß- und Regelstückliste piece list for measuring and control equipment	Kom. / Job No. 2590-75-83.01 / 520-83-83.01 MAELOR; Blatt / page 51
Proj. Ing. Engelhardt; Bearbeiter / responsible Hellmuth; Datum / date 7/11/84	Zeichn Nr / drwg no 157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
		TR 22 Temperature Registration			
22.01-					
22.05	5	resistance thermometers	Degussa		
		PT 100			
22.06	1	R/I transformer for rack mounting	Foxboro		
		model E94G6413			
		0 - 100 °C			
		output: 4 - 20 mA			
22.07	1	identical to item 22.06	Foxboro		
22.08	1	" " " "	"		
22.09	1	" " "	"		
22.10	1	" " " "	"		

Benennung description	
Meß- und Regelstückliste piece list for measuring and control equipment	WIEGAND Kom. 2590-75-83.01 MAELOR Job No. 520-83-83.01 Blatt page 52
Proj. Ing. Engelhardt | Bearbeiter responsible Hellmuth | Datum date 7/11/84	Zeichn Nr drwg no 157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
		CISA 23 Condensate Supervision			
23.01	1	conductivity measuring cell	Foxboro		
		temperature: 10 - 80 °C			
		model: 871CC-A2			
23.02	1	conductivity measuring transformer	Foxboro		
		meas. range: 0 - 100 µS			
		aux. energy: 110 volts, 50 cycles			
		output: 4 - 20 mA			
		model: 870CC-10-P			
23.03	3	4-way solenoid valve	Bürkert		
		gating: 24 volts, D.C.			
		with mounting plate			
23.05	1	on/off flap			
		gating: air/air			
		DN 32			
		with acknowledgement at			
		positions on and off			
		approximation initiators	Turk		
		type: BJ-5-S18-AP-6-X			
		with 6 m connecting cable			

Benennung
description

Meß- und Regelstückliste

piece list for measuring and control equipment

WIEGAND

Kom. / Job No. 2590-75-83.01 520-83-83.01 MAELOR

Blatt / page 53

Proj. Ing.	Bearbeiter / responsible	Datum / date	Zeichn Nr / drwg no
Engelhardt	Hellmuth	7/11/84	157-393-4

Pos item	Stück qnty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
23.06	1	on/off flap			
		gating: air/air			
		DN 32			
		with acknowledgement at			
		positions on and off			
		approximation initiators	Turk		
		type: BJ-5-S18-AP-6-X			
		with 6 m connecting cable			
23.07	1	on/off flap			
		gating: air/air			
		DN 32			
		with acknowledgement at positions			
		on and off			
		approximation initiators	Turk		
		type: BJ-5-S18-AP-6-X			
		with 6 m connecting cable			

Benennung description		Kom. Job No.	2590-75-83.01 520-83-83.01	MAELOR
Meß- und Regelstückliste — piece list for measuring and control equipment		Blatt page	54	

Proj. Ing.	Bearbeiter responsible	Datum date	Zeichn Nr drwg no
Engelhardt	Hellmuth	7/11/84	157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
23.08	1	on/off flap			
		gating: air/air			
		DN 32			
		with acknowledgement at positions			
		on and off			
		approximation initiators	Turk		
		type: BJ-5-S18-AP-6-X			
		with 6 m connecting cable			

Benennung description **Meß- und Regelstückliste** piece list for measuring and control equipment	WIEGAND Kom. Job No. 2590-75-83.01 520-83-83.01 MAELOR Blatt page 55
Proj. Ing. Engelhardt | Bearbeiter responsible Hellmuth | Datum date 7/11/84	Zeichn Nr drwg no 157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
		HS 24 Control			
24.01	1	inclined seat valve	Bürkert		
		casing VA, DN R 1/2"			
		opening by spring			
24.01.2	1	4-way solenoid valve	Bürkert	420 G	
		gating: 24 volts, D.C.			
		with mounting plate			
24.02.2	1	4-way solenoid valve	Bürkert	420 G	
		gating: 24 volts, D.C.			
		with mounting plate			
24.02	1	on/off flap			
		gating: air/air			
		DN 25			
		with acknowledgement at			
		positions on and off			
		approximation initiators	Turk		
		type: BJ-5-S18-AP-6-X			
		with 6 m connecting cable			

Benennung
description

Meß- und Regelstückliste

measuring control piece list

WEIGAND Karlsruhe GmbH D-7505 Ettlingen

Kom 2590-75-83.01 Maelor
520-83-83.01

Blatt page 56 von of

Proj. Ing. Engelhardt | Bearbeiter responsible Hellmuth | Datum date 7/11/84 | Zeichn Nr drwg no

Pos item	Stück piece	Benennung description	Fabrikat make	Type type	Bemerkun note
24.03	1	on/off flap			
		gating: air/air			
		DN 25			
		with acknowledgement at positions			
		on and off			
		approximation initiators type: BJ-5-S18-AP-6-X	Turk		
		with 6 m connecting cable			
24.03.2	1	4-way solenoid valve	Bürkert	420 G	
		gating: 24 V D.C., with mounting plate			
24.04	1	on/off flap			
		gating: air/air; DN 25			
		with acknowledgement at positions			
		on and off			
		approximation initiators	Turk		
		type: BJ-5-S18-AP-6-X			
		with 6 m connecting cable			
24.04.2	1	4-way solenoid valve	Bürkert	420 G	
		gating 24 V D.C.			
		with mounting plate			

Benennung description		Kom. Job No.	2590-75-83.01 520-83-83.01 MAELO
Meß- und Regelstückliste piece list for measuring and control equipment		Blatt page	57
Proj. Ing. Engelhardt	Bearbeiter responsible Hellmuth / Datum date 7/11/84	Zeichn Nr drwg no	157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkun remarks
24.05	1	on/off flap			
		gating: air/air; DN 25			
		with acknowledgement at positions			
		on and off			
		approximation initiators	Turk		
		type: BJ-5-S18-AP-6-X			
		with 6 m connecting cable			
24.05.2	1	4-way solenoid valve	Bürkert		
		gating: 24 V D.C.			
		with mounting plate			
24.06	1	on/off flap			
		gating: air/air; DN 25			
		with acknowledgement at positions			
		on and off			
		approximation initiators	Turk		
		type: BJ-5-S18-AP-6-X			
		with 6 m connecting cable			
24.06.2	1	4-way solenoid valve	Bürkert		
		gating: 24 V D.C.			
		with mounting plate			

Benennung description	
Meß- und Regelstückliste piece list for measuring and control equipment	WIEGAND Kom. 2590-75-83.01 Job No. 520-83-83.01 MAELOR Blatt page 57 a
Proj. Ing. Engelhardt | Bearbeiter responsible Hellmuth | Datum date 7/11/84	Zeichn Nr drwg no 157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
24.07	1	on/off angle valve	Alfa Laval		
		gating: opening by air			
		DN 40			
		with acknowledgement at positions			
		on and off			
		approximation initiators	Turk		
		type: BJ-5-S18-AP-6-X			
		with 6 m connecting cable			
24.07.2	1	4-way solenoid valve	Bürkert	420 G	
		gating: 24V DC			
		with mounting plate			
		actuation Item 24.07 / 24.08 /			
		24.09 / 24.10 / 24.11			

Benennung description Meß- und Regelstückliste piece list for measuring and control equipment	WIEGAND Kom. 2590-75-83.01 MAELOR Job No. 520-83-83.01 Blatt page 58

Proj. Ing.	Bearbeiter responsible	Datum date	Zeichn Nr drwg no
Engelhardt	Hellmuth	7/11/84	157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
24.08	1	on/off angle valve	Alfa Laval		
		gating: opening by air			
		DN 40			
		with acknowledgement at			
		positions on and off			
		approximation initiators	Turk		
		type: BJ-5-S18-AP-6-X			
		with 6 m connecting cable			
24.09	1	on/off angle valve	Alfa Laval		
		gating: opening by air			
		DN 40			
		with acknowledgement at			
		positions on and off			
		approximation initiators	Turk		
		type: BJ-5-S18-AP-6-X			
		with 6 m connecting cable			
24.10	1	on/off angle valve	Alfa Laval		
		gating: opening by air			
		DN 40			
		with acknowledgement at positions			
		on and off			
		approximation initiators	Turk		
		type: BJ-5-S18-AP-6-X with 6 m connecting cable			

Benennung description **Meß- und Regelstückliste** piece list for measuring and control equipment	WIEGAND — Kom. 2590-75-83.01 Job No. 520-83-83.01 MAELOR — Blatt page 59
Proj. Ing. Engelhardt — Bearbeiter responsible Hellmuth — Datum date 7/11/84	Zeichn Nr drwg no 157-393-4

Pos item	Stück qnty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
24.11	1	on/off flap			
		gating: air/air			
		DN 40			
		with acknowledgement at positions			
		on and off			
		approximation initiators	Turk		
		type: BJ-5-S18-AP-6-X			
		with 6 m connecting cable			
24.12	1	on/off flap			
		gating: air/air			
		DN 150			
		with acknowledgement at			
		positions on and off			
		approximation initiators	Turk		
		type: BJ-5-S18-AP-6-X			
		with 6 m connecting cable			
24.12.2	1	4-way solenoid valve	Bürkert	420 G	
		gating: 24 V D.C.			
		with mounting plate			

Benennung description		Kom. Job No.	2590-75-83.01 520-83-83.01	MAELOR
Meß- und Regelstückliste piece list for measuring and control equipment		Blatt page	60	
Proj. Ing. Engelhardt	Bearbeiter responsible Hellmuth	Datum date 7/11/84	Zeichn Nr drwg no	157-393-4

Pos item	Stück qty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
24.13.2	1	4-way solenoid valve	Bürkert	420 G	
		gating: 24 volts D.C.			
		with mounting plate			
24.13	1	on/off valve	Samson	241	
		DN 32,PN 16, Kvs max.			
		casing in grey cast			
		with soft seat			
		drive: 240 cm²			
		closing by spring towards 10 bar			
24.14.2	1	4-way solenoid valve	Bürkert	420 G	
		gating: 24 Volts D.C.			
		with mounting plate			
24.14	1	on/off flap			
		gating: air/air			
		DN 250			
		with acknowledgement at			
		positions on and off			
		approximation initiators	Turk		
		type: BJ-5-S18-AP-6-X			
		with 6 m connecting cable			

Benennung. description		Kom. 2590-75-83.01 MAELOR
Meß- und Regelstückliste	WIEGAND	Job No. 520-83-83.01
piece list for measuring and control equipment		Blatt / page 61

Proj. Ing.	Bearbeiter / responsible	Datum / date	Zeichn Nr / drwg no
Engelhardt	Hellmuth	7/11/84	157-393-4

Pos / item	Stück / qnty	Benennung / description	Fabrikat / make	Type / type	Bemerkung / remarks
24.15.2	1	4-way solenoid valve	Bürkert	420 G	
		gating: 24 volts D.C.			
		with mounting plate			
24.15	1	on/off valve	Samson	241	
		DN 25, PN 16, Kvs max.			
		casing in grey cast			
		with soft seat			
		drive: 240 cm^2			
		closing by spring towards 10 bar			

Benennung / description			Meß- und Regelstückliste / piece list for measuring and control equipment	WIEGAND	
				Kom. / Job No.	2590-75-83.01 / 520-83-83.01 MAELOR
				Blatt / page	62
Proj. Ing. Engelhardt	Bearbeiter / responsible Hellmuth		Datum / date 7/11/84	Zeichn Nr / drwg no	157-393-4

Pos item	Stück quty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
		26 Supply Air Reducing			
		Station			
26.01	1	water separator	Wilker-son	F20-C3-F00	
26.02	1	micro filter	Wilker-son	M21-C3-F00	
26.03	1	pressure reducer for 1.4 bar	Wilker-son	R10-C3-00	
		with pressure gauge 0 - 4 bar			
26.04	1	pressure reducer for 6 bar	Wilker-son	R10-C3-00	
		with pressure gauge 0 - 19 bar			
	1	mounting plate with the instru-	Lerch		
		ments of items 26.01 to 26.04			

Benennung: description:	Montagematerial — Liste list of materials for the erection	WIEGAND Karlsruhe GmbH D-7505 Ettlingen Kom. Job No.
Pos. item. 27	Datum: date:	Blatt page: 63 von: of:

Anzahl quantity	Benennung description	Hersteller manufacturer	Bemerkung remarks	Lieferung supply
10	Manometeranschlußverschraubung C pressure gauge connecting fitting		R 1/2" auf 12 mm	
5	Manometerhähne (A) pressure gauge cocks		R 1/2"	
	Kupferrohr (B)		12 mm ø aussen outside dia.	
100 m	Kunststoffschlauch schwarz (Istw.) synthetic hose black(actual value)		6 x 4 ø	
2000 m	Kunststoffschlauch rot Steuerdruck synthetic hose red (control pressure)		6 x 4 ø	
500 m	Kunststoffschlauch blau (Zuluft) synthetic hose blue (supply air)		6 x 4 ø	
100	Einschraubverbinder screw-in connector		NPT 1/8"	
100	Einschraubverbinder screw-in connector		NPT 1/4"	
20	Schlauchverbinder hose connector		f. 6 mm Schlauch for 6 mm hose	
20	T-Verbinder T-connector		f. 6 mm Schlauch for 6 mm hose	
50	Stützhülsen supporting sleeves		4 mm ø	
	PVC-Gewebeschlauch		DN 25 innen	
	Schlauchschellen		DN 25 innen	
100 m	PVC-Gewebeschlauch PVC fibre hose		R 1/2"	
6	Schlauchtüllen hose nozzles		R 1/2"	
12	Schlauchschellen hose clamps		R 1/2"	
	Mehrfachschlauchkabel		x6x 1	

Benennung description			WIEGAND
Meß- und Regelstückliste piece list for measuring and control equipment			Kom. 2590-75-83.01 MAELOR Job No. 520-83-83.01 Blatt page 64
Proj. Ing. Engelhardt	Bearbeiter responsible Hellmuth	Datum date 7/11/84	Zeichn Nr drwg no 157-393-4

Pos item	Stück qnty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
		LI 28 Level Control			
		(Float Balance Tank)			
28.01	1	level transmitter	Valmet		
		meas. range: 0 - 2.5 m WG			
		supply air: 1.4 bar			
		output signal: 0.2 - 1 bar			
		DN 80; PN 16			
28.02	1	P/I transformer	Foxboro		
		input: 0.2 - 1 bar			
		output: 4 - 20 mA			
		aux. energy: 110 volts, 50 cycles			
		type: identical to item 6.02			

Benennung
description

Meß- und Regelstückliste

piece list for measuring and control equipment

WIEGAND

Kom. / Job No.	2590-75-83.01 / 520-83-83.01 MAELOR
Blatt / page	65
Proj. Ing.	Engelhardt
Bearbeiter / responsible	Hellmuth
Datum / date	7/11/84
Zeichn Nr / drwg no	157-393-4

Pos item	Stück qty	Benennung description	Fabrikat make	Type type	Bemerkung remarks
		29 Control Panel			
29.01	1	control panel			
		construction: panel casing in VA			
		designed for being fixed to the			
		wall			
		protection type: IP 65			

13

Regelung Steuerung
und Überwachung

regulation controlling
and supervision
page 1 to 67

Pumpensteuerung
pump control
Evaporater page 60.1 to 73.1
High Concentr. page 74 to 80

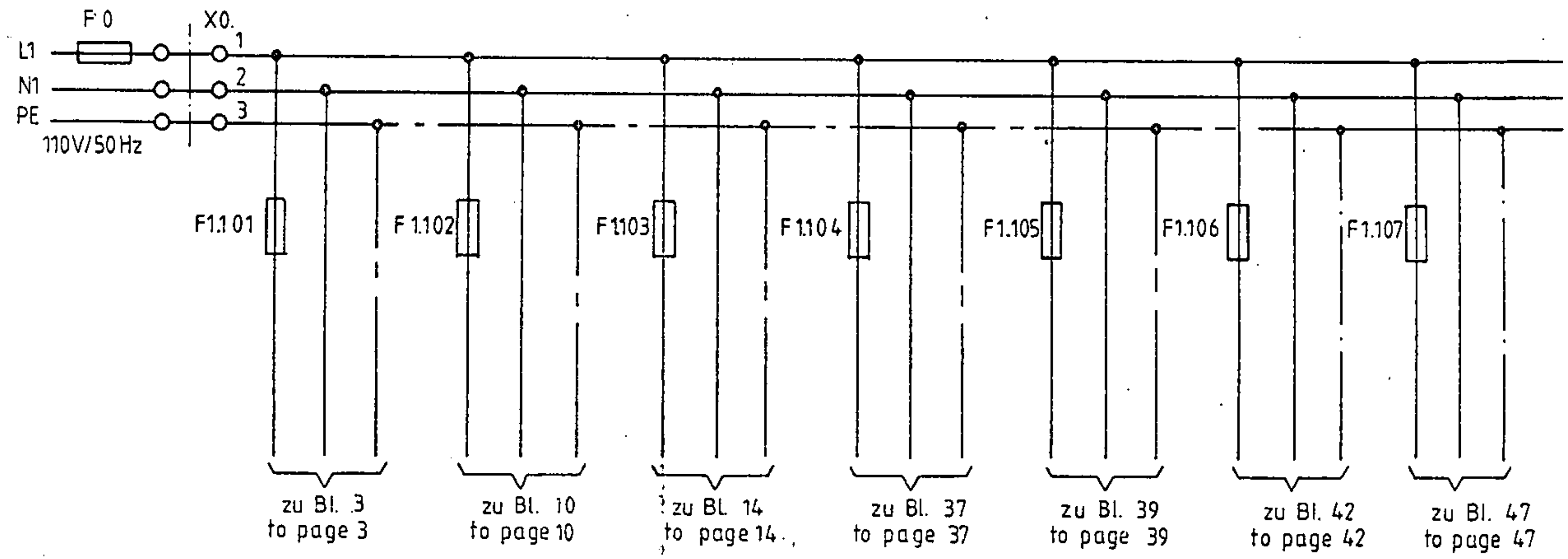
d	pump control add to it	27.9.84	
	modifications	6.11.84	

c	div. Änderungen	10.09.84	Se
b	div. Änderungen	01.08.84	Se
a	div. Änderungen	01.06.84	Se
Index			Name

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

	Datum	Name	Benennung	WIEGAND	
Gezeichn	28.3.84	Benz			
Geprüft			Kom 2590-75-83.01	Zeichng Nr 157-393-4	Index e f
Gesehen			Maelor	Blatt 1 von 80	

Index	Änderung	Datum	Name



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

	Datum	Name
Gezeichn.	10.09.84	[signature]
Geprüft		
Gesehen		

Benennung: Netzversorgung 110 V

Kom. 2590-75-83.01

WIEGAND
Karlsruhe GmbH D-7505 Ettlingen

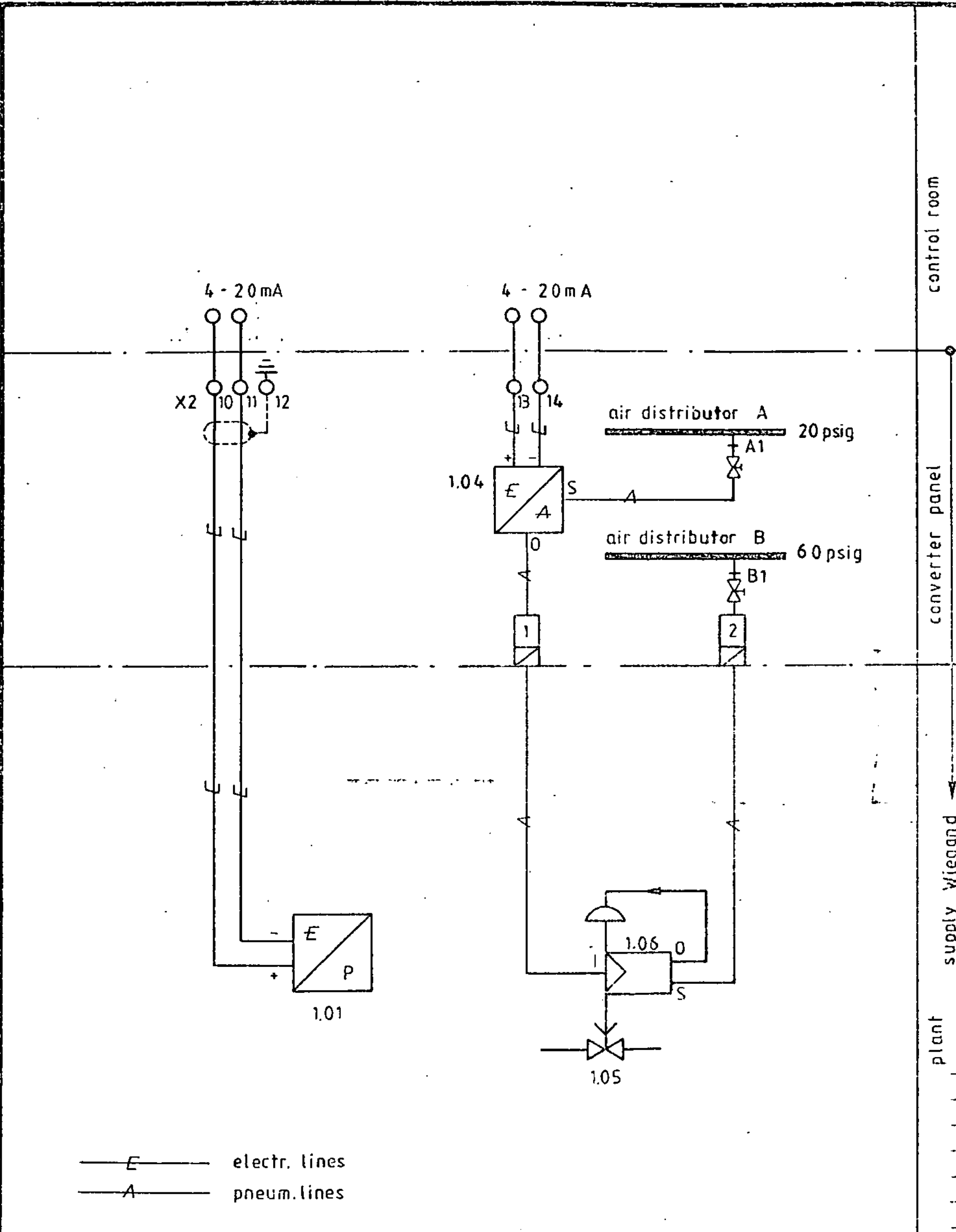
Zeichng. Nr. 157-393-4

Blatt 1.1 von

Index e f

Wehrle Rastatt 43-0556

A 4

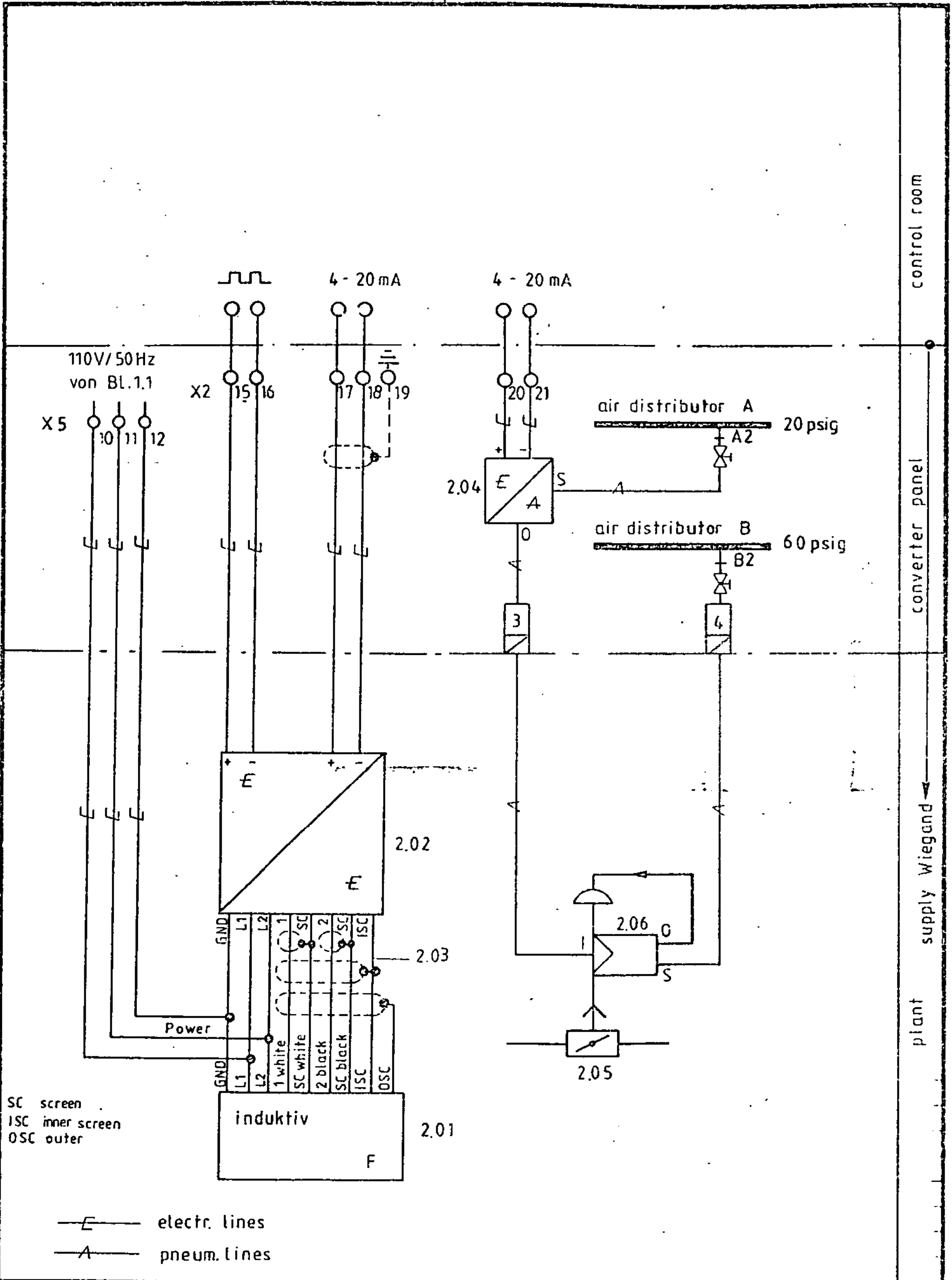


steam pressure control loop

	Datum	Name	Benennung	PICA_1	WIEGAND Karlsruhe GmbH D-7505 Ettlingen	
Gezeichn	20.3.84	Ba				
Geprüft			Kom	2590-75-83.01	Zeichng Nr 157-393-4	index
Gesehen					Blatt 2 von	

Änderung	Datum	Name
index		

Wohrle Rastatt 43-0556

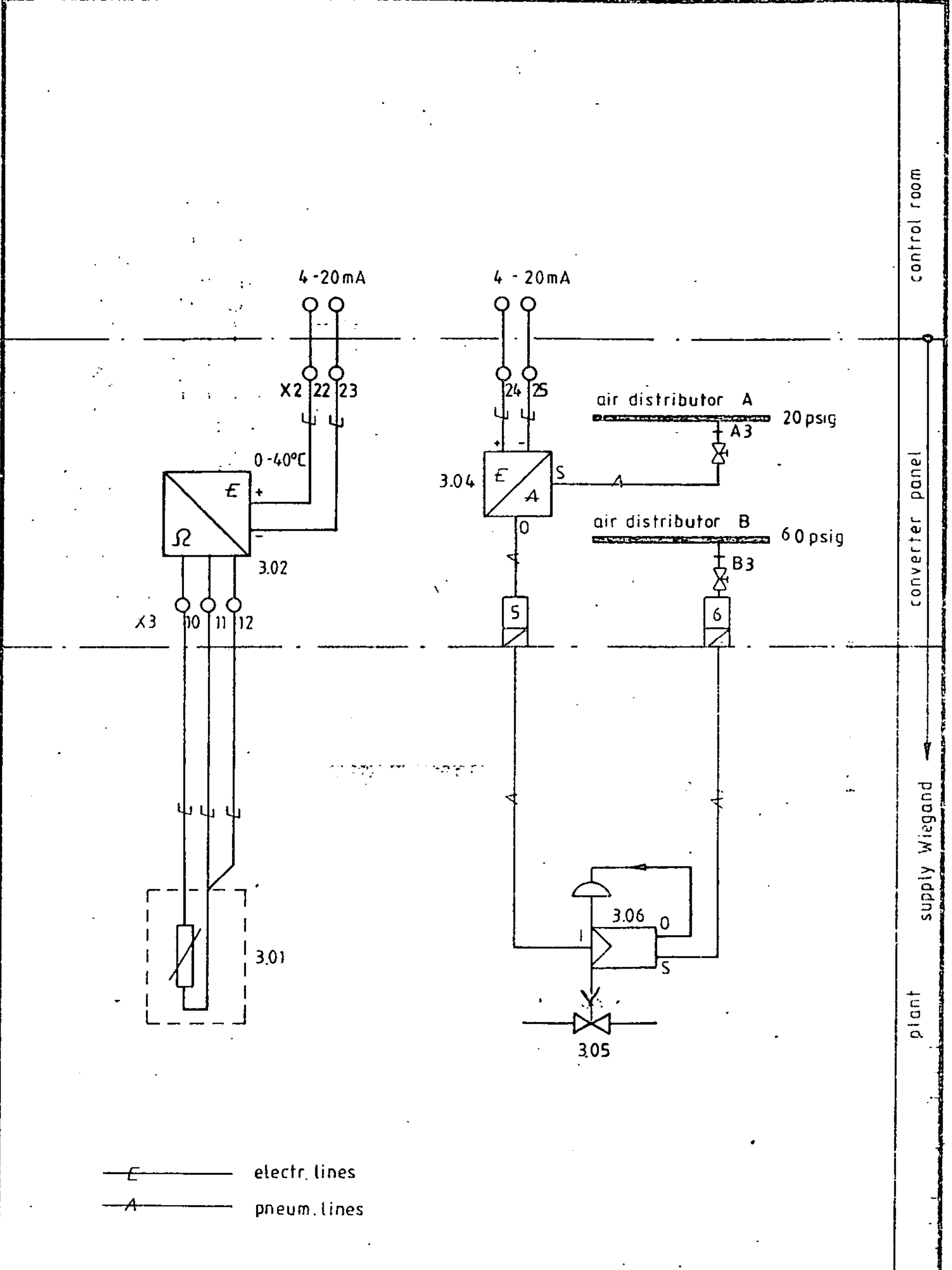


	Datum	Name	Benennung		
Gezeichn	21.3.84	Berf	FIC 2	WIEGAND Karlsruhe GmbH D-7505 Ettlingen	
Geprüft			Kom	Zeichng Nr	index
Gesehen			2590 - 75 - 83. 01	157 - 393 - 4	e
				Blatt 3 von	

Änderung | Datum | Name | Index

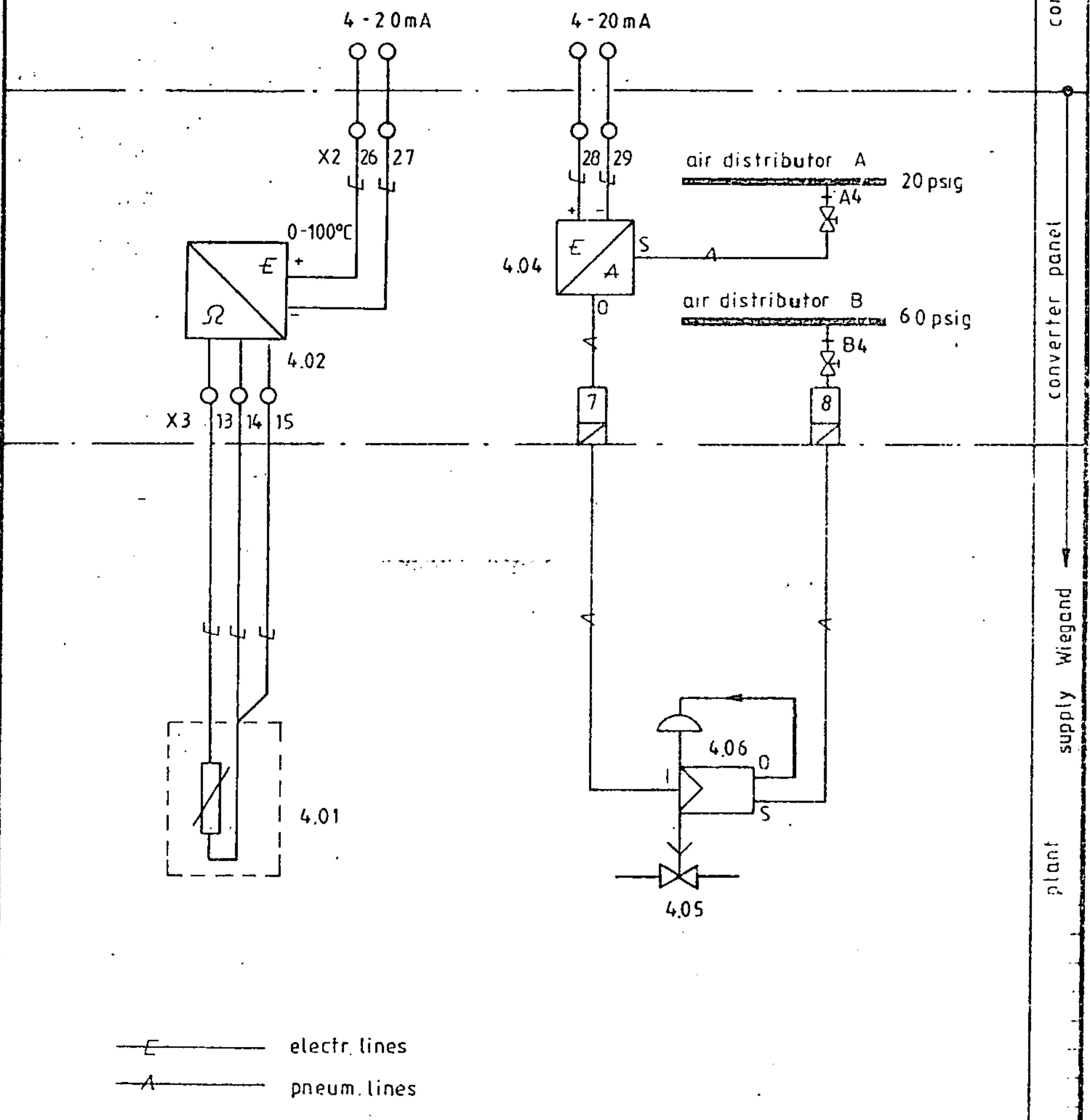
Wahrle Postan 43-0556

A 4

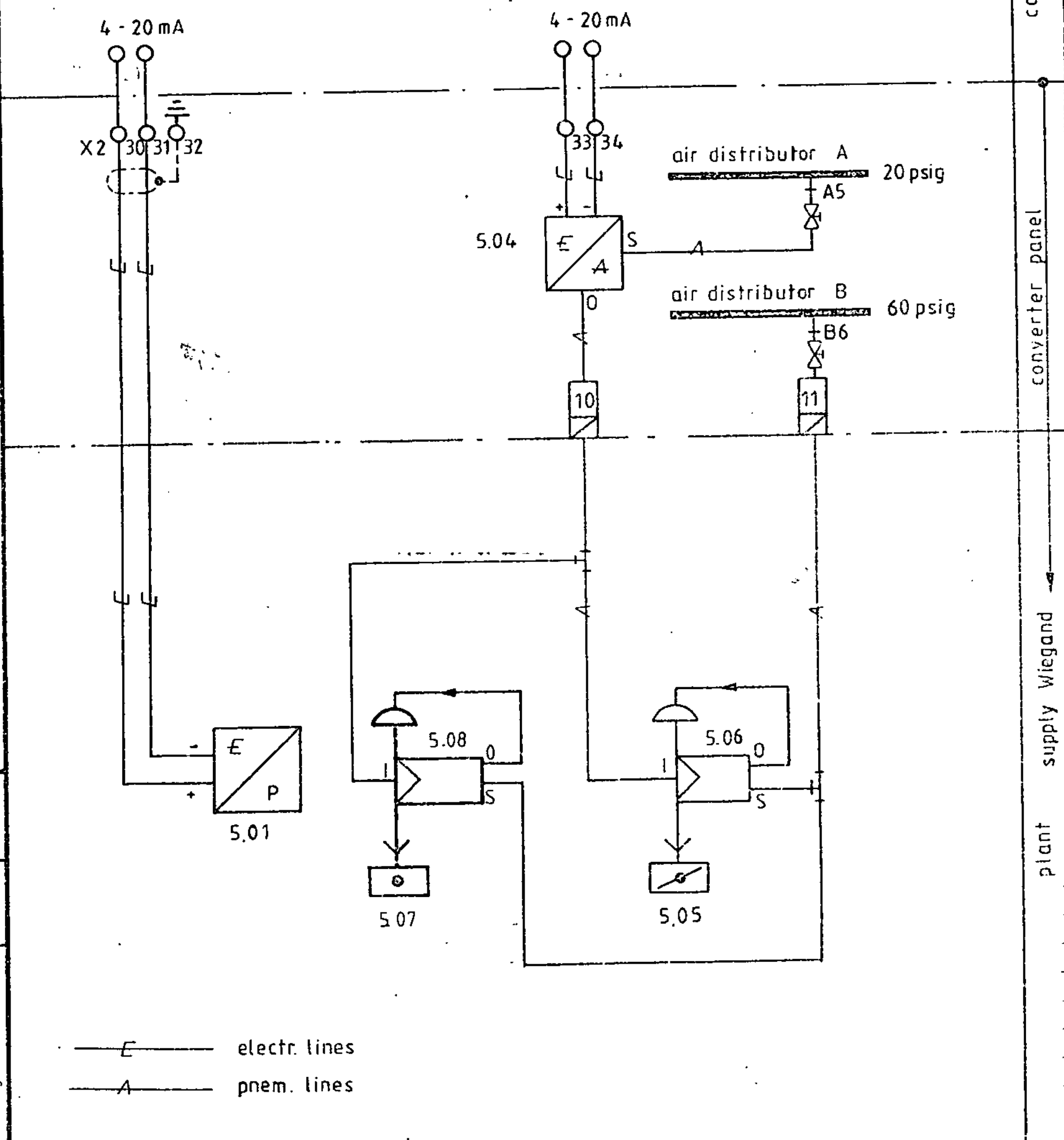


	Datum	Name	Benennung TIC 3	WIEGAND Karlsruhe GmbH D-7505 Ettlingen	
Gezeichn	21. 3. 84	[signature]			
Geprüft			Kom 2590-75-83.01	Zeichng. Nr 157-393-4	Index a
Gesehen				Blatt 4 von	

Änderung | Datum | Name | Index



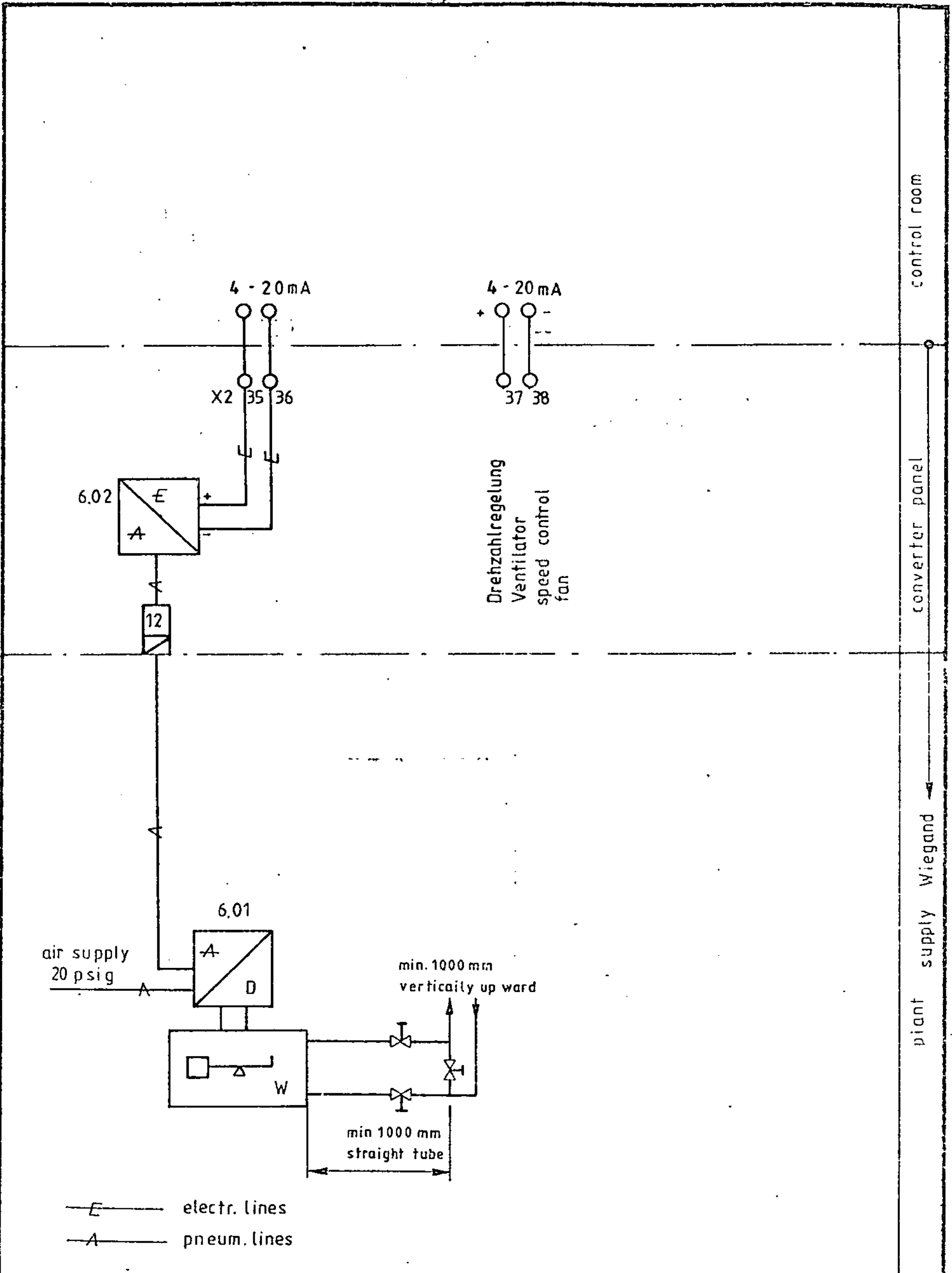
	Datum	Name	Benennung TIC 4	WIEGAND Karlsruhe GmbH D-7505 Ettlingen
Gezeichn.	21. 3. 84			
Geprüft			Kom. 2590-75-83.01	Zeichng. Nr. 157-393-4 — Index a
Gesehen				Blatt 5 von



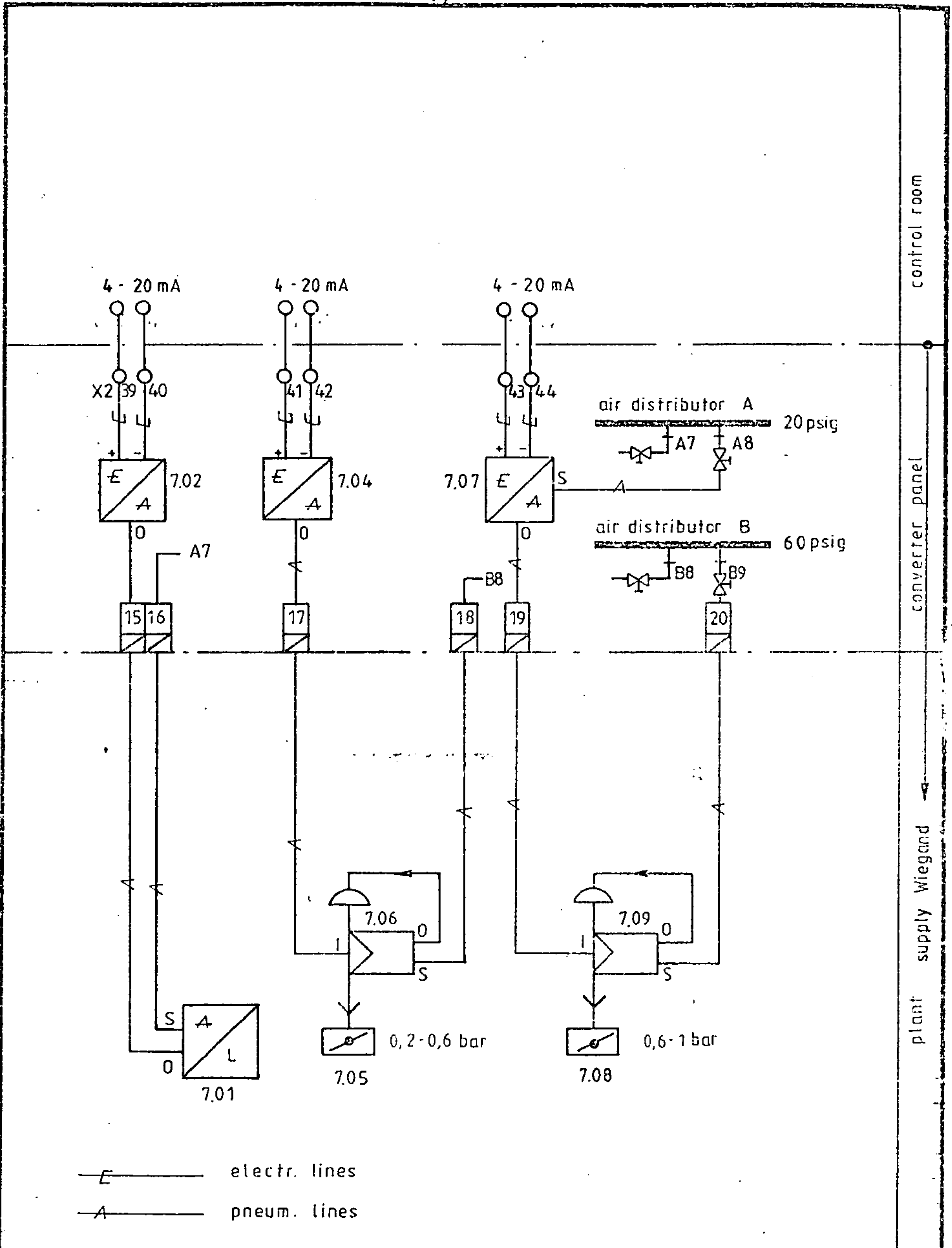
	Datum	Name	Benennung	WIEGAND Karlsruhe GmbH D-7505 Ettlingen	
Gezeichn	22.3.84	Berf	PIC 5		
Geprüft			Kom	Zeichng Nr 157-393-4	Index f
Gesehen			2590-75-83.01	Blatt 6 von	

Name | Datum | Änderung | Index

A 4



	Datum	Name	Benennung	WIEGAND
Gezeichn	22.3.84	Ben	DIC 6	Karlsruhe GmbH D-7505 Ettlingen
Geprüft			Kom	Zeichng Nr. 157-393-4	Index e
Gesehen			2590-75-83.01	Blatt 7 von



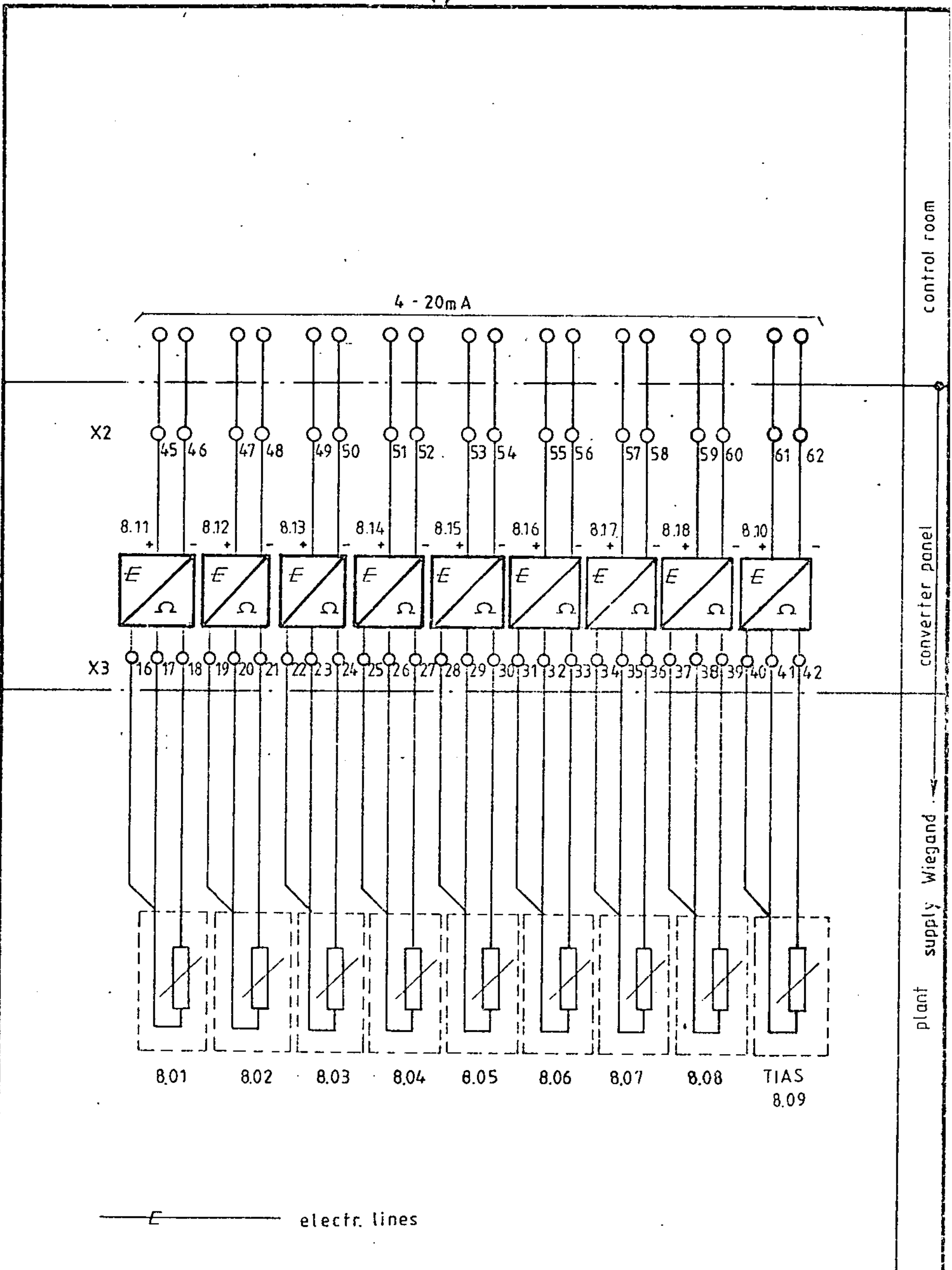
	Datum	Name	Benennung	LIC 7	WIEGAND Karlsruhe GmbH D-7505 Ettlingen	
Gezeichn	22.3.84	Ba. J				
Geprüft			Kom	2590-75-83.01	Zeichng Nr 157-393-4	Index
Gesehen					Blatt 8 von	

Name

Datum

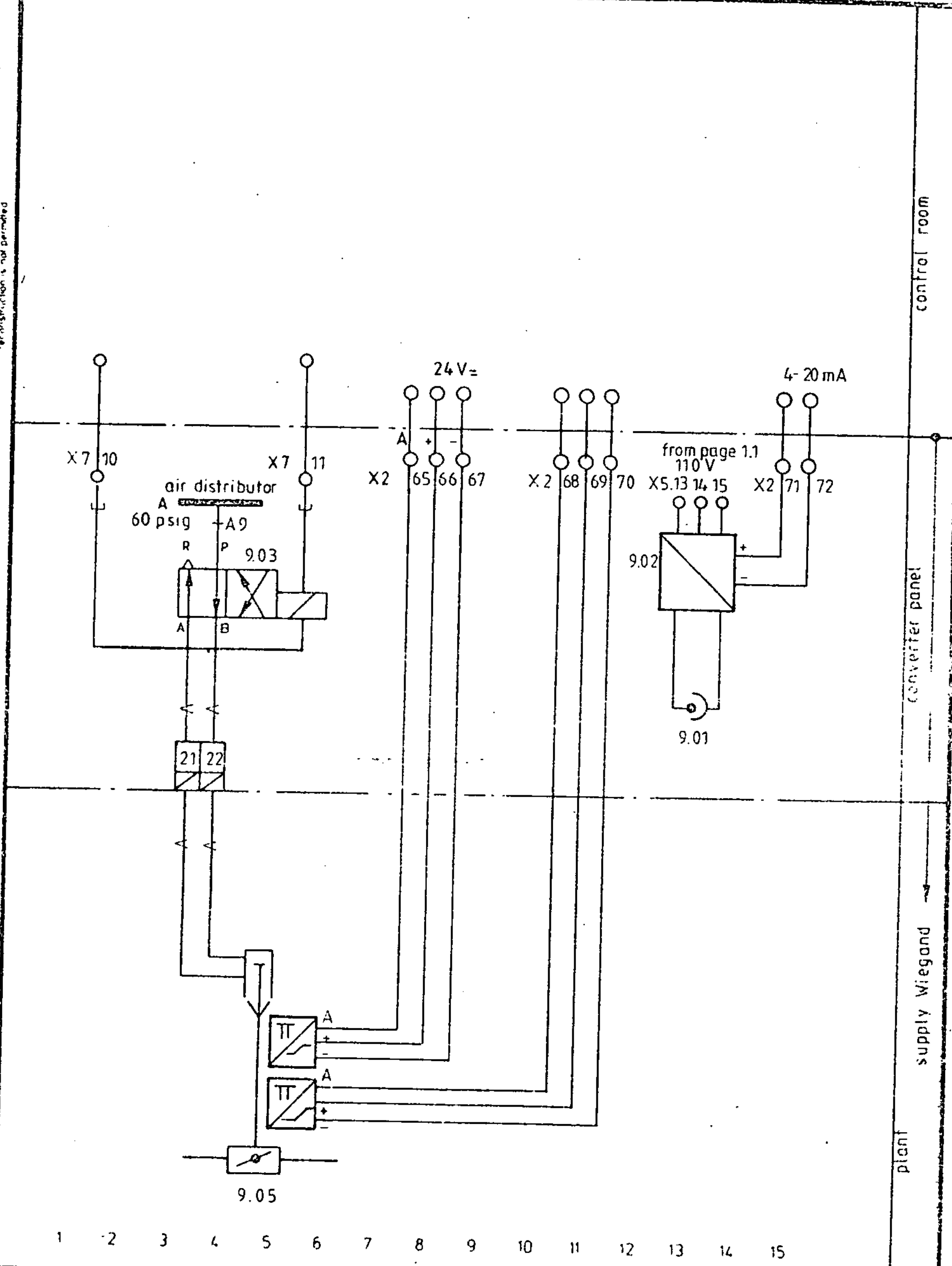
Änderung

Index



temperature recording

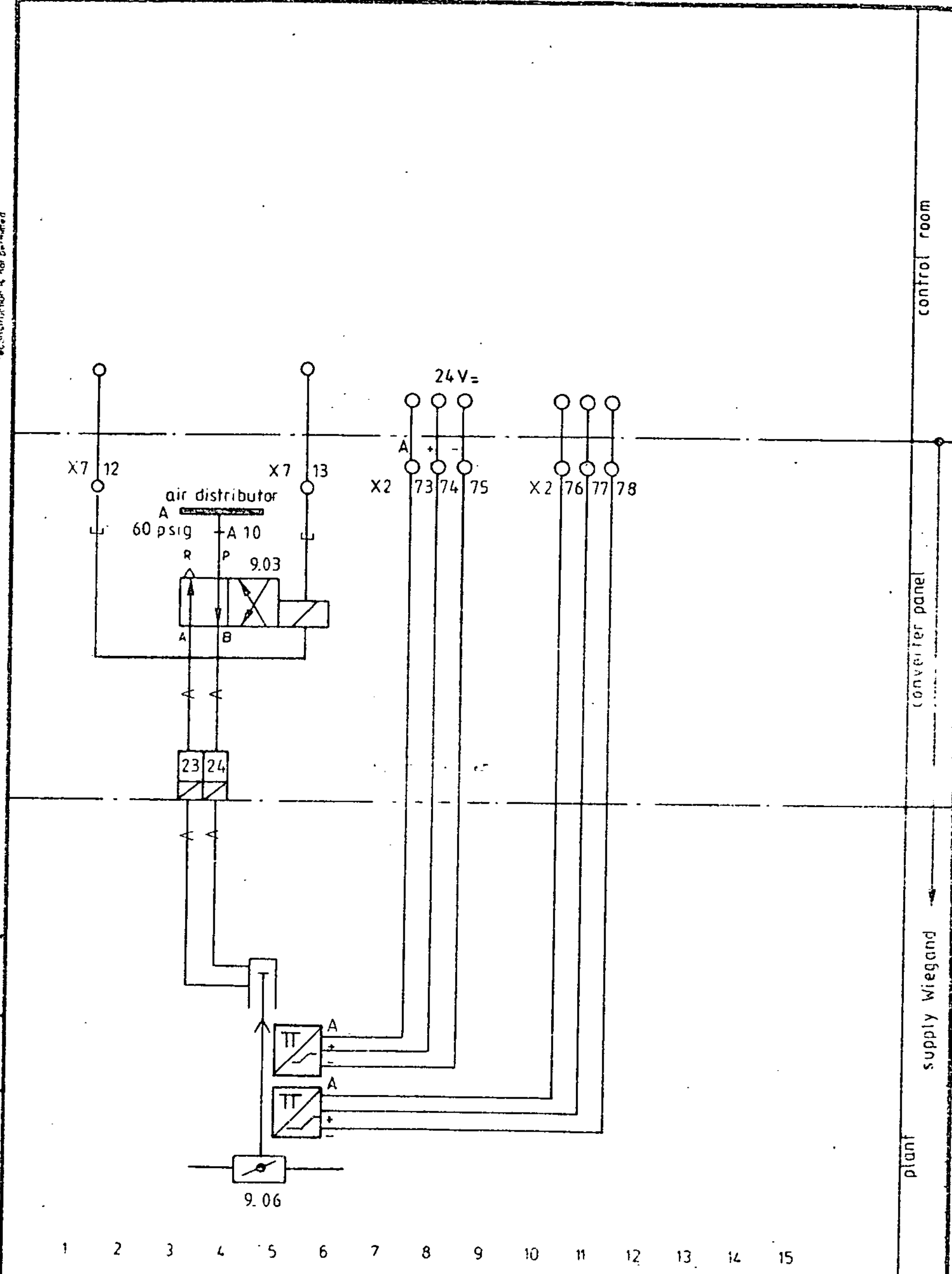
	Datum	Name	Benennung	WIEGAND
Gezeichn.	29. 3. 84	Berg	TR 8	Karlsruhe GmbH D 7505 Ettlingen
Geprüft			Kom	Zeichng. Nr 157 - 393 - 4 — Index a
Gesehen			2590 - 75 83.01	Blatt 9 von



condensate supervision

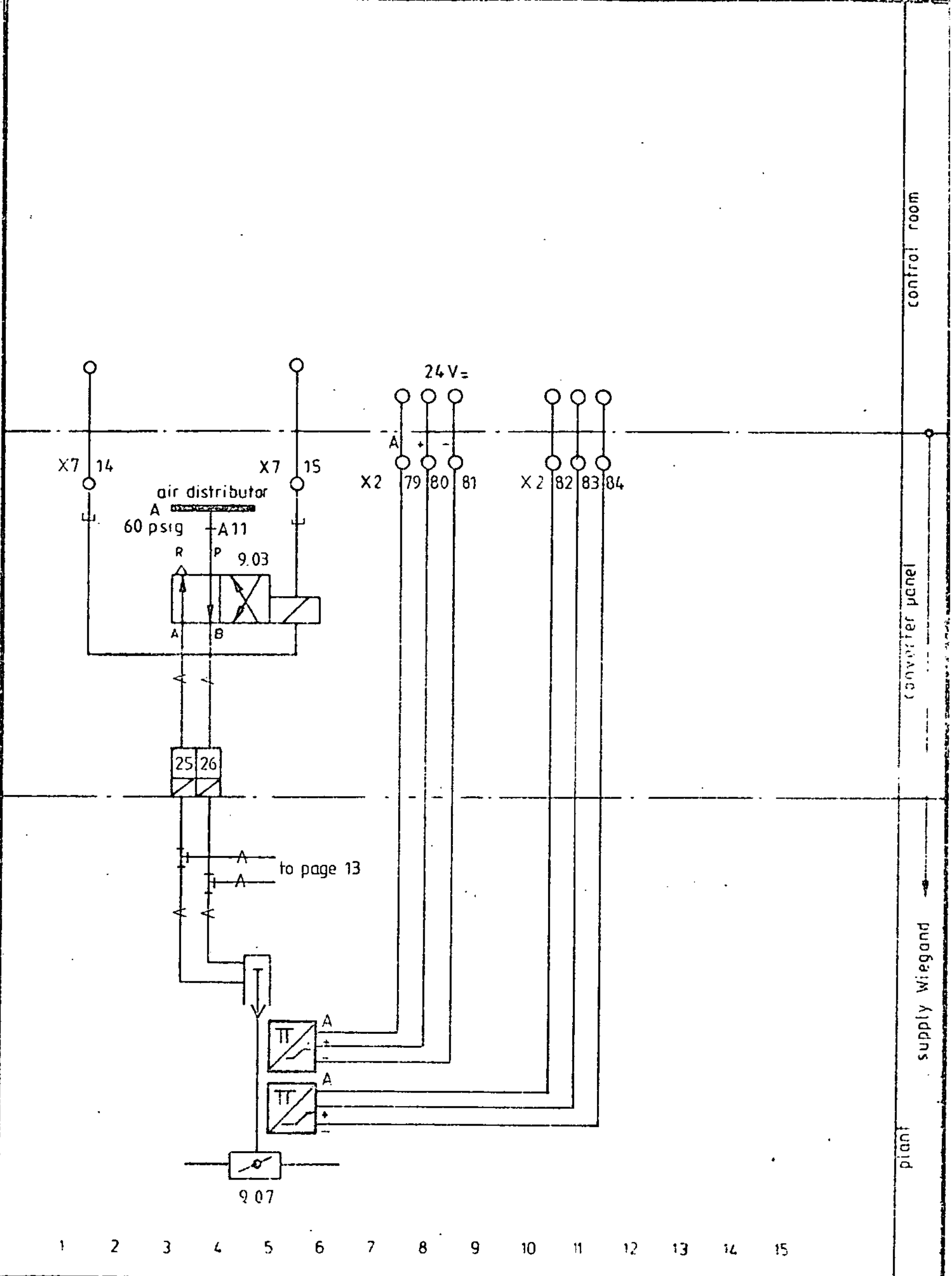
	Datum	Name	Benennung CISA 9	WIEGAND Karlsruhe GmbH D 7505 Ettlingen
Gezeichn	5.11.84	Hodann		
Geprüft			Kom 2590-75-83 01	Zeichng. Nr 157-393-4 / Index e f
Gesehen				Blatt 10 von

Wohrle Rastatt 43 0556



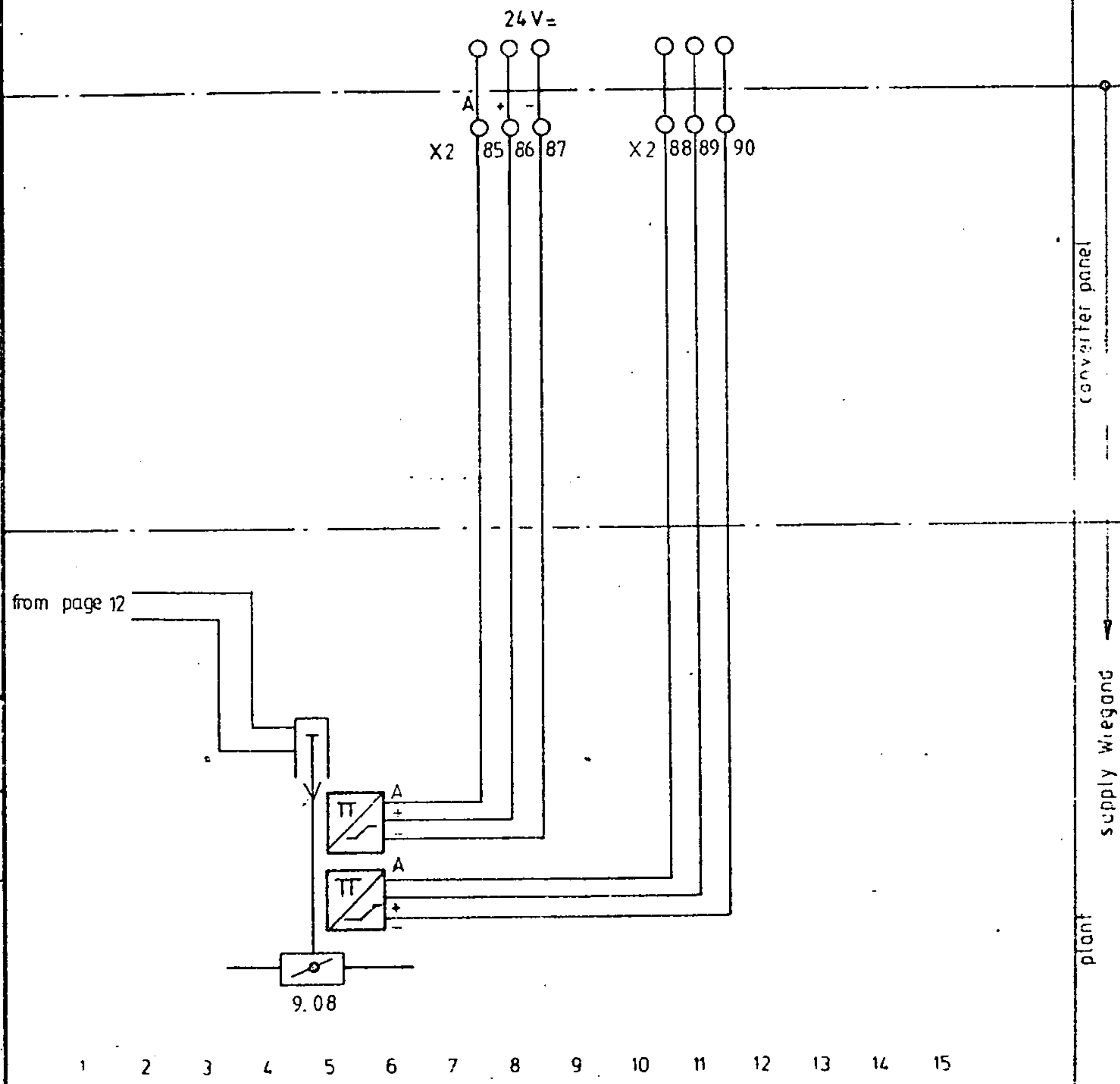
condensate supervision

	Datum	Name	Benennung CISA 9	WIEGAND Karlsruhe GmbH D 7505 Ettlingen	
Gezeichn	5.11.84	Hodum			
Geprüft			Kom. 2590-75-83 01	Zeichng. Nr. 157-393-4	Index: e f
Gesehen				Blatt 11 von	



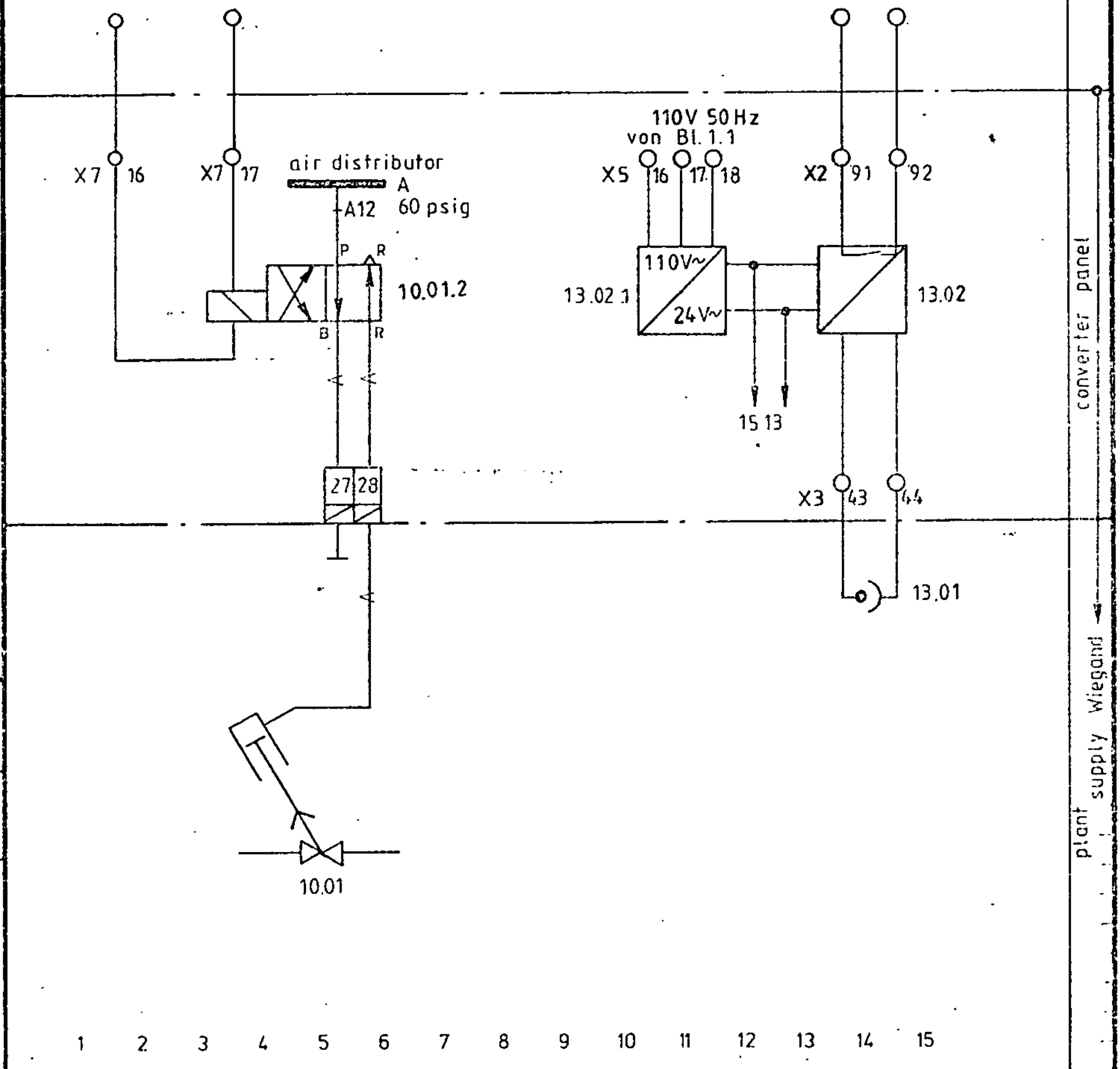
condensate supervision

	Datum	Name	Benennung	
Gezeichn	5.11.84	Hoclann	CISA 9	WIEGAND Karlsruhe GmbH D-7505 Ettlingen
Geprüft			Kom 2590-75-83 01	Zeichng Nr 157-393-4 Index e f
Gesehen				Blatt 12 von



condensate supervision

	Datum	Name	Benennung CISA 9	WIEGAND Karlsruhe GmbH D-7505 Ettlingen
Gezeichn.	5.11.84	Hodann		
Geprüft	-	-	Kom 2590-75-83 01	Zeichng. Nr. 157-393-4 — Index e f
Gesehen	-	-		Blatt 13 von



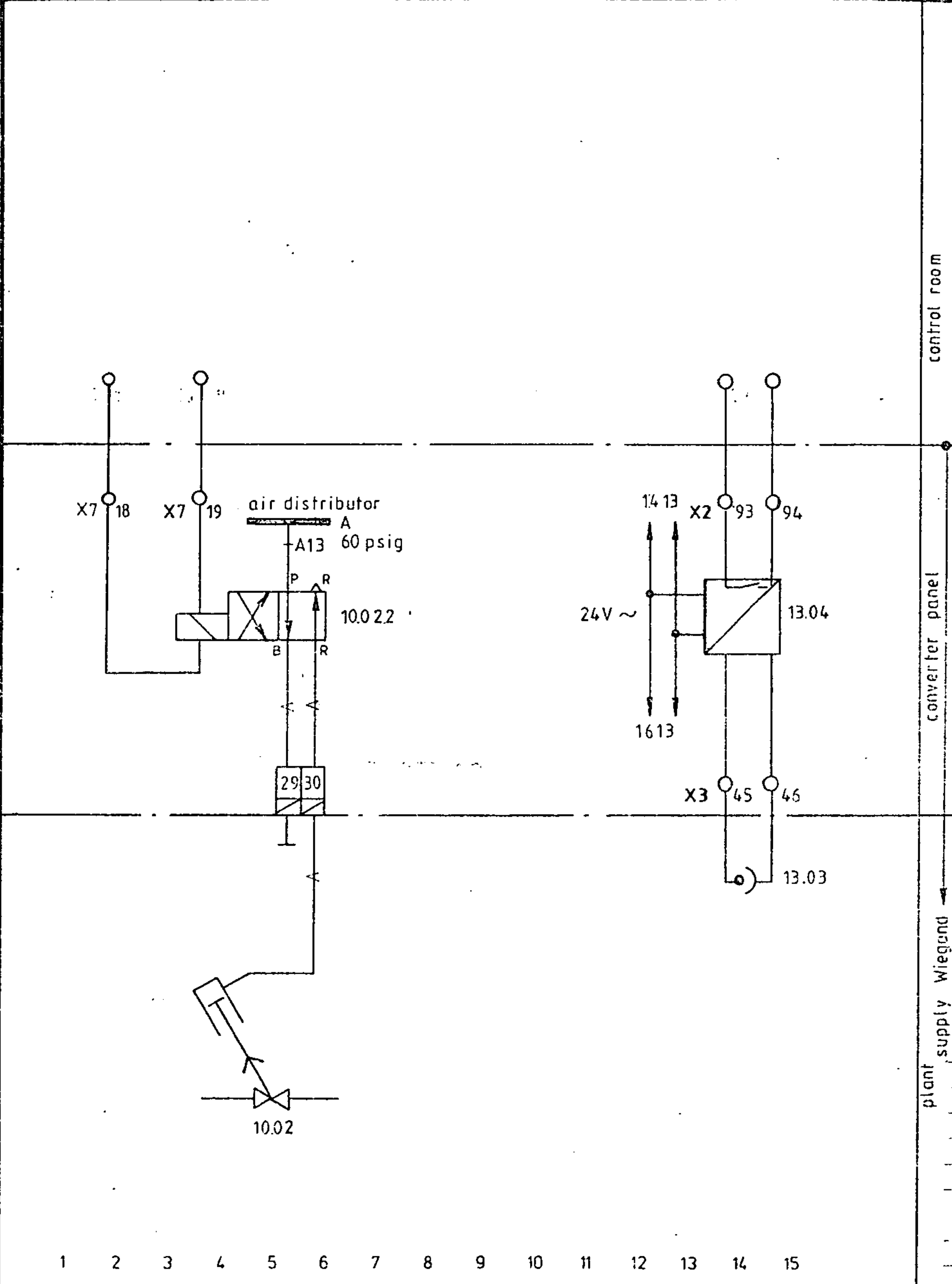
sealing water

	Datum	Name	Benennung	WIEGAND Karlsruhe GmbH D-7505 Ettlingen
Gezeichn	26. 4. 84	Bert	HS-control	
Geprüft			Kom 2590-75-83.01	Zeichng Nr 157-393-4
Gesehen				Index e f
				Blatt 14 von

Index | Änderung | Datum | Name

Wahrie Rastatt 43-0556

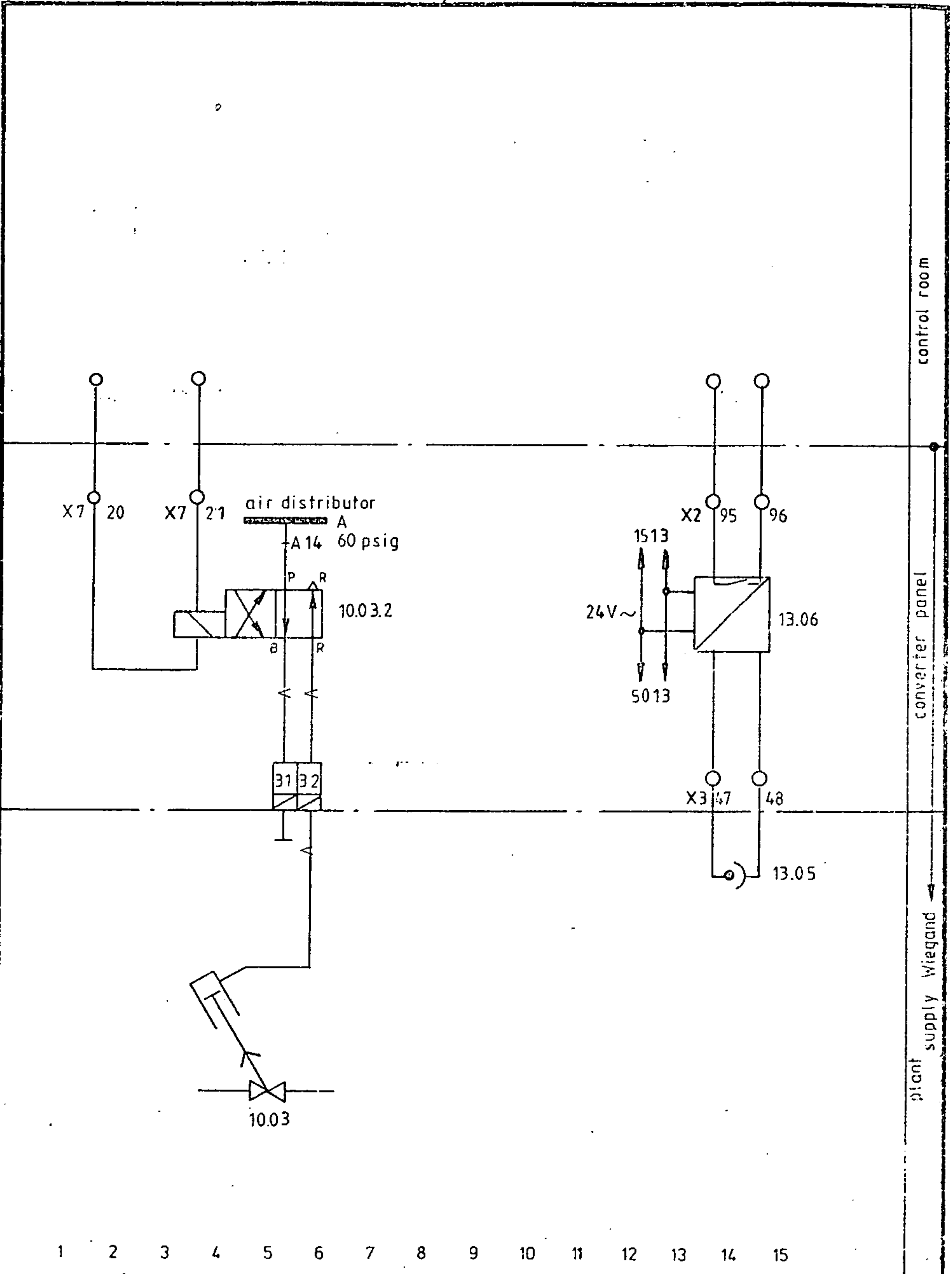
A 4



Speerwasser pump item 14.1

	Datum	Name	Benennung	WIEGAND Karlsruhe GmbH D-7505 Ettlingen
Gezeichn	26. 4. 84	Beuf	HS-control	
Geprüft			Kom 2590-75-83.01	Zeichng Nr 157-393-4 Index e f
Gesehen				Blatt 15 von

Index Änderung Datum Name



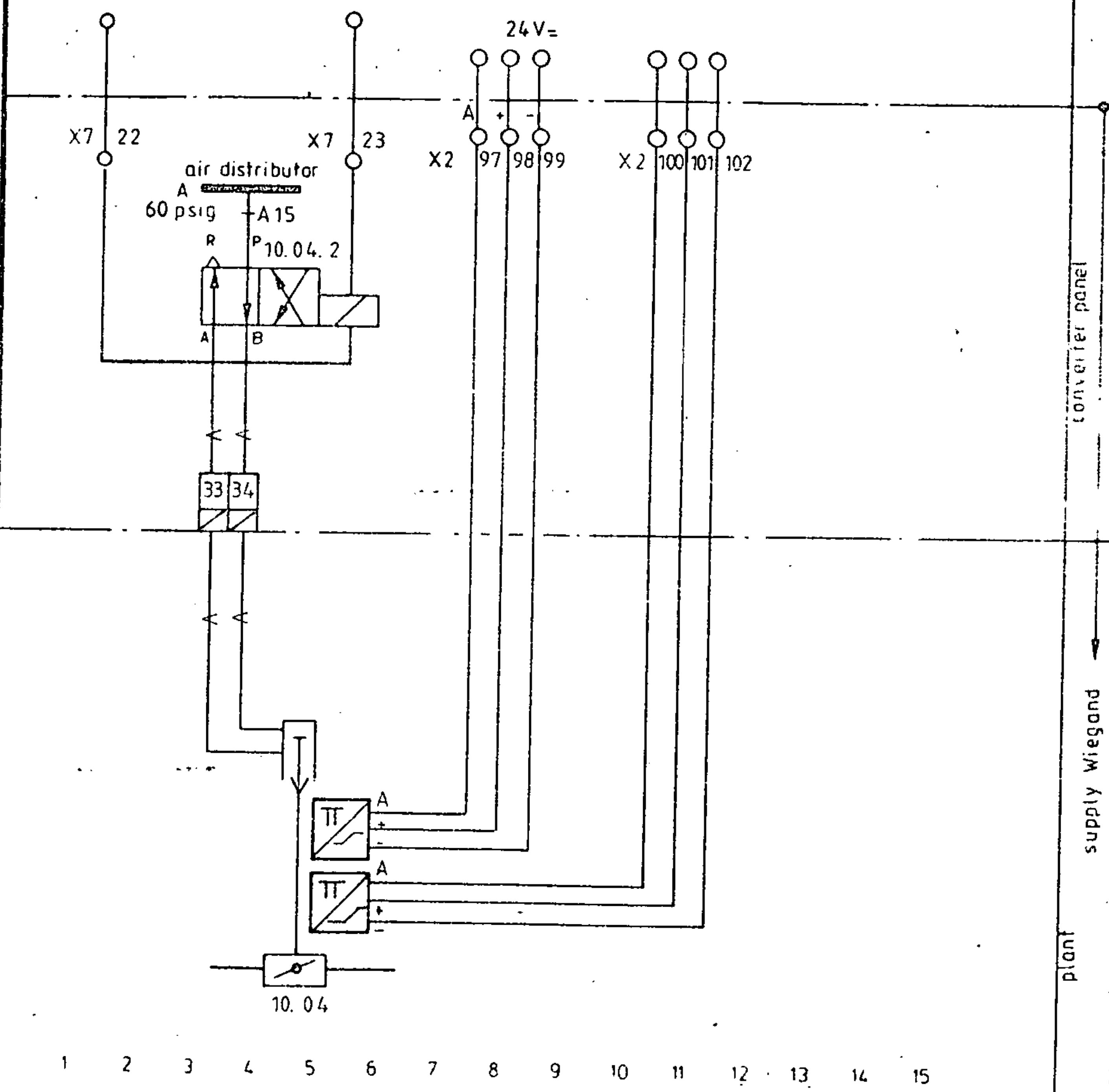
service water pump item 14.2

	Datum	Name	Benennung HS-control	WIEGAND Karlsruhe GmbH D-7505 Ettlingen
Gezeichn	26. 4. 84	Beut		
Geprüft			Kom 2590-75-83.01	Zeichng. Nr 157-393-4 Index e f
Gesehen				Blatt 16 von

Änderung | Datum | Name | Index

Wöhrle Rastatt 43-0556

A 4

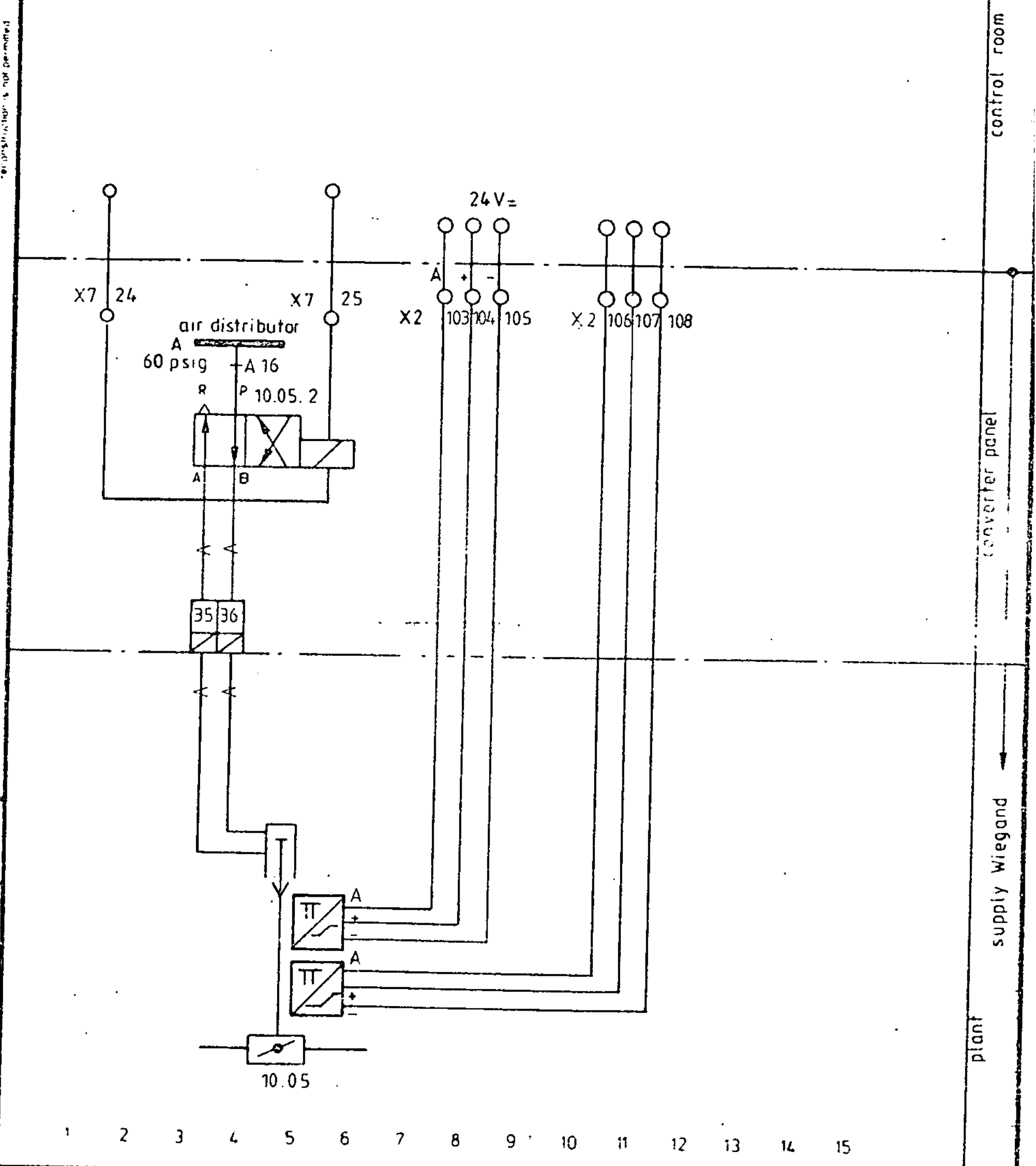


selection for item 10

	Datum	Name	Benennung HS-control	WIEGAND Karlsruhe GmbH D 7505 Ettlingen
Gezeichn.	5.11.84	Hodann		
Geprüft			Kom. 2590-75-83 01	Zeichng. Nr. 157-393-4 / Index e f
Gesehen				Blatt 17 von

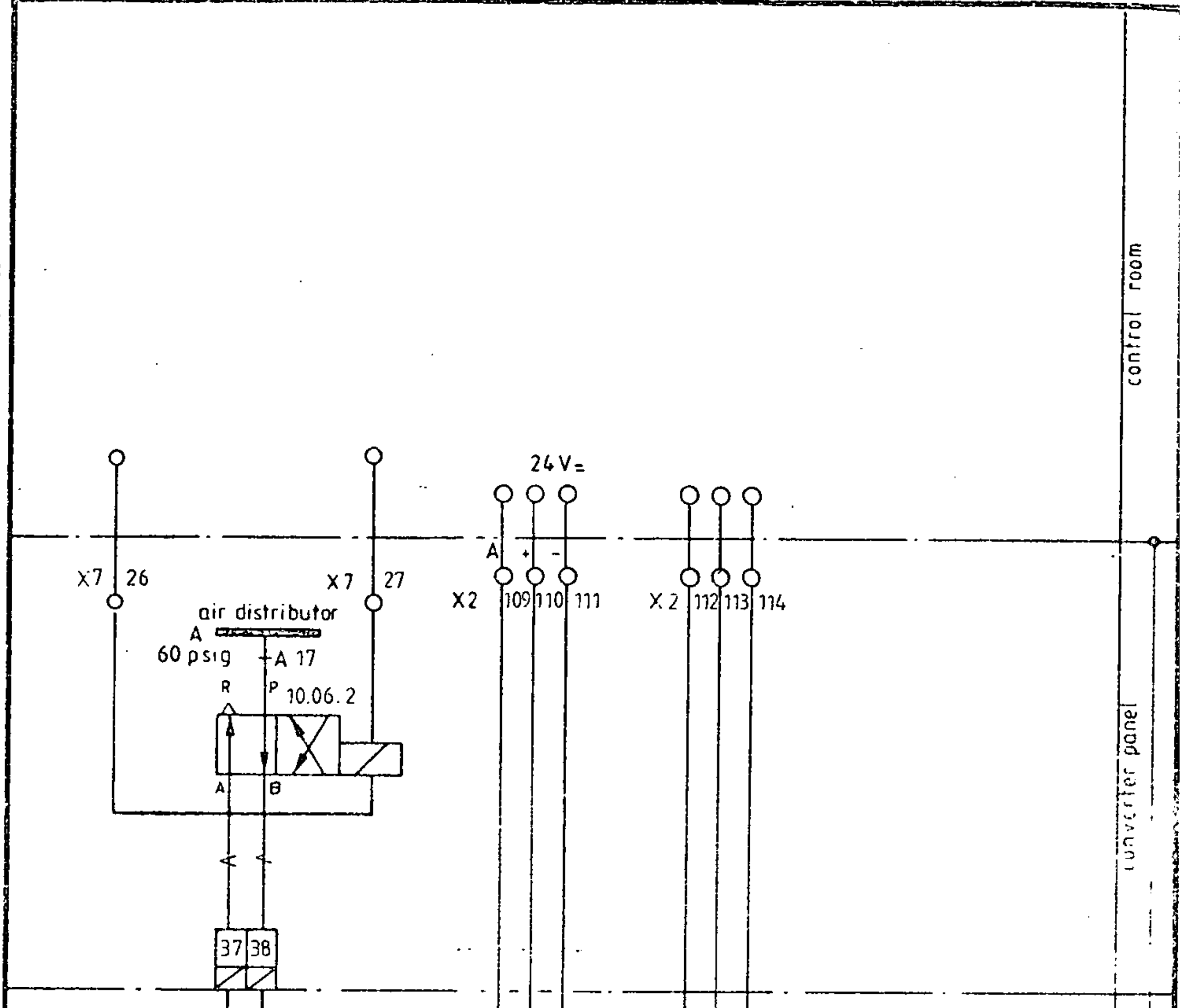
Wohrle Rastatt 43 0556

A4



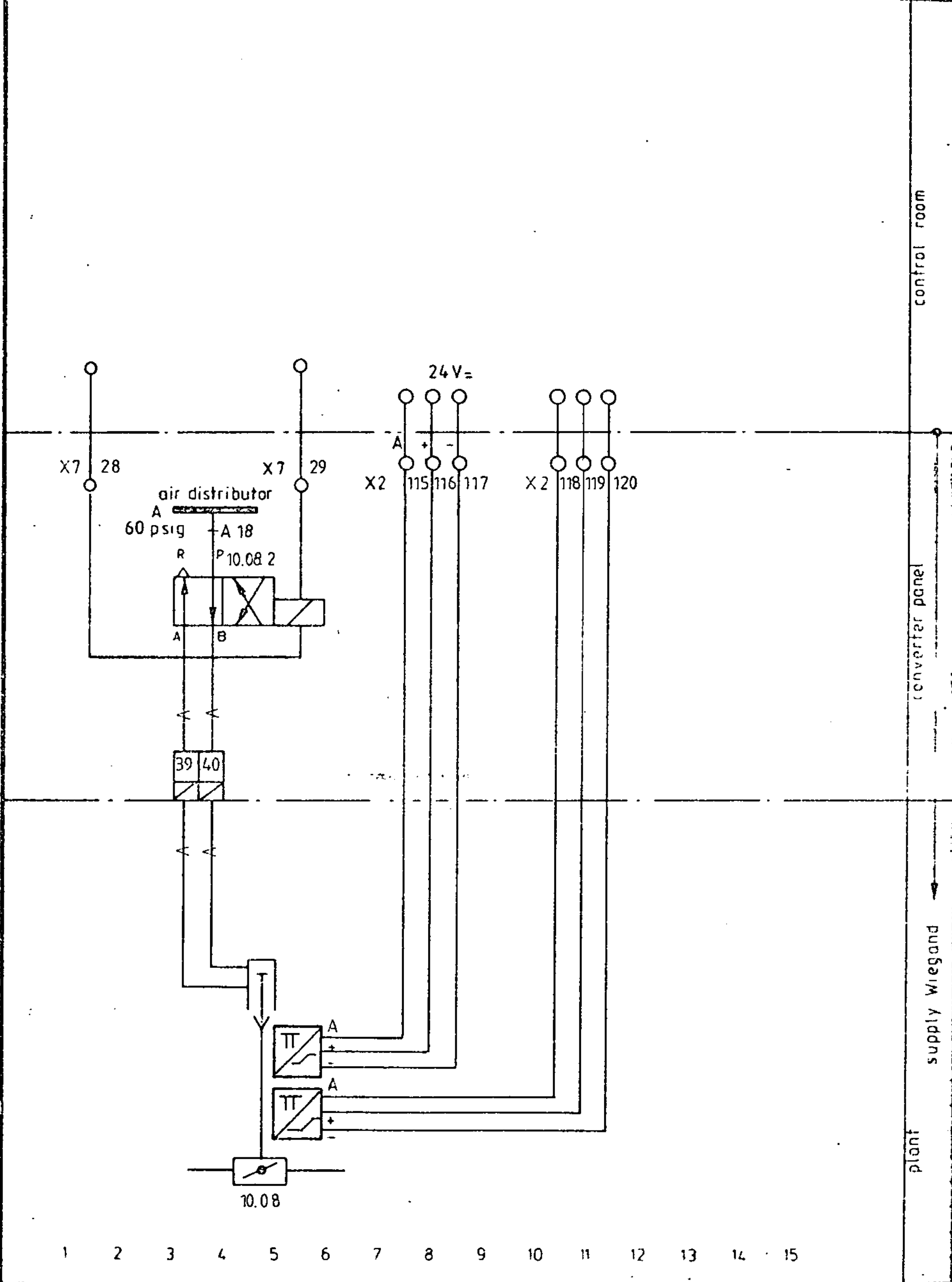
selection for item 10

	Datum	Name	Benennung	
Gezeichn	5.11.84	Rodaun	HS-control	WIEGAND Karlsruhe GmbH D 7505 Ettlingen
Geprüft			Kom 2590-75-83 01	Zeichng Nr 157-393-4, Index e f
Gesehen				Blatt 18 von



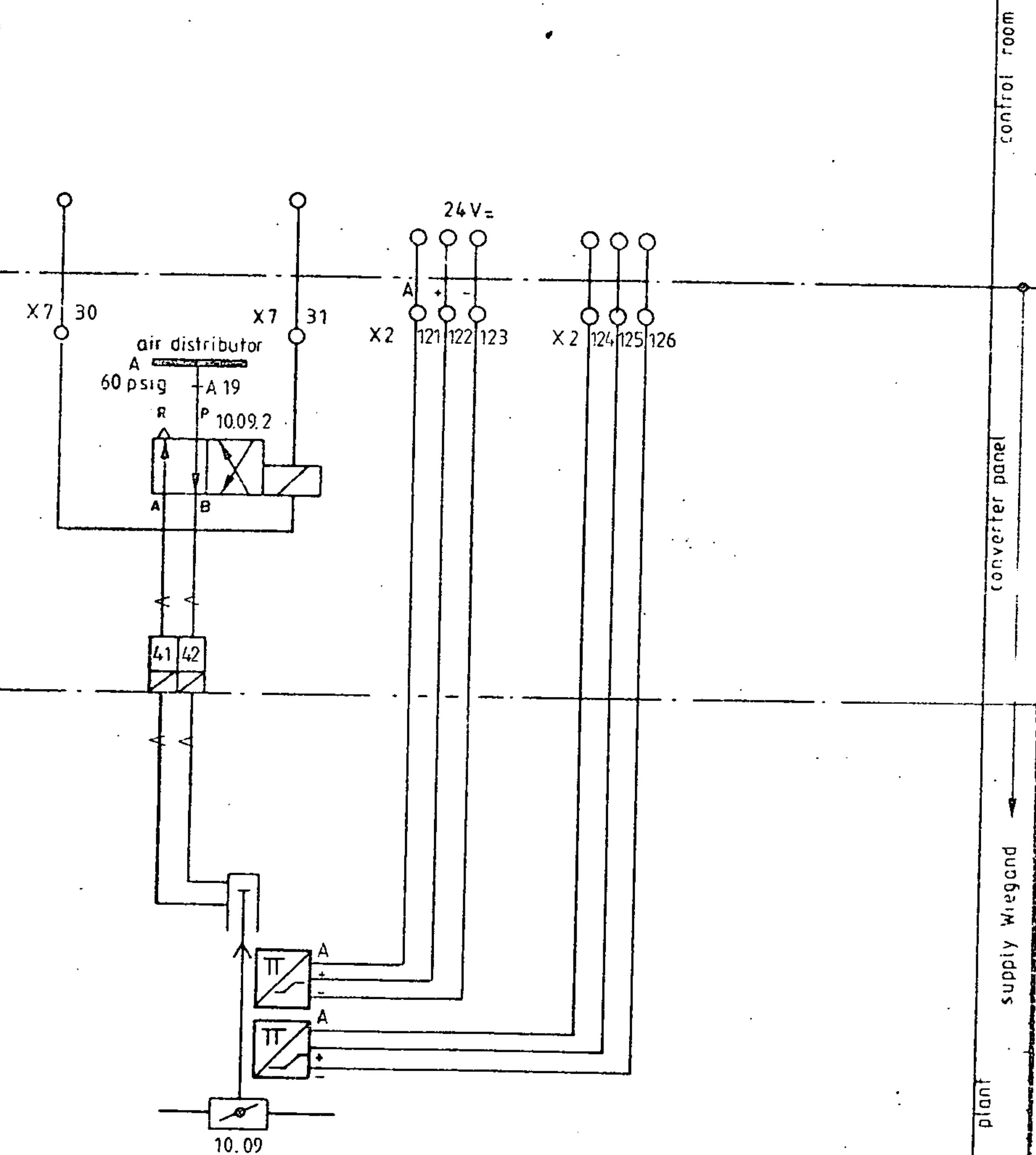
selection for item 10

	Datum	Name	Benennung	WIEGAND
Gezeichn	5.11.84	Hadamn	HS -control	Karlsruhe GmbH D 7505 Ettlingen
Geprüft			Kom 2590-75-83 01	Zeichng Nr 157-393-4 / Index e f
Gesehen				Blatt 19 von



to the float balance tank

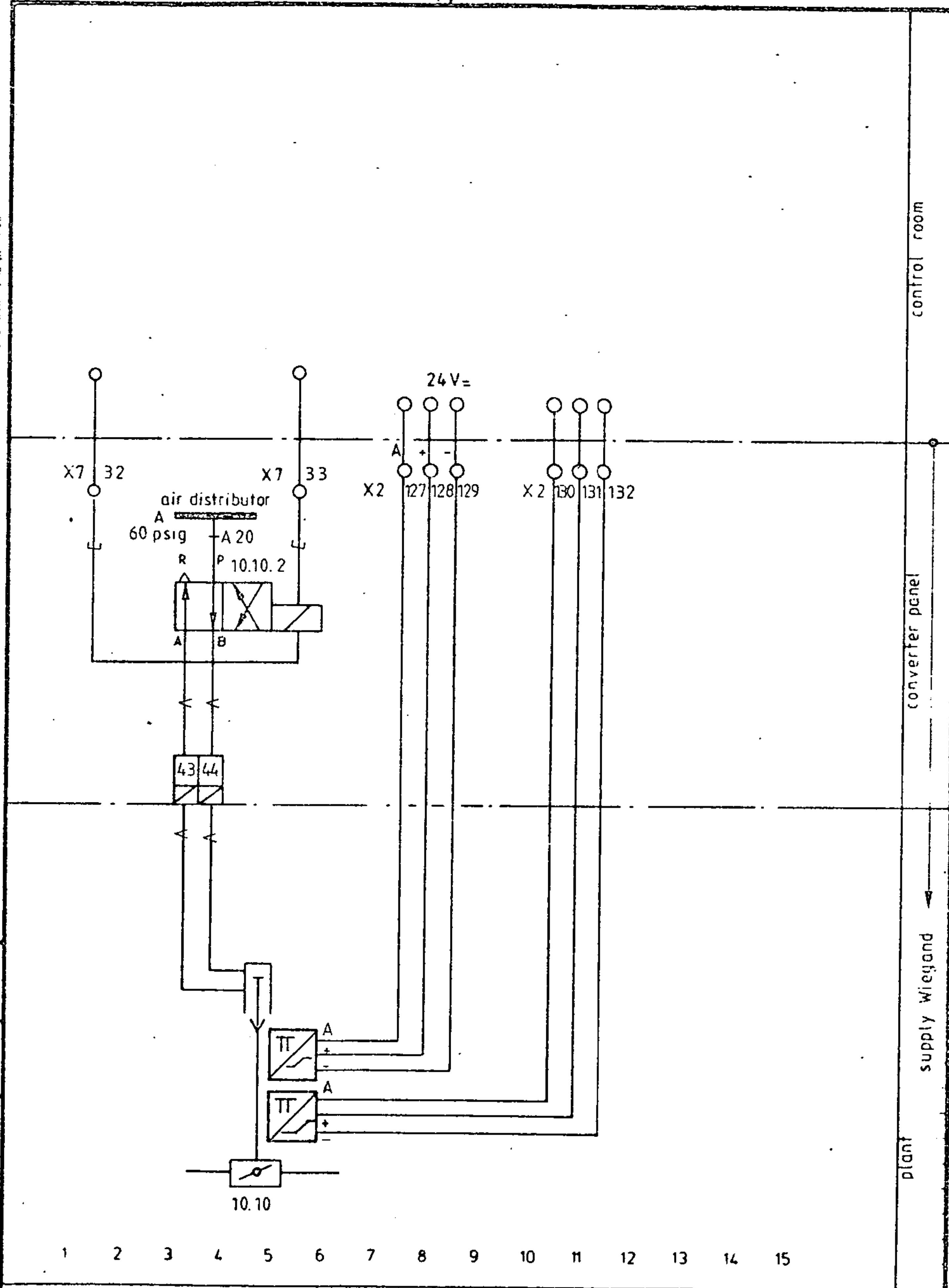
	Datum	Name	Benennung HS- control	WIEGAND Karlsruhe GmbH D 7505 Ettlingen	
Gezeichn	5.11.84	Hodann			
Geprüft			Kom 2590-75-83.01	Zeichng. Nr 157-393-4	Index e f
Gesehen				Blatt 20 von	



Condensate supervision

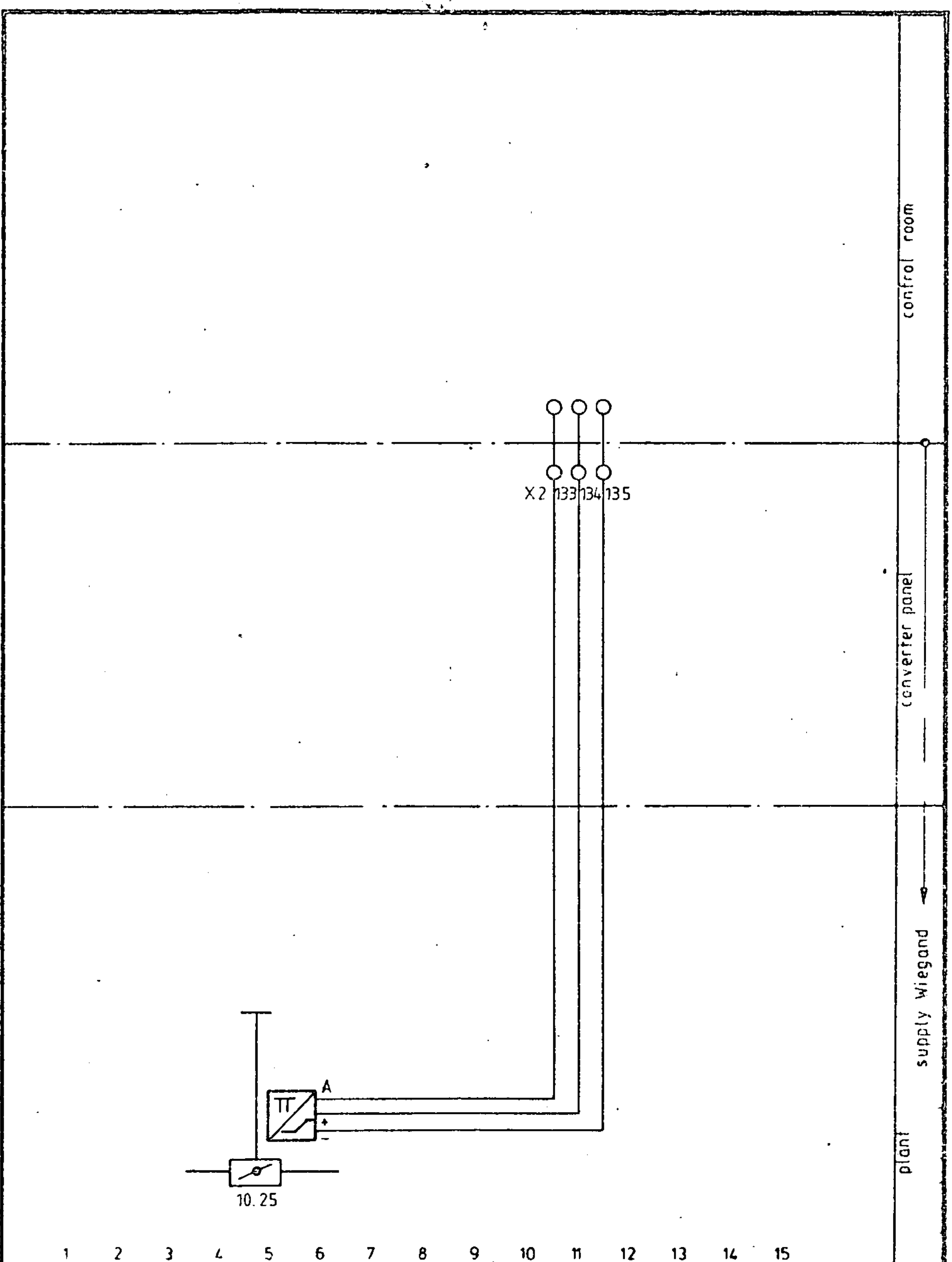
	Datum	Name	Benennung	
Gezeichn	6.11.84	(signature)	HS-control	**WIEGAND** Karlsruhe GmbH D-7505 Ettlingen
Geprüft			Kom. 2590-75-83 01	Zeichng. Nr. 157-393-4 — Index e f
Gesehen				Blatt 21 von

Name | Datum | Änderung | Index



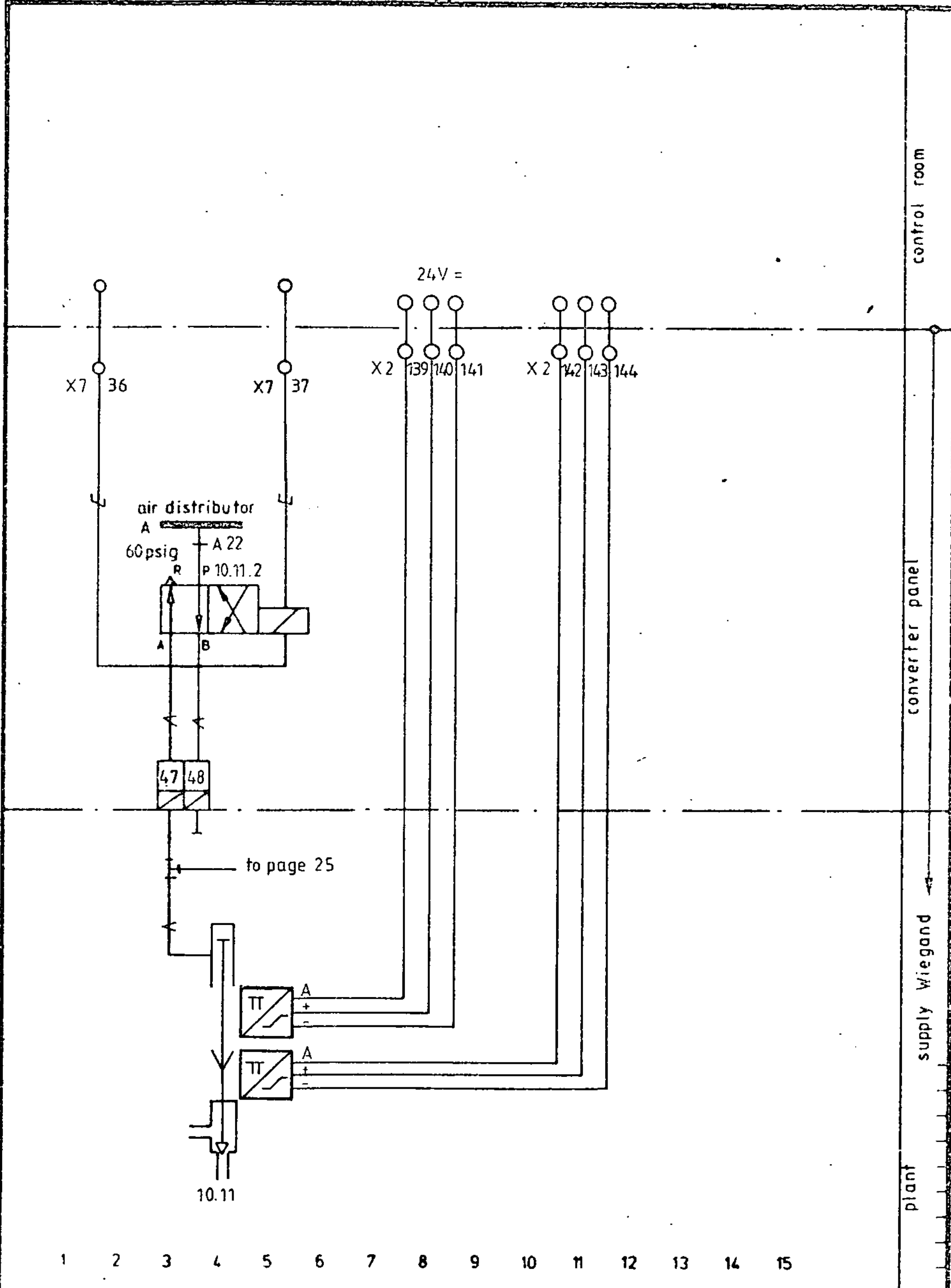
to the concentrate tank

	Datum	Name	Benennung HS-control	WIEGAND Karlsruhe GmbH D-7505 Ettlingen
Gezeichn	6.11.84	[illegible]		
Geprüft			Kom 2590-75-83.01	Zeichng Nr 157-393-4 · Index e f
Gesehen				Blatt 22 von



to the concentrate tank

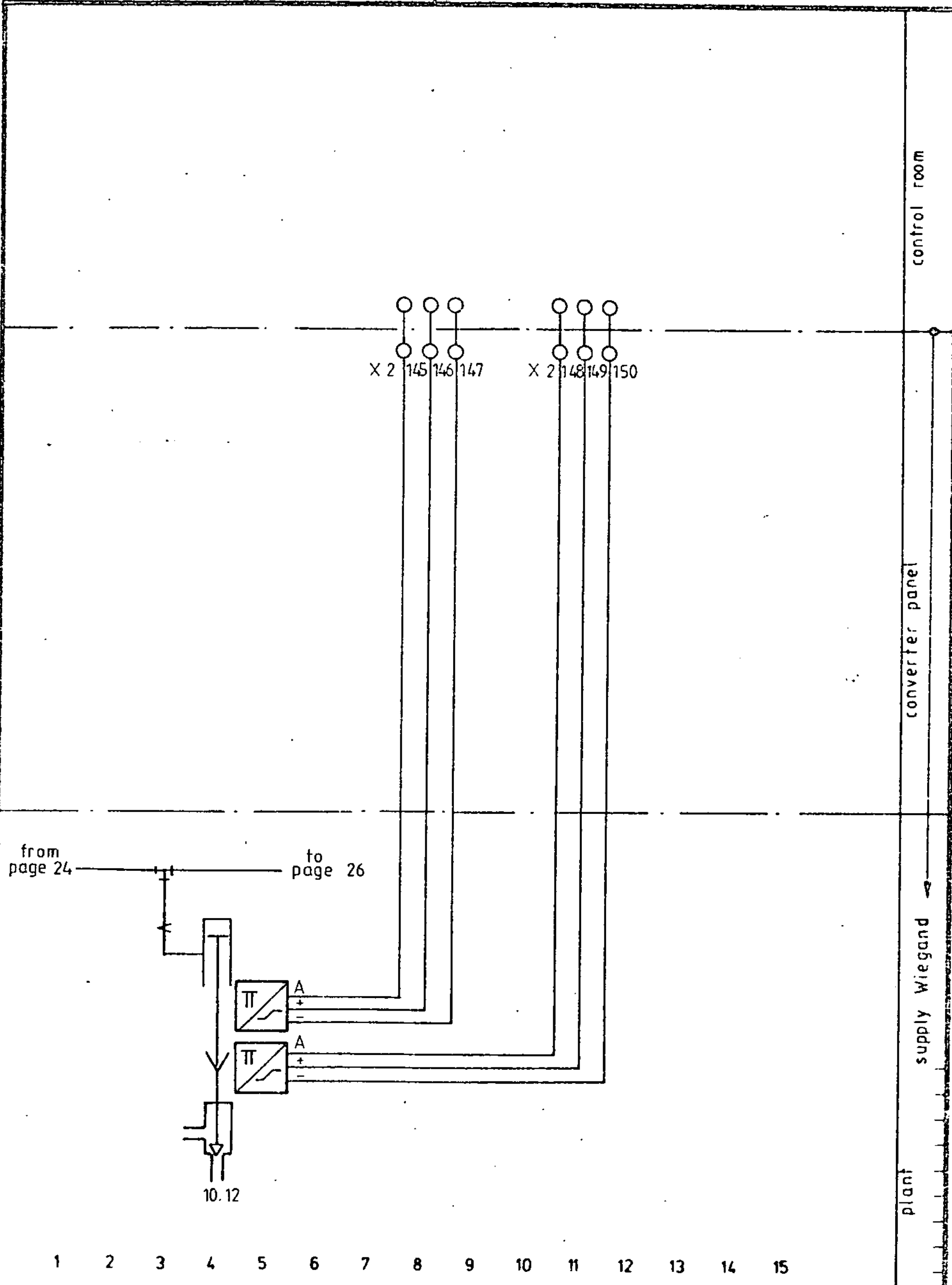
	Datum	Name	Benennung	WIEGAND Karlsruhe GmbH D-7505 Ettlingen	
Gezeichn	6.11.84	Hadaum	HS-control		
Geprüft			Kom 2590-75-83.01	Zeichng Nr 157-393-4	Index e f
Gesehen				Blatt 23 von	



spray cleaning

	Datum	Name	Benennung	WIEGAND
Gezeichn	6.11.84	[signature]	HS-control	Karlsruhe GmbH D-7505 Ettlingen
Geprüft			Kom 2590-75-83.01	Zeichng Nr 157-393-4
Gesehen				Blatt 24 von

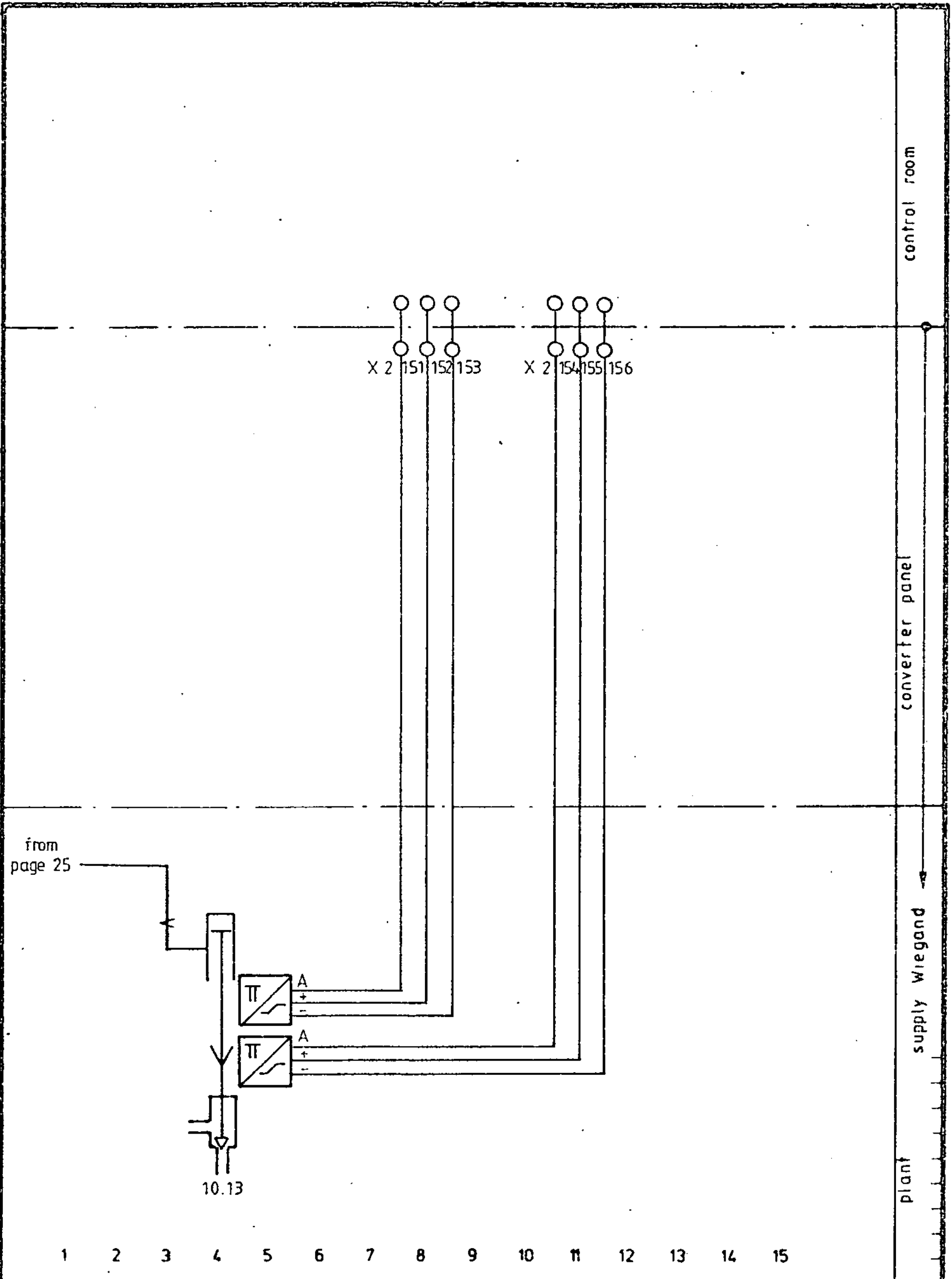
Index | Änderung | Datum | Name



spray cleaning

	Datum	Name	Benennung	WIEGAND
Gezeichn	6.11.84	Hollau	HS-control	Karlsruhe GmbH D-7505 Ettlingen
Geprüft			Kom	Zeichng Nr / Index
Gesehen			2590 -75-83.01	157-393-4 / e f
				Blatt 25 von

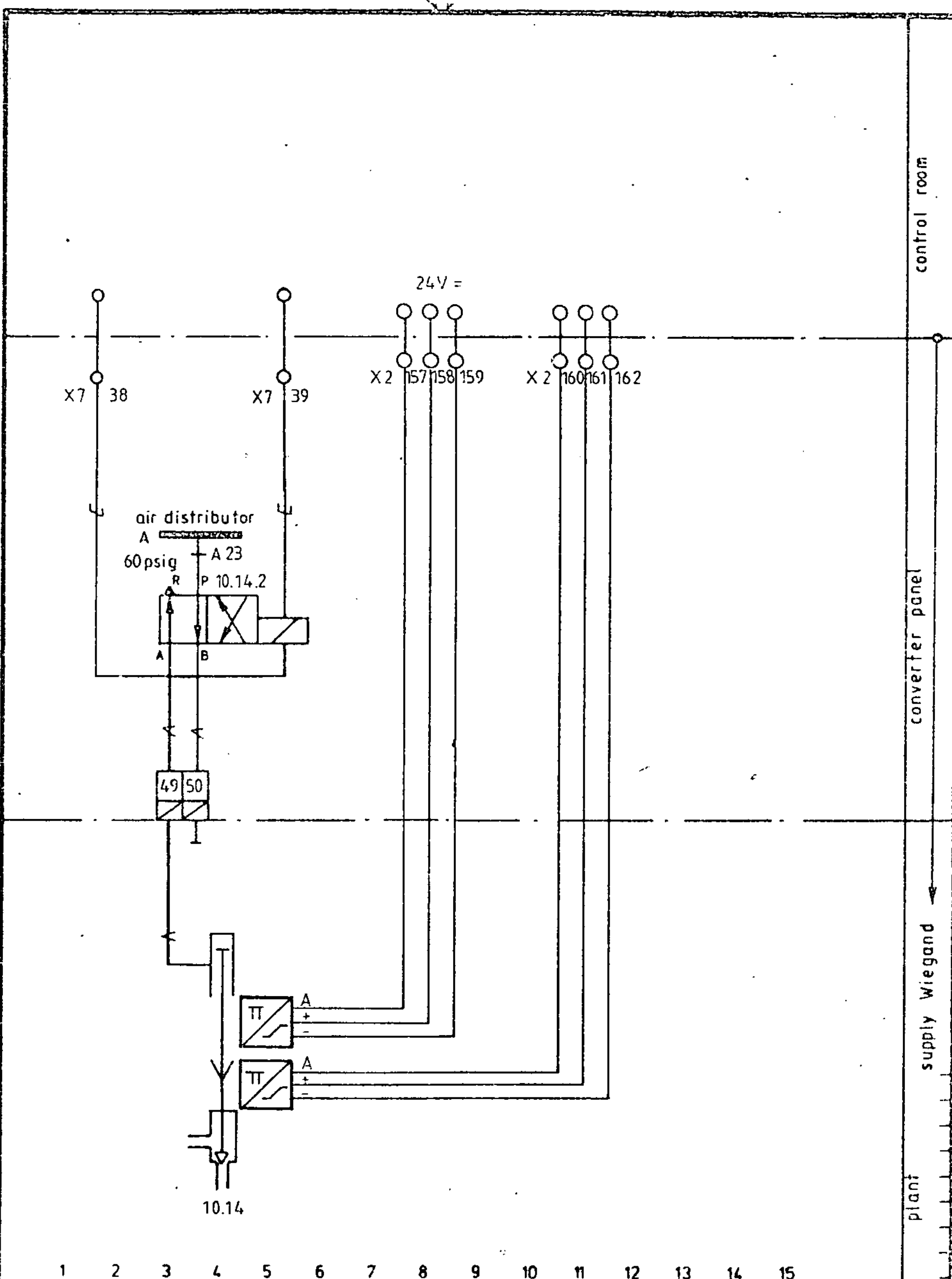
Name	Datum	Änderung



spray cleaning

	Datum	Name	Benennung HS-control	WIEGAND Karlsruhe GmbH D-7505 Ettlingen
Gezeichn	6.11 84	[signature]		
Geprüft			Kom	Zeichng Nr 157-393-4 / Index e f
Gesehen			2590-75-83.01	
				Blatt 26 von

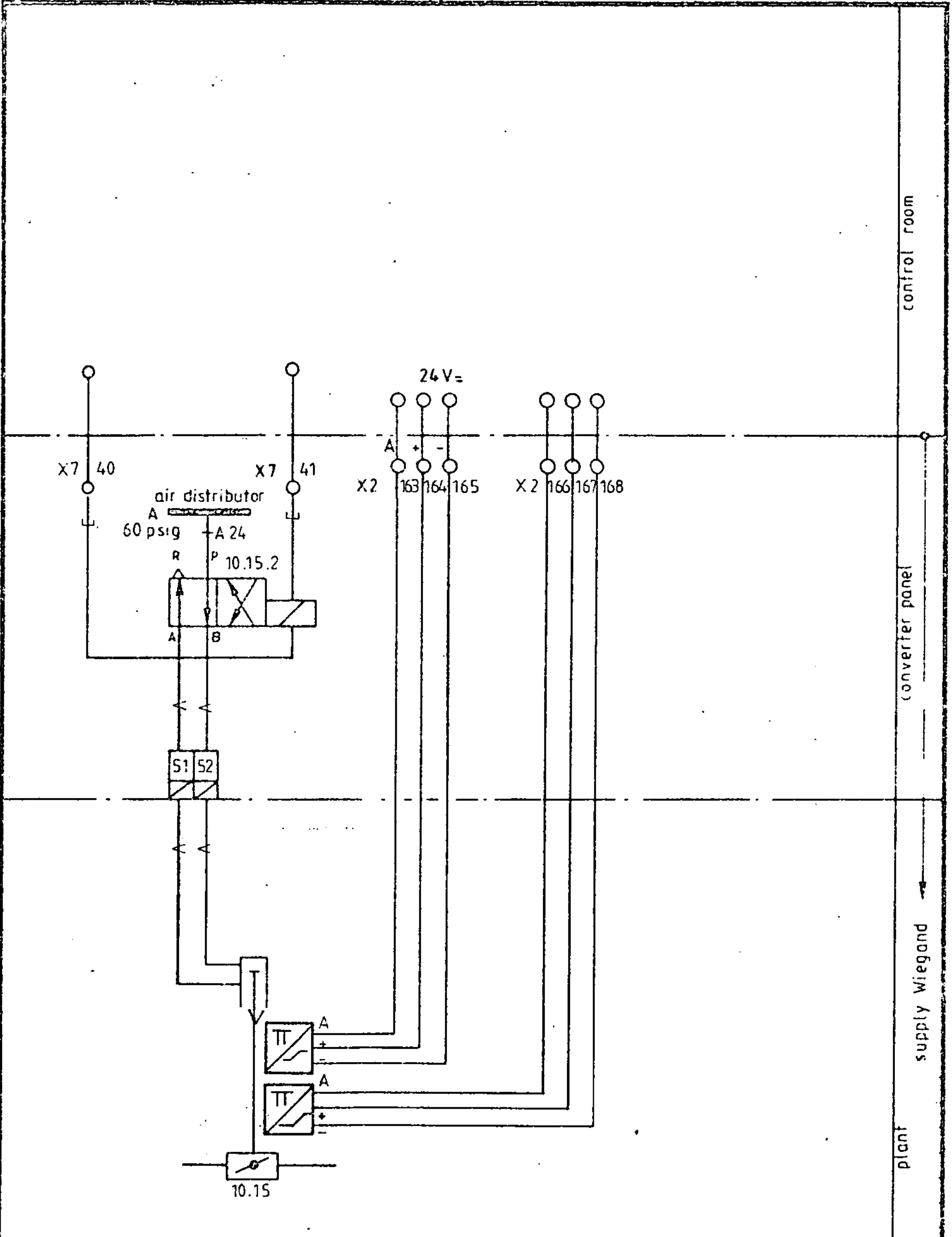
Änderung | Datum | Name | Index



spray cleaning

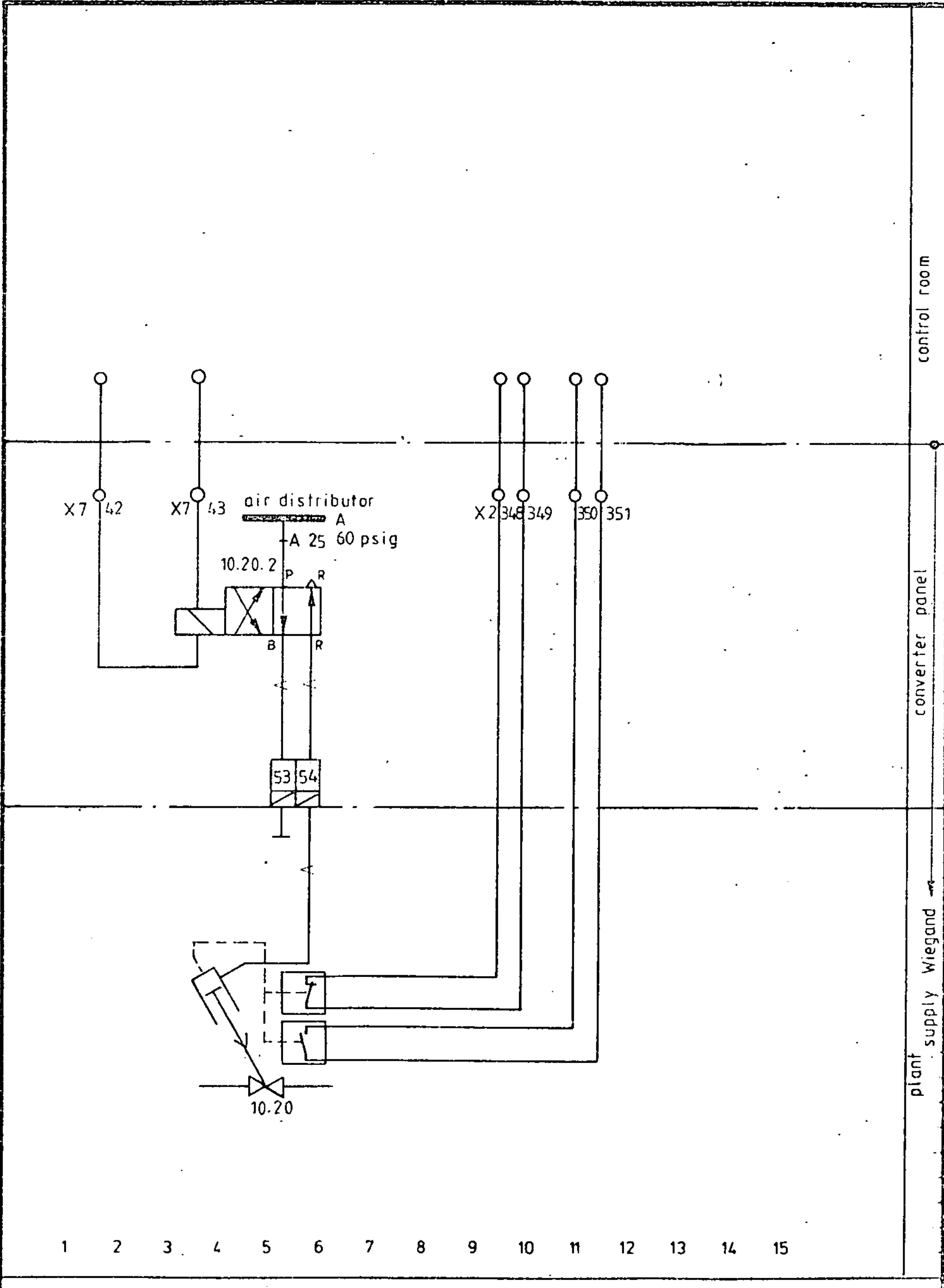
Index	Änderung	Datum	Name

	Datum	Name	Benennung	WIEGAND Karlsruhe GmbH D-7505 Ettlingen
Gezeichn	6.11.84	Hodalleu	HS-control	
Geprüft			Kom	Zeichng Nr 157-393-4
Gesehen			2590-75-83.01	Index e f
				Blatt 27 von



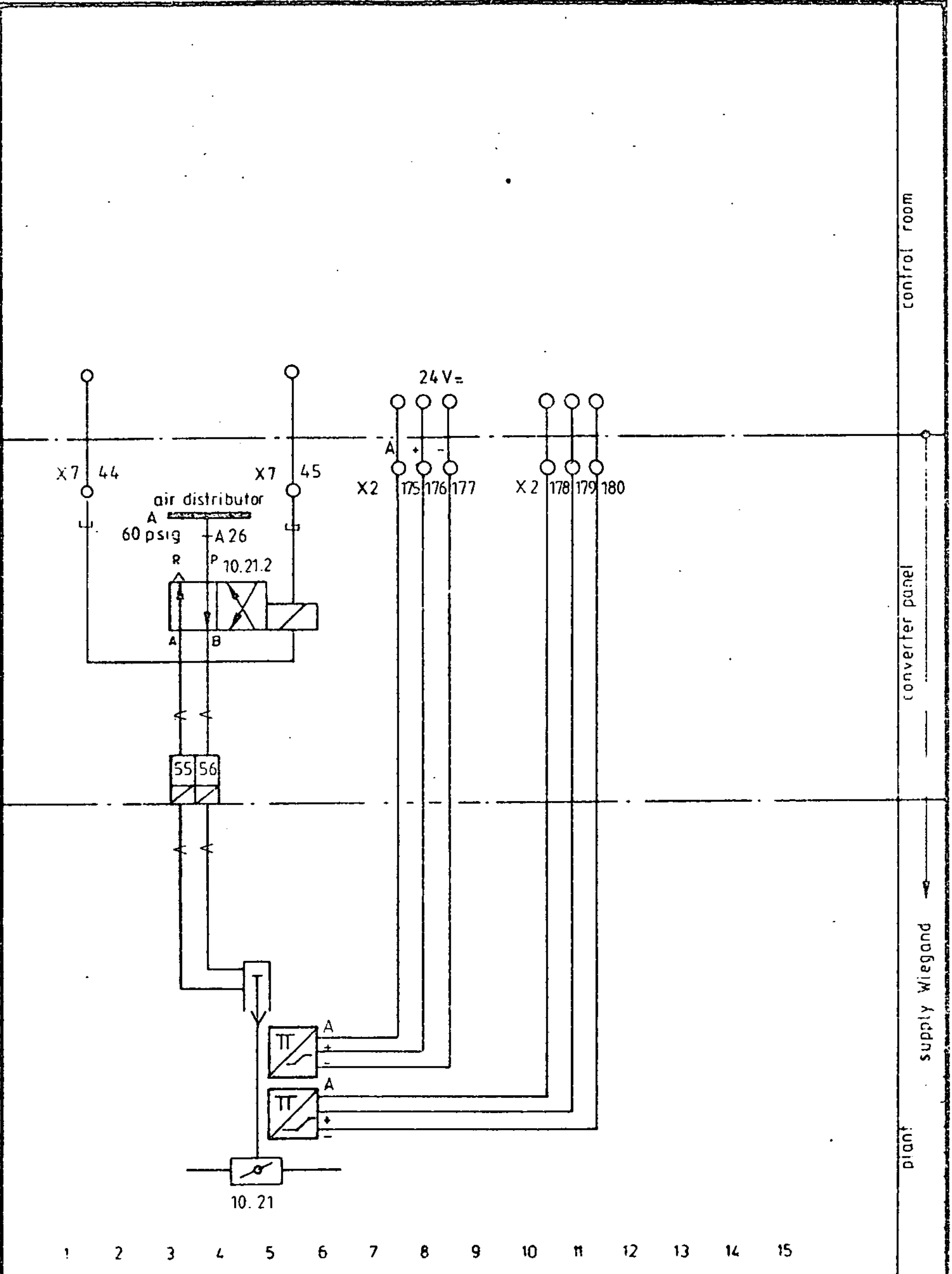
Spray cleaning

	Datum	Name	Benennung	
Gezeichn	6.11.84		HS-control	WIEGAND Karlsruhe GmbH D-7505 Ettlingen
Geprüft			Kom 2590-75-83 01	Zeichng Nr 157-393-4 / Index e f
Gesehen				Blatt 28 von



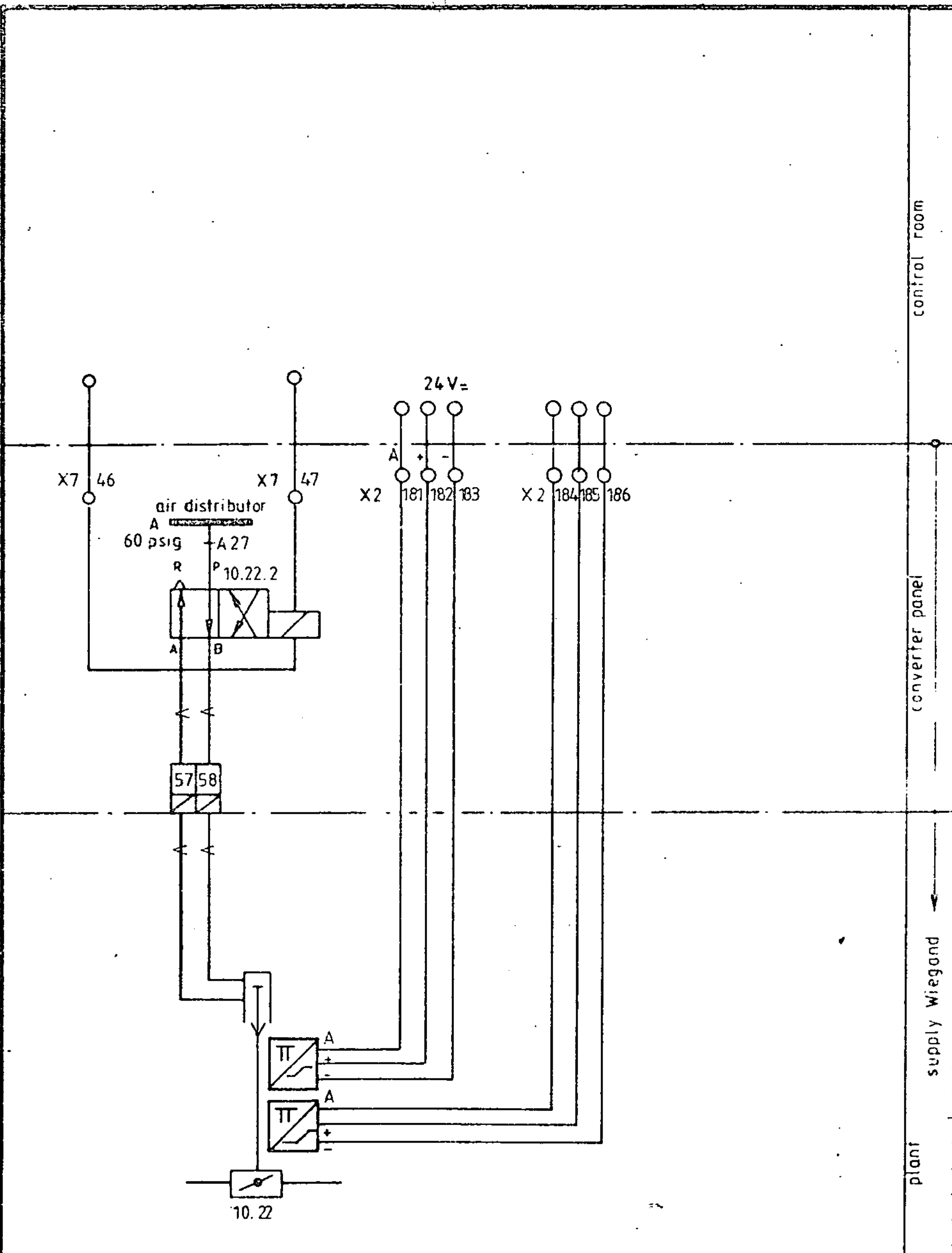
	Datum	Name	Benennung	HS-control	WIEGAND Karlsruhe GmbH D-7505 Ettlingen
Gezeichn.	26. 4. 84	Ba…			
Geprüft			Kom	2590-75-83.01	Zeichng. Nr. 157-393-4 · Index e f
Gesehen					Blatt 29 von

Änderung · Datum · Name · Index



Spray cleaning

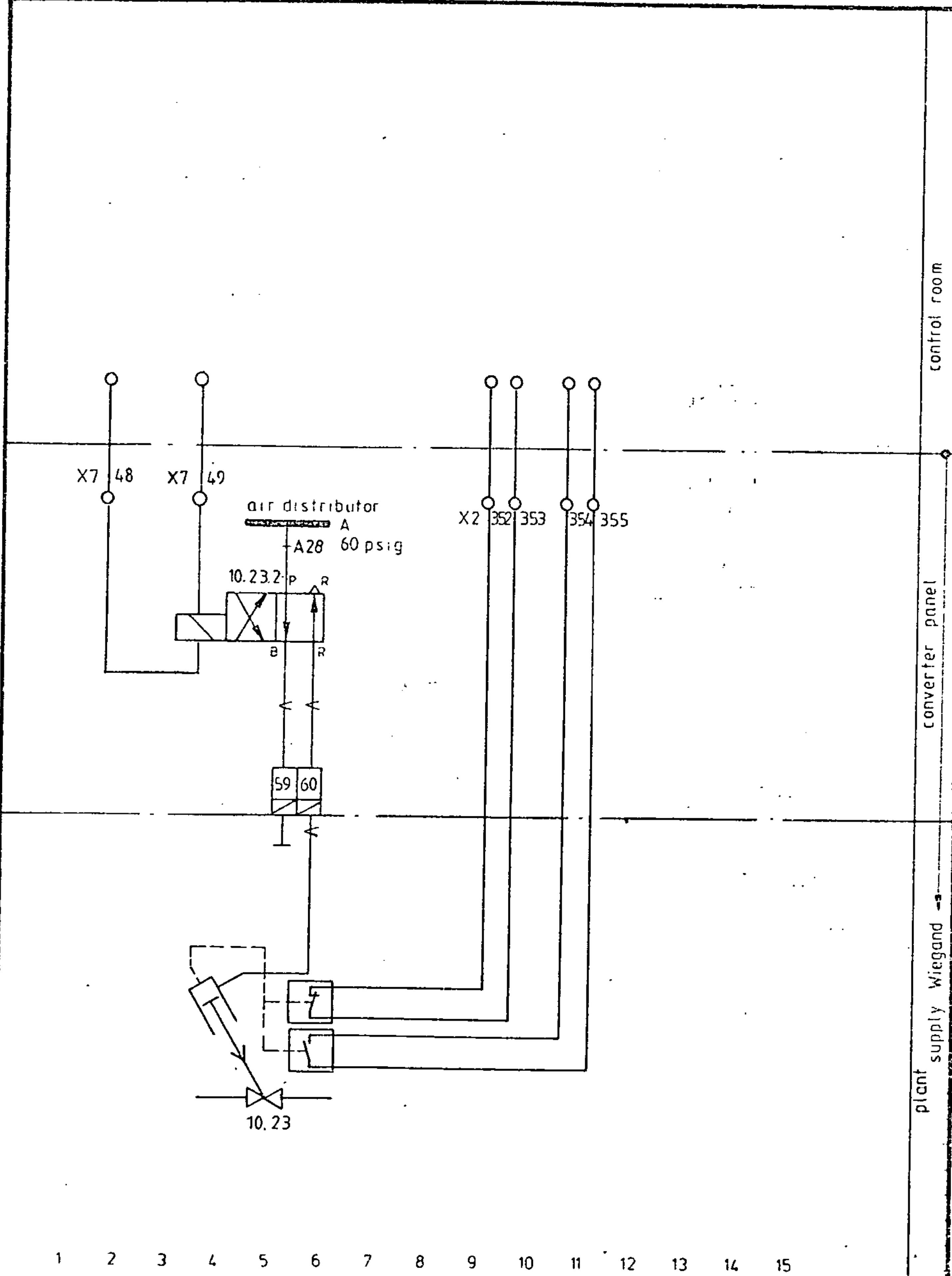
	Datum	Name	Benennung		
Gezeichn	6.11.84	Holaun	HS-control	WIEGAND Karlsruhe GmbH D 7505 Ettlingen	
Geprüft			Kom	Zeichng Nr	Index
Gesehen			2590-75-83 01	157-393-4	e f
				Blatt 30 von	



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

Spray cleaning

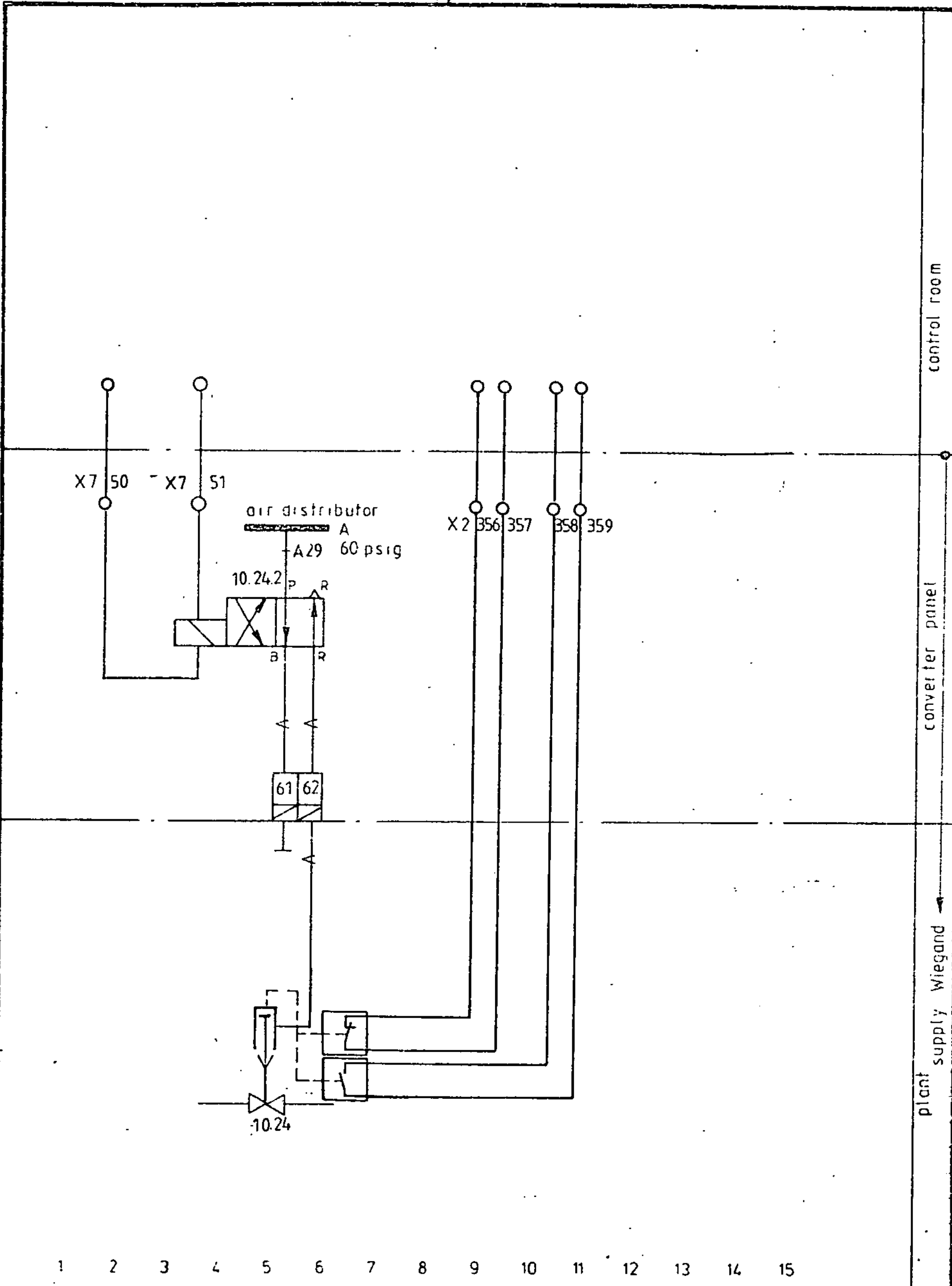
	Datum	Name	Benennung HS-control	WIEGAND Karlsruhe GmbH D 7505 Ettlingen
Gezeichn	6.11.84	[signature]		
Geprüft			Kom 2590-75-83 01	Zeichng Nr 157-393-4 Index e f
Gesehen				Blatt 31 von



Speerwasser / Sealing water.

	Datum	Name	Benennung	
Gezeichn	26. 4.84	Beck	HS-control	WIEGAND Karlsruhe GmbH D-7505 Ettlingen
Geprüft			Komm 2590-75-83.01	Zeichng Nr 157-393-4 Index e f
Gesehen				Blatt 32 von

Änderung Datum Name Index



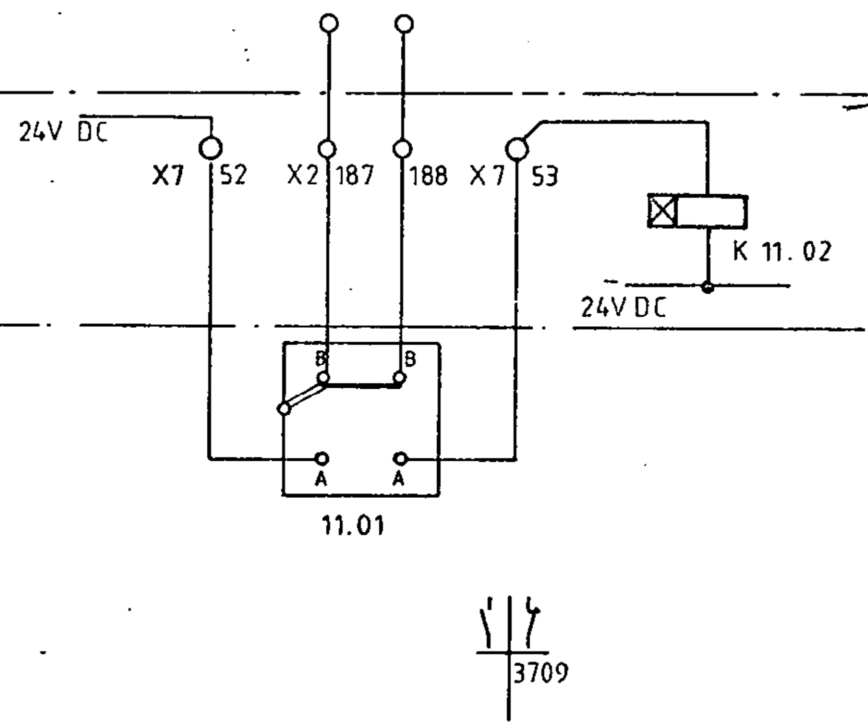
Speerwasser

	Datum	Name	Benennung	WIEGAND Karlsruhe GmbH D-7505 Ettlingen	
Gezeichnet	26. 4. 84	Bef	HS-control		
Geprüft		---	Kom. 2590-75-83.01	Zeichng. Nr 157-393-4	Index e. f
Gesehen				Blatt 33 von	

control room

converter plate

plant

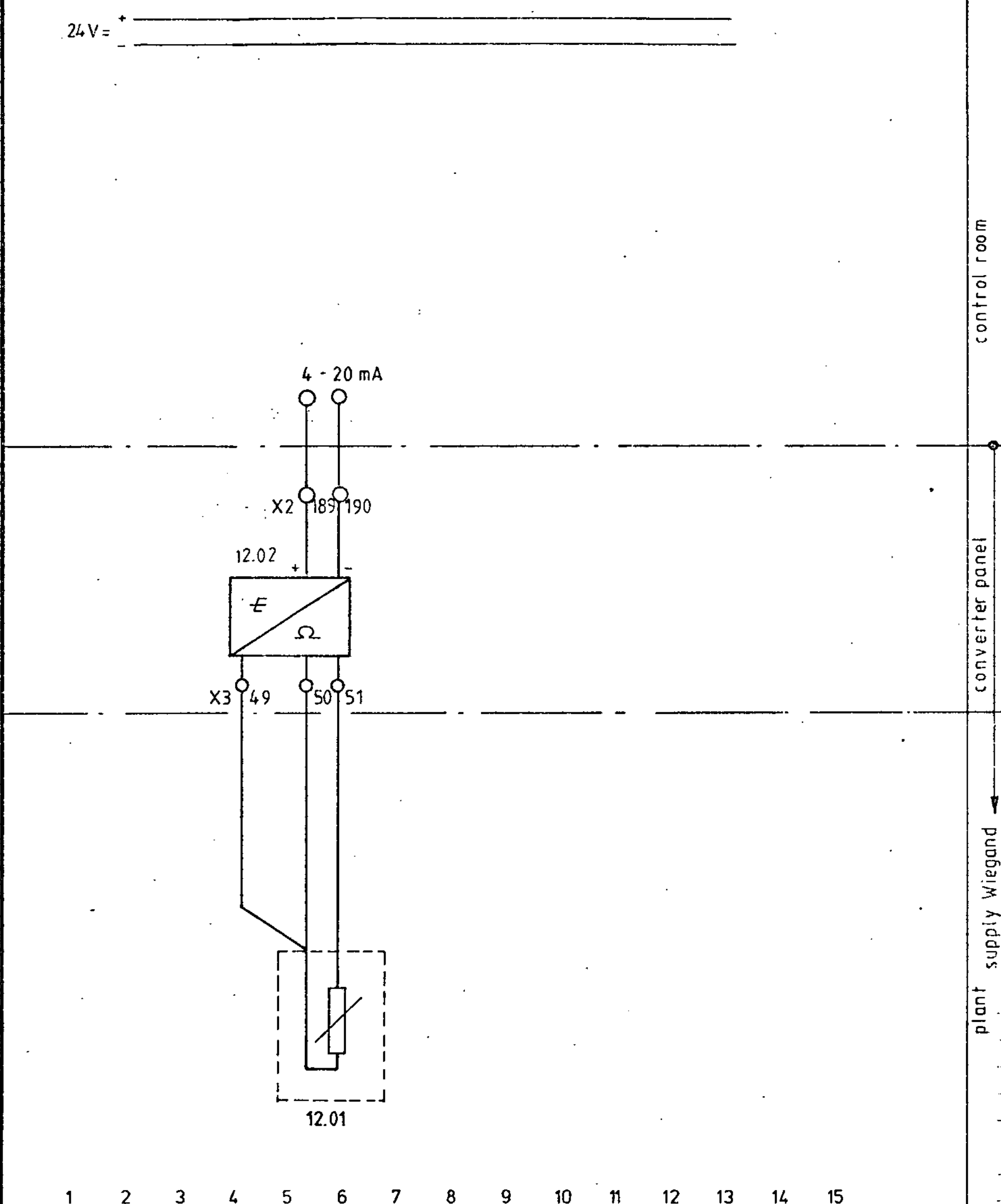


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

circuit breaker alarm and fan / level supervision

	Datum	Name	Benennung LSA 11	WIEGAND Karlsruhe GmbH D-7505 Ettlingen
Gezeichn.	3.5.84	Bep		
Geprüft			Kom. 2590-75-83.01	Zeichng. Nr. 157 393 4 — Index e f
Gesehen				Blatt 34 von

Index	Änderung	Datum	Name

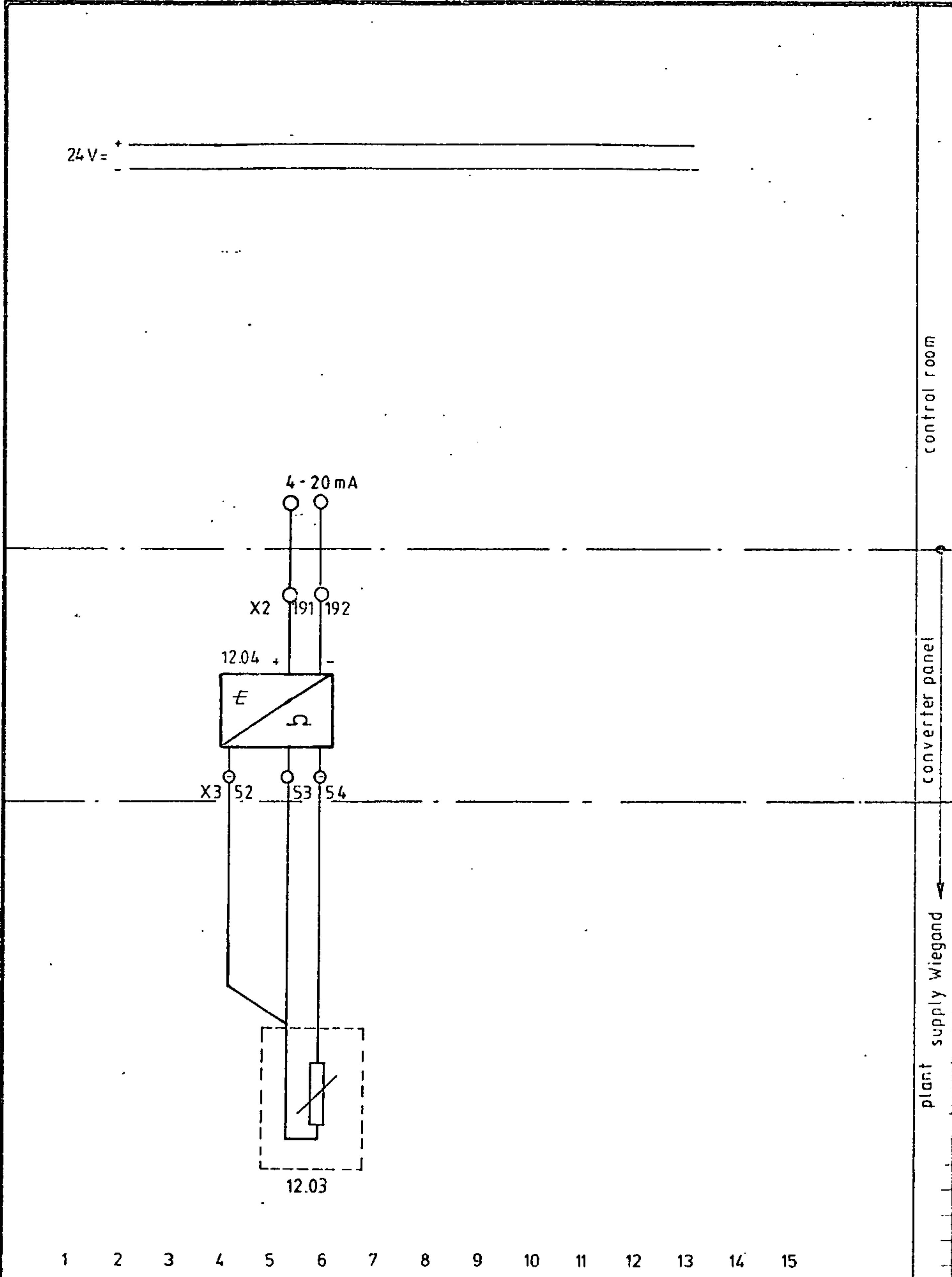


temperature supervision

	Datum	Name	Benennung		
			TIAS 12.01 fan	WIEGAND Karlsruhe GmbH D-7505 Ettlingen	
Gezeichn.	4.5.84	Blu J			
Geprüft			Kom	Zeichng. Nr. 157-393-4	Index a f
Gesehen			2590-75-83.01	Blatt 35 von	

Index	Änderung	Datum	Name

Index	Änderung	Datum	Name



temperature supervision

	Datum	Name	Benennung	TIAS 12.02 fan	WIEGAND Karlsruhe GmbH D-7505 Ettlingen	
Gezeichn	4.5.84	Be J				
Geprüft			Kom	2590-75-83.01	Zeichng. Nr 157-393-4	index a f
Gesehen					Blatt 36 von	

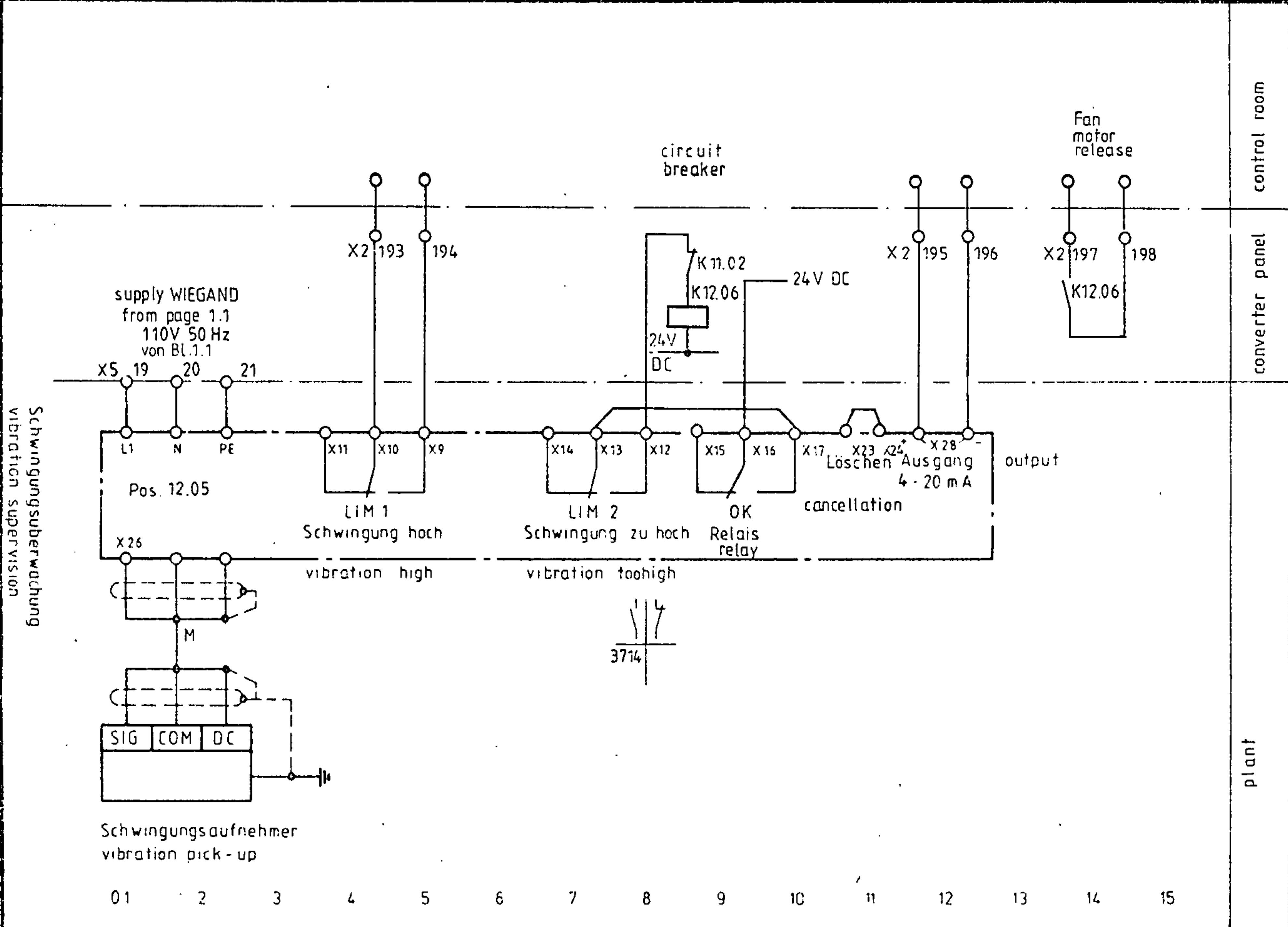
Index	Änderung	Datum	Name

	Datum	Name
Gezeichn	4.5.84	Be...
Geprüft		
Gesehen		

Benennung: XIAS 12.05

Kom: 2590-75-83.01

Schwingungsüberwachung
vibration supervision

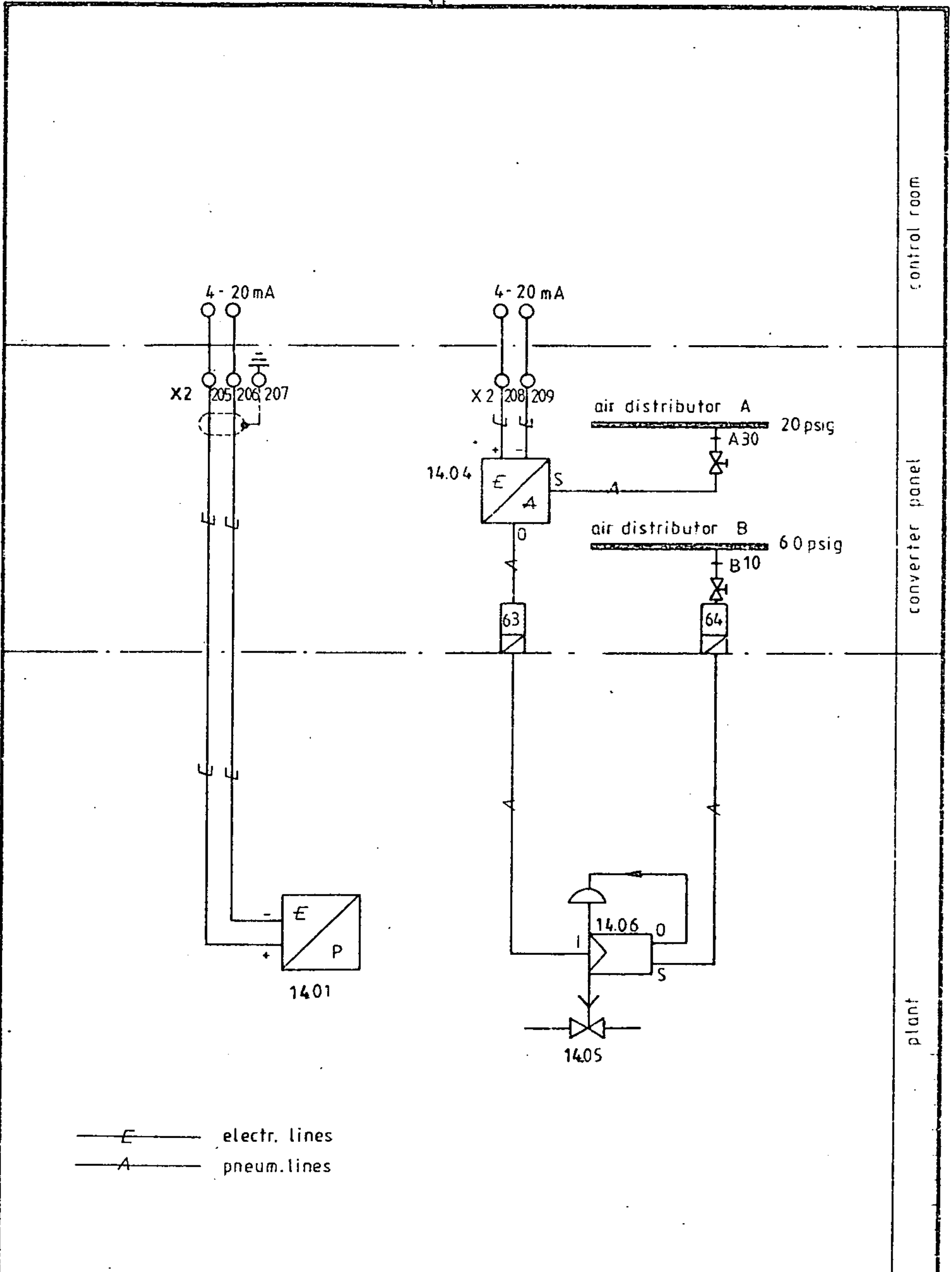


WIEGAND
Karlsruhe GmbH D-7505 Ettlingen

Zeichng Nr: 157-393-4

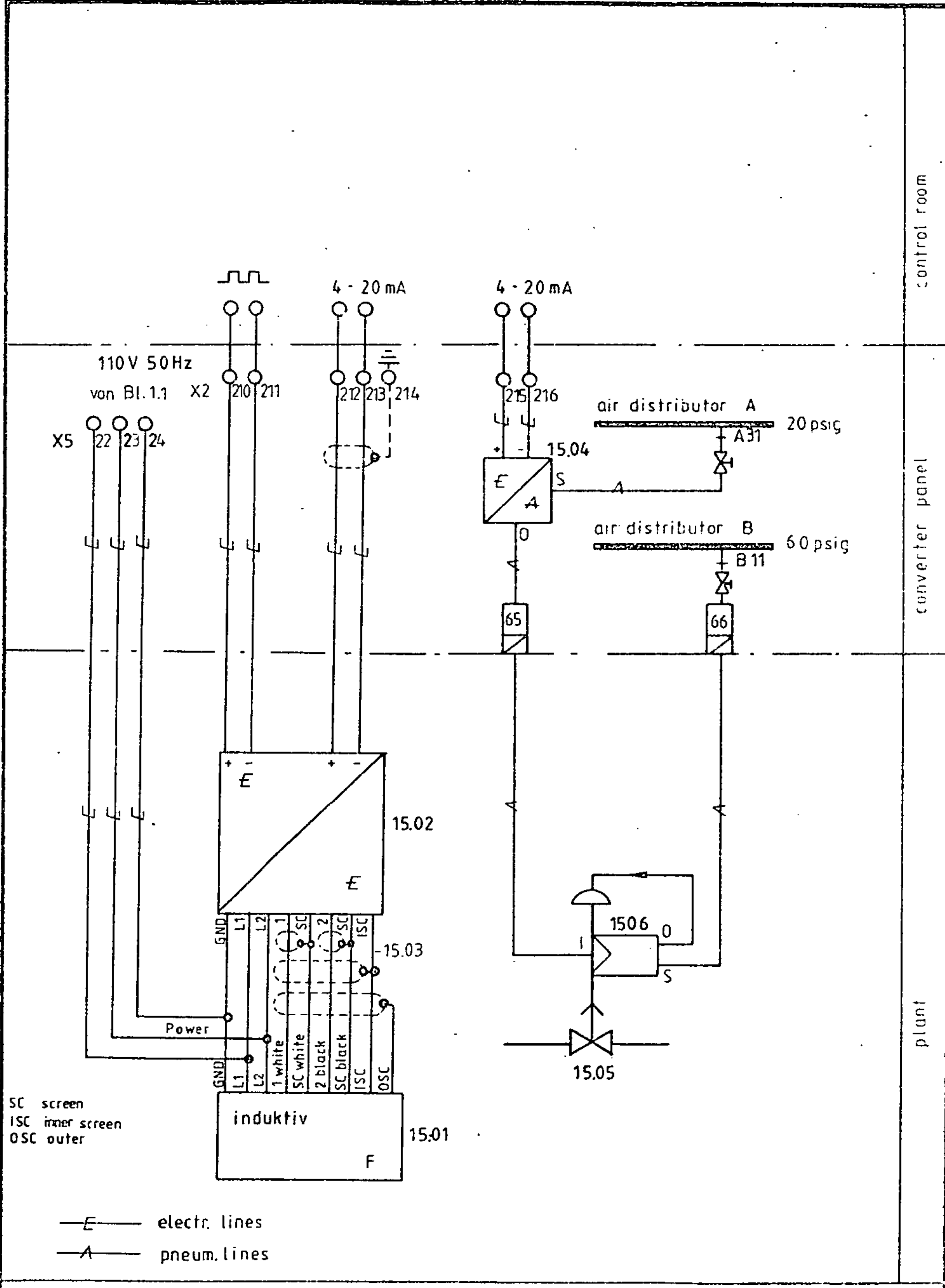
Blatt 37 von

Index e

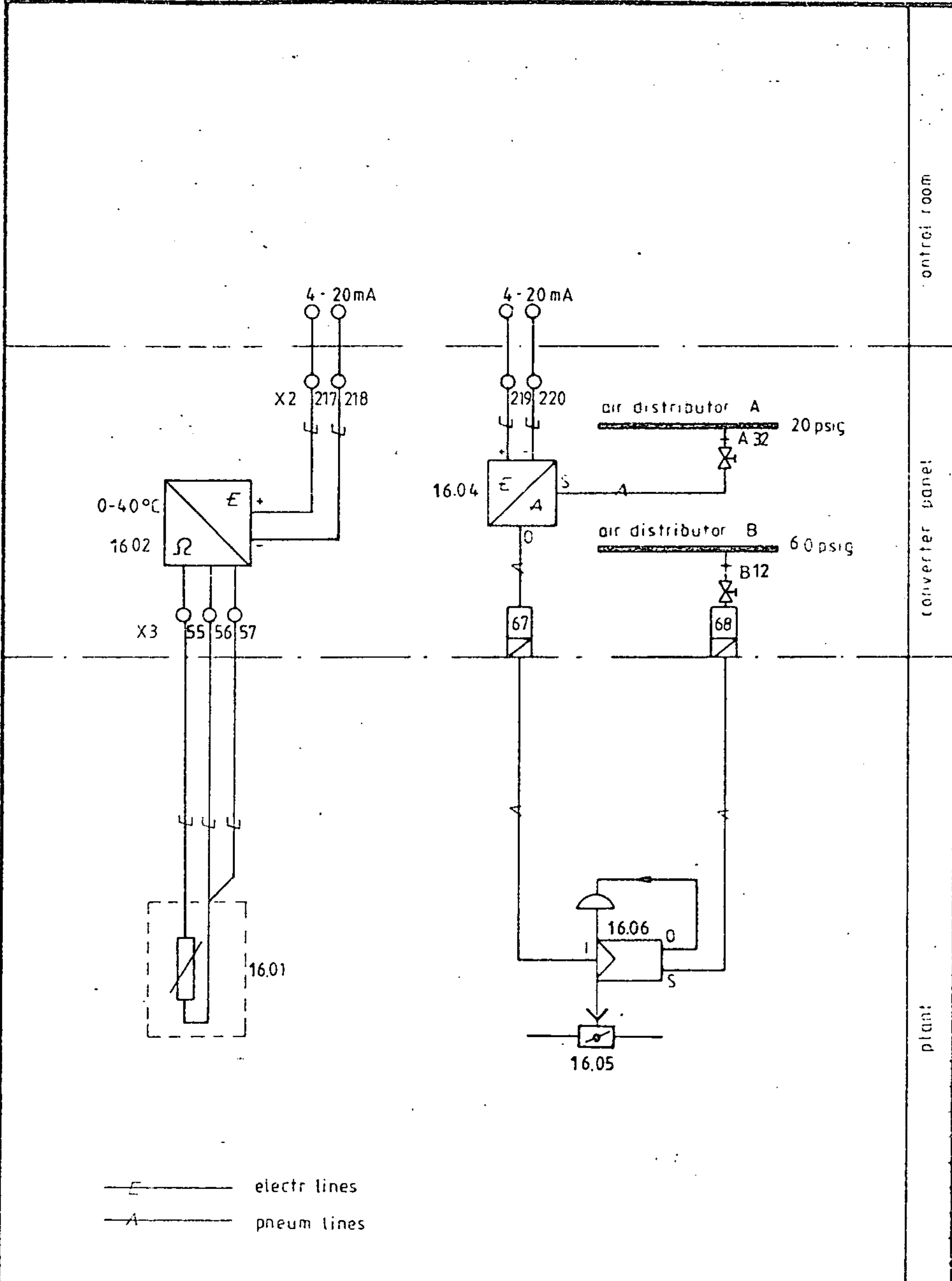


steam pressure control loop

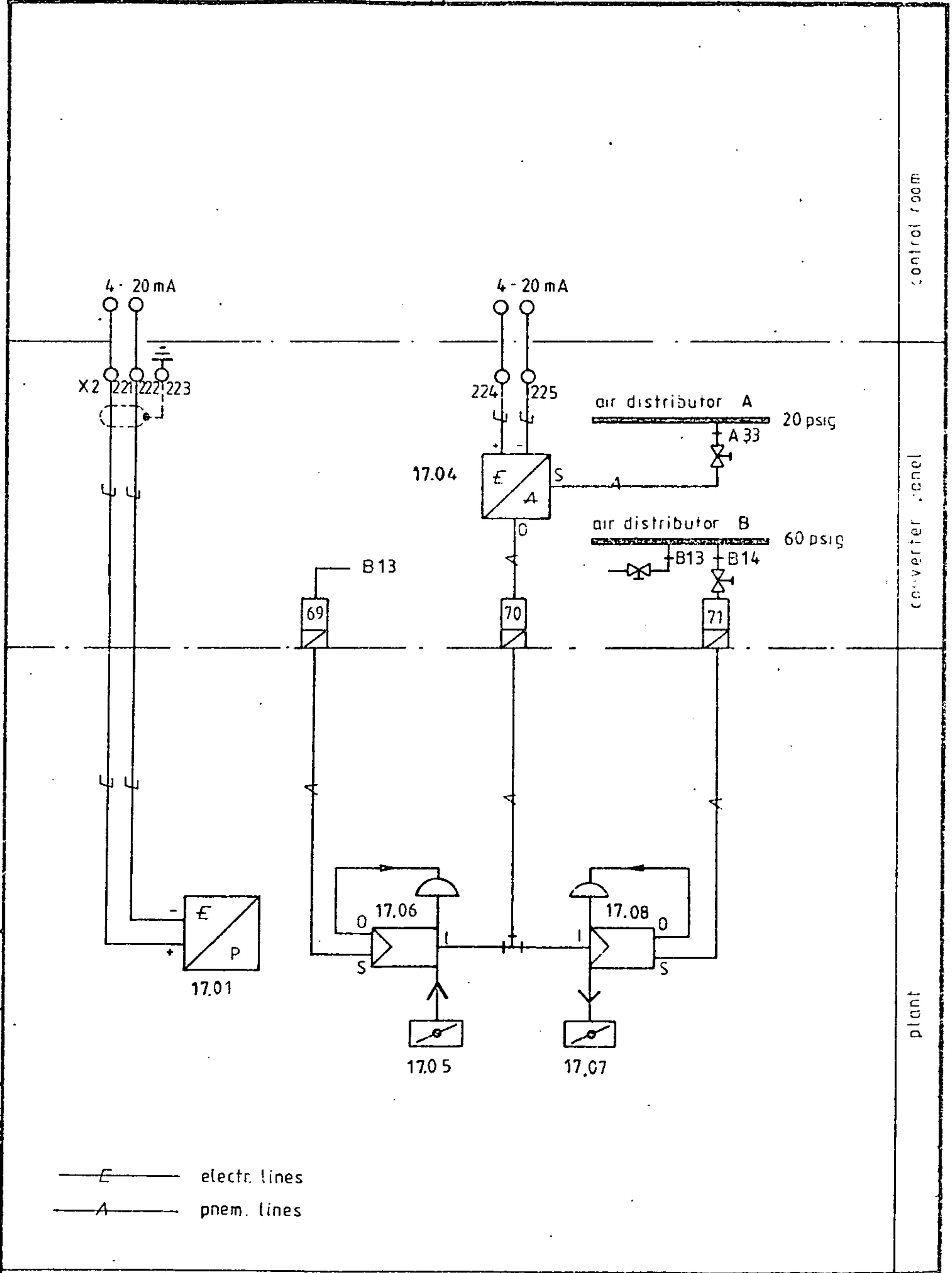
	Datum	Name	Benennung		WIEGAND Karlsruhe GmbH D 7505 Ettlingen	
Gezeichn	20.3.84	Bef	PIC 14			
Geprüft			Kom		Zeichng Nr	Index
Gesehen			2590 - 75 - 83. 01		157 - 393 - 4	e, f
					Blatt 38 von	



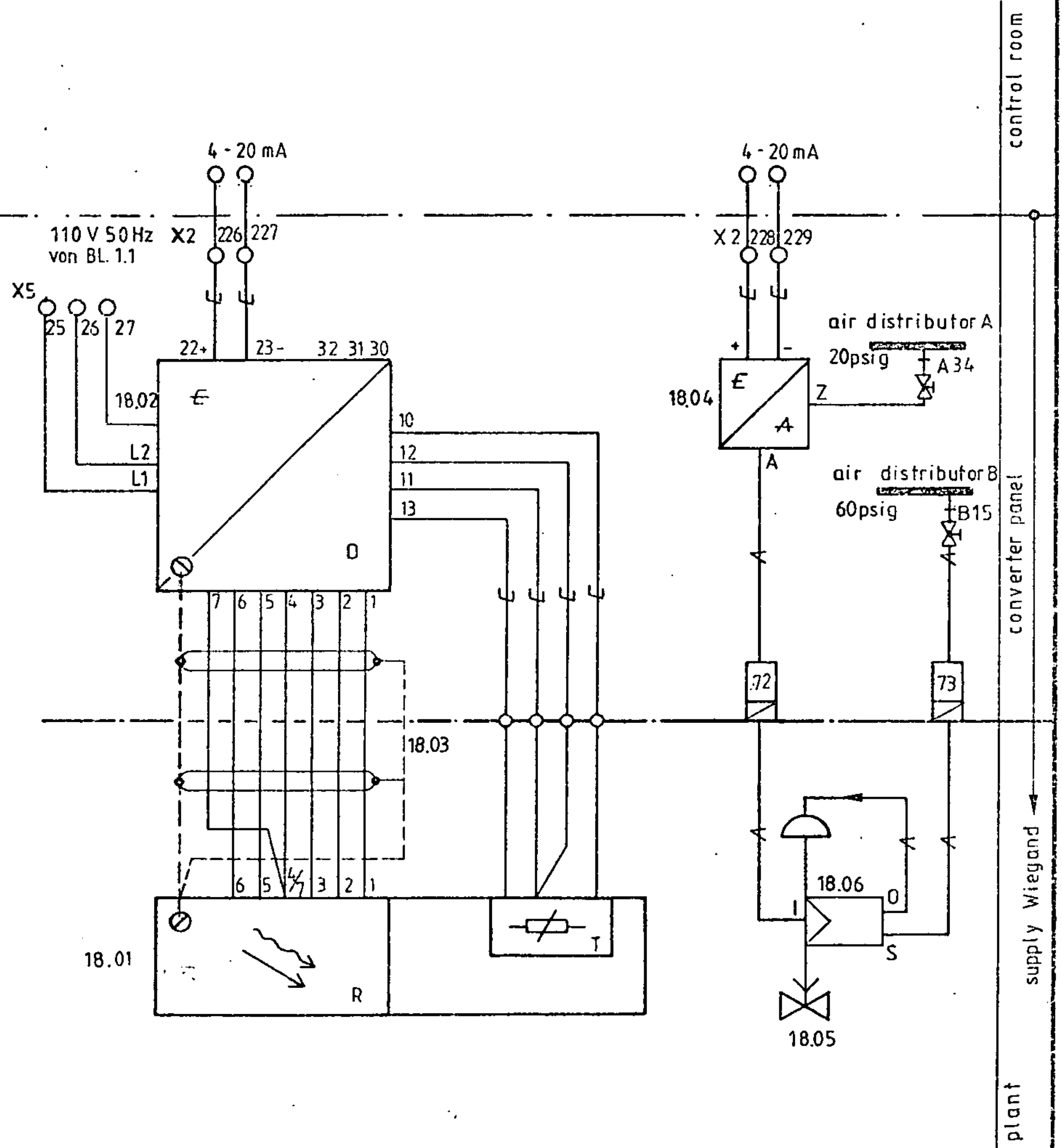
	Datum	Name	Benennung	WIEGAND Karlsruhe GmbH D-7505 Ettlingen	
Gezeichnet	21.3.84	Beuf	FIC 15		
Geprüft			Kom 2590 - 75 - 83.01	Zeichng. Nr 157 - 393 - 4	e f
Gesehen				Blatt 39 von	



	Datum	Name	Benennung TIC 16	WIEGAND	
gezeichnet	21.3.84				
geprüft			Kom	Zeichnung Nr	Index
Gesehen			2590-75-83.01	157-393-4	e f
				Blatt 40 von	

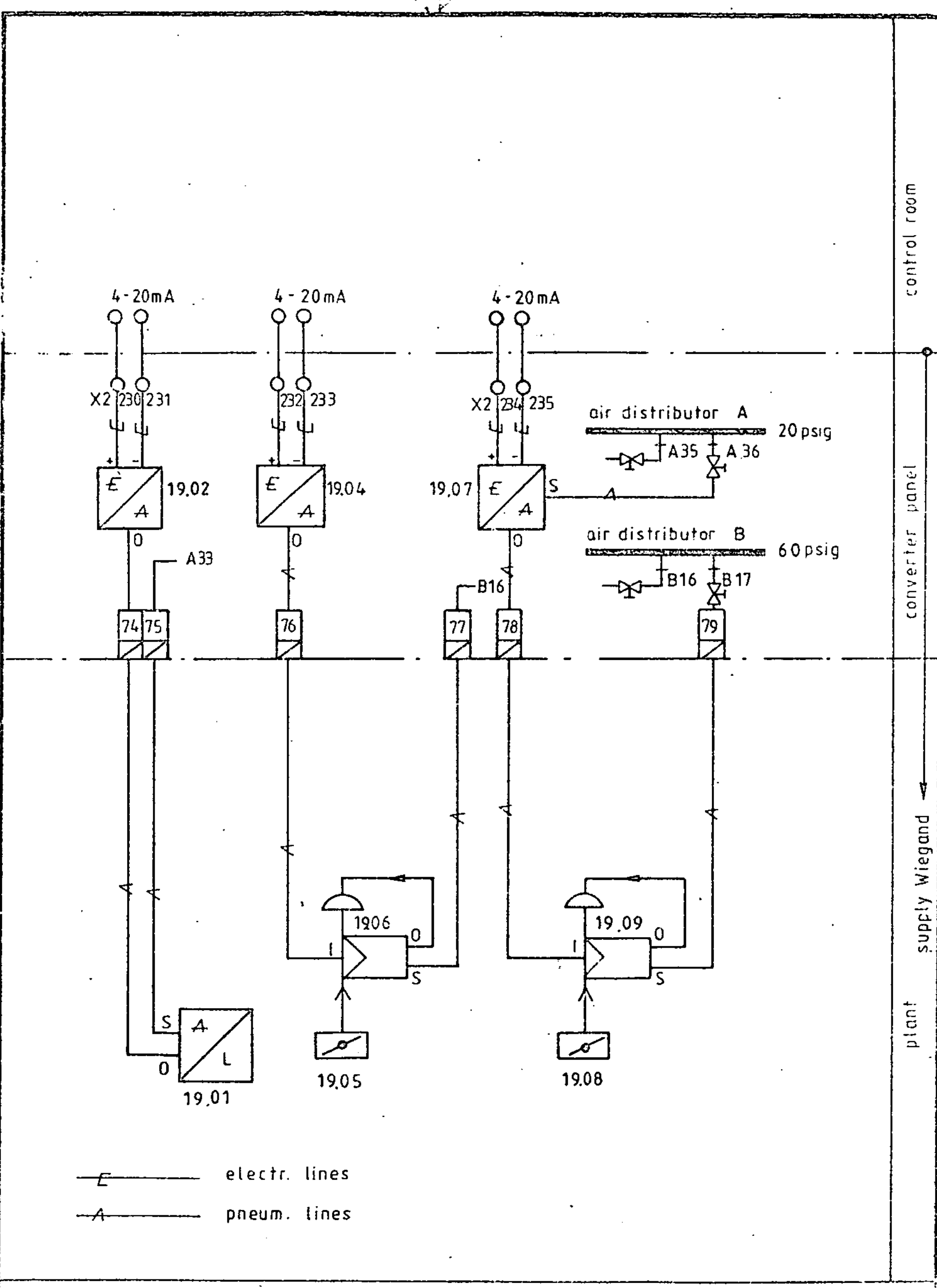


	Datum	Name	Benennung	WIEGAND Karlsruhe GmbH D-7505 Ettlingen
Gezeichn	22.3.84		PIC 17	
Geprüft			Kom	Zeichng. Nr. 157 - 393 - 4
Gesehen			2590 - 75 - 83.01	Blatt 41 von

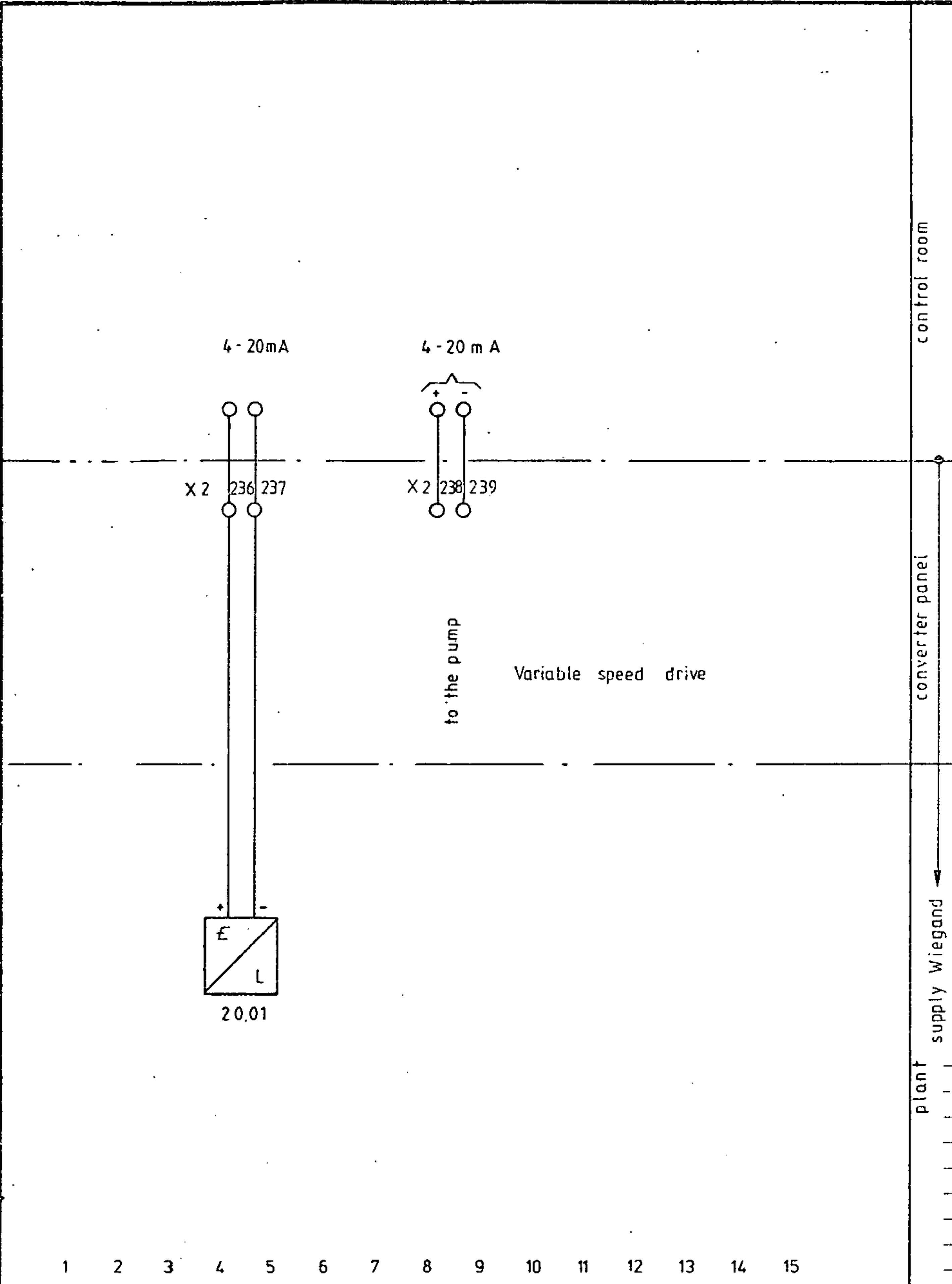


Dichteregelkreis density control loop

	Datum	Name	Benennung	
Gezeichn	9.5.84	Berf	DIC 18	WIEGAND Karlsruhe GmbH
Geprüft			Kom.	Zeichng Nr
Gesehen			2590-75-83.01	157-393-4
		Berthold		Blatt 42 von

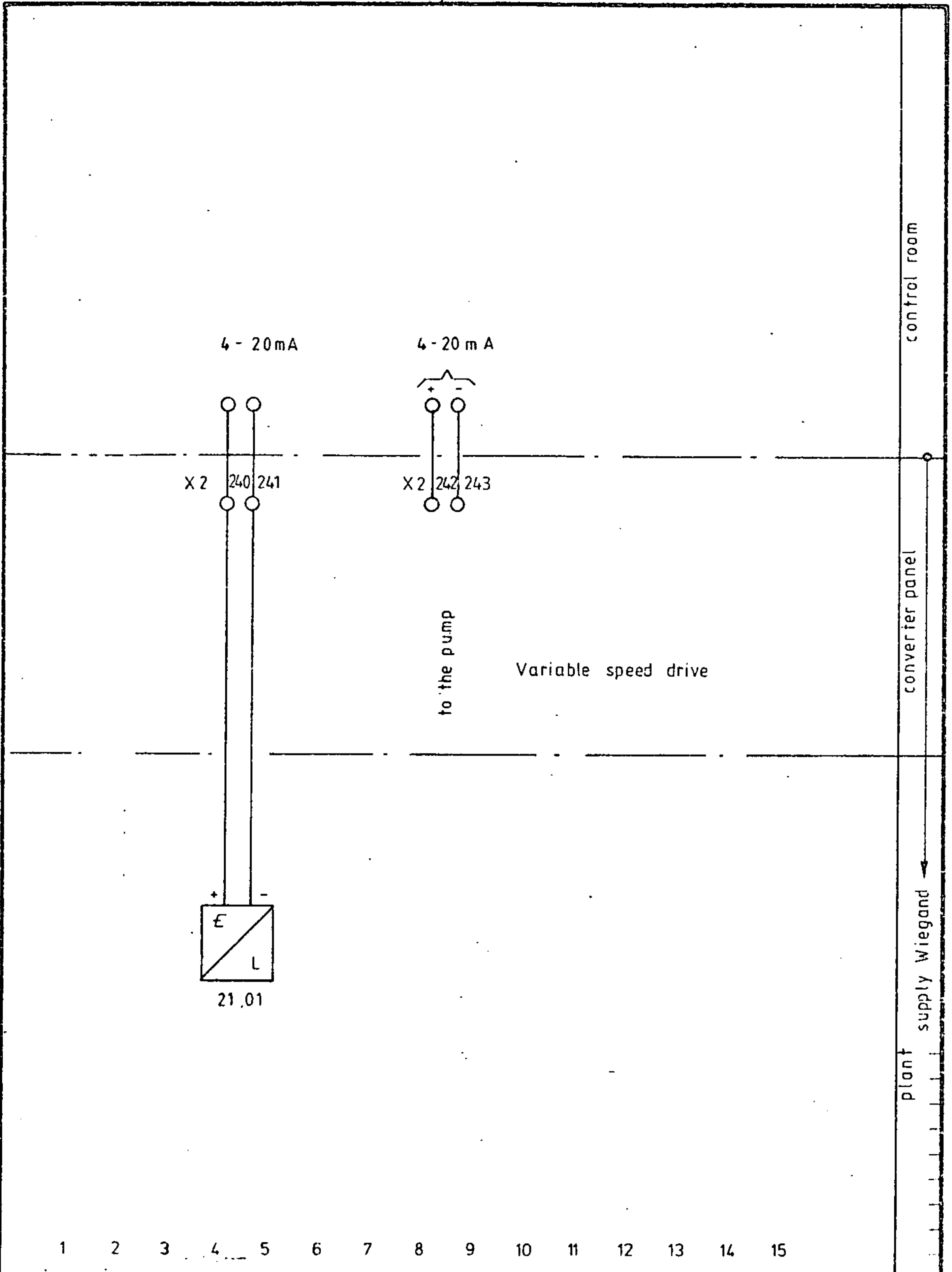


	Datum	Name	Benennung LIC 19	WIEGAND Karlsruhe GmbH
Gezeichn.	22.3.84	Ber J		
Geprüft			2590-75-83.01	Zeichng Nr 157-393-4
				Blatt 43 von



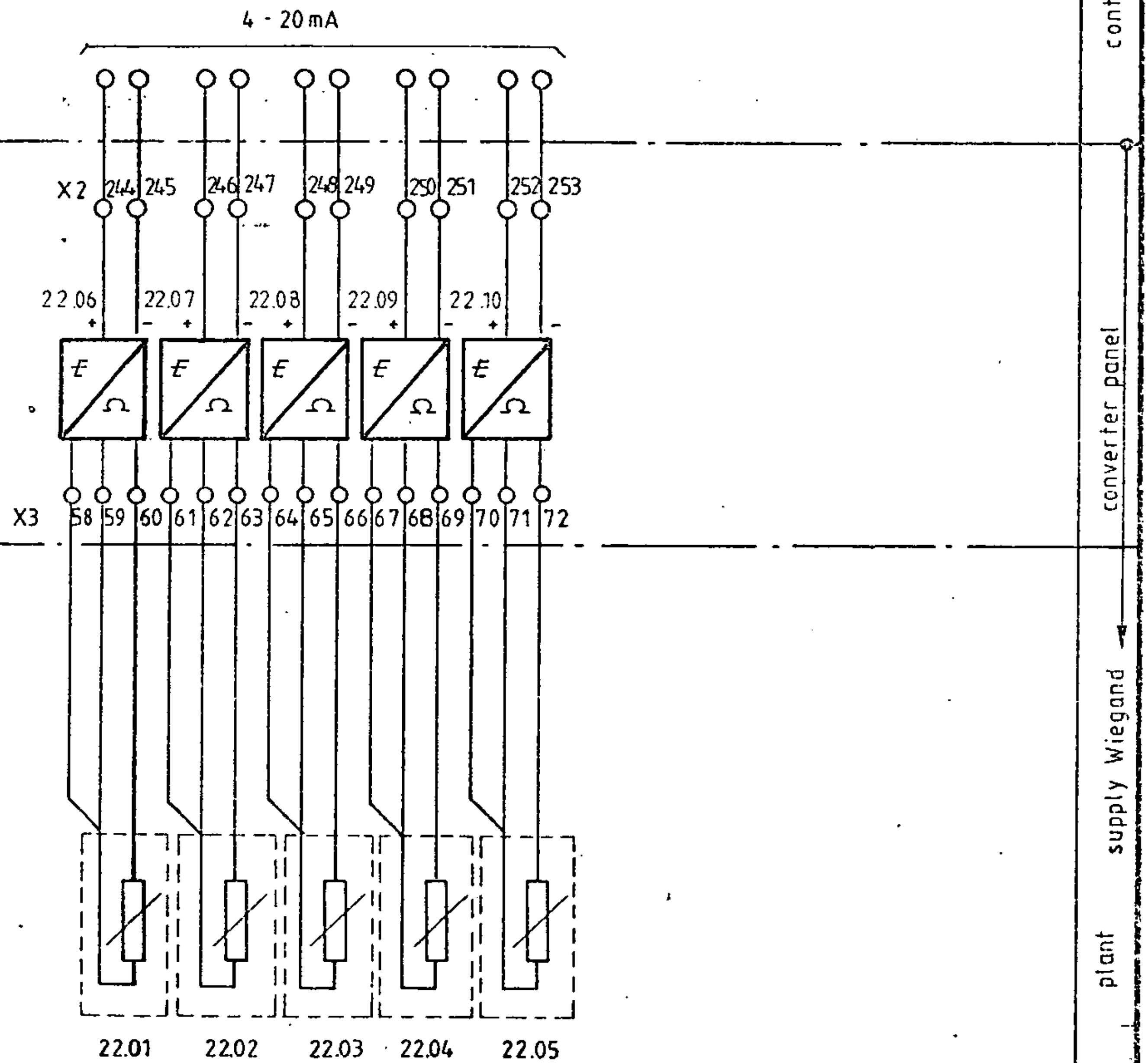
Index	Datum	Name	Änderung

	Datum	Name	Benennung	WIEGAND Karlsruhe GmbH D-7505 Ettlingen	
Gezeichn	9. 5. 84	Ben z	LIC 20		
Geprüft			Kom 2590-75-83.01	Zeichng Nr 157 - 393 - 4	Index f
Gesehen				Blatt 44 von	



	Datum	Name	Benennung		
Gezeichn	9. 5. 84	Ber	LIC 21	WIEGAND Karlsruhe GmbH D-7505 Ettlingen	
Geprüft			Kom	Zeichng Nr 157 - 393 - 4	Index a f
Gesehen			2590-75-83.01	Blatt 45 von	

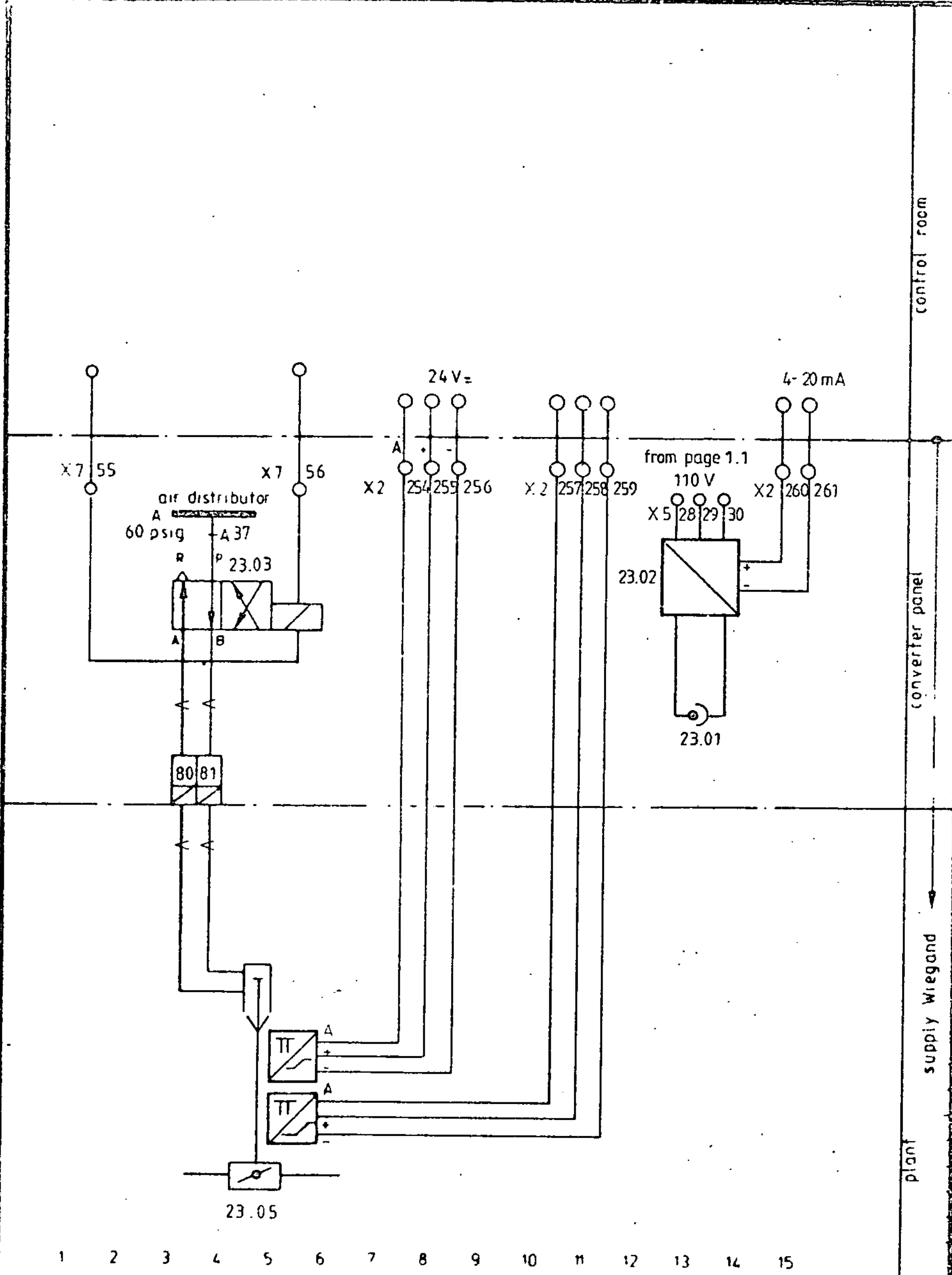
Änderung	Datum	Name	Index



temperature recording

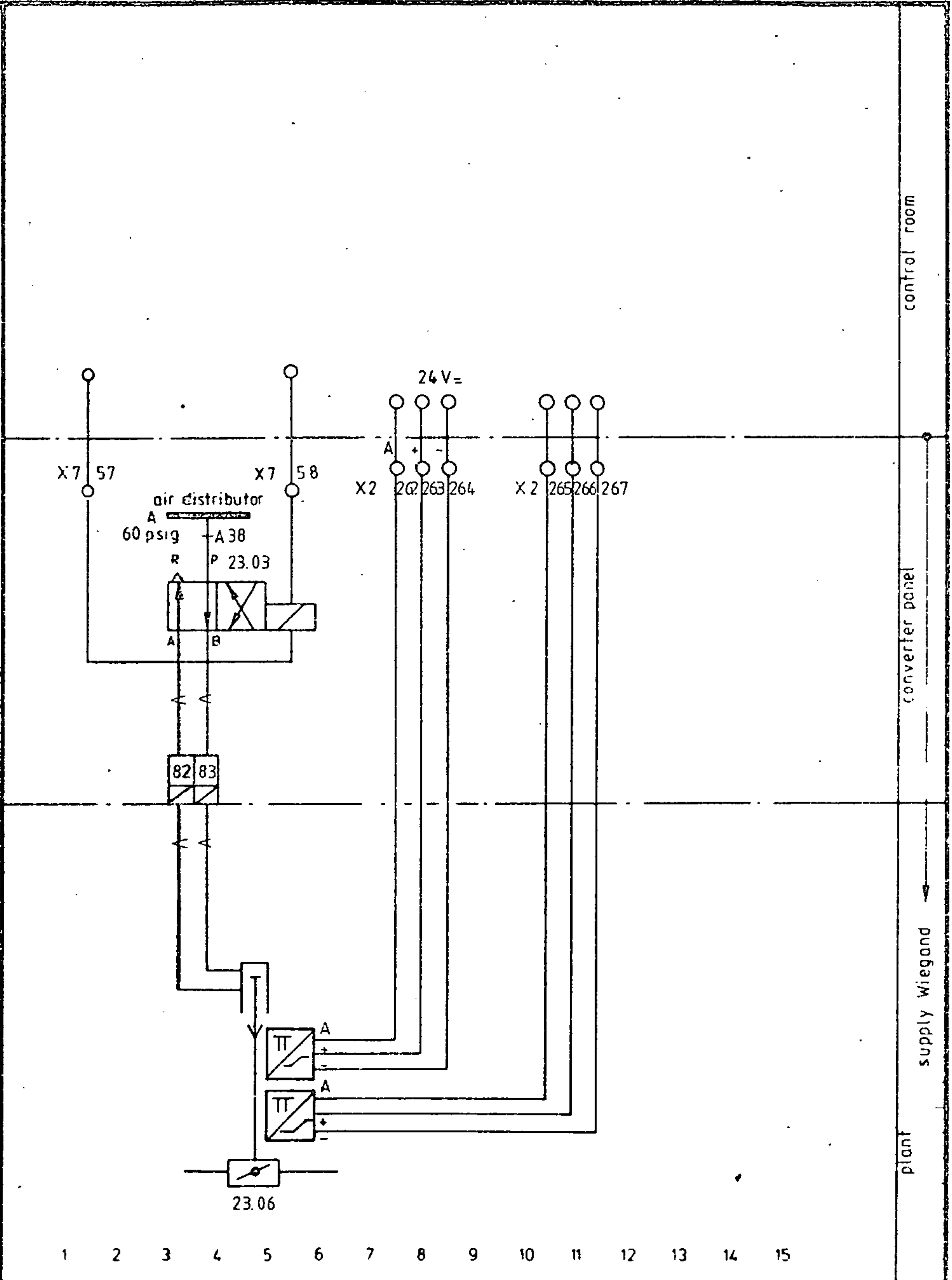
	Datum	Name	Benennung	WIEGAND Karlsruhe GmbH D-7505 Ettlingen
Gezeichn	10. 5. 84	Ber	TR 22	
Geprüft			Kom 2590-75-83.01	Zeichng Nr 157-393-4 — Index a f
Gesehen				Blatt 46 von

Änderung | Datum | Name | Index



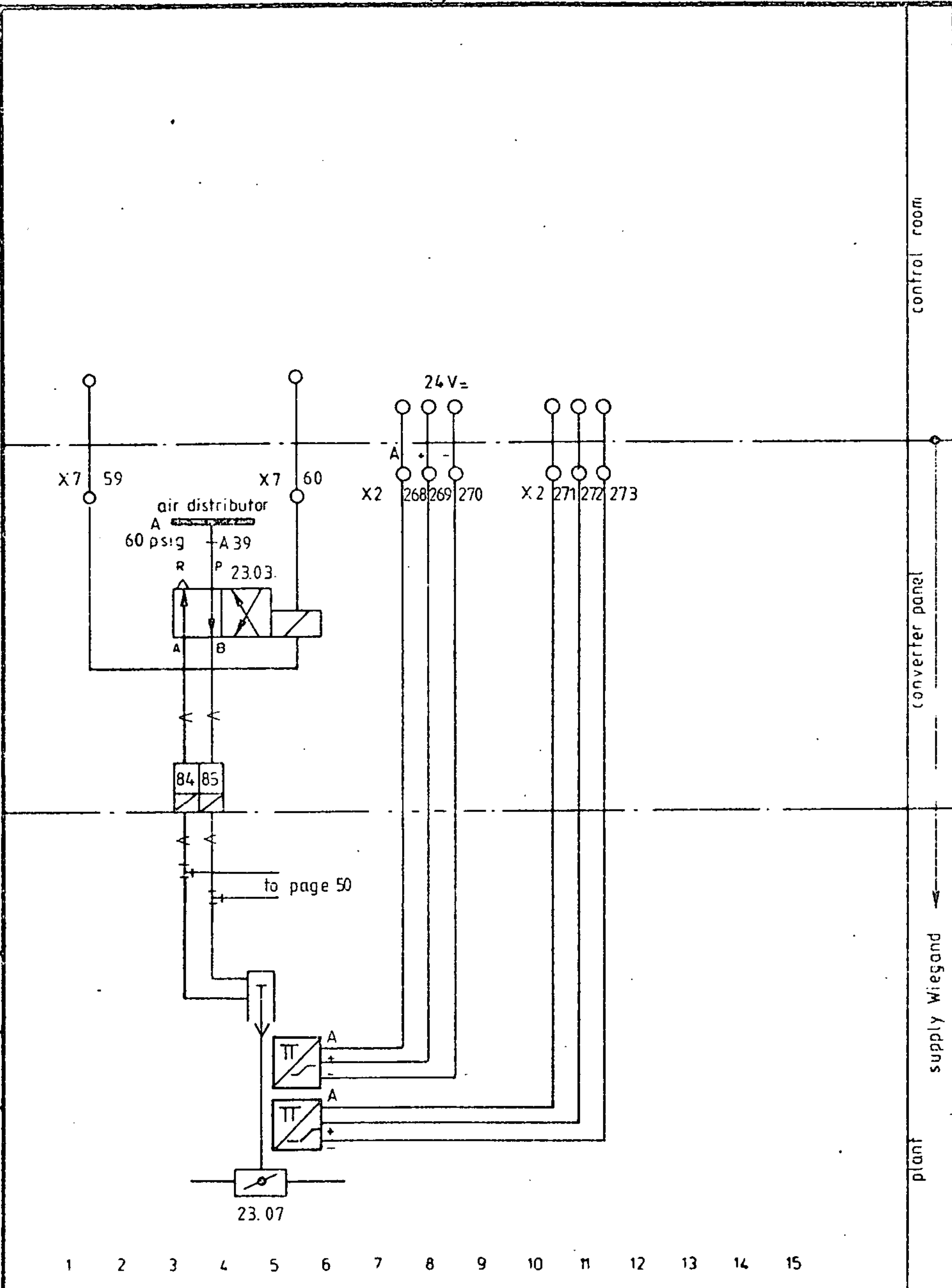
condensate supervision

	Datum	Name	Benennung		
Gezeichn	5.11.84	Hodam	CISA 23	WIEGAND Karlsruhe GmbH D-7505 Ettlingen	
Geprüft			Kom 2590-75-83 01	Zeichnung Nr 157-393-4	Index e f
Gesehen				Blatt 47 von	



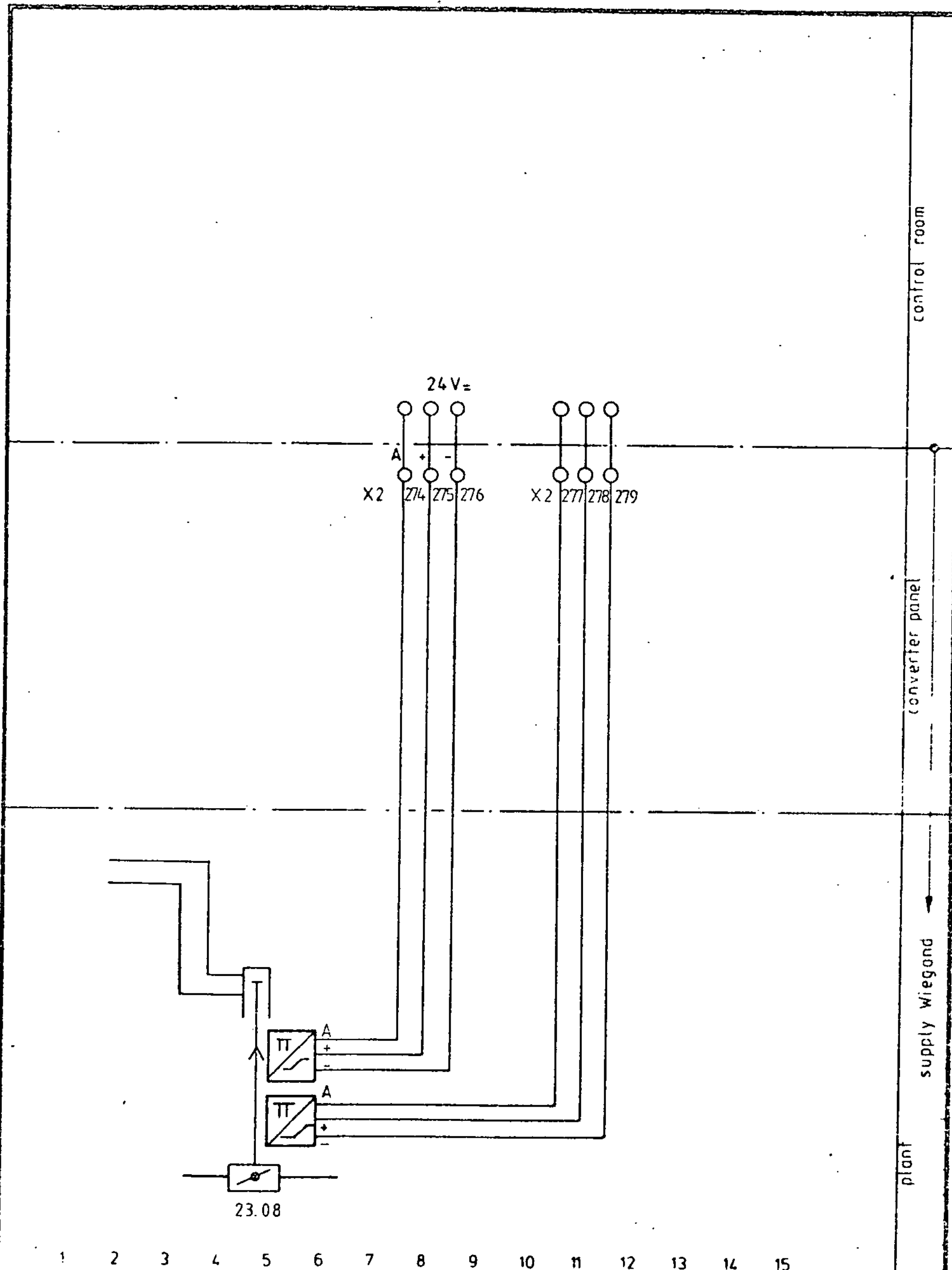
condensate supervision

	Datum	Name	Benennung CISA . 23	WIEGAND Karlsruhe GmbH D-7505 Ettlingen	
Gezeichn	6.11.84	Hodauer			
Geprüft			Kom 2590-75-83 01	Zeichng. Nr 157-393-4	Index a f
Gesehen				Blatt 48 von	



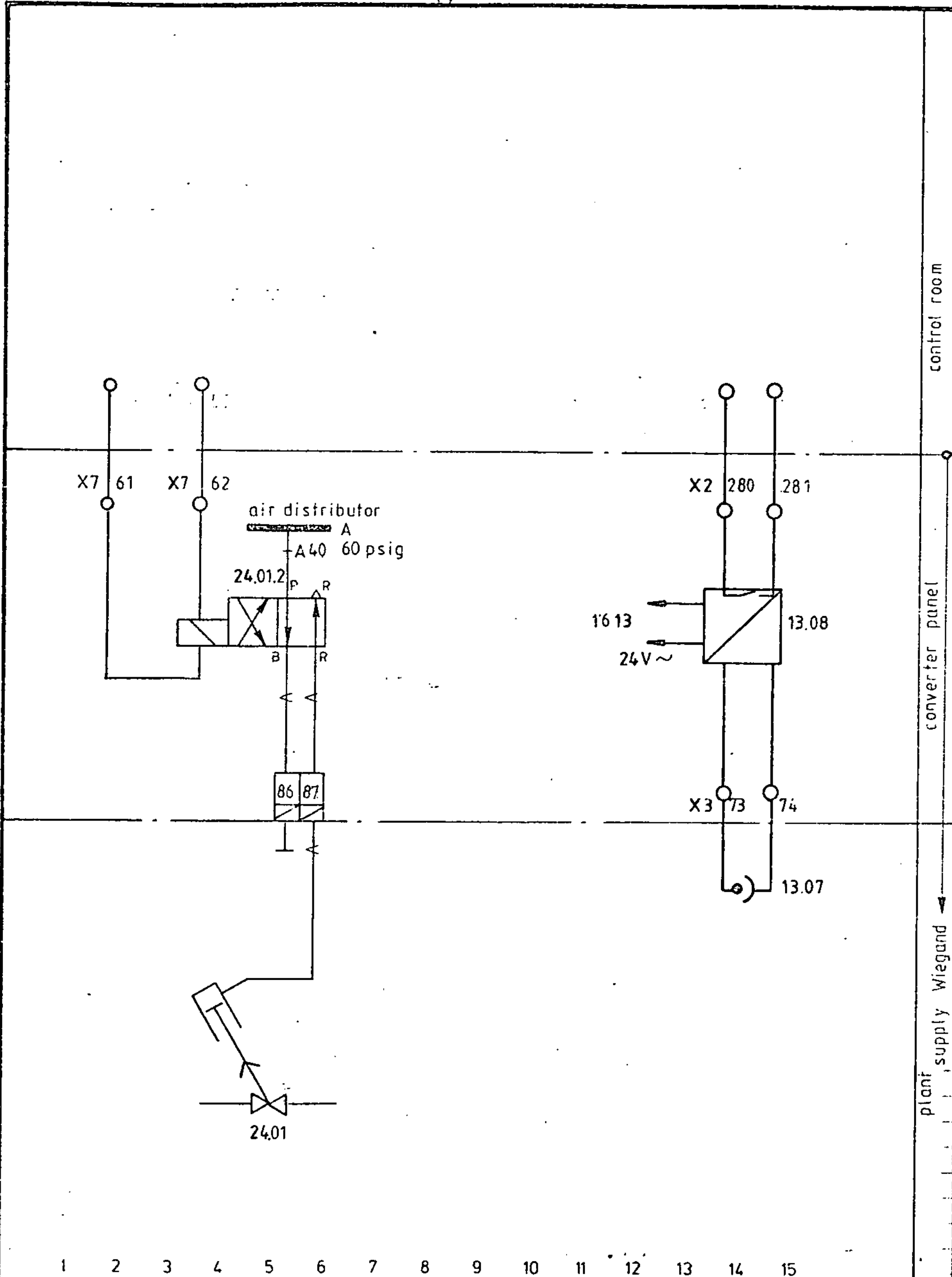
condensate supervision

	Datum	Name	Benennung CISA 23	WIEGAND Karlsruhe GmbH D-7505 Ettlingen
Gezeichn.	6.11.84	Holau		
Geprüft			Kom. 2590-75-83 01	Zeichng Nr 157-393-4 Index e f
Gesehen				Blatt 49 von



condensate supervision

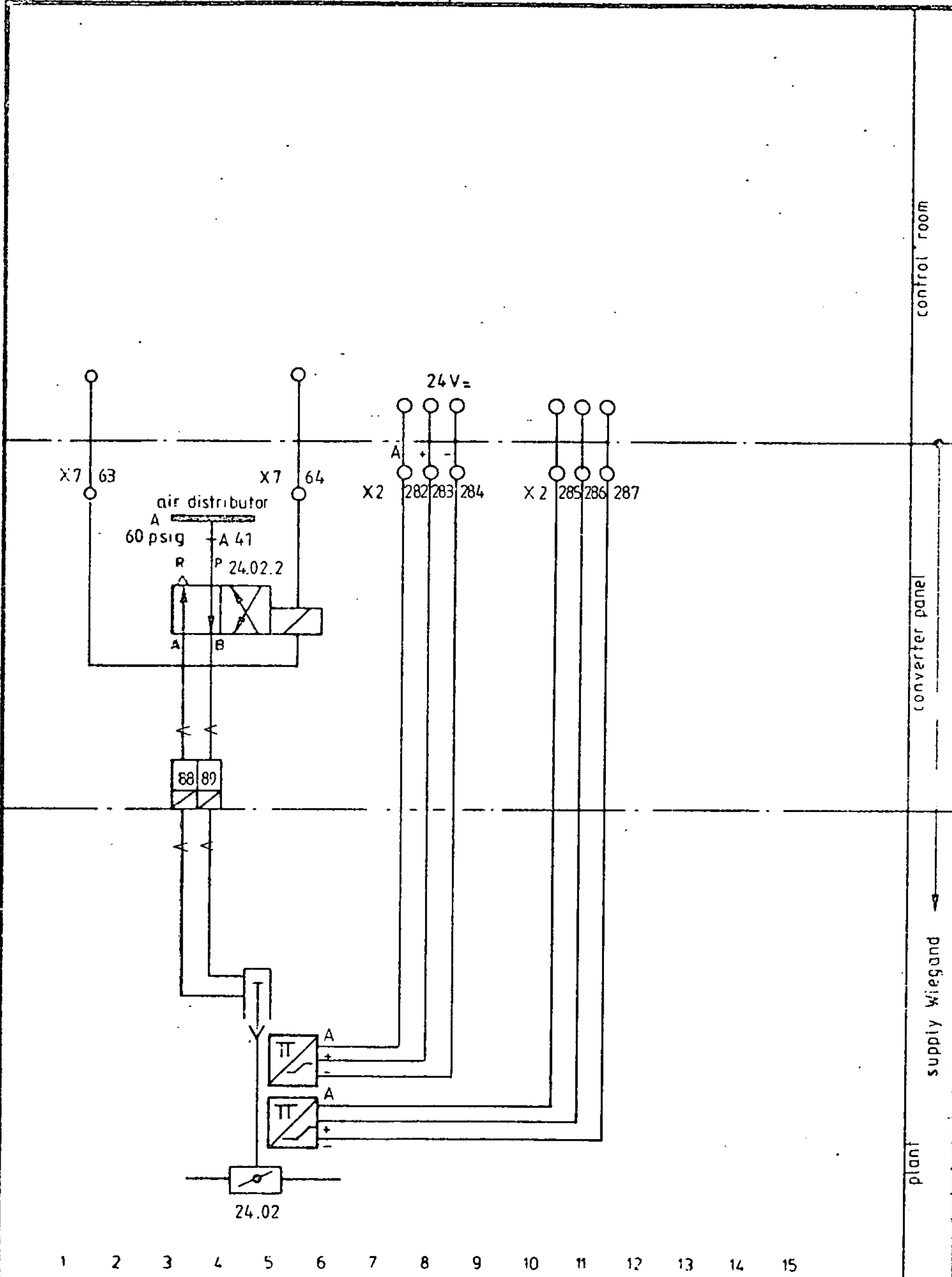
	Datum	Name	Benennung CISA 23	WIEGAND Karlsruhe GmbH D-7505 Ettlingen
Gezeichn	6.11.84	Hodain		
Geprüft			Kom 2590-75-83 01	Zeichng Nr 157-393-4 Index e f
Gesehen				Blatt 50 von



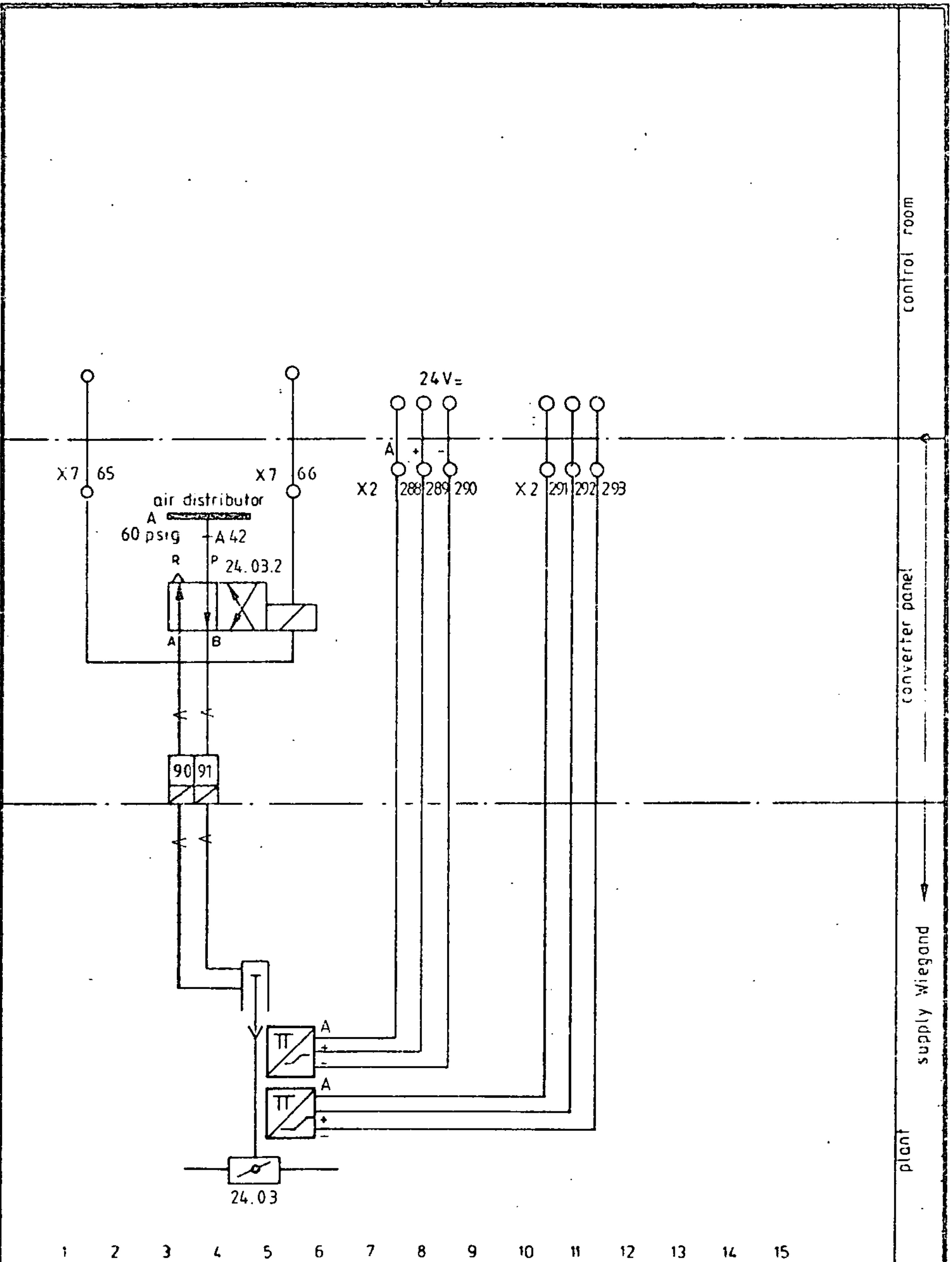
Speerwasser

	Datum	Name	Benennung	WIEGAND Karlsruhe GmbH D-7505 Ettlingen	
Gezeichn	26. 4. 84	Benf	HS-control		
Geprüft			Kom	Zeichng Nr 157-393-4	Index e. f
Gesehen			2590-75-83.01		
				Blatt 51 von	

Index	Änderung	Datum	Name

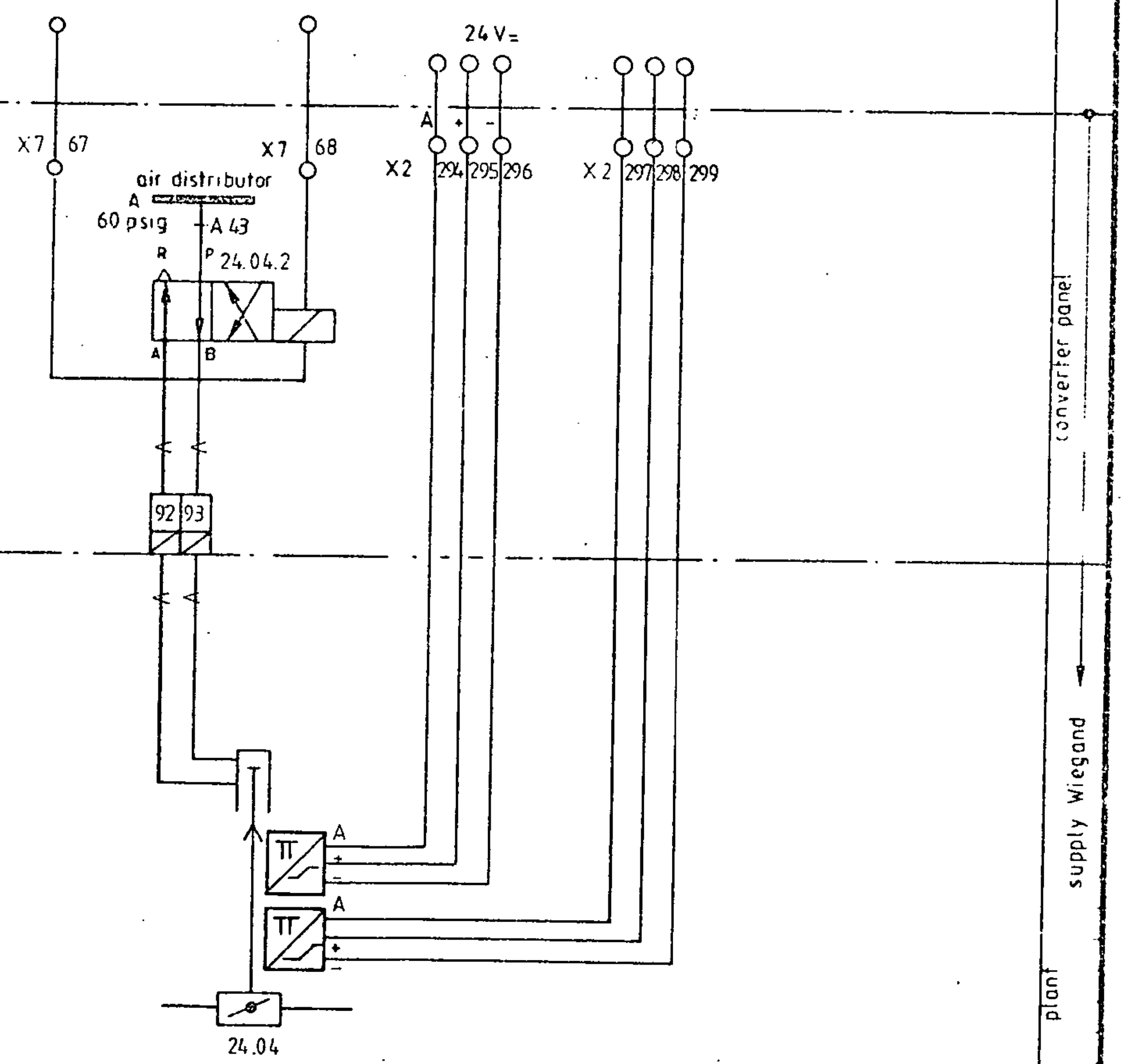


	Datum	Name	Benennung	
Gezeichn	6.11.84		HS-control	WIEGAND Karlsruhe GmbH D 7505 Ettlingen
Geprüft			Komm. 2590-75-83 01	Zeichng Nr 157-393-4 Index e f
Gesehen				Blatt 52 von



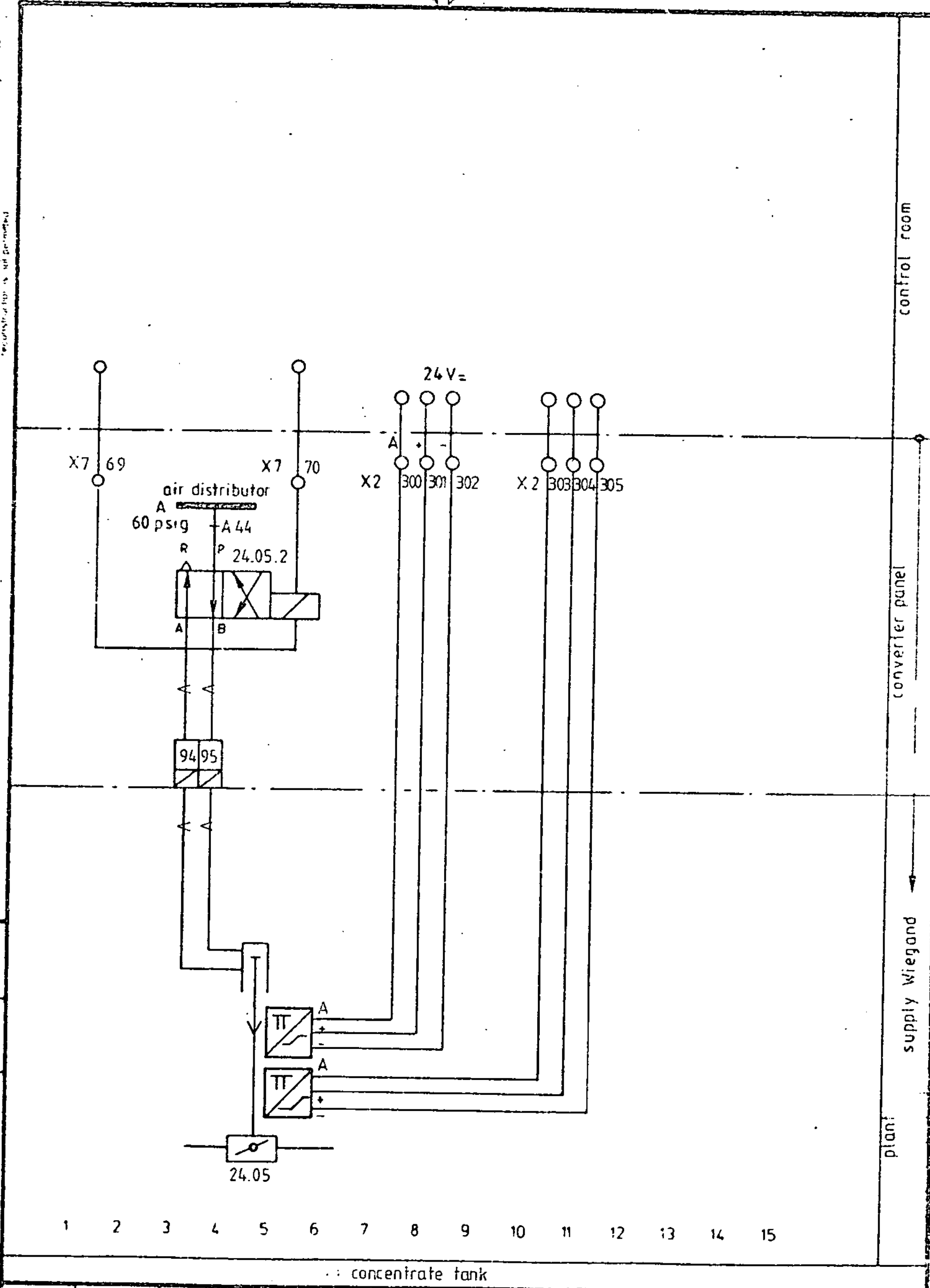
to float balance tank

	Datum	Name	Benennung HS-control	WIEGAND Karlsruhe GmbH D 7505 Ettlingen
Gezeichn	6.11.84	Hoheisen		
Geprüft			Kom 2590-75-83.01	Zeichng Nr 157-393-4 · Index e f
Gesehen				Blatt 53 von

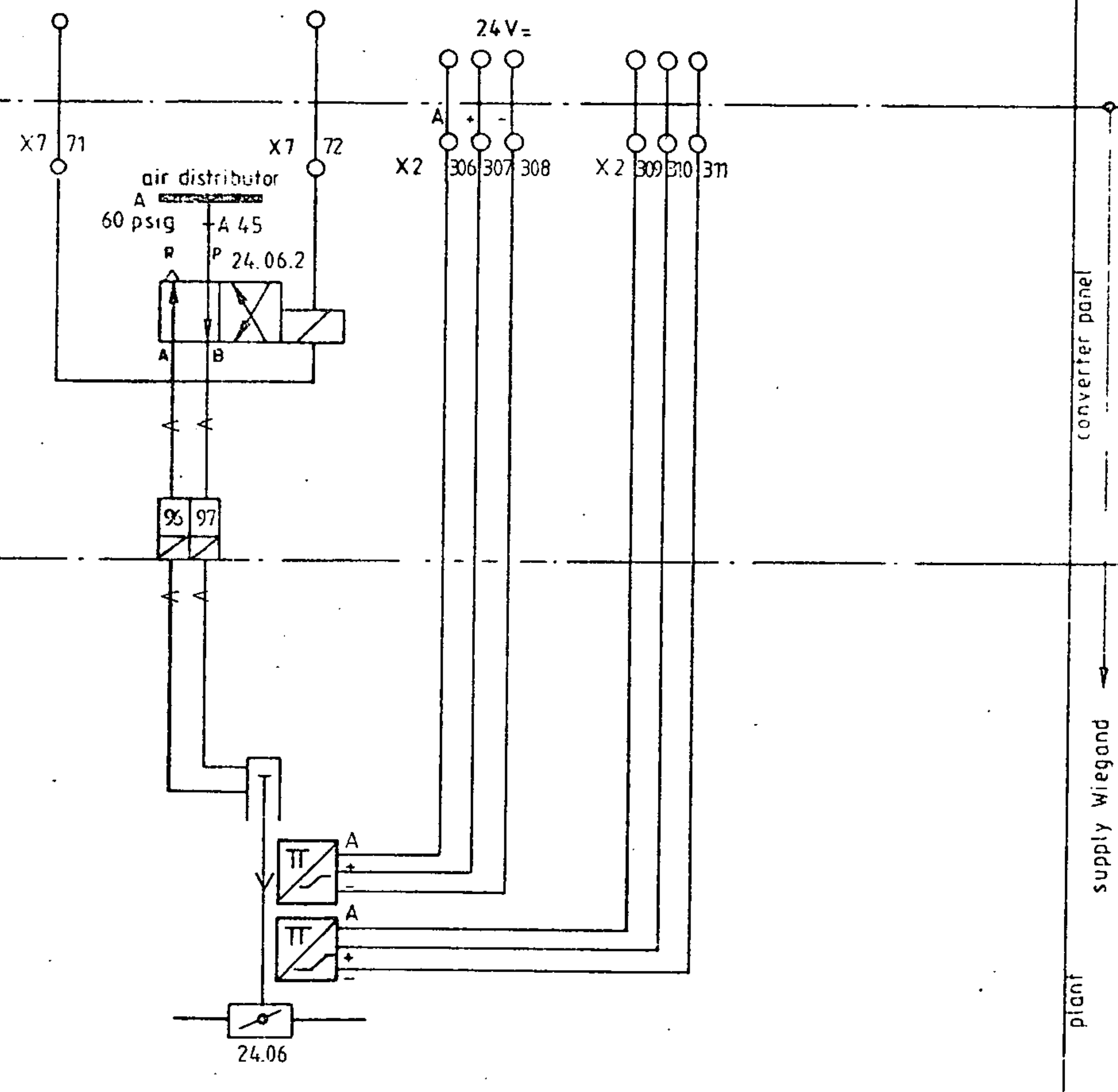


to the drain

	Datum	Name	Benennung HS-control	WIEGAND Karlsruhe GmbH D-7505 Ettlingen	
Gezeichn	6.11.84	Rodeeu	Kom 2590-75-83 01	Zeichng Nr 157-393-4	Index e f
Geprüft				Blatt 54 von	
Gesehen					



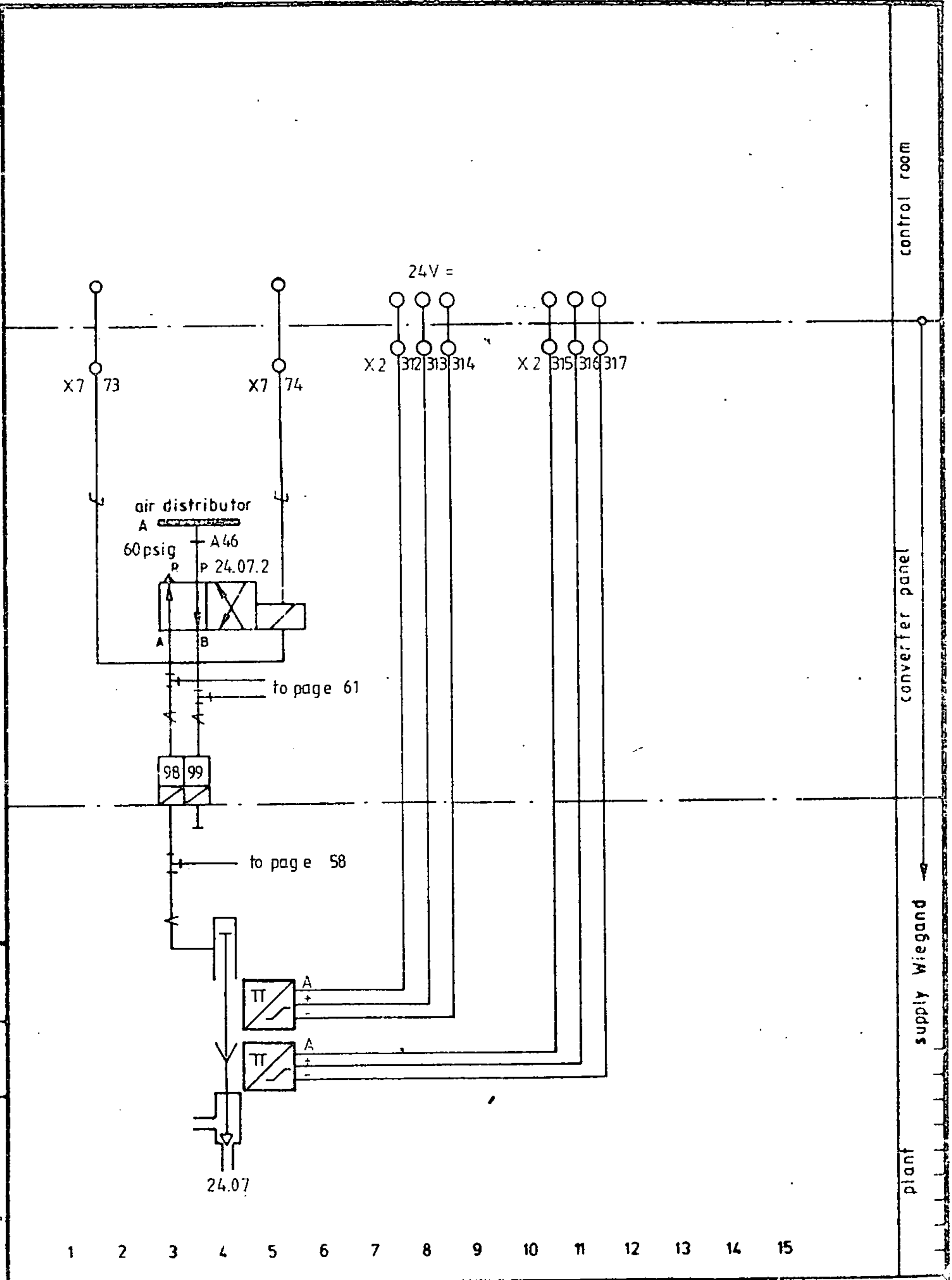
	Datum	Name	Benennung	HS-control	WIEGAND Karlsruhe GmbH D 7505 Ettlingen	
Gezeichn	6.11.84	Hodaun	Kom	2590-75-83 01	Zeichng Nr 157-393-4	Index e f
Geprüft					Blatt 55 von	
Gesehen						



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

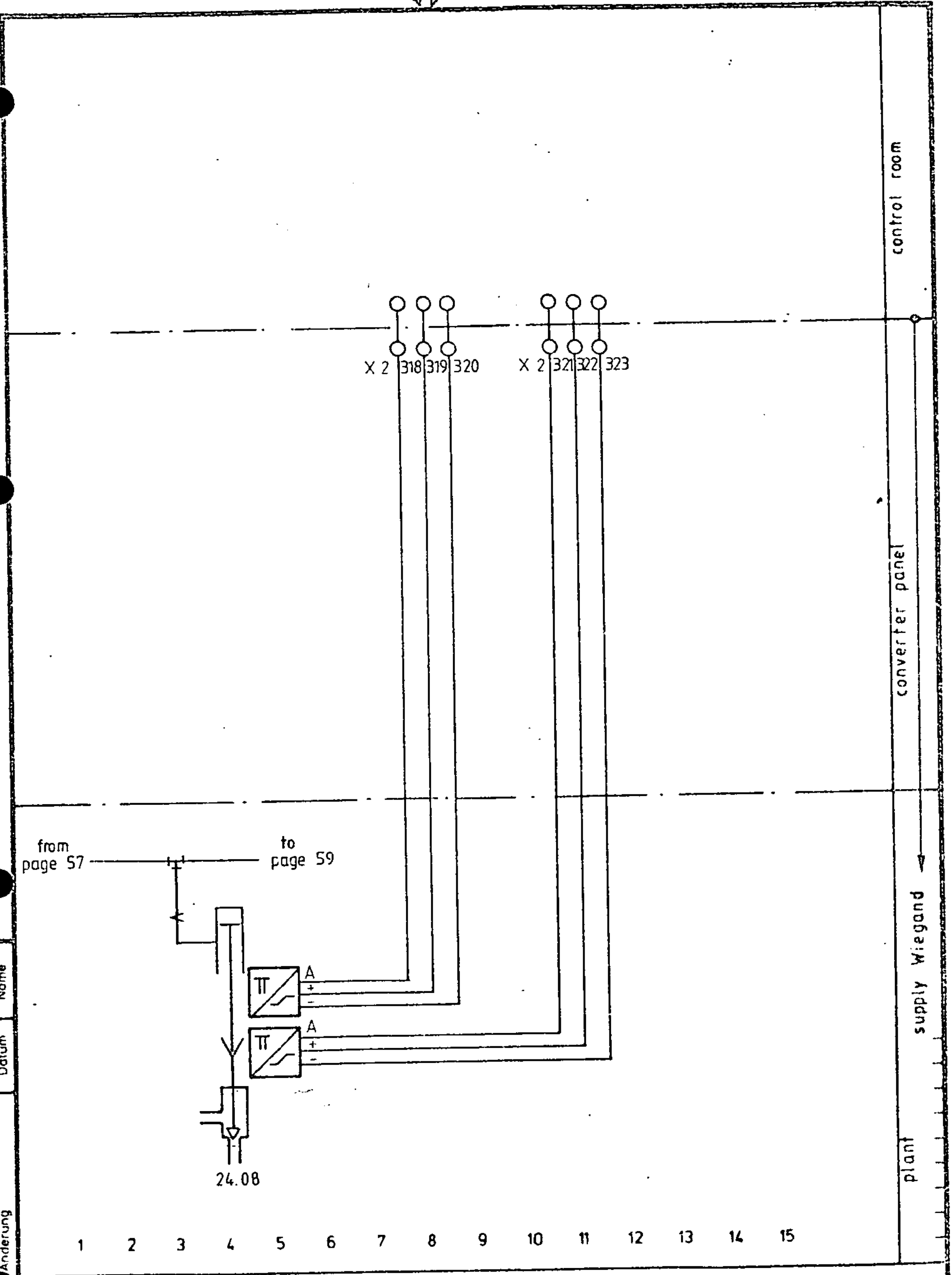
to the cleaning

	Datum	Name	Benennung HS-control	WIEGAND Karlsruhe GmbH D 7505 Ettlingen	
Gezeichn	6.11.84	Lachmann			
Geprüft			Kom. 2590-75-83 01	Zeichnung Nr 157-393-4	Index e f
Gesehen				Blatt 56 von	

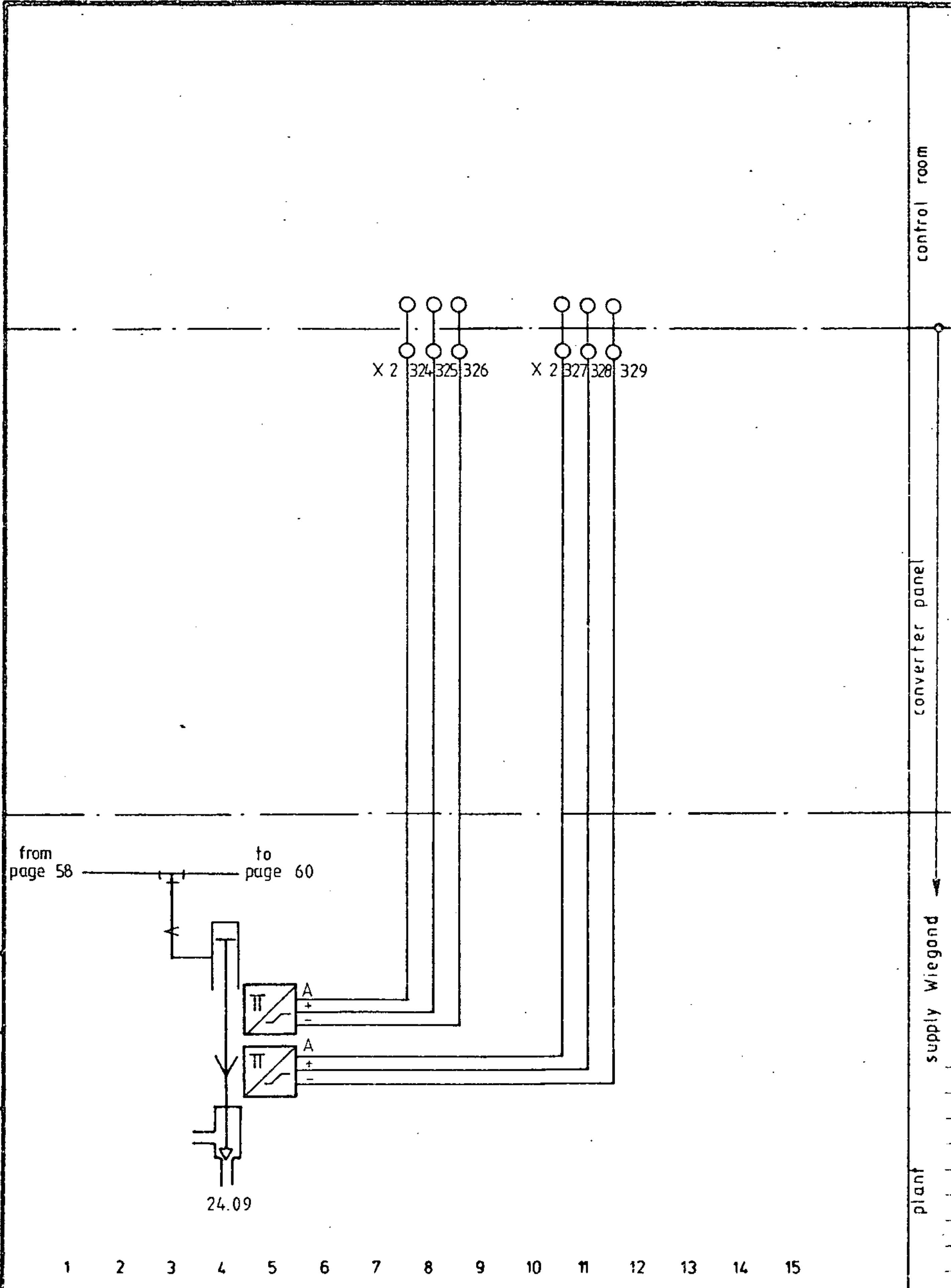


	Datum	Name	Benennung	
Gezeichn	6.11.84	[signature]	HS-control	WIEGAND Karlsruhe GmbH D-7505 Ettlingen
Geprüft			Kom	Zeichng Nr 157-393-4 — Index e f
Gesehen			2590-75-83.01	Blatt 57 von

Änderung | Datum | Name | Index

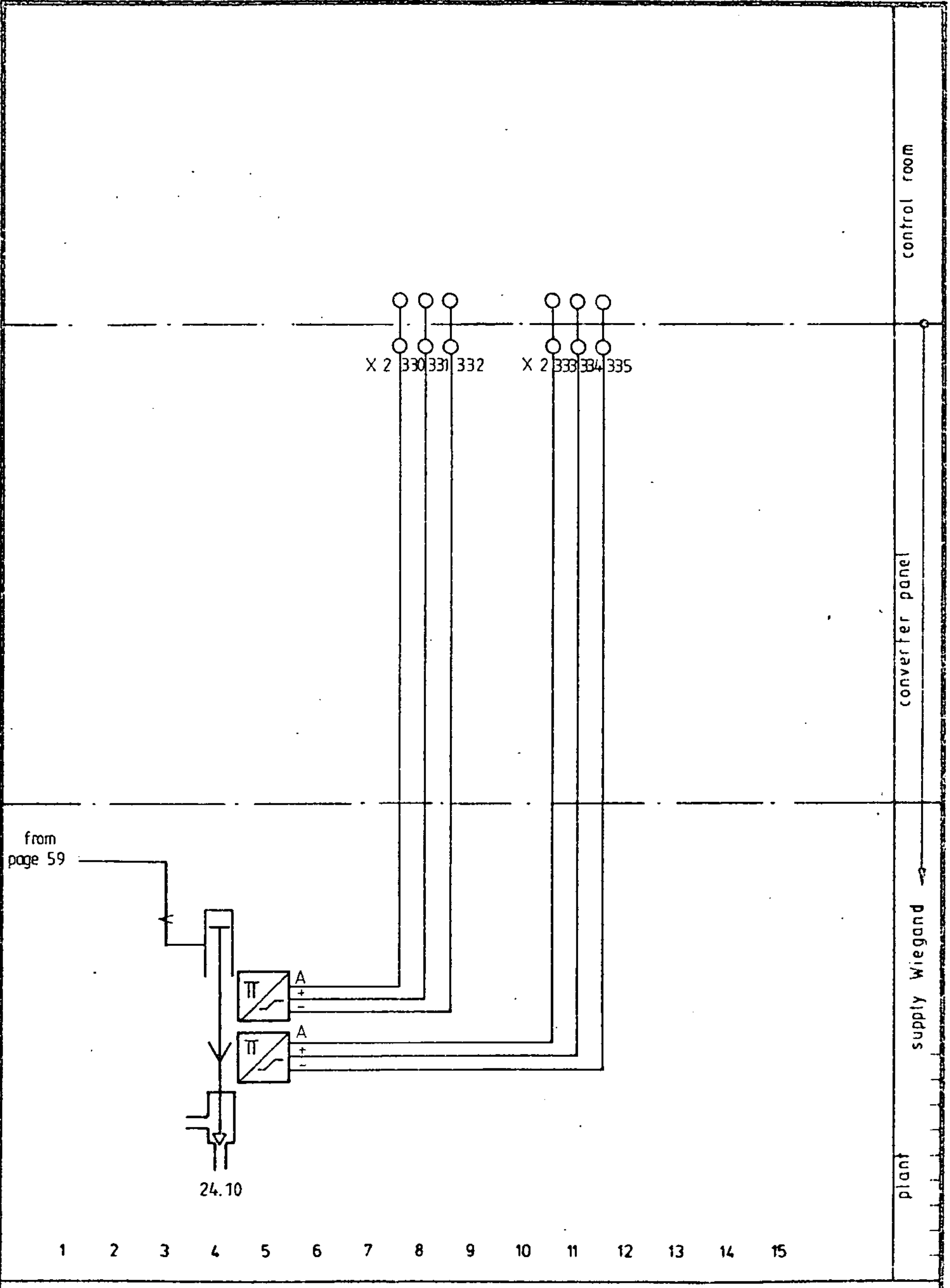


	Datum	Name	Benennung	WIEGAND
Gezeichn	6.11 84	Rodaum	HS-control	Karlsruhe GmbH D-7505 Ettlingen
Geprüft			Kom 2590 -75-83.01	Zeichng Nr 157-393-4
Gesehen				Blatt 58 von



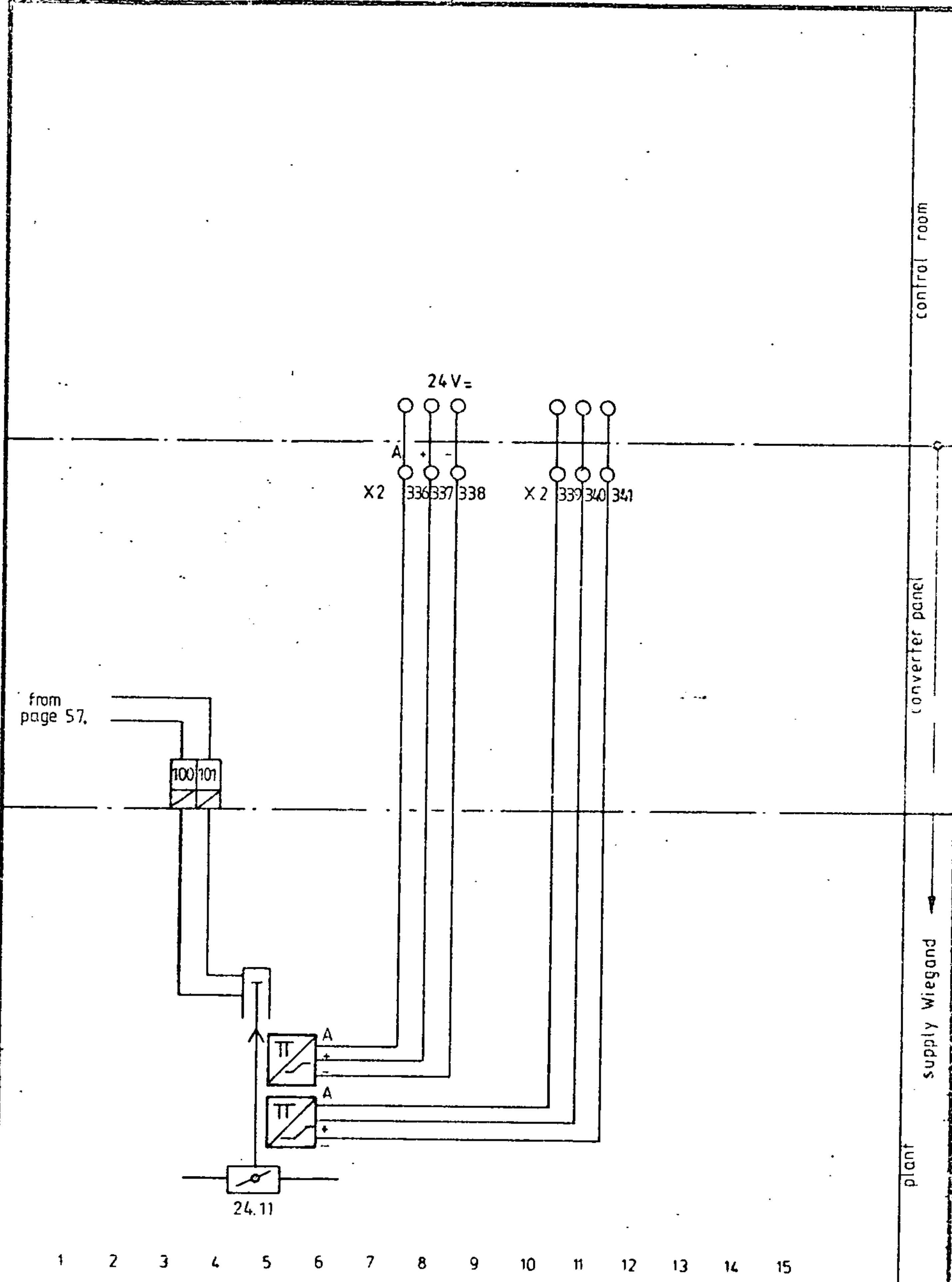
Änderung	Datum	Name

	Datum	Name	Benennung	WIEGAND
Gezeichn	6.11.84	Hodaeu	HS-control	Karlsruhe GmbH D-7505 Ettlingen
Geprüft			Kom	Zeichng Nr / Index e f
Gesehen			2590-75-83.01	157-393-4
				Blatt 59 von

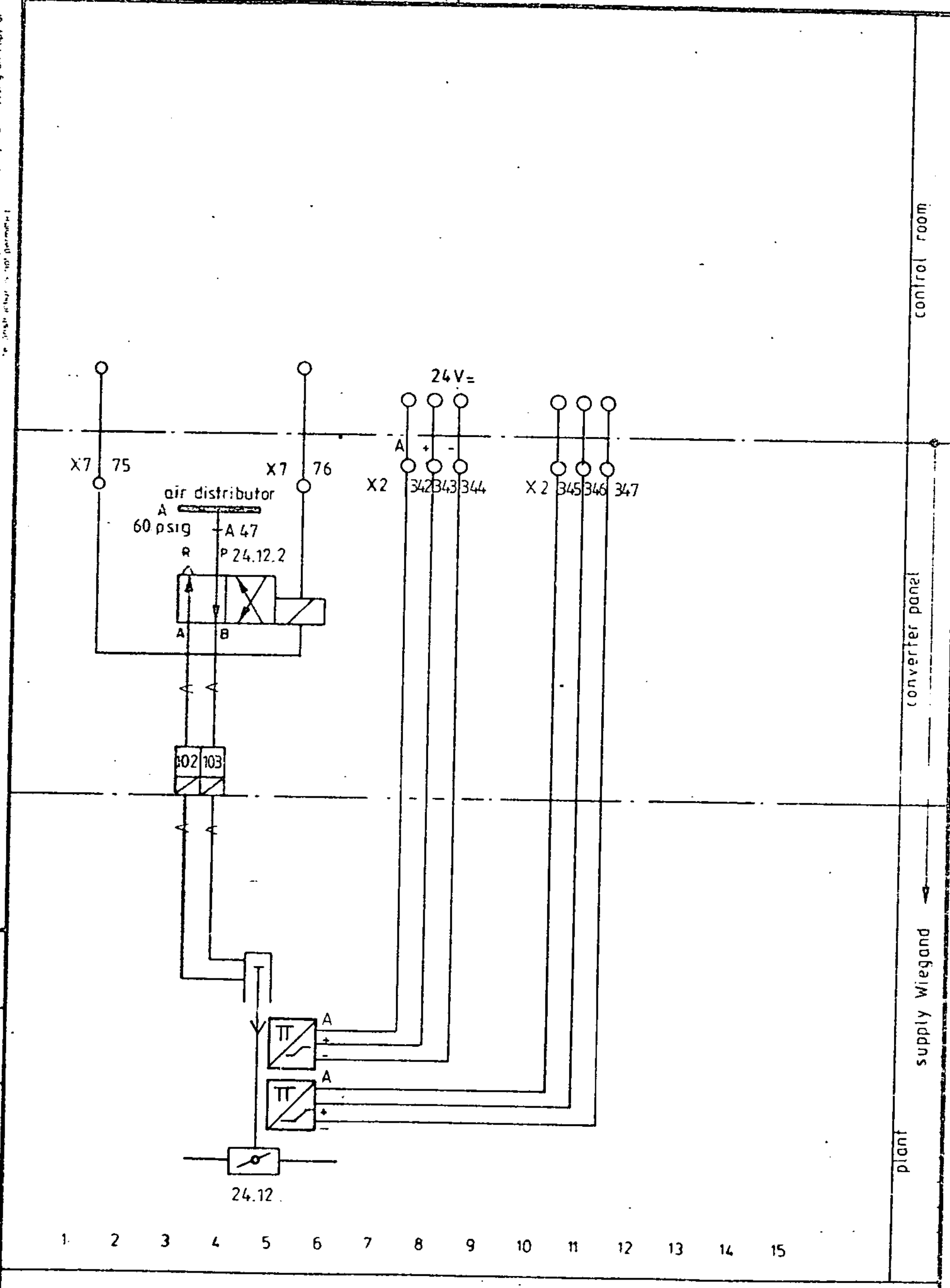


	Datum	Name	Benennung	WIEGAND Karlsruhe GmbH D-7505 Ettlingen
Gezeichn	6.11.84	Hedmann	HS-control	
Geprüft			Kom	Zeichng Nr 157-393-4
Gesehen			2590-75-83.01	Index e f
				Blatt 60 von

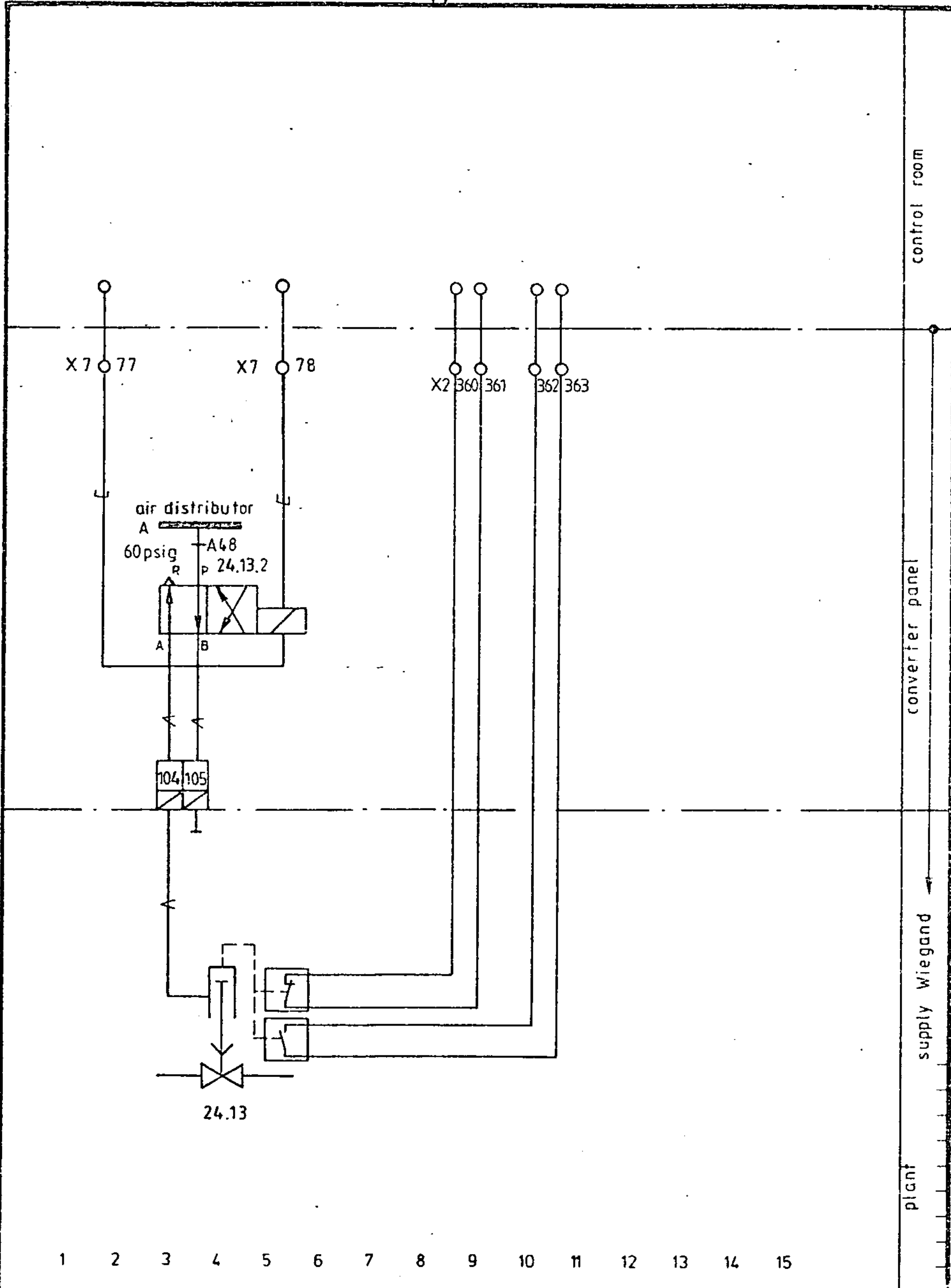
Änderung	Datum	Name
Index		



	Datum	Name	Benennung	WIEGAND Karlsruhe GmbH D 7505 Ettlingen	
Gezeichn	6.11.84	Rodeun	HS-control		
Geprüft			Kom	Zeichng. Nr	Index
Gesehen			2590-75-83 01	157-393-4	e f
				Blatt 61 von	



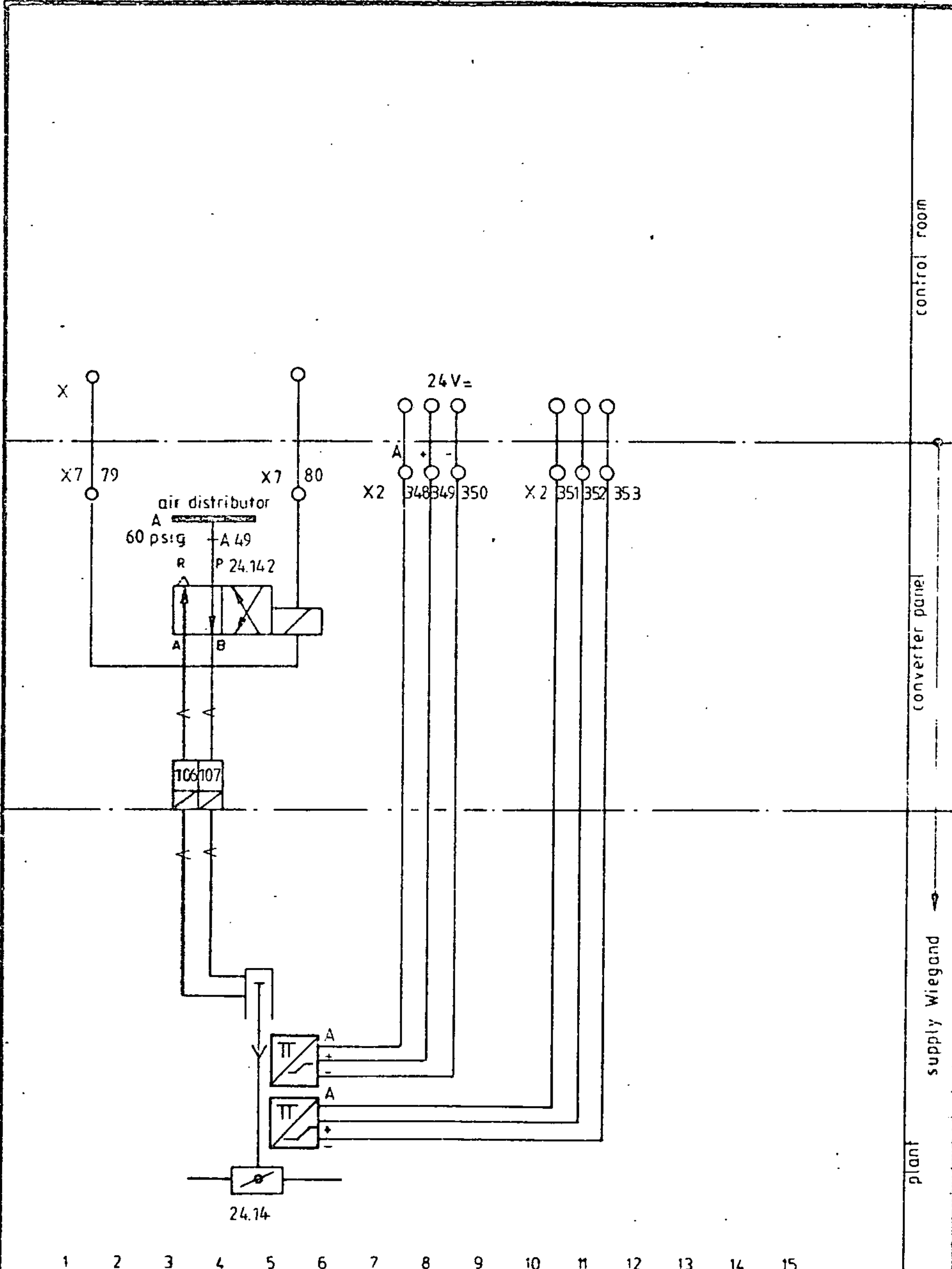
	Datum	Name	Benennung HS-control	WIEGAND Karlsruhe GmbH D 7505 Ettlingen	
Gezeichn	6.11.84	[signature]			
Geprüft			Kom 2590-75-83 01	Zeichng Nr 157-393-4	Index e f
Gesehen				Blatt 62 von	



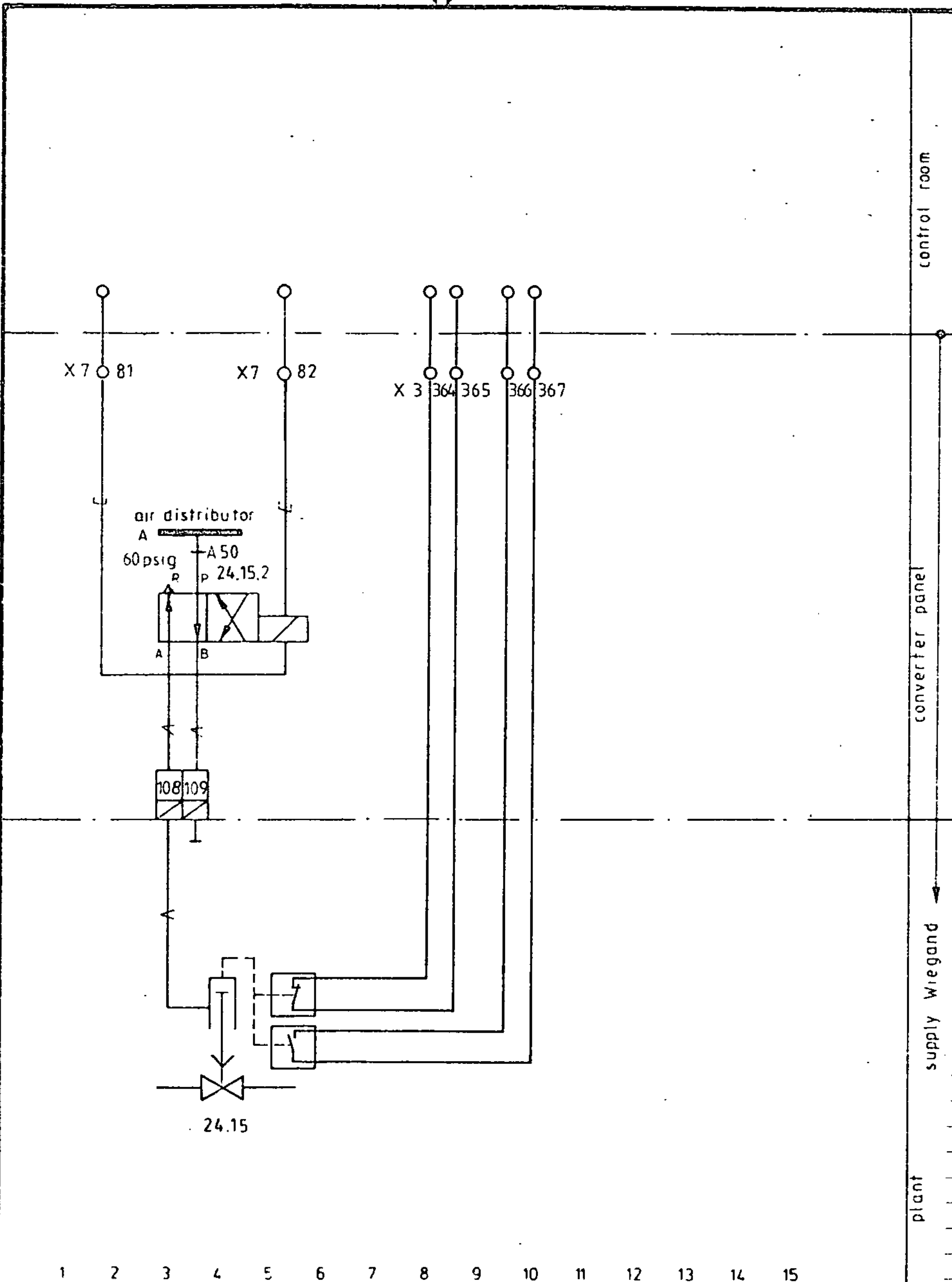
STEAM

	Datum	Name	Benennung	
Gezeichn	26.4.84	Be	HS-control	WIEGAND Karlsruhe GmbH D-7505 Ettlingen
Geprüft			Kom 2590-75-83.01	Zeichng Nr 157-393-4 — Index a f
Gesehen				Blatt 63 von

Index	Datum	Name	Änderung

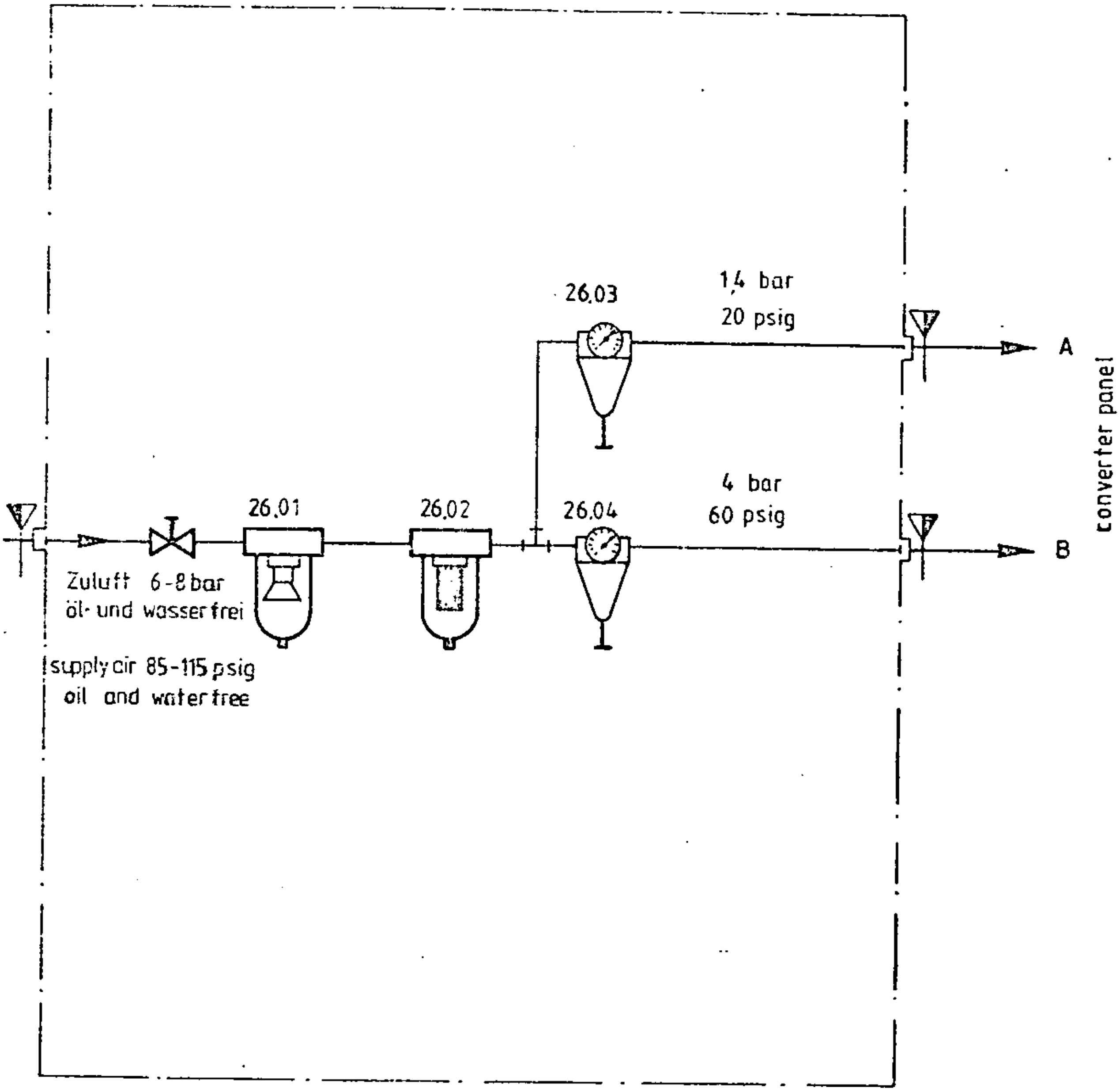


	Datum	Name	Benennung HS-control	WIEGAND Karlsruhe GmbH D 7505 Ettlingen
Gezeichn	6.11.84	Rodanu		
Geprüft			Kom 2590-75-83 01	Zeichng Nr 157-393-4 Index e f
Gesehen				Blatt 64 von



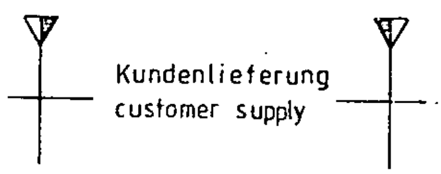
	Datum	Name	Benennung		WIEGAND Karlsruhe GmbH D 7505 Ettlingen	
Gezeichn	26 4. 84	Beuf	HS-control			
Geprüft			Kom	2590-75-83.01	Zeichng Nr 157-393-4	Index a f
Gesehen					Blatt 65 von	

Änderung Datum Name Index



Diese Reduzierstation wird in der Nähe vom Regelschrank montiert

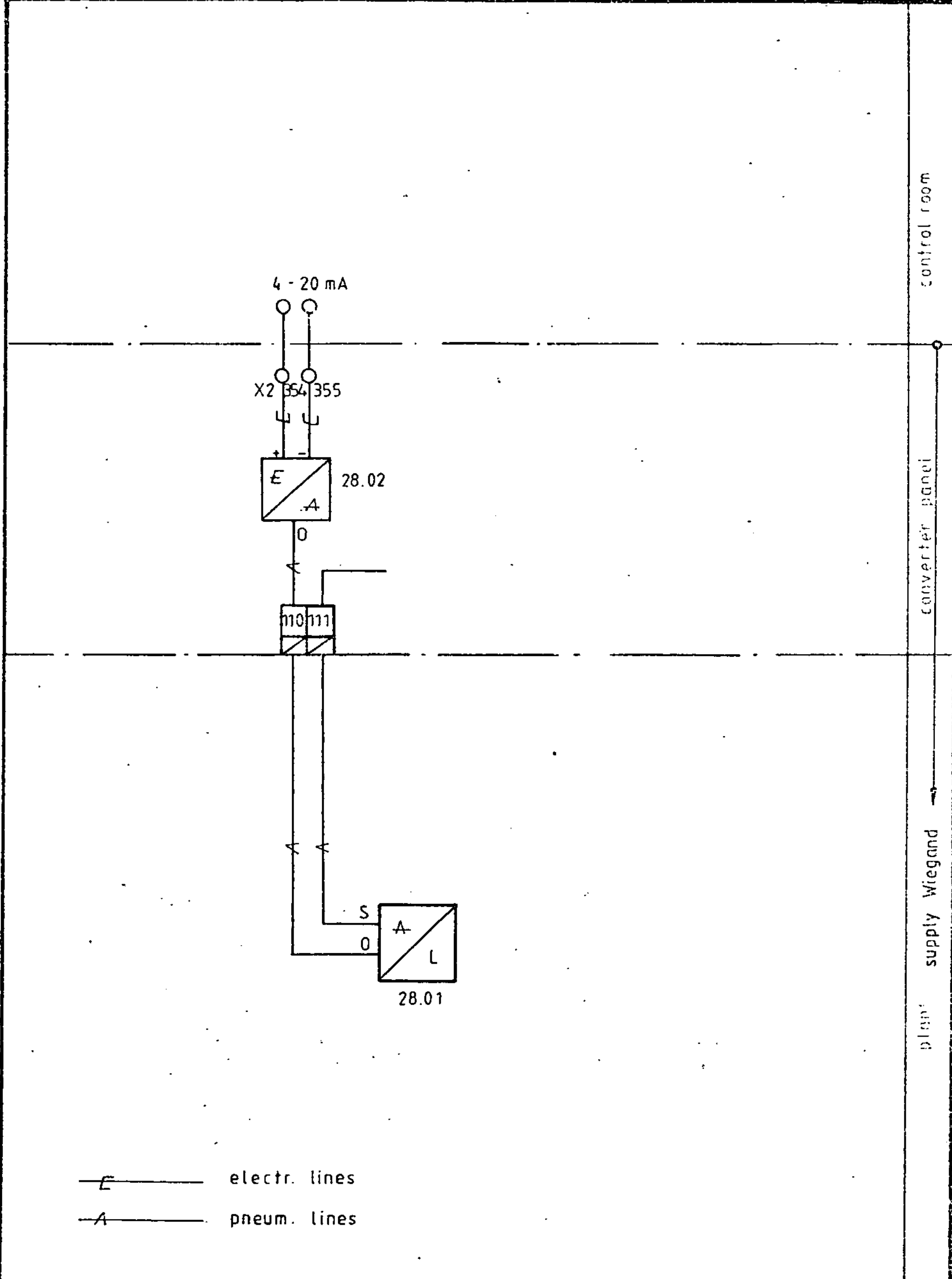
This air station has to be mounted near the control panel



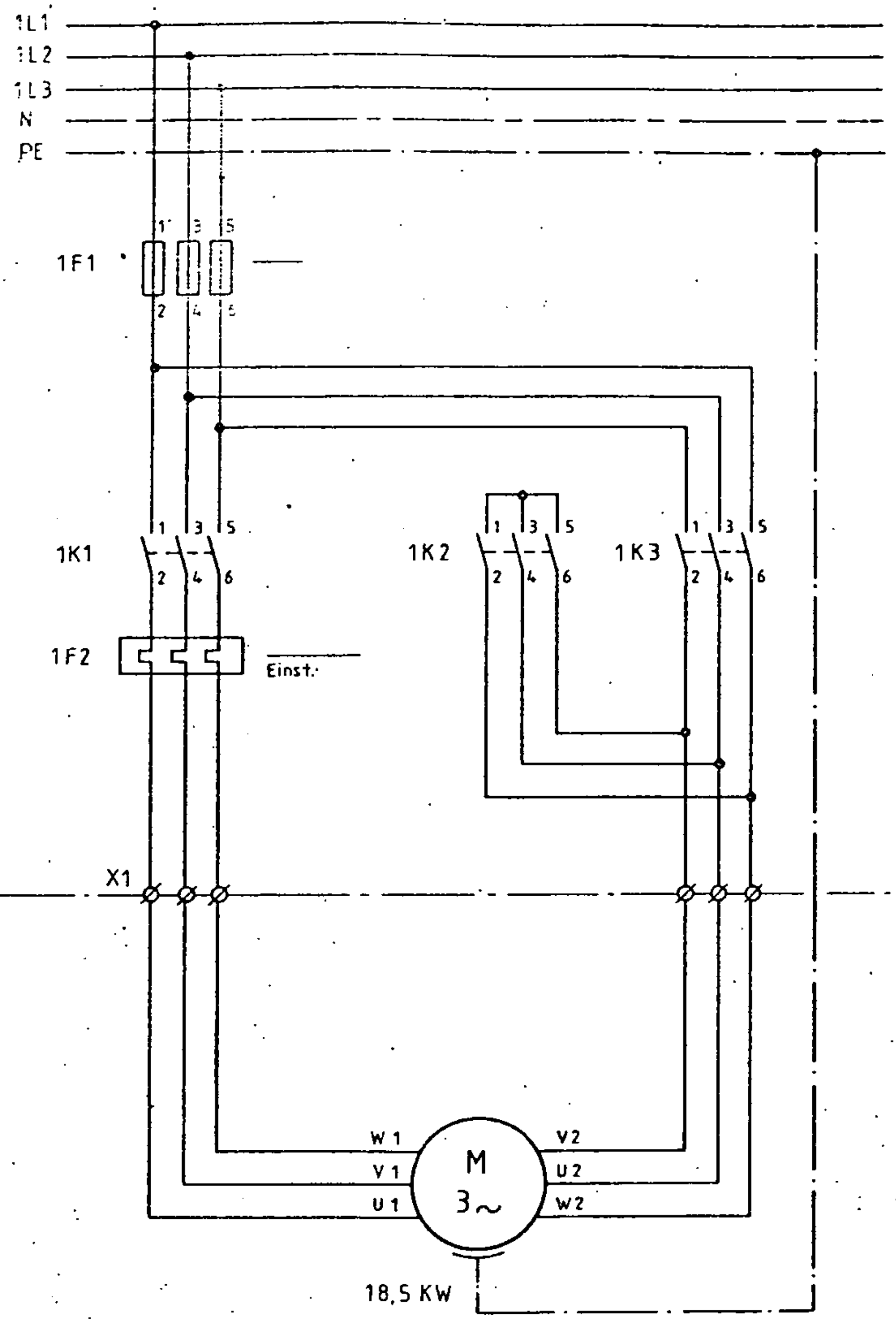
pneum. Regelung pneum. control

	Datum	Name	Benennung	WIEGAND
Gezeichn	14. 5. 84	Blu	Zuluftreduzierstation air reducing station	Karlsruhe GmbH D-7505 E...
Geprüft			Kom 2590-75-83.01	Zeichng Nr 157-393-4 · Index f
Gesehen				Blatt 66 von

Änderung | Datum | Name | Index



	Datum	Name	Benennung	WIEGAND Karlsruhe GmbH D 7505 Ettlingen	
Gezeichn.	22.3.84	Ber	LI 28		
Geprüft			2590-75-83.01	Zeichng. Nr. 157-393-4	f
Gesehen				Blatt 67 von	



Schützenschrank / MCC panel

Anlage / plant

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

Index	Änderung	Datum	Name

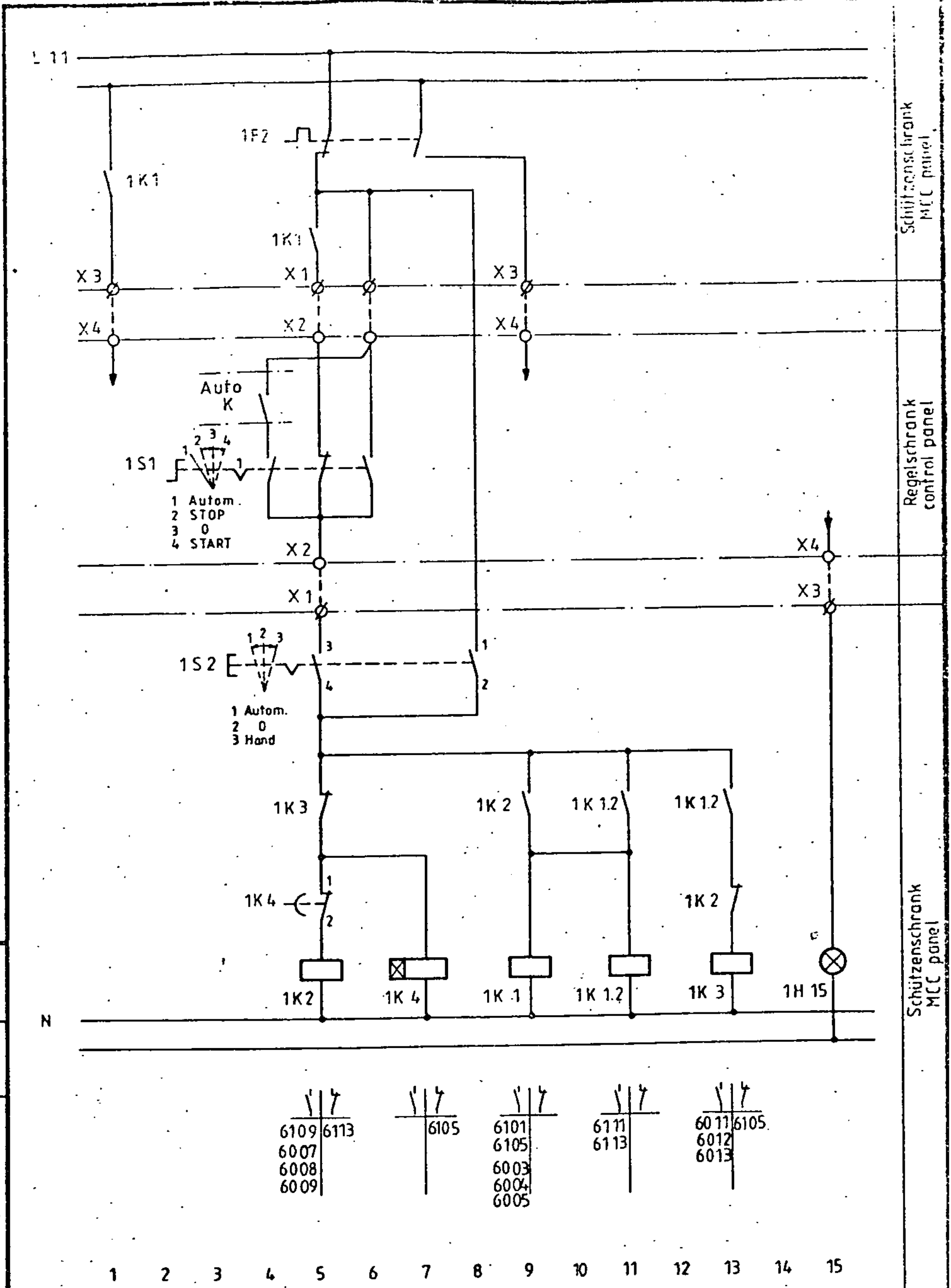
	Datum	Name	Benennung
Gezeichn	27.9.84	[illegible]	14.1 Vacuum pump
Geprüft			Kom 2590-75-83.01
Gesehen			

WIEGAND
Karlsruhe GmbH D-7505 Ettlingen

Zeichng Nr 157-393-4

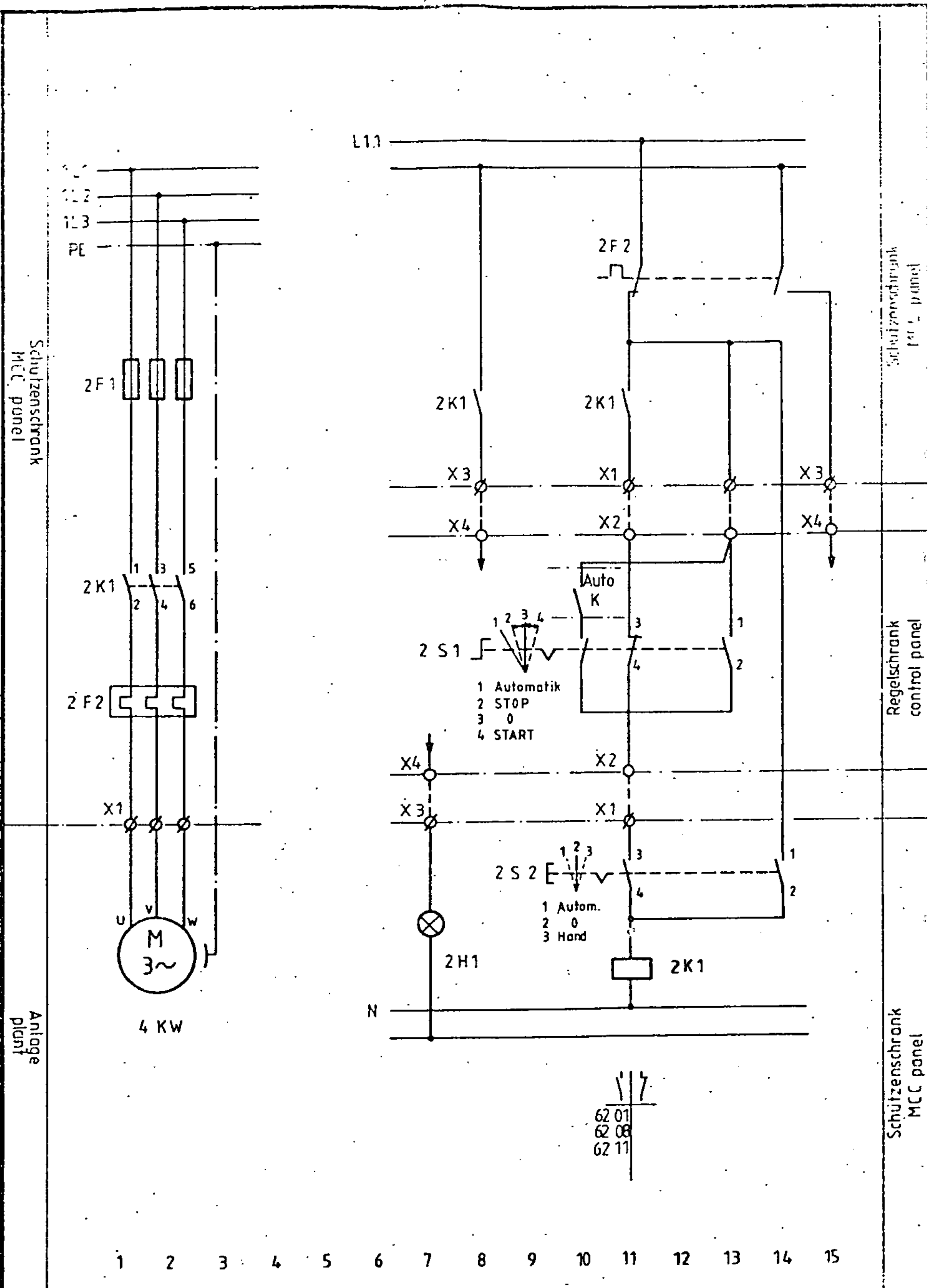
Index

Blatt 60.1 von



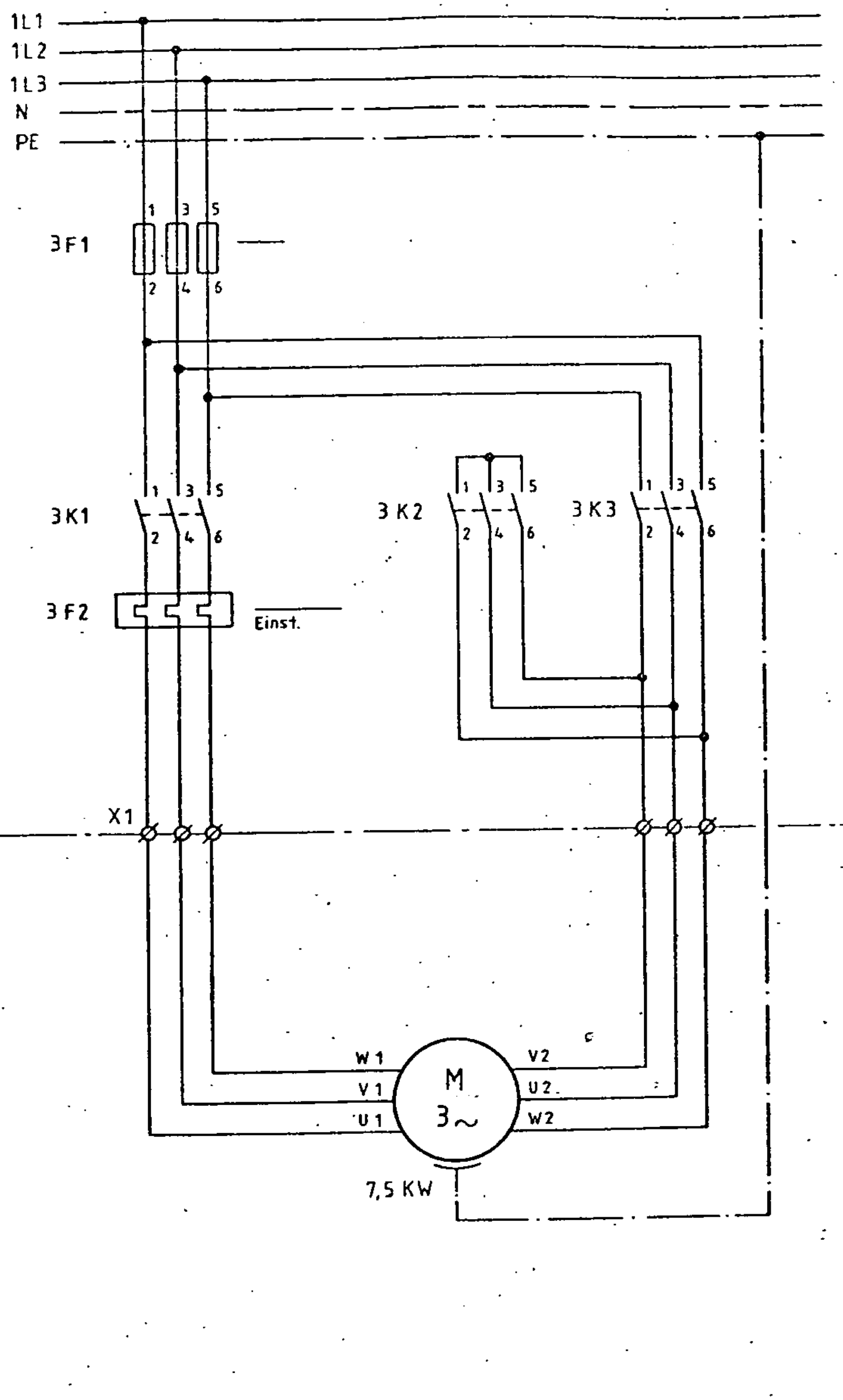
	Datum	Name	Benennung	WIEGAND Karlsruhe GmbH D-7505 Ettlingen
Gezeichn.	27.9.84	[illegible]	14.1 Vacuum pump	
Geprüft			Kom 2590-75-83.01	Zeichnung Nr 157-393-4 / Index
Gesehen				Blatt 61.1 von

Index | Änderung | Datum | Name



	Datum	Name	Benennung. 14.2 Vacuumpump	WIEGAND Karlsruhe GmbH D-7505 Ettlingen
Gezeichn	27.9.84			
Geprüft			Kom 2590 - 75 - 83.01	Zeichng Nr 157 - 393 - 4
Gesehen				Blatt 62.1 von

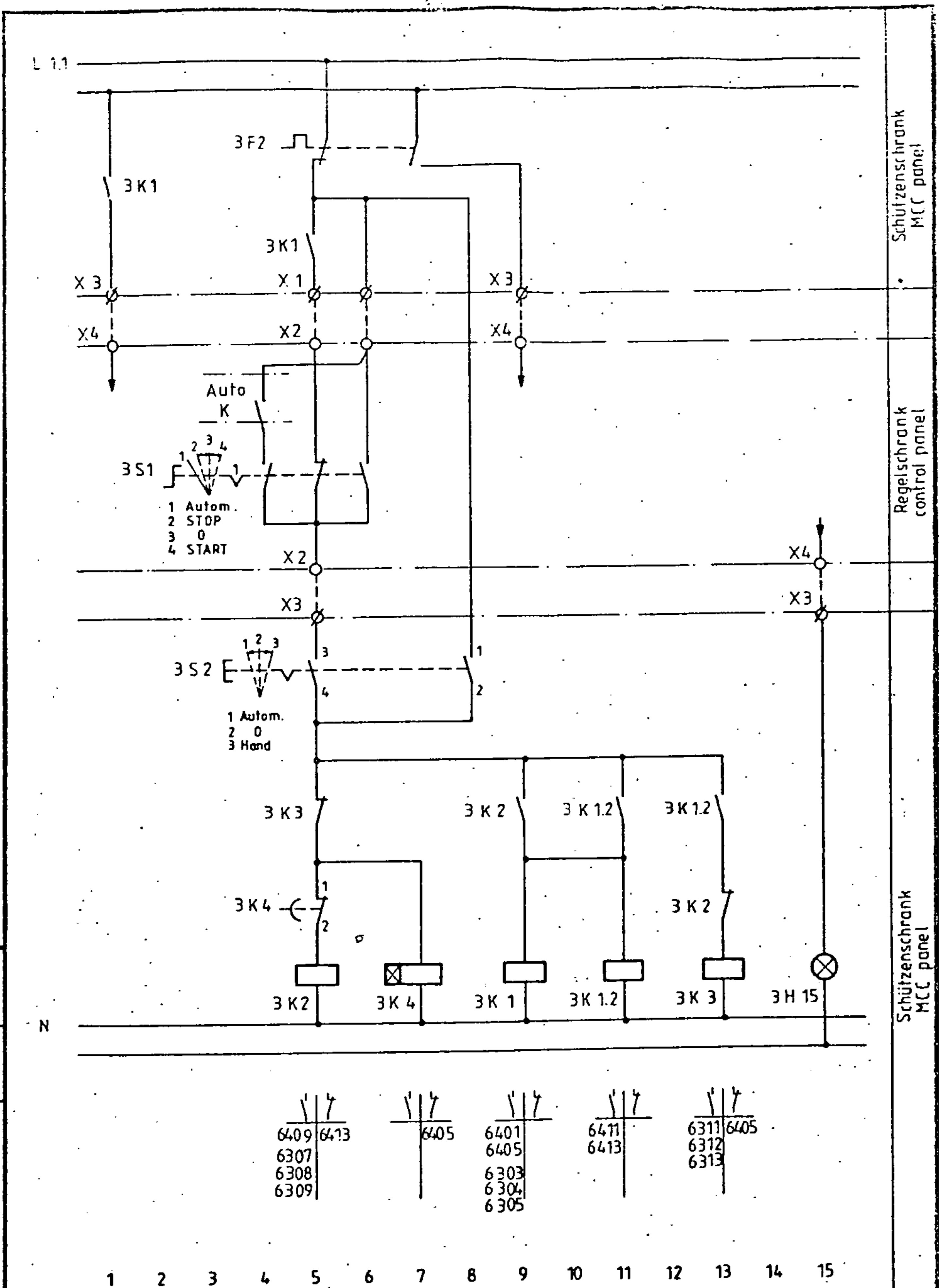
Index	Änderung	Datum	Name



Schützenschrank / MCC panel

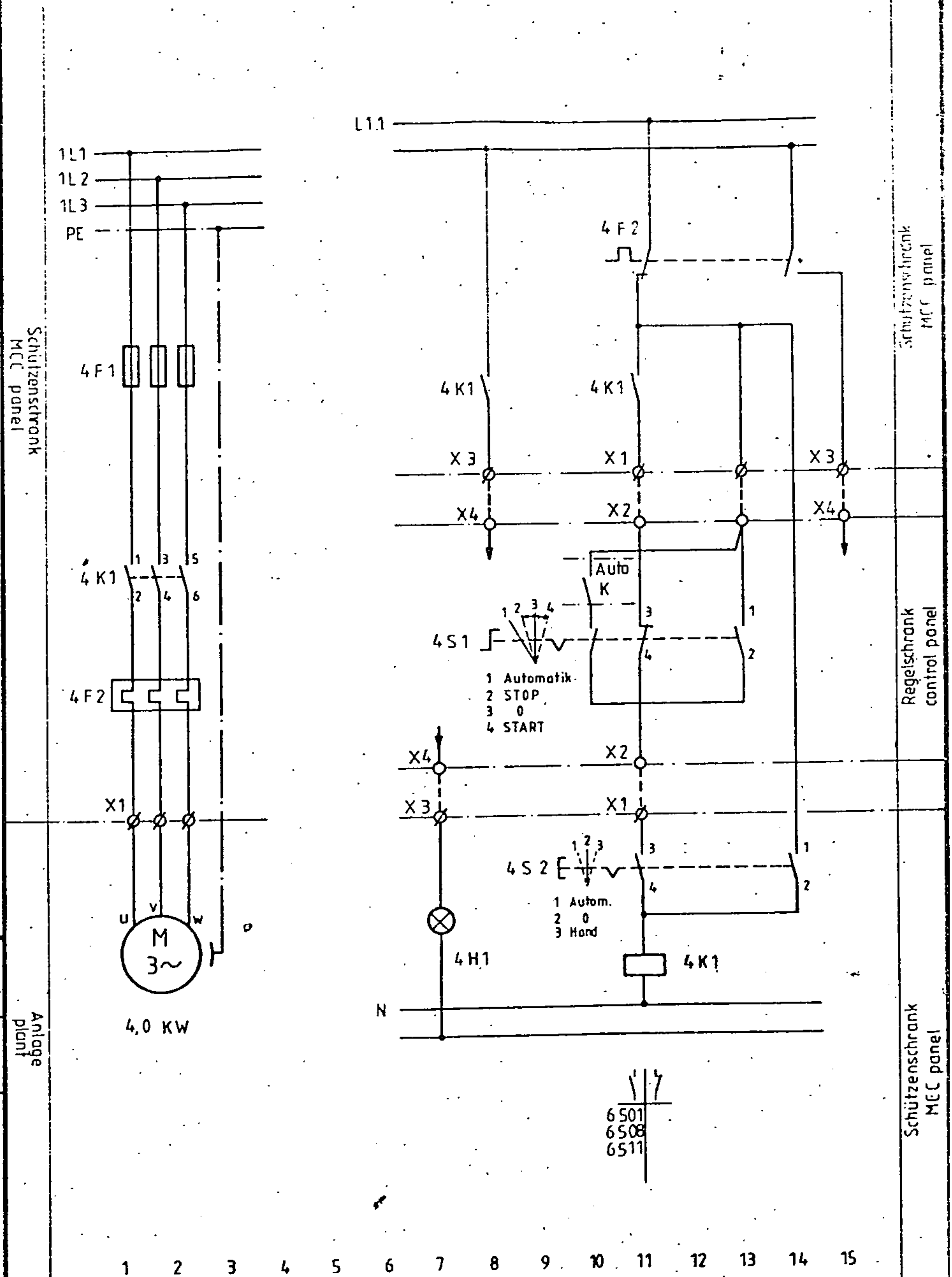
Anlage / plant

	Datum	Name	Benennung	WIEGAND Karlsruhe GmbH D-7505 Ettlingen
Gezeichn.	27.9.84	[signature]	14.3 Feed pump	
Geprüft	-		Kom 2590-75-83.01	Zeichng. Nr 157-393-4
Gesehen				Blatt 63.1 von



Index	Änderung	Datum	Name

	Datum	Name	Benennung	
Gezeichn	27 9 84	[illegible]	14.3 Feed pump	WIEGAND Karlsruhe GmbH D-7505 Ettlingen
Geprüft			Kom 2590-75-83.01	Zeichng Nr 157-393-4 — Index
Gesehen				Blatt 64.1 von



Index	Änderung	Datum	Name

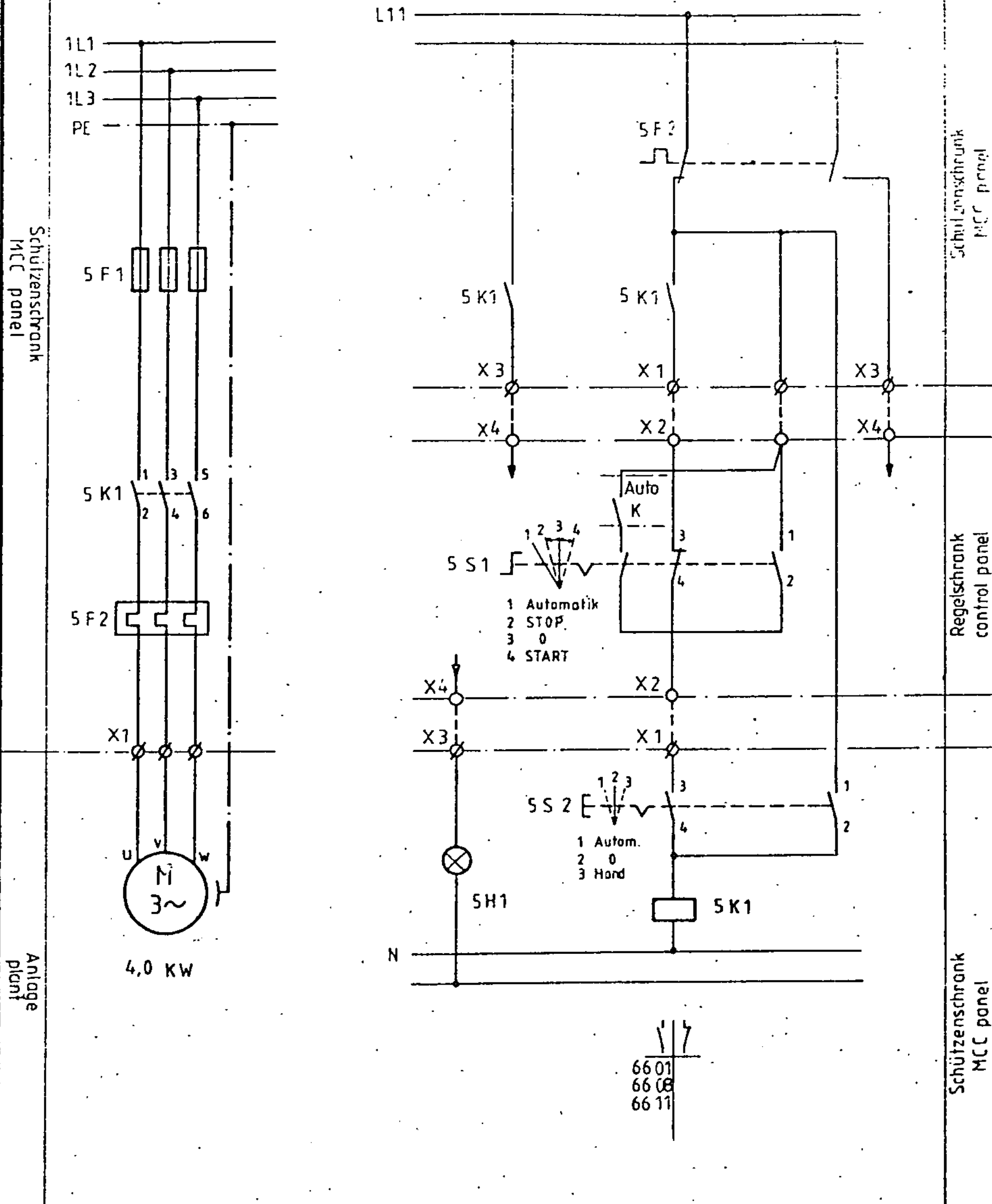
	Datum	Name	Benennung
Gezeichn	27.9 84	[illegible]	14.4 Pump ex - way 1
Geprüft			Kom 2590 - 75 - 83.01
Gesehen			

WIEGAND
Karlsruhe GmbH D-7505 Ettlingen

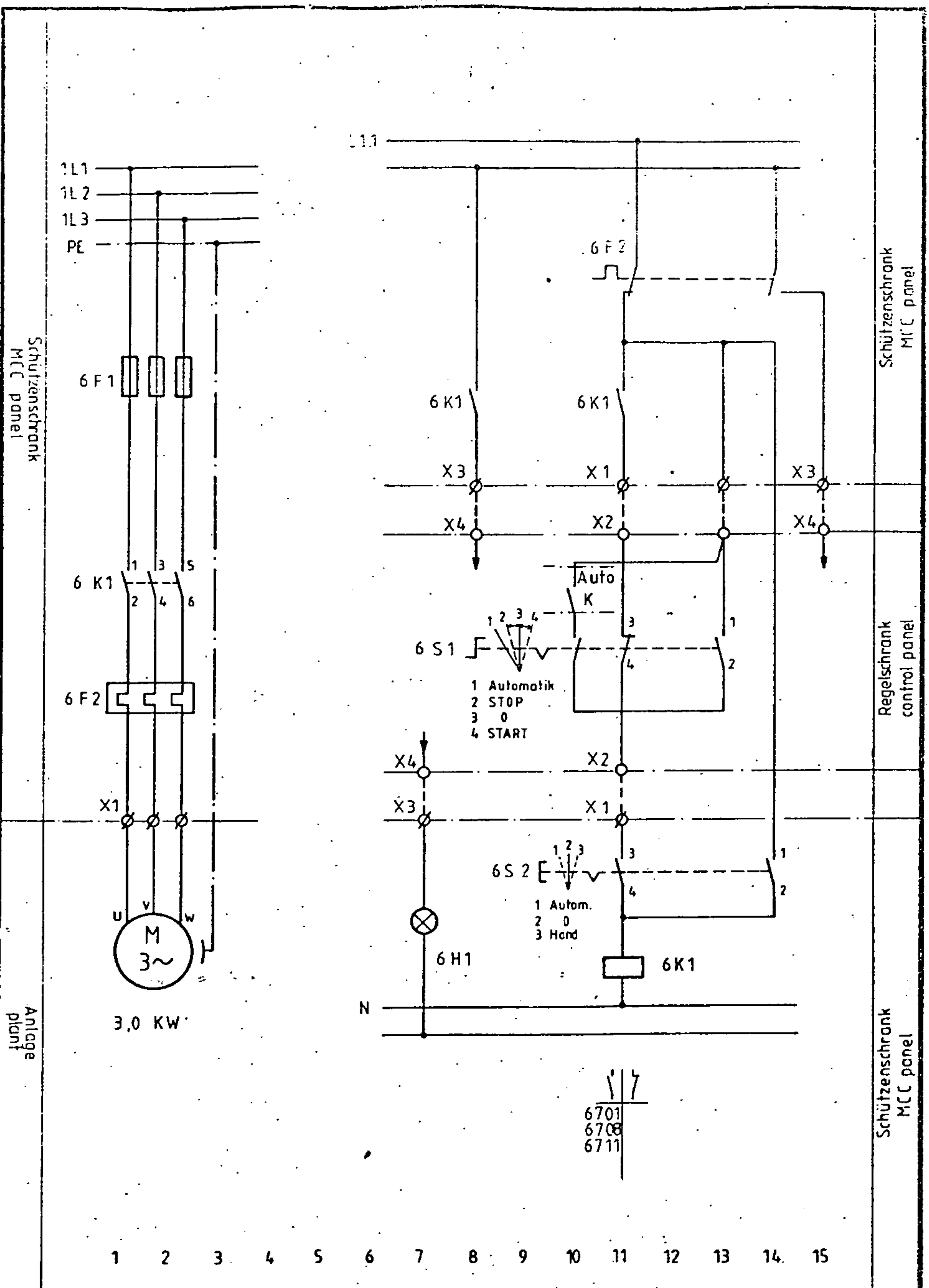
Zeichng Nr 157 - 393 - 4

Index

Blatt 65.1 von

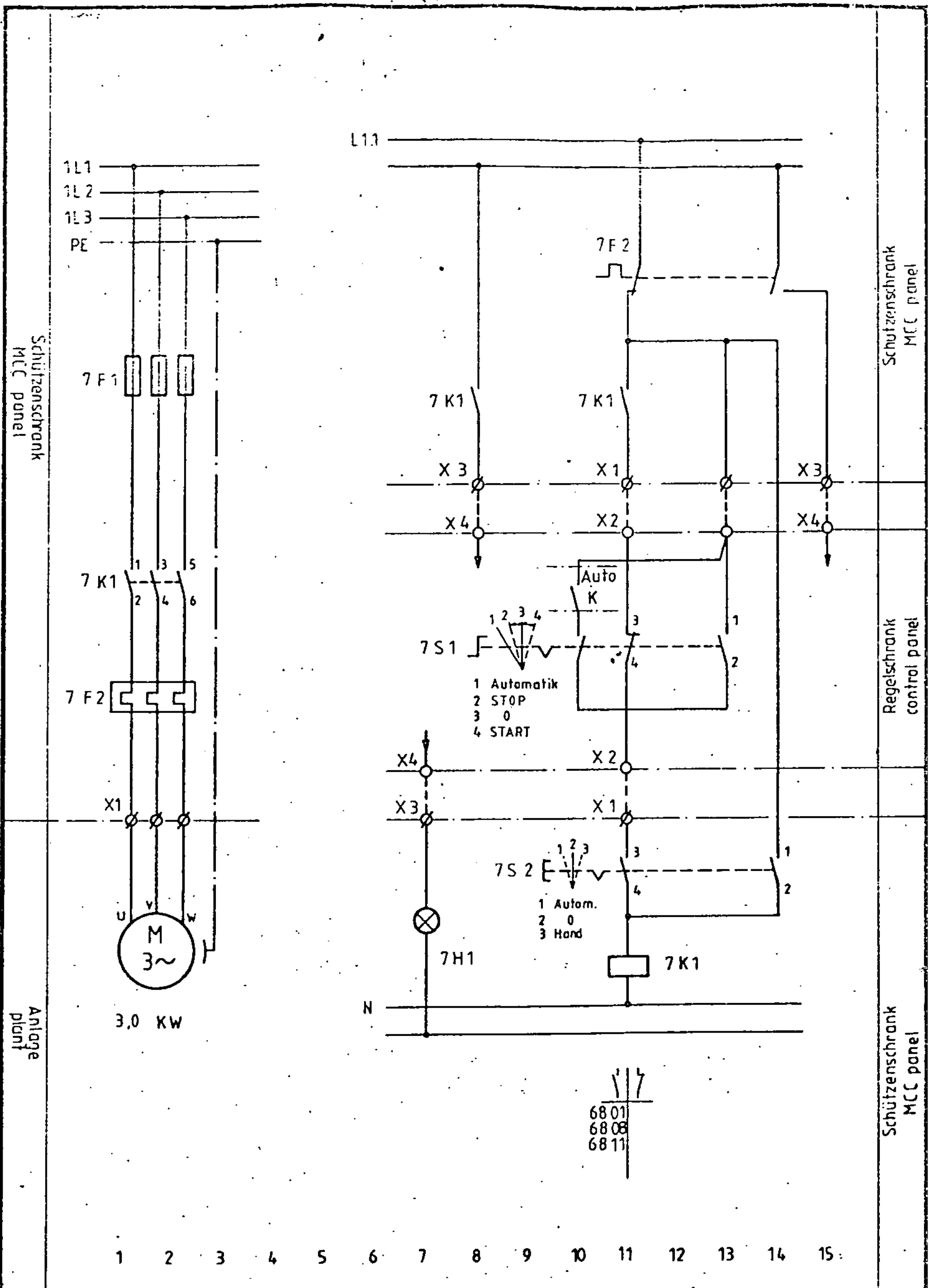


	Datum	Name	Benennung	WIEGAND Karlsruhe GmbH D-7505 Ettlingen
Gezeichn	27.9.84		14.5 Pump ex- way 2	
Geprüft			Kom 2590 - 75 - 83.01	Zeichng Nr 157 - 393 - 4
Gesehen				Blatt 66.1 von



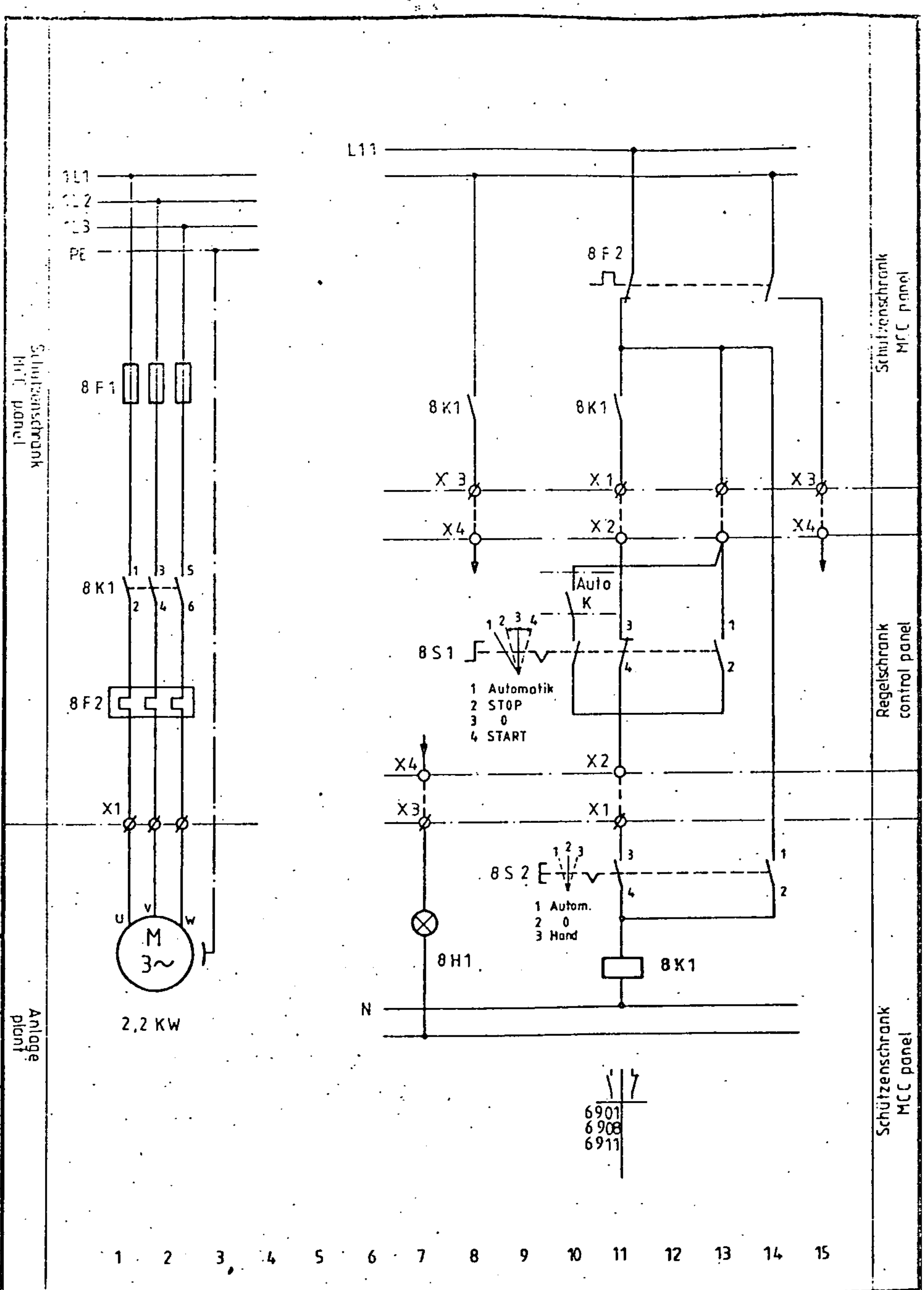
	Datum	Name	Benennung	WIEGAND
Gezeichn	27.9.84	[illegible]	14.6 Pump ex-way 3	Karlsruhe GmbH D-7505 Ettlingen
Geprüft			Kom	Zeichng Nr 157-393-4
Gesehen			2590-75-83.01	Blatt 67.1 von

Index	Änderung	Datum	Name

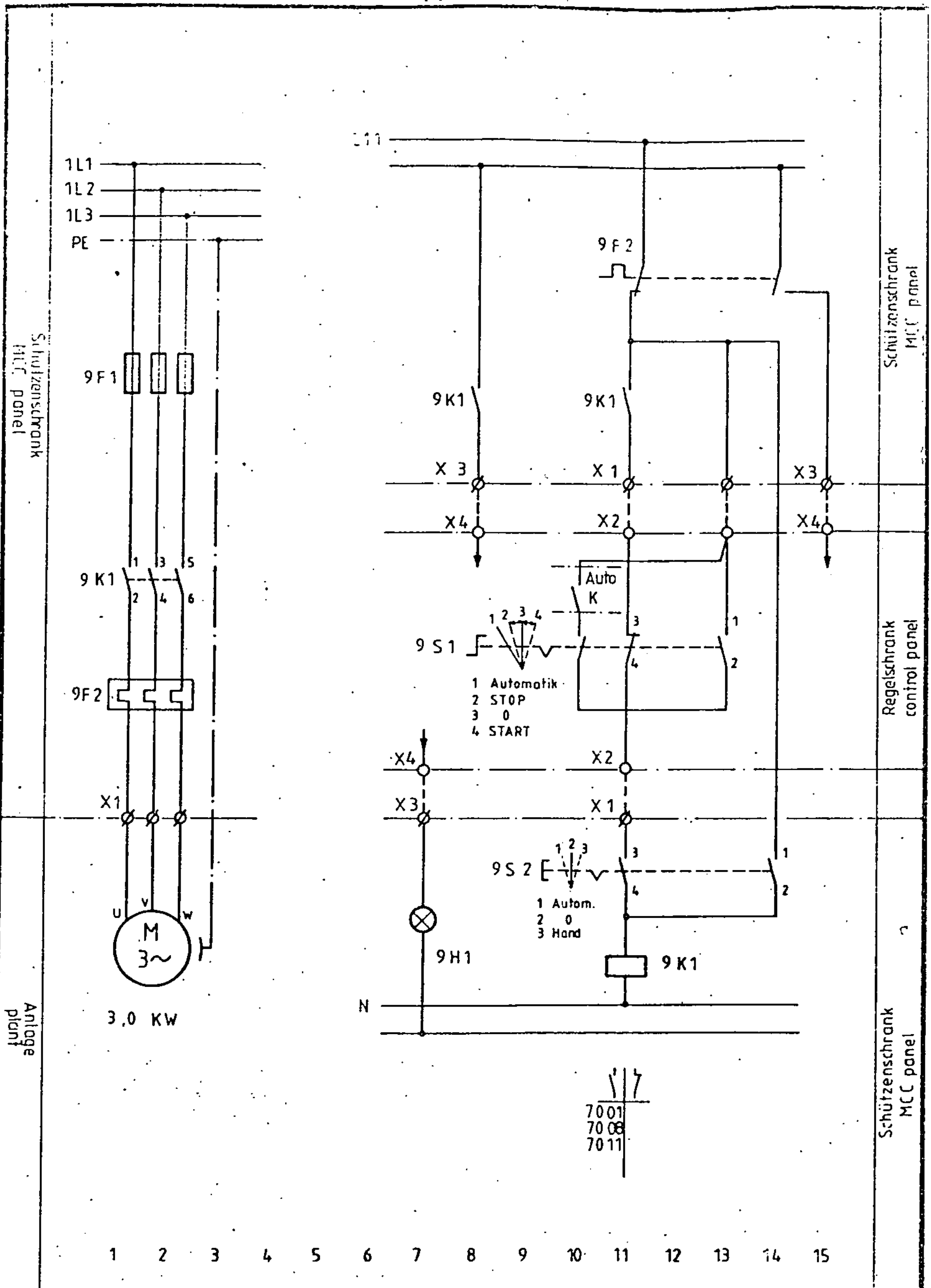


Index	Änderung	Datum	Name

	Datum	Name	Benennung	WIEGAND Karlsruhe GmbH D-7505 Ettlingen
Gezeichn	279.84	[illegible]	14.7 Pump ex - way 4	
Geprüft			Kom 2590 - 75 - 83.01	Zeichng Nr 157 - 393 - 4 · Index
Gesehen				Blatt 68.1 von

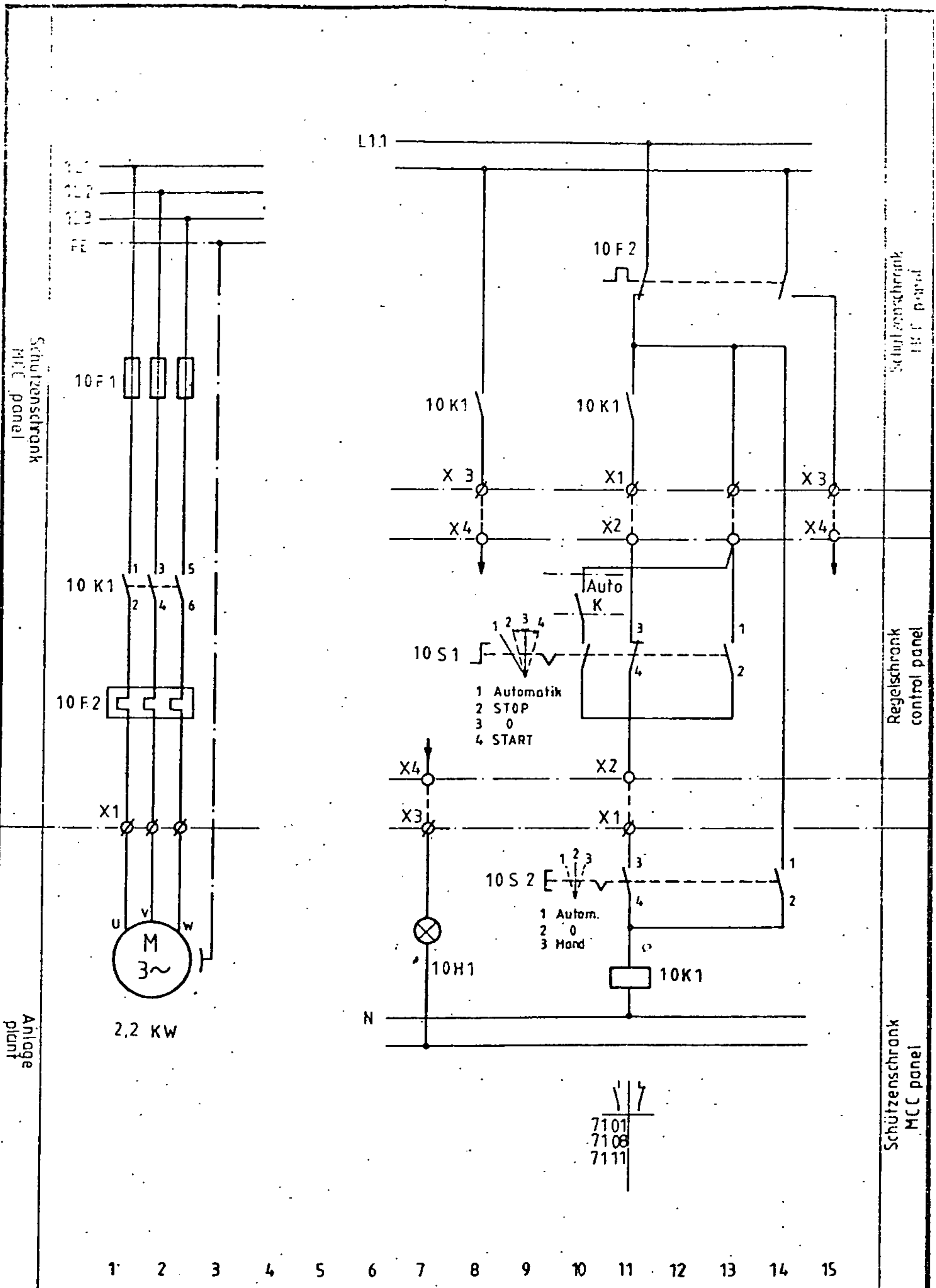


	Datum	Name	Benennung	WIEGAND Karlsruhe GmbH D-7505 Ettlingen
Gezeichn	27.9.84	[illegible]	14.8 Pump ex- way 5	
Geprüft			Kom 2590-75-83.01	Zeichng Nr 157-393-4
Gesehen				Blatt 69 von

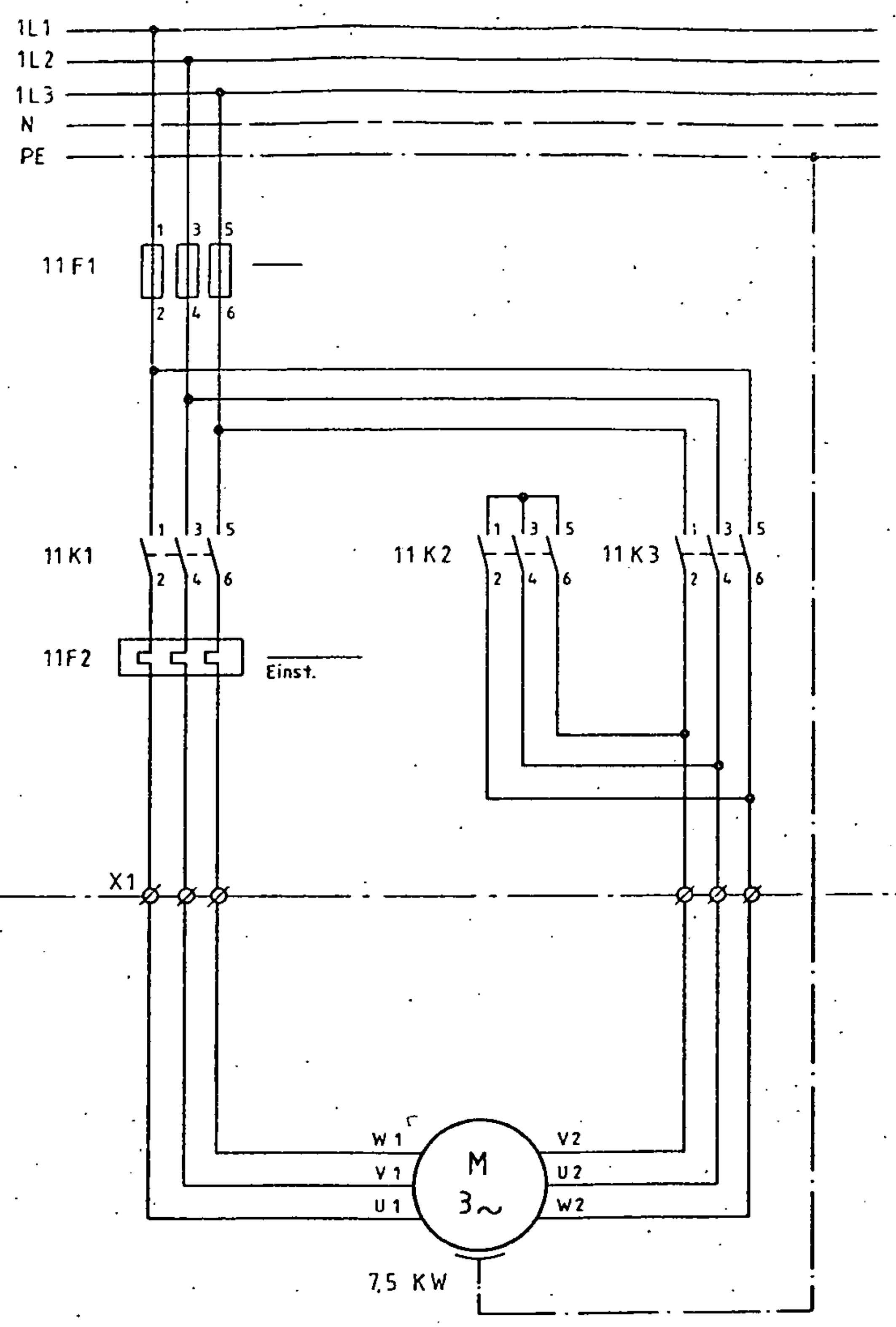


	Datum	Name	Benennung	WIEGAND
Gezeichn	27.9.84	[illegible]	14.9 Concentrate pump	Karlsruhe GmbH D-7505 Ettlingen
Geprüft			Kom 2590 - 75 - 83.01	Zeichng Nr 157 - 393 - 4
Gesehen				Blatt 70 von

Änderung	Datum	Name	Index



	Datum	Name	Benennung	WIEGAND Karlsruhe GmbH D-7505 Ettlingen	
Gezeichn	279 84		14.10 Pump by tank		
Geprüft			Kom 2590-75-83.01	Zeichng Nr 157-393-4	Index
Gesehen				Blatt 71 von	



Änderung	Datum	Name

	Datum	Name
Gezeichn.	27.9.84	[illegible]
Geprüft		
Gesehen		

Benennung
14.11 Condensate pump

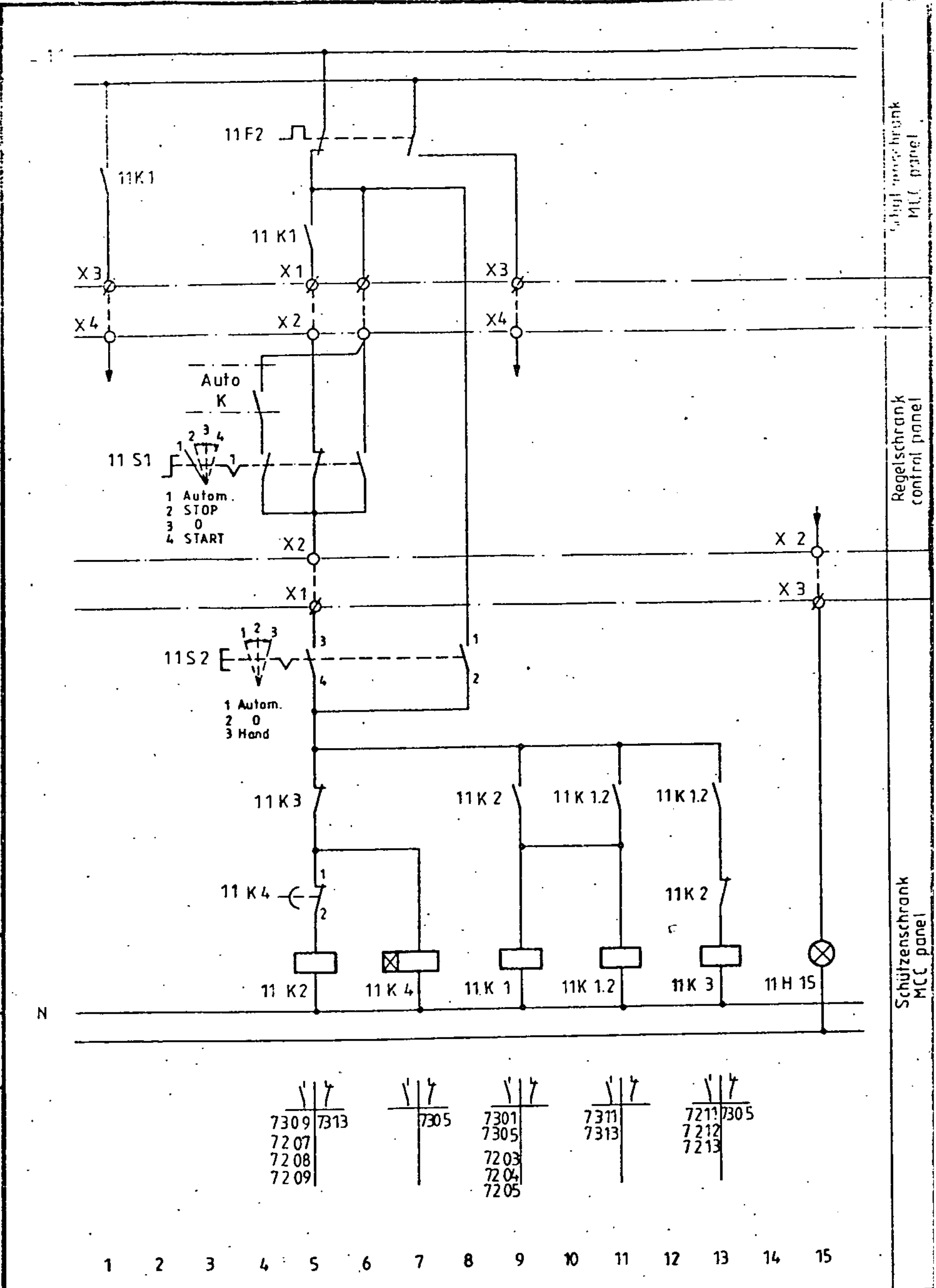
Kom
2590-75-83.01

WIEGAND
Karlsruhe GmbH D-7505 Ettlingen

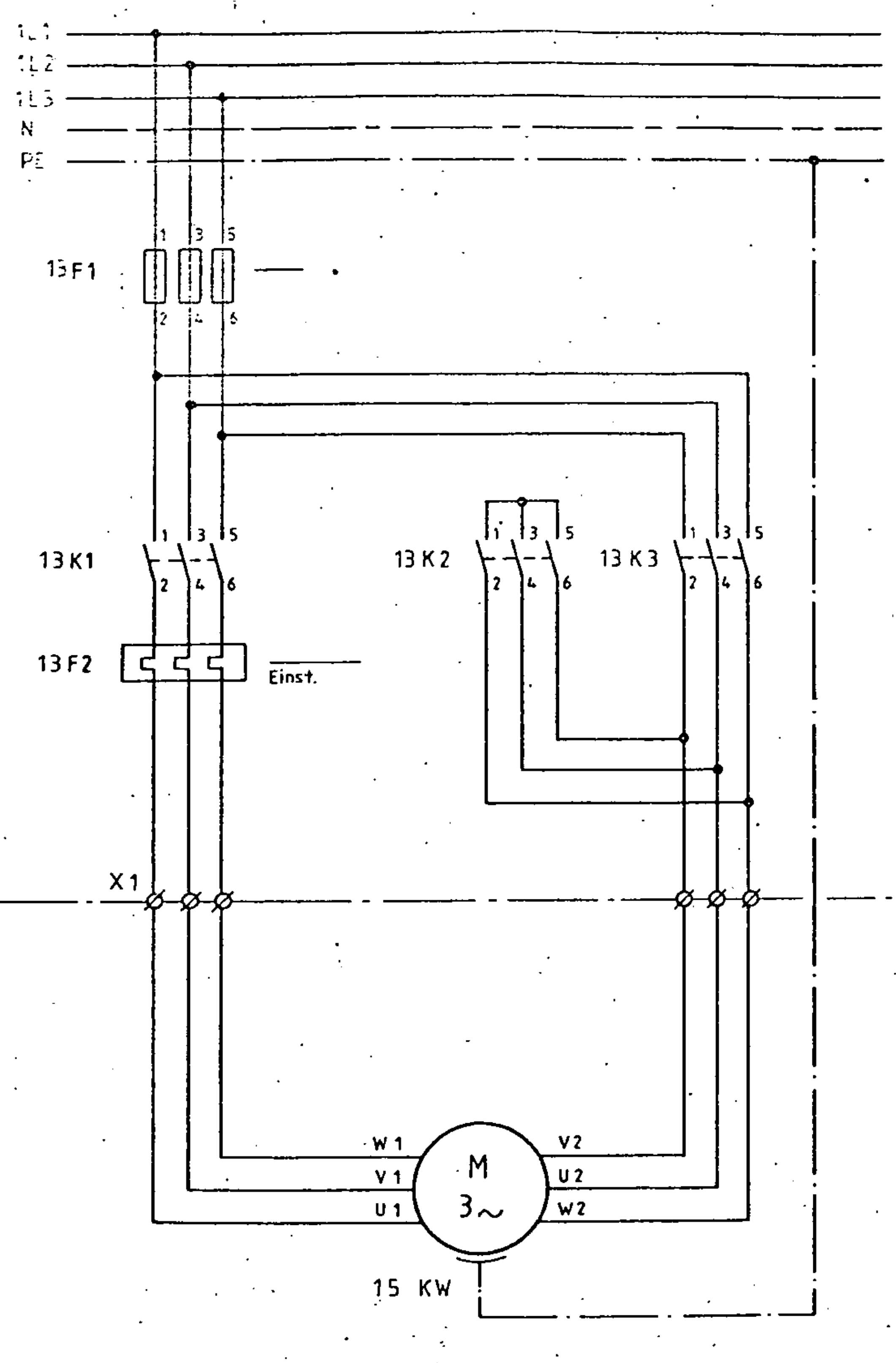
Zeichng. Nr
157-393-4

Index

Blatt 72 von



	Datum	Name	Benennung	WIEGAND
Gezeichn	279 84	Sachau	14.11 Condensate pump	Karlsruhe GmbH D-7505 Ettlingen
Geprüft			Kom	Zeichng Nr 157-393-4
Gesehen			2590-75-83.01	Blatt 73 von



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

Schützenschrank / MCC panel

Anlage / plant

Index	Änderung	Datum	Name

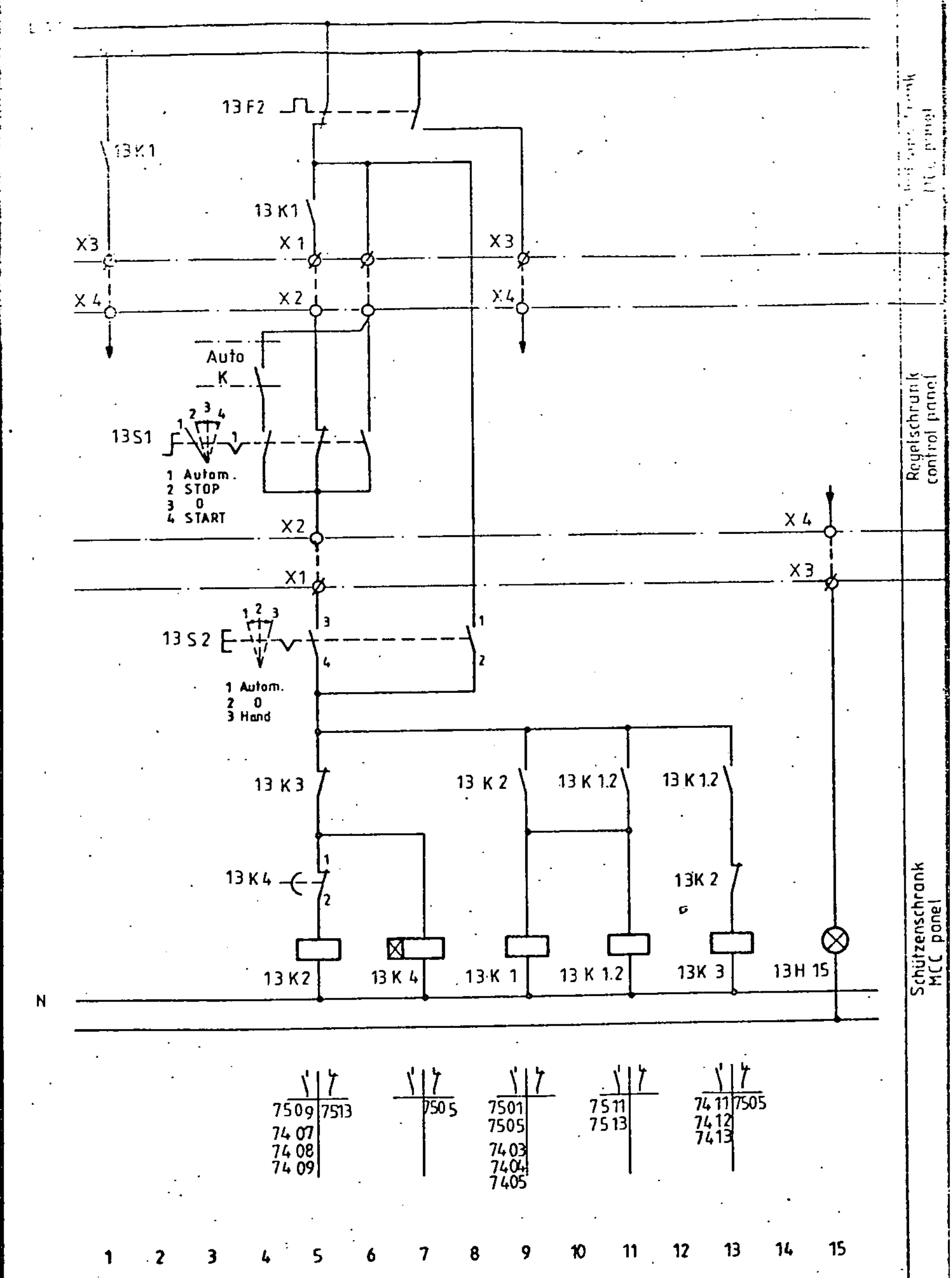
	Datum	Name	Benennung
Gezeichn	27.9.84	[illegible]	14.13 Cooling water pump
Geprüft			Kom 2590-75-83.01
Gesehen			

WIEGAND
Karlsruhe GmbH D-7505 Ettlingen

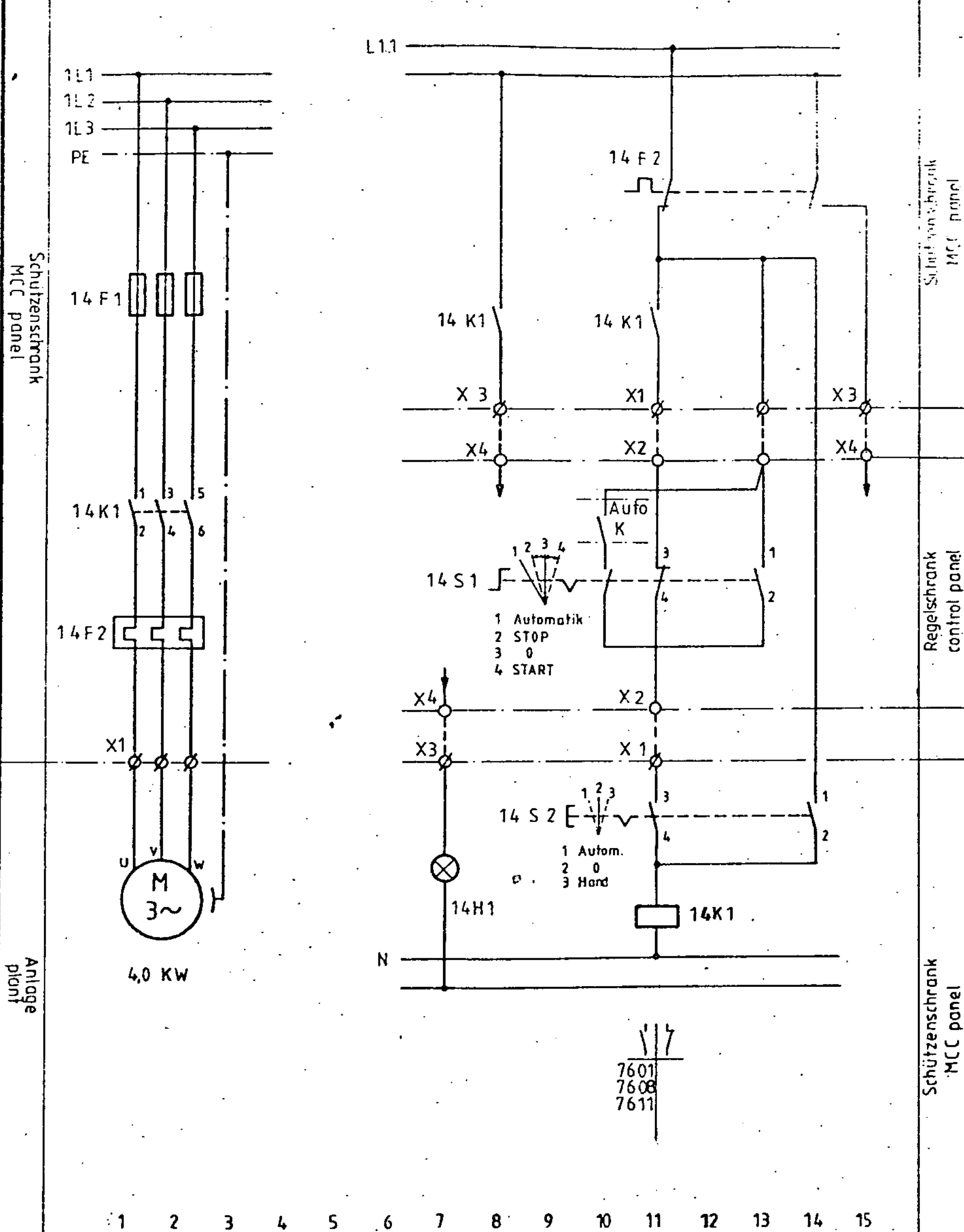
Zeichng Nr 157-393-4

Index

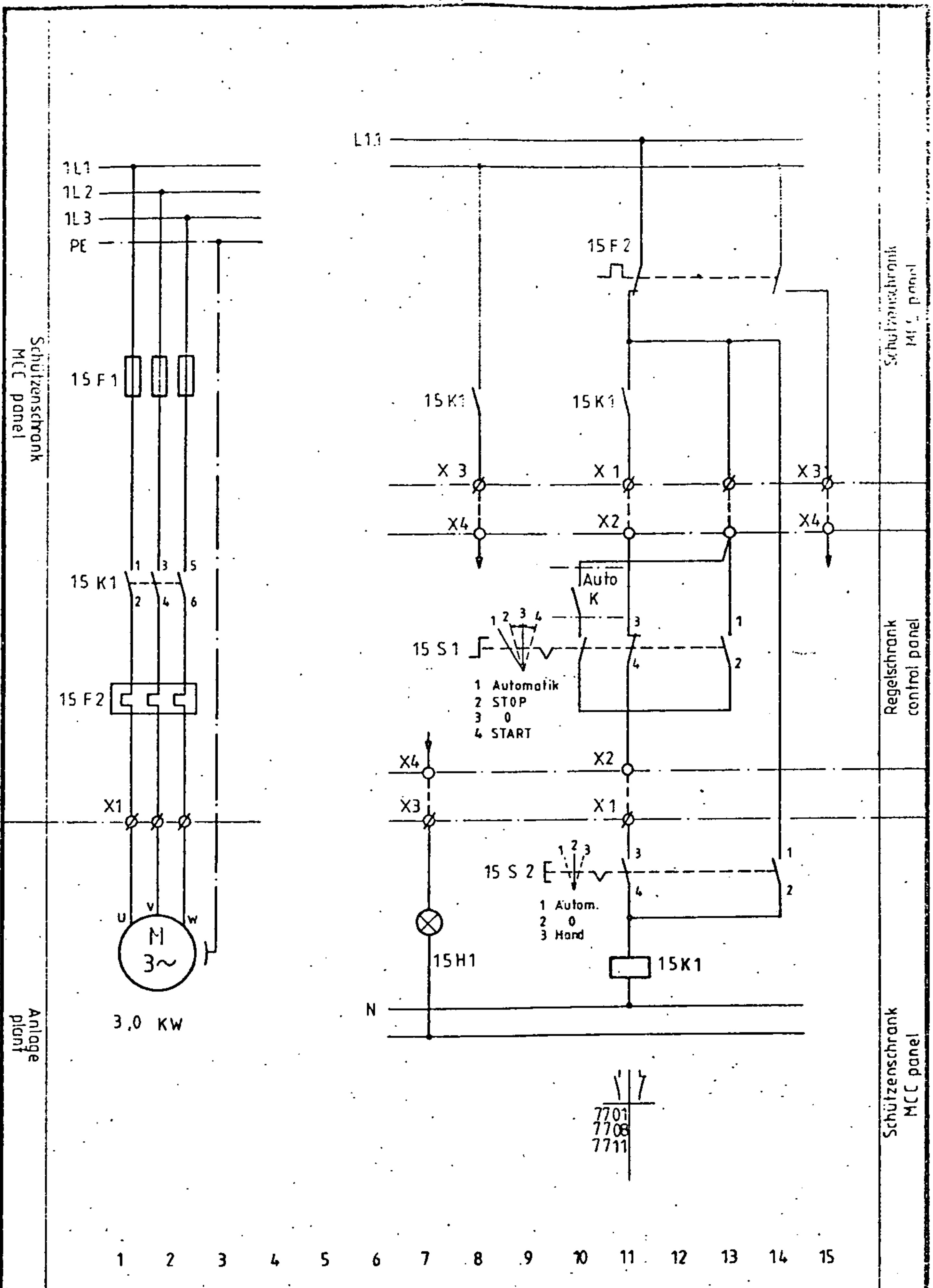
Blatt 74 von



	Datum	Name	Benennung	WIEGAND
Gezeichn	27.9.84		14.13 Cooling water pump	Karlsruhe GmbH D-7505 Ettlingen
Geprüft			Kom	Zeichng Nr 157-393-4
Gesehen			2590-75-83.01	Blatt 75 von

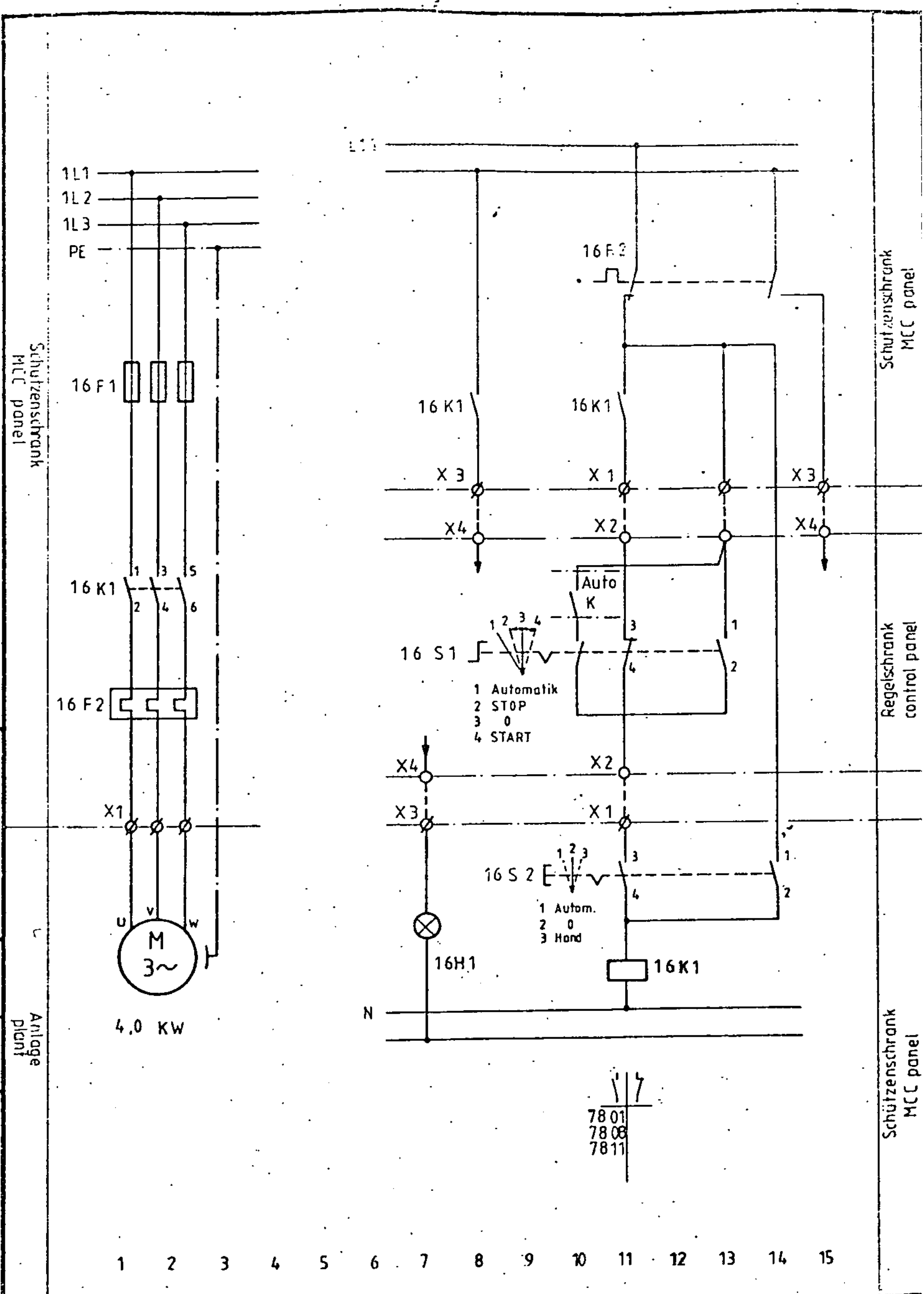


	Datum	Name	Benennung	WIEGAND Karlsruhe GmbH D-7505 Ettlingen
Gezeichn	27.9.84		14.14 Vacuum pump	
Geprüft			Kom 2590-75-83.01	Zeichng Nr 157-393-4 Index
Gesehen				Blatt 76 von

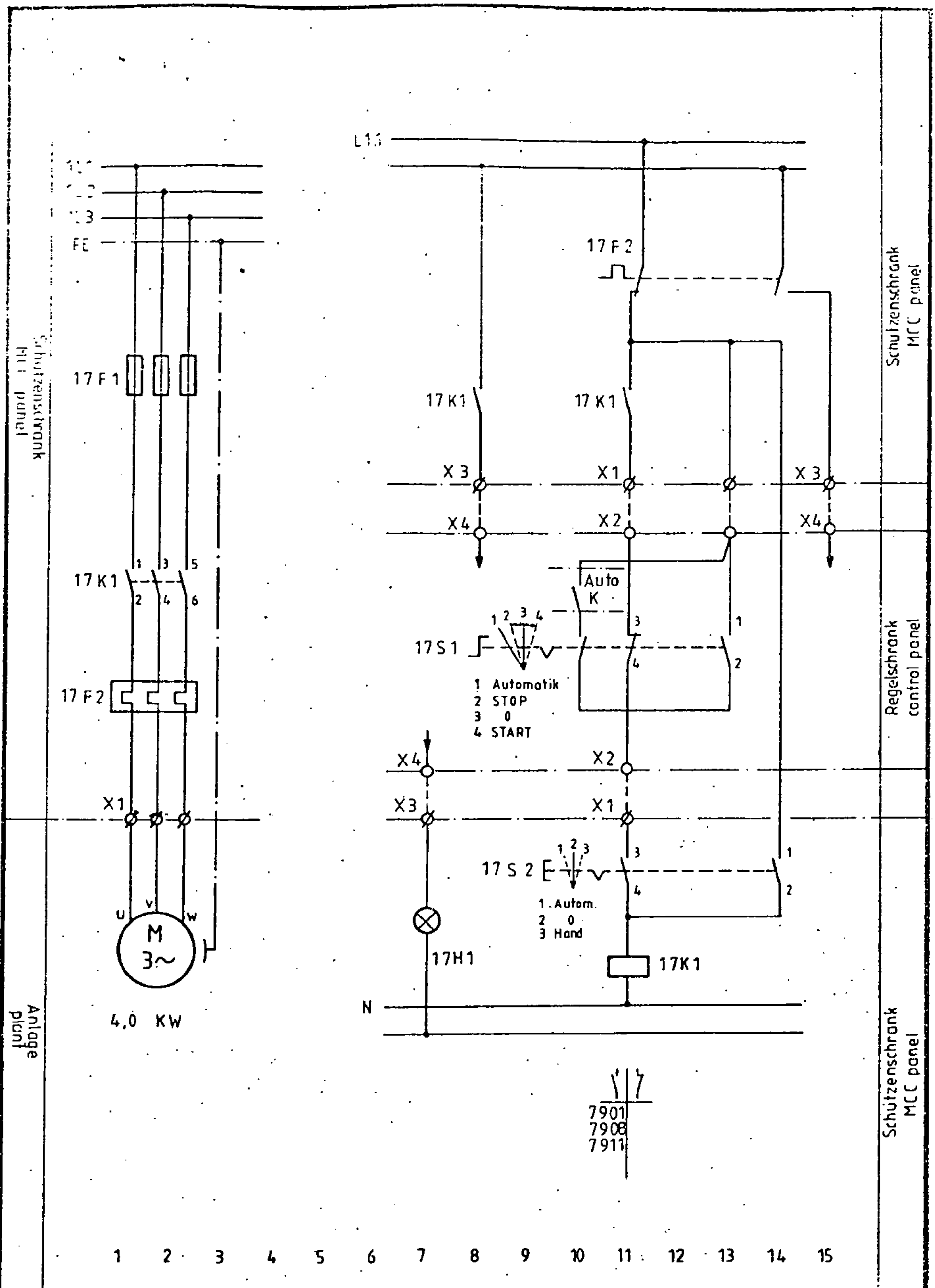


	Datum	Name	Benennung	WIEGAND
Gezeichn	27.9.84		14.15 Feed pump	Karlsruhe GmbH D-7505 Ettlingen
Geprüft			Kom	Zeichng Nr 157 - 393 - 4 / Index
Gesehen			2590 - 75 - 83.01	Blatt 77 von

Index	Änderung	Datum	Name

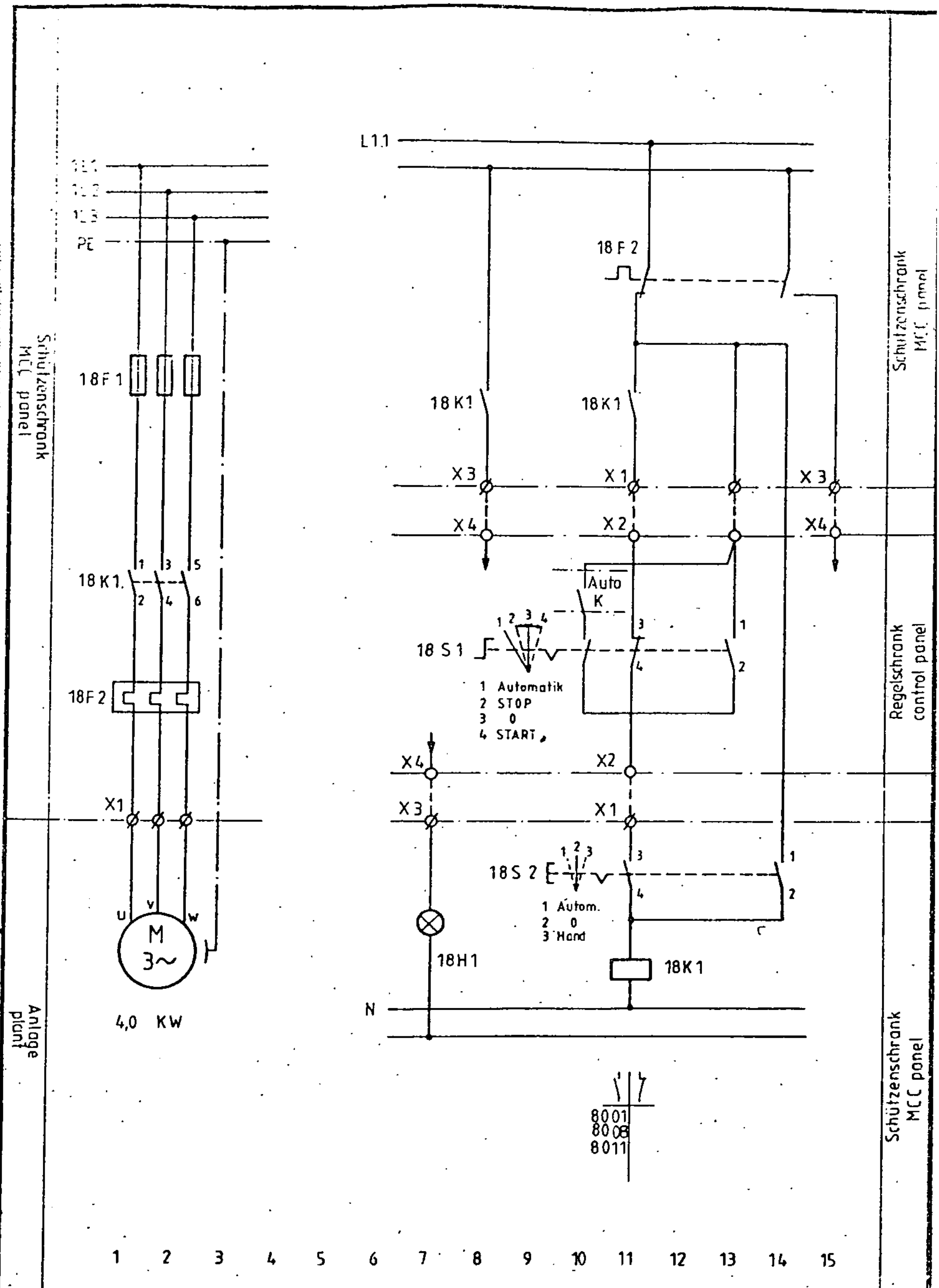


	Datum	Name	Benennung	
Gezeichn	279 84	[illegible]	14.16 Product pump ex 3	WIEGAND Karlsruhe GmbH D-7505 Ettlingen
Geprüft			Kom 2590-75-83.01	Zeichng Nr 157-393-4 Index
Gesehen				Blatt 78 von



	Datum	Name	Benennung	WIEGAND
Gezeichn.	27.9.84		14.17 Product pump ex 2	Karlsruhe GmbH D-7505 Ettlingen
Geprüft			Kom	Zeichng. Nr. / Index
Gesehen			2590 - 75 - 83.01	157 - 393 - 4
				Blatt 79 von

Änderung | Datum | Name | Index



	Datum	Name	Benennung	WIEGAND Karlsruhe GmbH D-7505 Ettlingen
Gezeichn	279 84		14.18 Product pump ex 1A	
Geprüft			Kom 2590 - 75 - 83.01	Zeichng Nr 157 - 393 - 4
Gesehen				Index
				Blatt 80 von

Index	Änderung	Datum	Name

14

MAINTENANCE

Differential Pressure Transmitters with Remote Seal Elements

3423T, 3424T, 3473T, 3474T, 3478T, 3479T, 3481T, 3482T Model B

IB-12B956
Issue 1
Oct 1981

Refer to the Table of Contents in one of the following publications for a list of all sections applicable to these transmitters.

3423T, 3424T: IB-12B229
3473T, 3474T, 3478T, 3479T: IB-12B230
3481T, 3482T: IB-12B231

TABLE OF CONTENTS

ILLUSTRATIONS

TABLE OF CONTENTS

ILLUSTRATIONS (Cont'd)

TABLES

Use of **DANGER, WARNING, CAUTION** and NOTE

This publication includes **DANGER, WARNING, CAUTION** and NOTE information where appropriate to point out safety related or other important information.

DANGER — Hazards which will result in severe personal injury or death.

WARNING — Hazards which could result in personal injury.

CAUTION — Hazards which could result in equipment or property damage.

NOTE — Alerts user to pertinent facts and conditions.

Although **DANGER** and **WARNING** hazards are related to personal injury, and **CAUTION** hazards are associated with equipment or property damage, it should be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process system performance leading to personal injury or death. Therefore, comply fully with all **DANGER, WARNING** and **CAUTION** notices.

DIFFERENTIAL PRESSURE TRANSMITTER
with Remote Seal Elements
3423T, 3424T, 3473T, 3474T,
3478T, 3479T, 3481T, 3482T
Model B

IB-12B956(AS)
Issue 1
Dec 1981

ADDENDA SHEET

Use only with Instruction IB-12B956, Issue 1

Substitute the following for the corresponding instructions on pages 22 and 23.

4.1.3 Installing New Electronics

> CAUTION
> *Do not bend bellows which connects stud to strain gage. If bellows becomes bent, the electronics may have to be replaced.*

1. Assemble nut L on stud of new strain gage. Turn nut until it is flush with end of threads nearest strain gage.

2. Insert strain gage stud into hole in yoke and temporarily fasten strain gage to bracket with one nut T, Figure 19 or 20. (Strain gage will be removed again in Step 8 for a zero adjustment.)

3. Assemble potentiometers as follows:

   a. **Bolted Cover** — Insert each potentiometer shaft into hole in base, Figure 19, and slowly turn plastic adjustment cap until driving rib on cap engages slot on end of shaft. Retain potentiometers with screws B.

   b. **Threaded Cover** — Assemble potentiometers in base and retain with screw E, Figure 20.

4. Mount circuit board as follows:

   a. **Bolted Cover** — Mount board in base and retain with two screws A. Be sure wires are not pinched in board mounting grooves.

   b. **Threaded Cover** — Assemble board on circuit board bracket with four screws C, then mount bracket in base and retain with screws D.

5. Connect black and gray wires to terminal block TB1 on circuit board. Black wire connects to + (plus) terminal and gray wire connects to − (minus) terminal.

6. Connect calibration circuit, Figure 3.

7. Place ZERO jumper in NORM position, Figure 2.

8. Adjust output with strain gage in its free position. Proceed as follows:

   a. Turn **SPAN** adjustment fully clockwise (22-turn potentiometer).

   b. Remove strain gage from mounting bracket and hold strain gage in same orientation as its mounted position with nothing touching stud.

   c. Turn **ZERO** adjustment until output is 1.263V dc ±0.005. Clockwise rotation increases output.

   d. Turn **SPAN** adjustment counterclockwise until output is 1V dc ±0.002.

   e. Turn ZERO adjustment clockwise until output is 0.709V dc ±0.002.

   f. Allow strain gage to hang over side of base and proceed to Step 9.

9. Be sure both sides of measuring element are vented.

10. Insert strain gage mounting posts into holes in mounting bracket.

11. Lubricate the threads of three strain gage mounting posts, Figure 19 or 20, with Dow Corning Molykote 505[1] (or equivalent). Be sure shoulders of posts are free of lubricant.

> CAUTION
> *The raised shoulder of three nuts T must face the strain gage. Incorrect positioning of the nuts can interfere with transmitter performance.*

Finger-tighten strain gage to bracket with three nuts T. The raised shoulder of nuts T must face strain gage.

12. Align the strain gage so stud is centered in hole in yoke; then tighten three nuts T to a torque of 8 inch-lbs (0.9 Nm).

[1]T.M. of Dow Corning Co.

13. Finger-tighten nut K on stud of strain gage.

14. Adjust nuts K and L until output is 1V dc ±0.04, then tighten nuts. Do not overtighten. Output must be 1V dc ±0.04 after tightening.

NOTE
Be sure to replace and securely fasten cover as soon as maintenance is completed.

15. Calibrate transmitter. Refer to 2 Calibration.

Substitute the following for the corresponding instructions on pages 23 and 26.

4.2.2 Installing New Measuring Element

> **CAUTION**
> *Do not bend bellows which connects stud to strain gage. If bellows becomes bent, the electronics may have to be replaced.*

1. Remove force beam protector from new measuring element.

2. Continue assembly as follows:

   a. **Bolted Cover** – Assemble base on measuring element, Figure 21. Position base so that terminal box faces HI side of measuring element. Retain base with two spring washers and screws P.

   b. **Threaded Cover** – Assemble mounting plate and retain with four screws N, Figure 22.

3. Assemble yoke to end of force beam. Orient yoke as shown in Figure 21 or 22 and retain with screw R. Tighten screw R to a torque of 20 inch-lbs (2.2 Nm).

4. Lubricate threads and underside of screw heads of two screws M with Dow Corning Molykote 505, or equivalent.

5. Assemble strain gage bracket and retain with two screws M. Tighten screws alternately to a torque of 10 inch-lbs (1.1 Nm); then tighten to a torque of 50 inch-lbs (5.7 Nm).

6. Adjust nut L on strain gage stud until it is flush with end of threads nearest strain gage.

7. Insert strain gage center stud into hole in yoke and temporarily fasten strain gage to bracket with one nut T, Figure 19 or 20. (Strain gage will be removed again in Step 13b for a zero adjustment.)

8. Assemble potentiometers in base as follows:

   a. **Bolted Cover** – Insert each potentiometer shaft, Figure 19, into hole in base and slowly turn plastic adjustment cap until driving rib on cap engages slot on end of shaft. Retain potentiometers with screws B.

   b. **Threaded Cover** – Assemble potentiometers in base and retain with screw E, Figure 20.

9. Mount circuit board as follows:

   a. **Bolted Cover** – Mount board in base and retain with screws A. Be sure wires are not pinched in board mounting grooves.

   b. **Threaded Cover** – Mount circuit board bracket in base and retain with screws D.

10. Connect black and gray wires to terminal blocks TB1 on circuit board. Black wire connects to + (plus) terminal and gray wire connects to – (minus) terminal.

11. Connect calibration circuit, Figure 3.

12. Place ZERO jumper in NORM position, Figure 2.

13. Adjust output with strain gage in its free position. Proceed as follows:

    a. Turn SPAN adjustment fully clockwise (22-turn potentiometer).

    b. Remove strain gage from mounting bracket and hold strain gage in same orientation as its mounted position with nothing touching stud.

    c. Turn ZERO adjustment until output is 1.263V dc ±0.005. Clockwise rotation increases output.

d. Turn **SPAN** adjustment counterclockwise until output is 1V dc ±0.002.

e. Turn **ZERO** adjustment clockwise until output is 0.709V dc ±0.002.

f. Allow strain gage to hang over side of base and proceed to Step 14.

14. Be sure both sides of measuring element are vented.

15. Insert strain gage mounting posts into holes in mounting bracket,

16. Lubricate the threads of three strain gage mounting posts, Figure 19 or 20, with Dow Corning Molykote 505 (or equivalent). Be sure shoulders of posts are free of lubricant. Be sure no lubricant is on bracket.

> CAUTION
> *The raised shoulder of three nuts T must face the strain gage. Incorrect positioning of the nuts can interfere with transmitter performance.*

Finger-tighten strain gage to bracket with three nuts T. The raised shoulder of nuts T must face the strain gage.

17. Align the strain gage so center stud is centered in hole in yoke; then tighten three nuts T to a torque of 8 inch-lbs (0.9 Nm).

18. Finger-tighten nut K on center stud of strain gage.

19. Adjust nuts K and L until output is 1V dc ±0.04, then tighten nuts. Do not overtighten. Output must be 1V dc ±0.04 after tightening.

NOTE

Be sure to replace and securely fasten cover as soon as maintenance is completed.

20. Calibrate transmitter. Refer to 2 **Calibration**.

1

INTRODUCTION

1.1 REMOVING TRANSMITTER FROM SERVICE

WARNING
Process pressure and material retained by the seal elements can cause injury and damage equipment. Standard plant safety procedures must be followed when removing the instrument from service.

Turn off power to transmitter and disconnect wiring. Do not loosen or remove bolts and nuts in the measuring element body.

When removing the seal elements from service, do not allow the seal diaphragm to be bumped or scraped. After removing a seal element, immediately attach a cover over the seal diaphragm to protect it from damage during handling. If a seal diaphragm is damaged, the transmitter must be returned to Taylor for factory repair.

1.2 TEST EQUIPMENT AND TOOLS

The test equipment required to calibrate and troubleshoot the transmitter is shown in Table 1.

The tools required to disassemble and reassemble the transmitter are shown in Table 2.

WARNING
Do not use a soldering iron in an area classed as hazardous by the electrical code. Explosion or fire may result, thus causing injury or property damage. Remove instrument from service for repair in a workshop.

Table 1. Test Equipment

DESCRIPTION	MINIMUM CHARACTERISTICS	QUANTITY
Power Supply	24V dc ±10%	1
Voltmeter	0 to 25V dc ±1 mV accuracy at 1.25V	1
Ohmmeter	0 to 5k	1
Jumper Wire	4 inches	1
62.5 Ohm Precision Resistor	0.1%	1
Manometer or Gage	As required for transmitter range. Accurate to 0.25% of transmitter range	1
Air Supply	–	1
Pressure Regulator	–	1
Shutoff Valves	–	2
Tubing & Fittings	–	As req.

E-1211-145

Table 2. Tools

TOOL	SIZE	QTY	USE
Screwdrivers	3/32-inch	1	TB1 Screws & Screw B
	3/16-inch	1	Screws A, C, D, E & N
Open End Wrench	1/4-inch	2	Nuts K & L
Hex Wrenches	3/32-inch	1	Screw R
	5/32 by 4-inch long with T-Handle	1	Screws M & P
Torque Wrenches	100 in. lb (12 Nm) capacity with 5/32-inch hex driver	1	Screw M
	50 in. lb (5 Nm) capacity with 3/32-inch hex driver	1	Screw R
	25 in. lb (2.5 Nm) capacity with 1/4-inch socket	1	Nuts T
	Capacity and socket as required. Refer to Replacing Diaphragm Capsule.	1	Flange nuts on measuring element
Soldering Iron	40W	1	Replacing Electronic Components

E-1211-146A

1.3 REPAIR-BY-EXCHANGE PROGRAM

If it is necessary to replace the transmitter electronics assembly, Figure 1, the used assembly can be returned for credit against the purchase of a new electronics assembly. Contact Taylor for detailed information about this program.

The strain gage force unit and circuit board in the electronics assembly are factory temperature compensated as a matched pair. Individual replacement strain gages or circuit boards are not available.

NOTE

The hermetically sealed strain gage is not field repairable. Any attempt to repair the strain gage will void the instrument warranty and make the electronics assembly ineligible for credit under the Repair-By-Exchange Program.

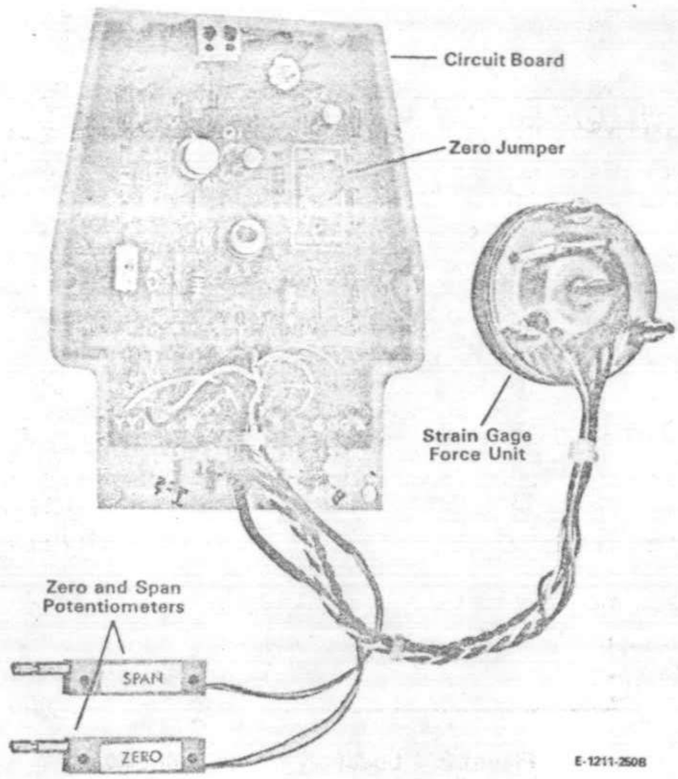


Figure 1. Electronics Assembly

2

CALIBRATION

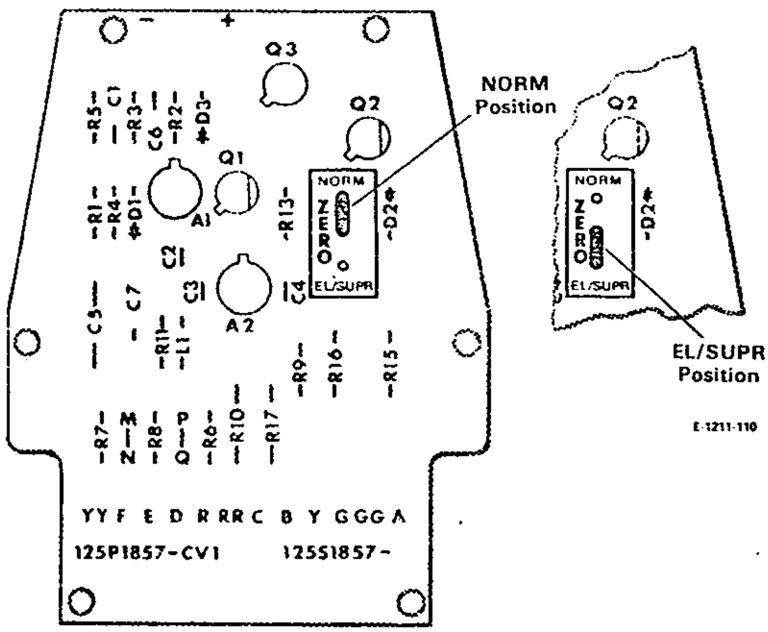


Figure 2. Location of Zero Jumper

2.1 SPAN AND ZERO ADJUSTMENTS

2.1.1 General

The design of the transmitter circuit minimizes the interaction between the span and zero adjustments to simplify the calibration procedure. Because of this feature, the transmitter output will not respond linearly to changes in input which are below the lower range value by more than 0.5% of span. Also, there will be essentially no output changes in response to input changes which are below the lower range value by more than 1.5% of span.

For example, assume that a transmitter has been calibrated for a span of 100 inches of water (25 kPa) with a lower range value of 50 (12) and an upper range value of 150 inches of water (37 kPa). When the input is 50 inches of water (12 kPa) the output measured across the 62.5 ohm resistor, Figure 3, will be 0.25V dc (4 mA). If the input is lowered by 0.5% of span to 49.5 inches (11.88 kPa), the output will decrease linearly by 0.5% to 0.245V dc. If the input is further lowered to 48.5 inches of water (11.63 kPa), the output response will not be linear; and if the input is lowered below 48.5 inches of water (11.63 kPa), the output will remain essentially constant at approximately 0.233V dc.

2.1.2 Zero Jumper

A zero jumper is located on the circuit board, Figure 2. The **NORM** position is for zero based calibration and increases the sensitivity of the external **ZERO** adjustment. The jumper must be moved to the **EL/SUPR** position for some elevated, suppressed, and center zero calibrations. Refer to **1.4 Specifications**, for ranges available in both the **NORM** and **EL/SUPR** positions. Adjustments to trim an existing calibration can be made using the **SPAN** and **ZERO** adjustments located on the outside of the housing.

2.2 TEST SETUP

The transmitter is part of a two-wire system. Thus, it does not contain an internal power supply. The test equipment required to calibrate the transmitter is shown in Table 1. Calibrate the transmitter using the circuit shown in Figure 3. The voltage drop across the 62.5 ohm precision resistor will be 0.25 to 1.25V dc for a 4 to 20 mA dc output change.

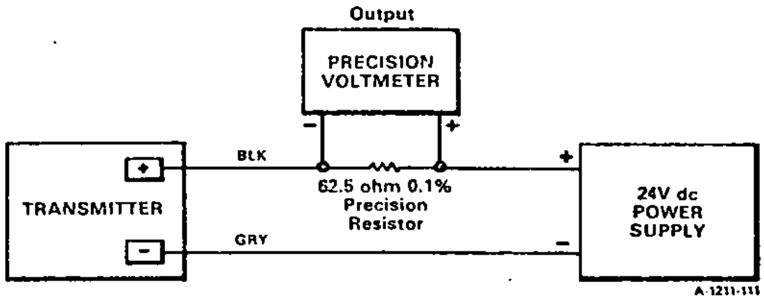


Figure 3. Calibration Circuit

If the transmitter catalog number has electrical connection suffix 02, 03, 04, 05, or 08, the terminal box on the transmitter contains a 2.5 ohm, 0.1% precision calibration resistor. This resistor may be used in place of the 62.5 ohm resistor shown in Figure 10. The voltage drop across the 2.5 ohm resistor will be 10 to 50 mV dc for a 4 to 20 mA dc output change.

If the transmitter catalog number has electrical connection suffix 03, an output test jack is connected across the 2.5 ohm precision resistor. The test jack accepts a standard miniature phone plug, Taylor Part No. 113S290. Other acceptable plugs are G.E. Electronics numbers 33-660, 662, 664, 666, 668, or 670.

If the transmitter catalog number has electrical connection suffix 08, an output current meter jack which accepts a miniature phone plug is connected across a shunting diode. Refer to the schematic diagram in the back of this **Instruction Manual**.

Use the test hookup shown in either Figure 5 or Figure 8 for applying calibration inputs. To determine the type of calibration required for a specific application, refer to the **Process Installation Section**.

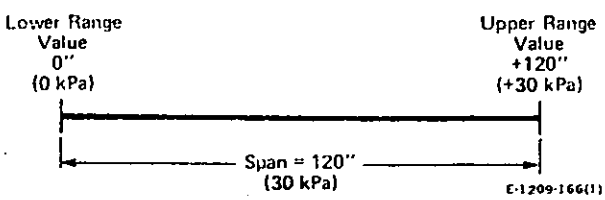


Figure 4. Example of Span and Range Values for a Zero Based Calibration

2.3 ZERO BASED CALIBRATION

An example of a zero based calibration is shown in Figure 4.

1. Connect output to calibration circuit as shown in Figure 3; and connect input to test hookup as shown in Figure 5.

   Be sure that both seal elements are at the same elevation, so that the head pressures in the measuring element are equalized.

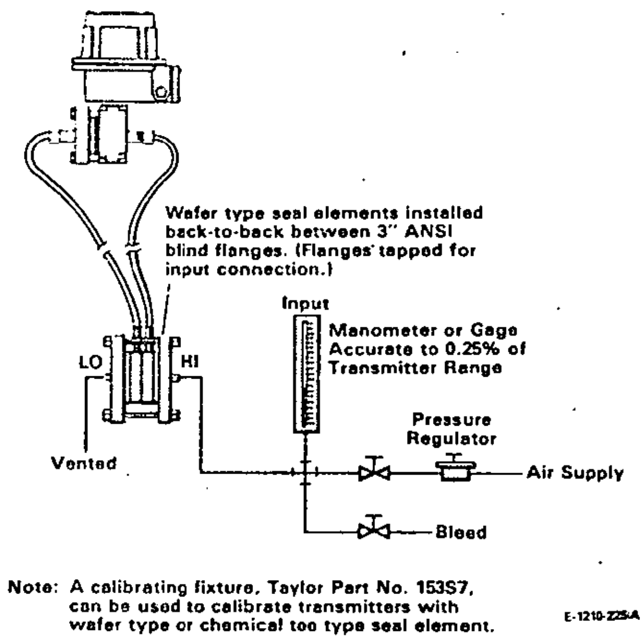


Figure 5. Test Hookup for Zero Based and Suppressed Zero Calibration

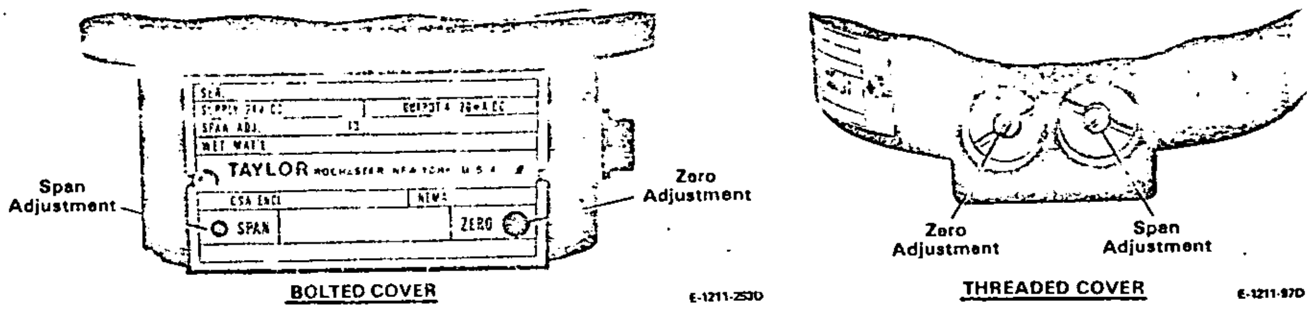


Figure 6. Span and Zero Adjustments

2. Place **ZERO** jumper in **NORM** position, Figure 2.

3. Adjust input to lower range value.

Examples
U.S. Units: 0 inches of water for a 0 to +120 inch range.

SI Units: 0 kPa for a 0 to +30 kPa range.

4. Turn ZERO adjustment, Figure 6, until output is 0.25V dc ±0.001. Clockwise rotation increases output.

5. Adjust input to upper range value.

Examples
U.S. Units: 120 inches of water for a 0 to +120 inch range.

SI Units: 30 kPa for a 0 to +30 kPa range.

6. Output should be 1.25V dc ±0.0025. If it is not, turn **SPAN** adjustment to obtain 1.25V dc. Clockwise rotation increases output and decreases span.

7. Repeat Steps 3 through 6 for required accuracy.

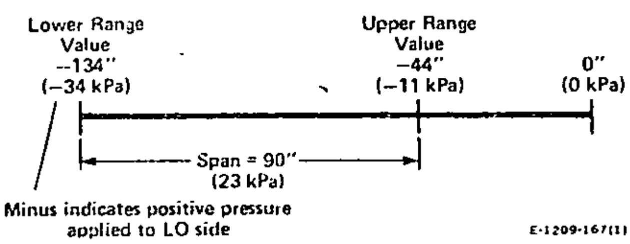


Figure 7. Example of Span and Range Values for an Elevated Zero Calibration with Negative Upper Range Value

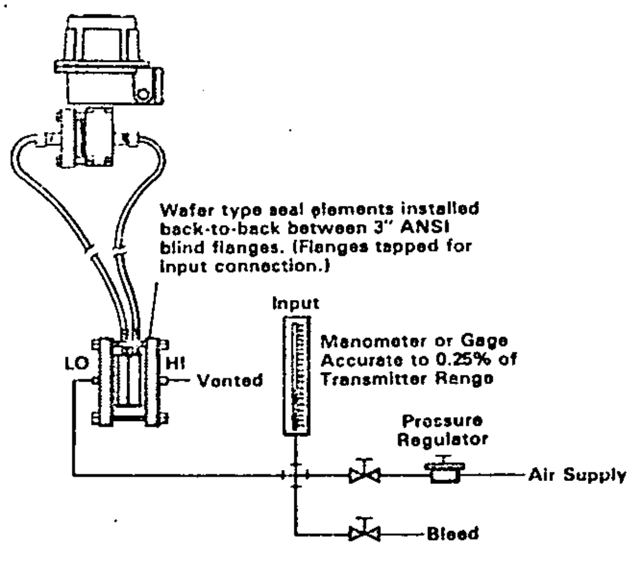
2.4 ELEVATED ZERO CALIBRATION (Negative Upper Range Value)

An example of an elevated zero calibration with negative upper range value is shown in Figure 7.

1. Connect output to calibration circuit as shown in Figure 3, and connect input to test hookup as shown in Figure 8.

   Be sure that both seal elements are at the same elevation, so that head pressures in the measuring element are equalized.

2. Place **ZERO** jumper in **NORM** position, Figure 2.



Note: A calibrating fixture, Taylor Part No. 153S7, can be used to calibrate transmitters with wafer type or chemical tee type seal element. E-1210-224A

Figure 8. Test Hookup for Elevated Zero and Center Zero Calibrations

3. Adjust input to lower range value.

   Examples
   U.S. Units: 134 inches of water for a −134 to −44 inch range.

   SI Units: 34 kPa for a −34 to −11 kPa range.

4. Turn **ZERO** adjustment, Figure 6, until output is 0.25V dc ±0.001. Clockwise rotation increases output. If output of 0.25V dc ±0.001 is not possible, refer to **2.1.2 Zero Jumper**; then repeat Steps 3 and 4.

5. Adjust input to upper range value.

   Examples
   U.S. Units: 44 inches of water for a −134 to −44 inch range.

   SI Units: 11 kPa for a −34 to −11 kPa range.

6. Output should be 1.25V dc ±0.0025. If it is not, turn **SPAN** adjustment to obtain 1.25V dc. Clockwise rotation increases output and decreases span.

7. Repeat Steps 3 through 6 for required accuracy.

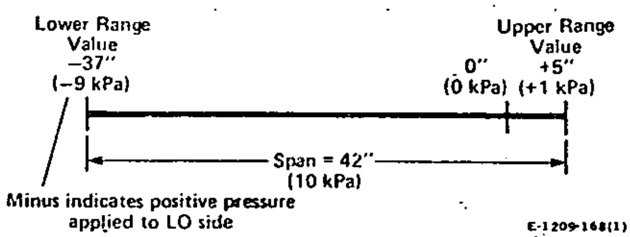


Figure 9. Example of Span and Range Values for an Elevated Zero Calibration with Positive Upper Range Value

2.5 ELEVATED ZERO CALIBRATION (Positive Upper Range Value)

An example of an elevated zero calibration with positive upper range value is shown in Figure 9.

1. Connect output to calibration circuit as shown in Figure 3; and connect input to test hookup as shown in Figure 8. Arrange input line so that it can be switched from the **LO** side to the **HI** side connection. Be sure that both seal elements are at the same elevation, so that the head pressures in the measuring element are equalized.

2. Place **ZERO** jumper in **NORM** position, Figure 2.

3. With input connected to **LO** side, adjust input to lower range value.

   Examples
   U.S. Units: 37 inches of water for a −37 to +5 inch range.

   SI Units: 9 kPa for a −9 to +1 kPa range.

4. Turn **ZERO** adjustment, Figure 6, until output is 0.25V dc ±0.001. Clockwise rotation increases output. If output of 0.25V dc ±0.001 is not possible, refer to **2.1.2 Zero Jumper**; then repeat Steps 3 and 4.

5. Connect input to **HI** side; and adjust input to upper range value.

   Examples
   U.S. Units: 5 inches of water for a −37 to +5 inch range.

   SI Units: 1 kPa for a −9 to +1 kPa range.

6. Output should be 1.25V dc ±0.0025. If it is not, turn **SPAN** adjustment to obtain 1.25V dc. Clockwise rotation increases output and decreases span.

7. Repeat Steps 3 through 6 for required accuracy.

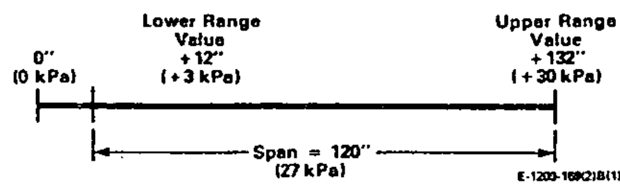


Figure 10. Example of Span and Range Values for a Suppressed Zero Calibration

2.6 SUPPRESSED ZERO CALIBRATION

An example of a suppressed zero calibration is shown in Figure 10.

1. Connect output to calibration circuit as shown in Figure 3; and connect input to test hookup as shown in Figure 5.

Be sure that both seal elements are at the same elevation, so that the head pressures in the measuring element are equalized.

2. Place **ZERO** jumper in **NORM** position, Figure 2.

3. Adjust input to lower range value.

   Examples
   U.S. Units: 12 inches of water for a +12 to +132 inch range.

   SI Units: 3 kPa for a +3 to +30 kPa range.

4. Turn **ZERO** adjustment, Figure 13, until output is 0.25V dc ±0.001. Clockwise rotation increases output. If output of 0.25V dc ±0.001 is not possible, refer to **2.1.2 Zero Jumper**; then repeat Steps 3 and 4.

5. Adjust input to upper range value.

   Examples
   U.S. Units: 132 inches of water for a +12 to +132 inch range.

   SI Units: 30 kPa for a +3 to +30 kPa range.

6. Output should be 1.25V dc ±0.0025. If it is not, turn **SPAN** adjustment to obtain 1.25V dc. Clockwise rotation increases output and decreases span.

7. Repeat Steps 3 through 6 for required accuracy.

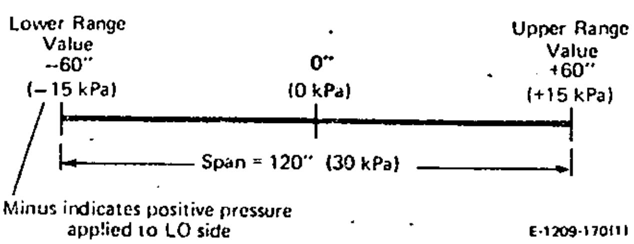


Figure 11. Example of Span and Range Values for a Center Zero Calibration

2.7 CENTER ZERO CALIBRATION

An example of a center zero calibration is shown in Figure 11.

1. Connect output to calibration circuit, Figure 3, and connect input to test hookup, Figure 8. Arrange input line so that it can be switched from **LO** side to **HI** side connection.

   Be sure that both seal elements are at the same elevation, so that the head pressures in the measuring element are equalized.

2. Place **ZERO** jumper in **NORM** position, Figure 2.

3. With input connected to **LO** side, adjust input to lower range value.

   Examples
   U.S. Units: 60 inches of water for a −60 to +60 inch range.

   SI Units: 15 kPa for a −15 to +15 kPa range.

4. Turn **ZERO** adjustment, Figure 6, until output is 0.25V dc ±0.001. Clockwise rotation increases output. If output of 0.25V dc ±0.001 is not possible, refer to **2.1.2 Zero Jumper**; then repeat Steps 3 and 4.

5. Connect input to **HI** side and adjust input to upper range value.

   Examples
   U.S. Units: 60 inches of water for a −60 to +60 inch range.

   SI Units: 15 kPa for a −15 to +15 kPa range.

6. Output should be 1.25V dc ±0.0025. If it is not, turn **SPAN** adjustment to obtain 1.25V dc. Clockwise rotation increases output and decreases span.

7. Repeat Steps 3 through 6 for required accuracy.

8. Adjust input to 0 inches of water (0 kPa).

9. Turn **ZERO** adjustment until output is 0.75V dc ±0.001.

2.8 ADJUSTING OVERRANGE STOP

The purpose of this procedure is to position the overrange stop so that it does not interfere with operation over the calibrated range of the transmitter. Use this procedure only if the factory setting of the overrange stop has been disturbed.

1. Connect output to calibration circuit as shown in Figure 3; and connect test hookup as shown in Figure 5. Be sure that the seal elements are at the same elevation so that head pressures in the measuring element are equalized.

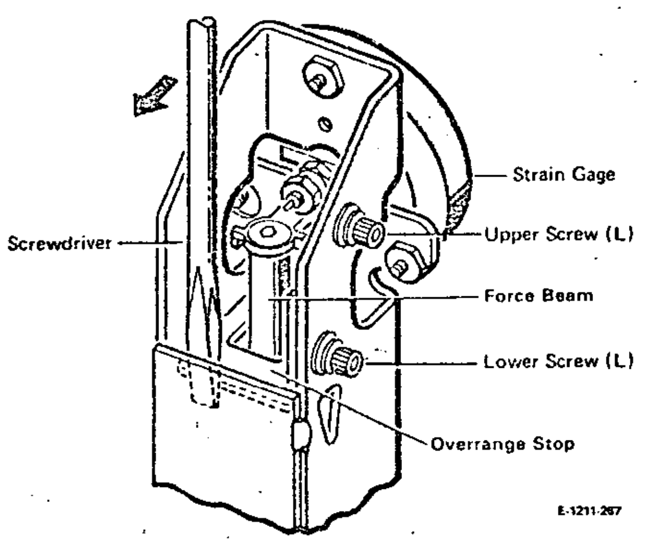


Figure 12. Adjusting Overrange Stop

2. Loosen both screws L, Figure 12. Check overrange stop to be sure it does not obstruct movement of force beam.

3. Place zero jumper in **NORM** position, Figure 2.

4. Adjust input to 0 inches of water (0 kPa).

5. Turn **ZERO** adjustment, Figure 6, until output is 0.25V dc ±0.001. Clockwise rotation increases output.

6. Adjust input to 115% of maximum span, Table 3.

7. Output should be 1.4V dc ±0.05. If it is not, turn **SPAN** adjustment to obtain 1.4V dc. Clockwise rotation increases output and decreases span.

Table 3. Input Values for Adjusting Overrange Stop

Catalog Number	Input (115% of Maximum Span)	
	inches of water	kPa
3423T 3473T 3478T 3481T	230	56
3424T 3474T 3479T 3482T	747.5	184

8. Repeat Steps 4 through 7 until required output is obtained.

9. Adjust input to 115% of maximum span and note output. This output must be maintained while performing Steps 10 through 12.

10. Tighten upper screw L. This screw will serve as the pivot point for the overrange stop.

11. Use a screwdriver to adjust overrange stop as shown in Figure 12. Move stop toward strain gage until stop contacts force beam. Contact is indicated by a slight decrease in output (0.02V dc maximum). After adjustment, output must be within 0.02V dc of value noted in Step 9.

12. Tighten both screws L securely. After tightening, output must be within 0.02V dc of value noted in Step 9.

    If it is not, loosen both screws L and repeat Steps 10 through 12.

13. Adjust input to 0 inches of water (0 kPa). Output should return to 0.25V dc ±0.002.

    If it does not, check for interference between overrange stop and force beam. Repeat Steps 9 through 13, if necessary.

14. Calibrate transmitter for required span.

3

TROUBLESHOOTING

3.1 GENERAL

The symptoms shown in Table 4 provide a guide for isolating a problem related to either transmitter installation or operation. If an operation problem is traced to the transmitter electronics, the cause may be in the circuit board. Refer to paragraph 3.2 for information on isolating an electronic problem. If the transmitter has an optional surge protector, refer to paragraph 3.3 for information on isolating a problem in the surge protector circuit. Refer to **1.3 Repair-By-Exchange Program** for information on the replacement electronics assemblies.

Table 4. Troubleshooting Chart

Problem	Possible Cause	Action
No output signal	a. Transmitter on closed tank liquid level installation; not calibrated for elevated zero b. LO side seal element is above HI side element c. No power to transmitter d. Transmitter leads reversed e. Loose wire on transmitter terminal f. Strain gage incorrectly connected to force beam g. Electronics Assembly h. Surge Protector Circuit i. Damaged diaphragm	a. Recalibrate as required. Refer to **2 Calibration.** b. Bring both elements to same elevation. c. Turn on power. d. Check electrical connections. e. Check wiring inside transmitter. f. Check adjustment of nuts K and L. Refer to **4.1 Replacing Electronics Assembly.** g. Refer to **3.2 Troubleshooting Electronics Assembly.** h. Refer to **3.3 Troubleshooting Optional Surge Protector.** i. Replace measuring element. Refer to **4.3 Replacing Measuring Element.**
Output signal too low	a. Incorrect calibration b. LO side seal element is above HI side element c. Strain gage incorrectly connected to force beam d. Electronics	a. Recalibrate as required. Refer to **2 Calibration.** b. Bring seal elements to same elevation. c. Check adjustment of nuts K and L. Refer to **4.1 Replacing Electronics Assembly.** d. Refer to **3.2 Troubleshooting Electronics Assembly.**
Output signal too high	a. Incorrect calibration b. HI side seal element is above LO side seal element c. Strain gage incorrectly connected to force beam d. Electronics	a. Perform calibration. b. Bring seal elements to same elevation. c. Check adjustment of nuts K and L. Refer to **4.1 Replacing Electronics Assembly.** d. Refer to **3.2 Troubleshooting Electronics Assembly.**

Table 4. Troubleshooting Chart (Cont'd)

Problem	Possible Cause	Action
Output remains at 0 mA dc	a. No power to transmitter b. Transmitter leads reversed c. Electronics	a. Turn on power supply. b. Check electrical connections. c. Refer to **3.2 Troubleshooting Electronics Assembly.** Replace strain gage or circuit board as required.
Output remains at 4 mA dc	a. Electronics	a. Refer to **3.2 Troubleshooting Electronics Assembly.**
Unable to rezero to 4 mA dc after changing span setting	a. Strain gage incorrectly connected to force beam	a. Check adjustment of nuts K and L. Refer to **4.1 Replacing Electronics Assembly.**
Turning zero or span adjustment does not change output	a. Electronics	a. Refer to **3.2 Troubleshooting Electronics Assembly.**
Zero shifts on vibration service	a. Strain gage bracket shifting	a. Tighten screws M, Figure 21 or 22, to 50 inch-lbs (5.7 Nm).
Zero shifts due to deflection of housing	a. Transmitter housing used as a step	a. Do not stand on transmitter.

3.2 TROUBLESHOOTING ELECTRONICS ASSEMBLY

If an electronic component malfunctions, it can be located using Figure 13 in conjunction with the troubleshooting flow chart, Figure 14, and the schematic diagram in the back of this **Instruction Manual**. If the cause is the strain gage force unit, the electronics assembly (strain gage and circuit board) must be replaced with a factory-tested assembly. The strain gage and circuit board are factory temperature compensated as a matched pair. Individual replacement strain gages or circuit boards are not available.

If a problem is traced to a component on the circuit board, it is recommended that the electronics assembly be replaced. This is because of the low-level signals on the board and the selected components required for proper circuit operation.

If it is necessary to replace a component on the circuit board, refer to **4.3 Replacing Electronic Components** before making the replacement. After a component has been replaced, recalibrate the transmitter. If the transmitter cannot be calibrated, further troubleshooting is required.

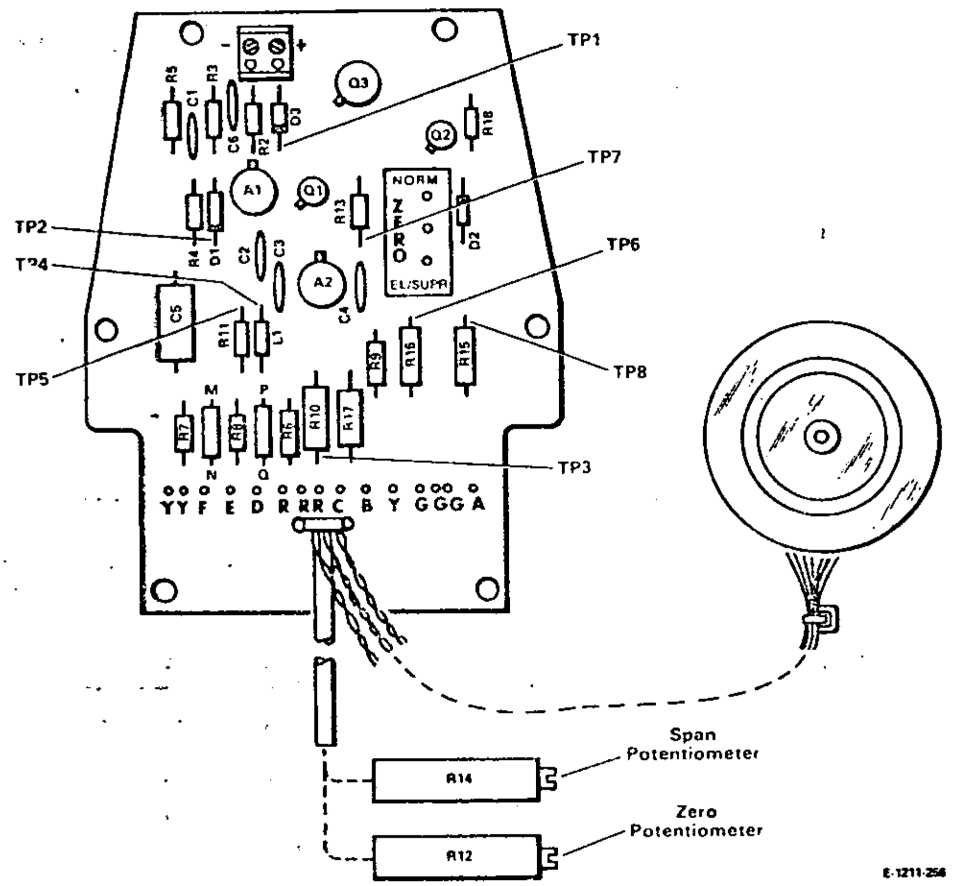


Figure 13. Component Locations for Electronics Assembly

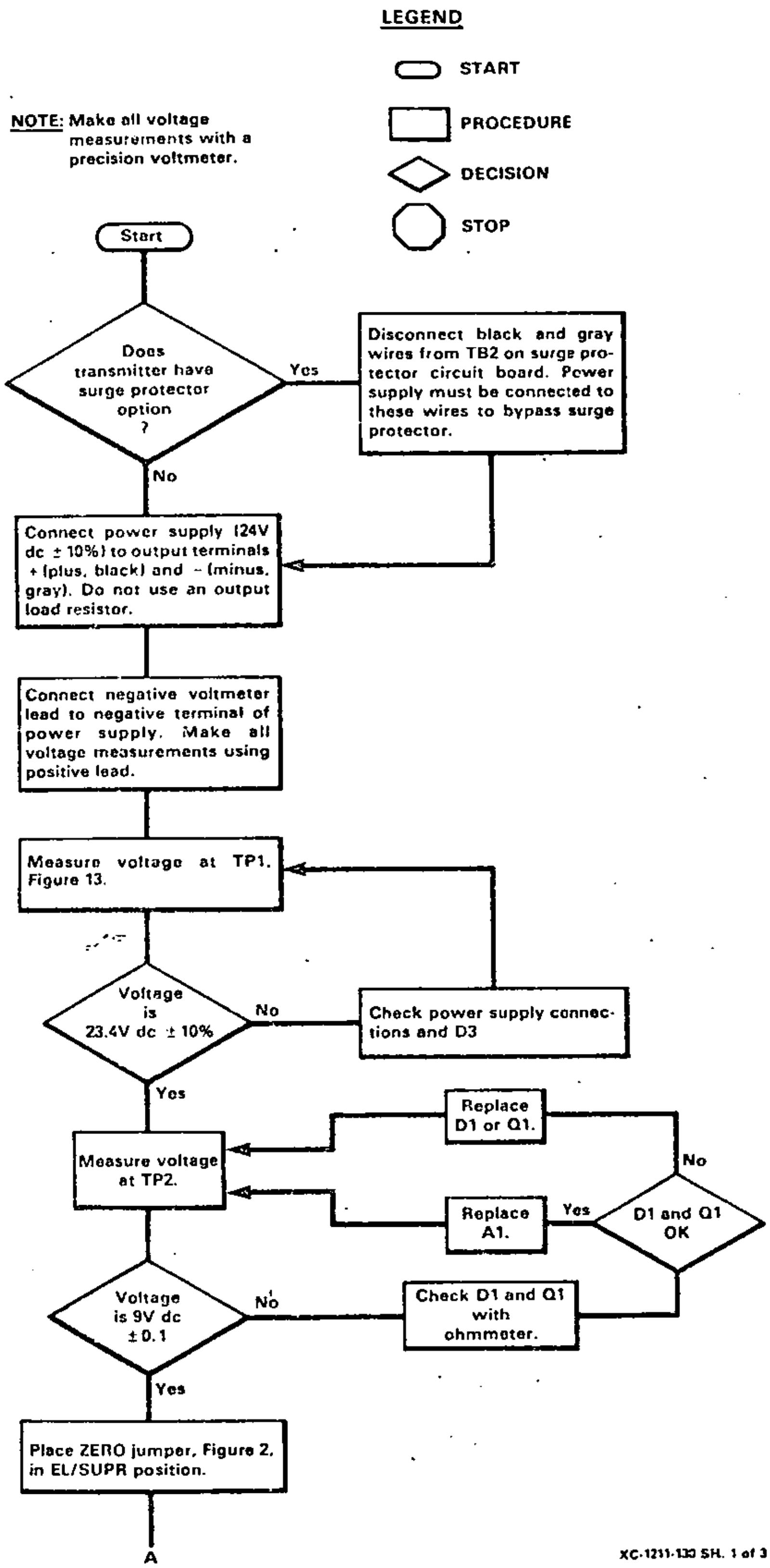


Figure 14. Troubleshooting Flow Chart for Transmitter Electronics

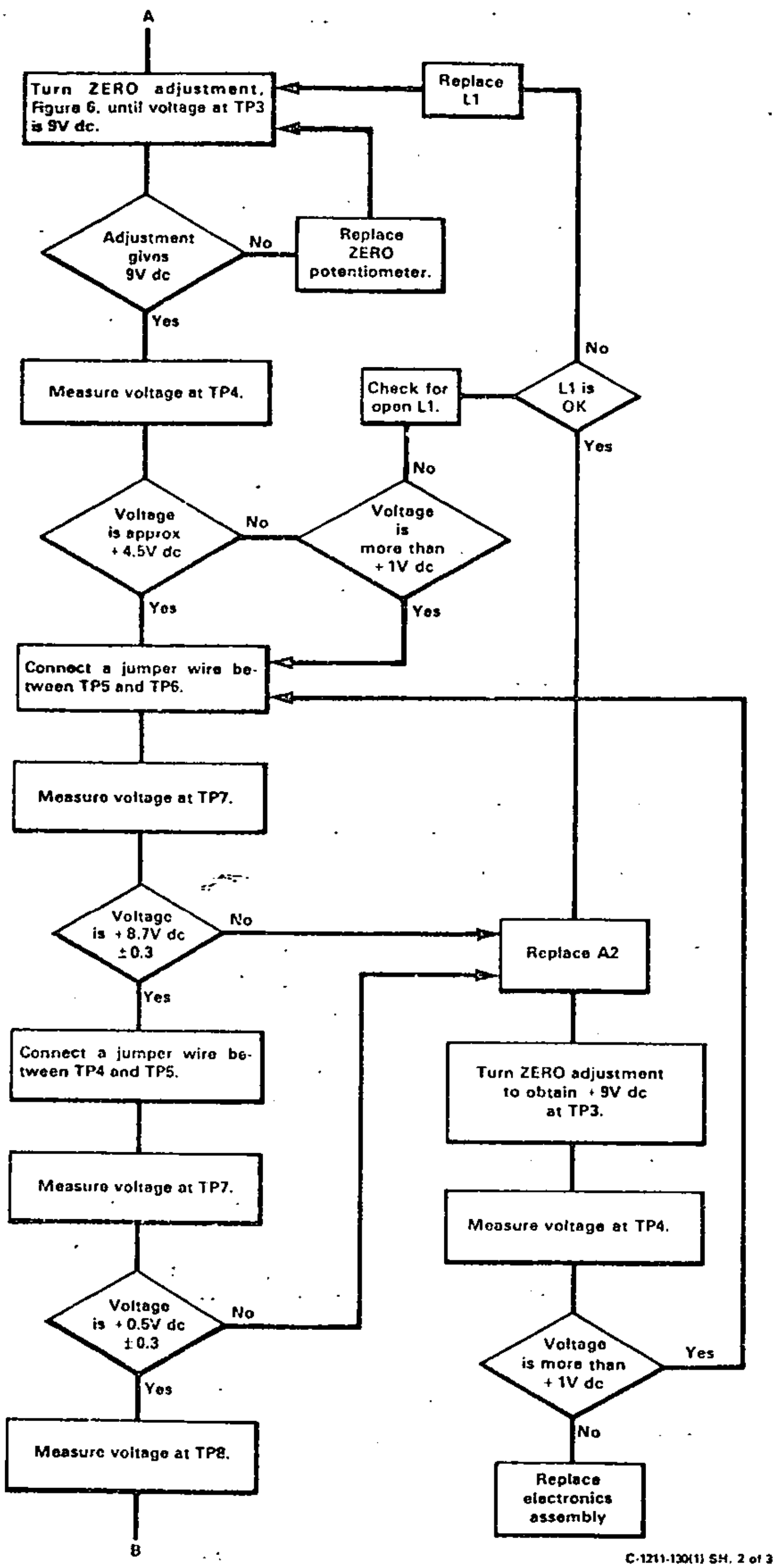


Figure 14. Troubleshooting Flow Chart for Transmitter Electronics (Cont'd)

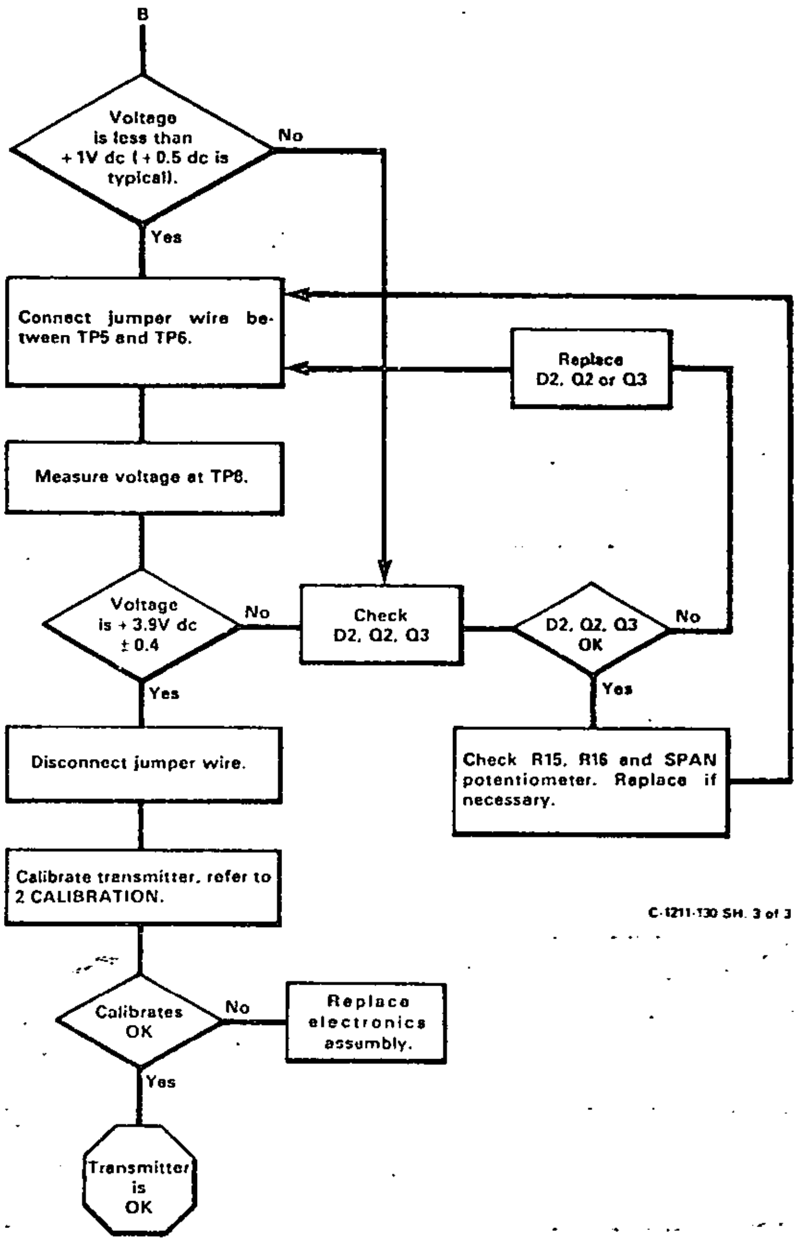


Figure 14. Troubleshooting Flow Chart for Transmitter Electronics (Cont'd)

3.3 TROUBLESHOOTING OPTIONAL SURGE PROTECTOR

DANGER

Capacitor C1 retains up to 200V dc of charge. Bodily contact with the charged capacitor can result in injury or death. Discharge the capacitor before disassembly of the test circuit.

A defect in the surge protector circuit can be isolated using the troubleshooting flow chart, Figure 15, in conjunction with Figures 16 through 18, and the schematic diagram in the back of this **Instruction Manual**. If a problem is traced to a component, replacement of the surge protector circuit board is recommended.

TROUBLESHOOTING

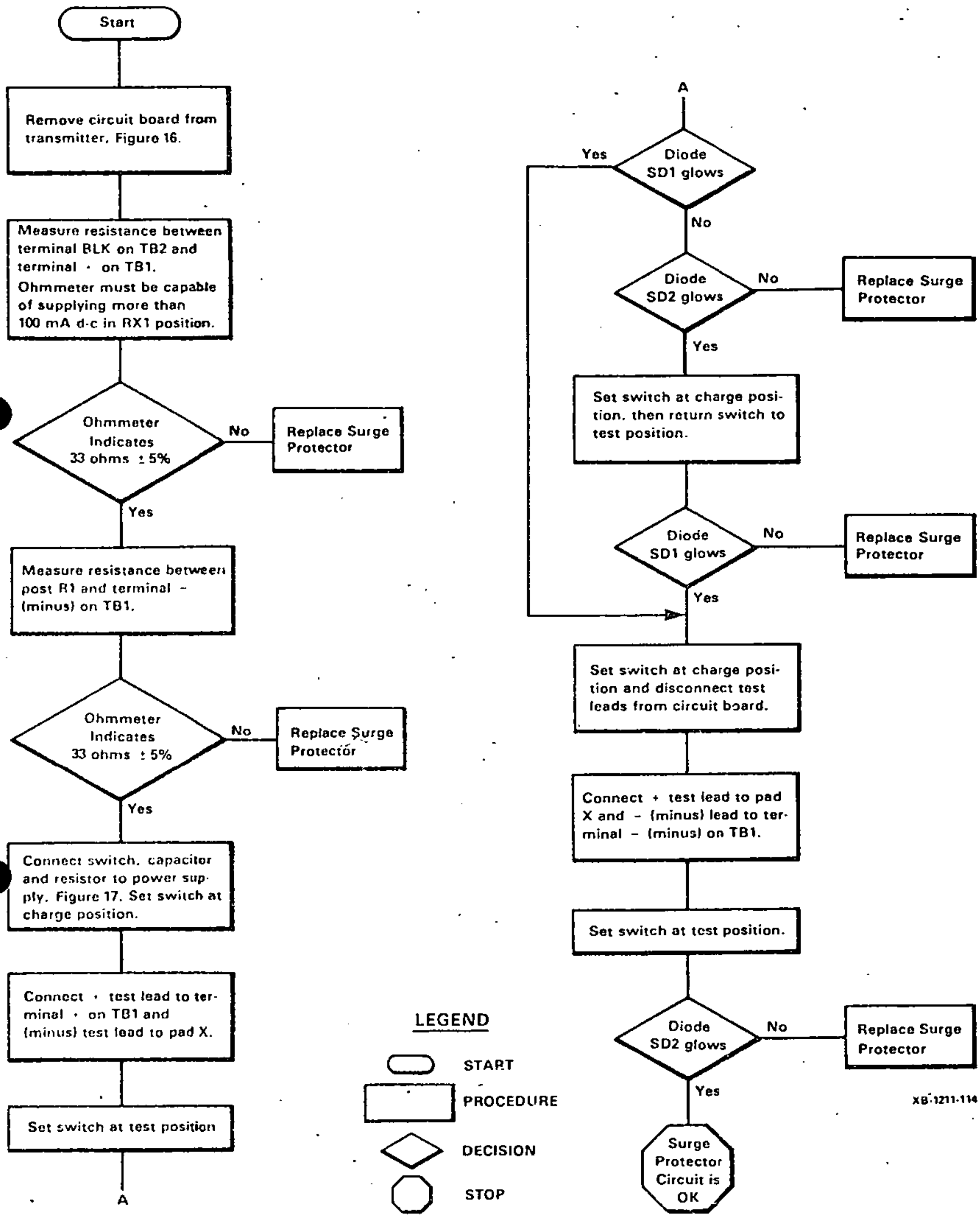


Figure 15. Troubleshooting Flow Chart for Optional Surge Protector

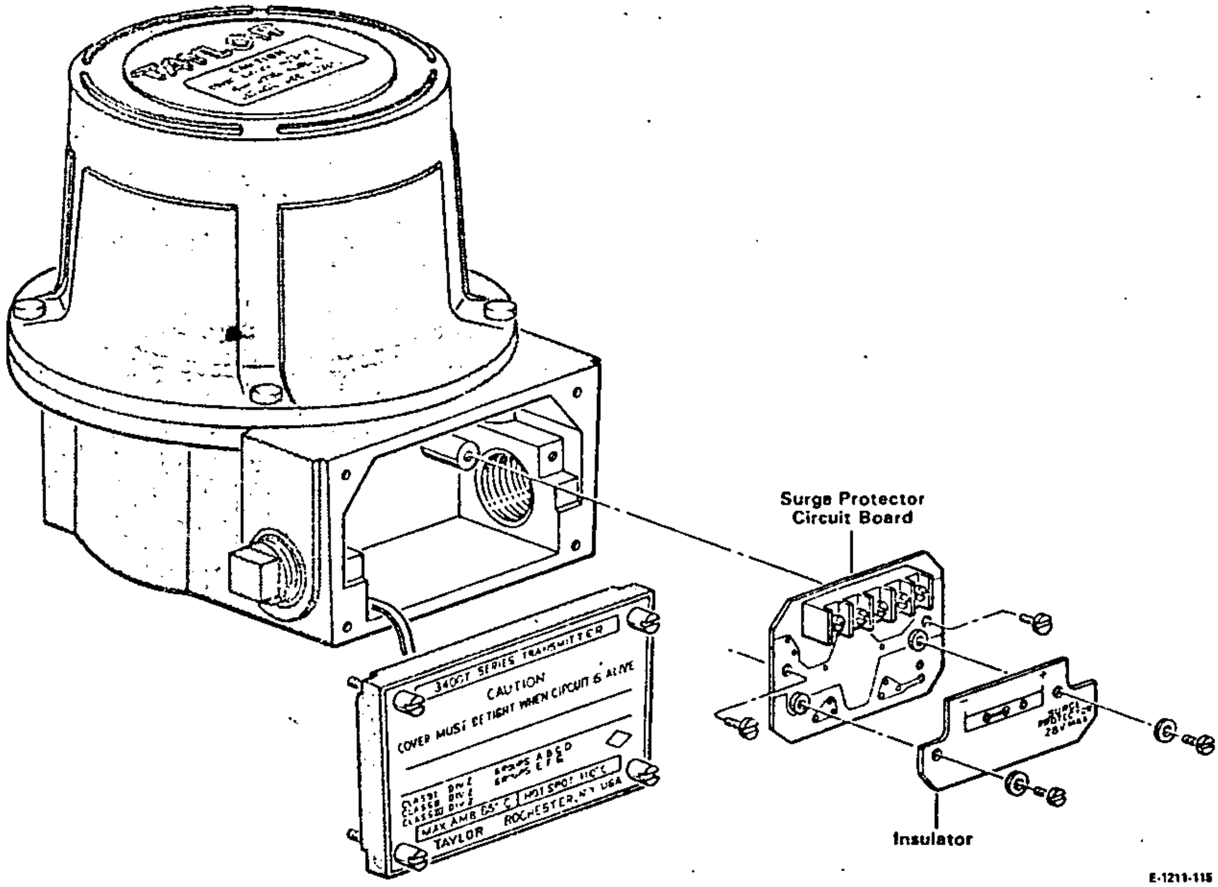


Figure 16. Removing Surge Protector

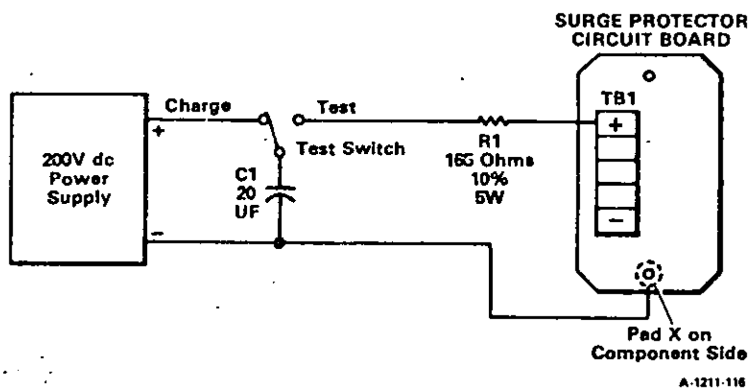


Figure 17. Test Circuit for Surge Protector

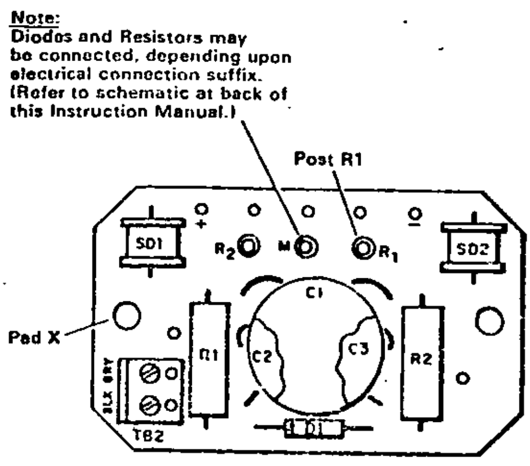


Figure 18. Surge Protector Circuit Board

4

REPAIR

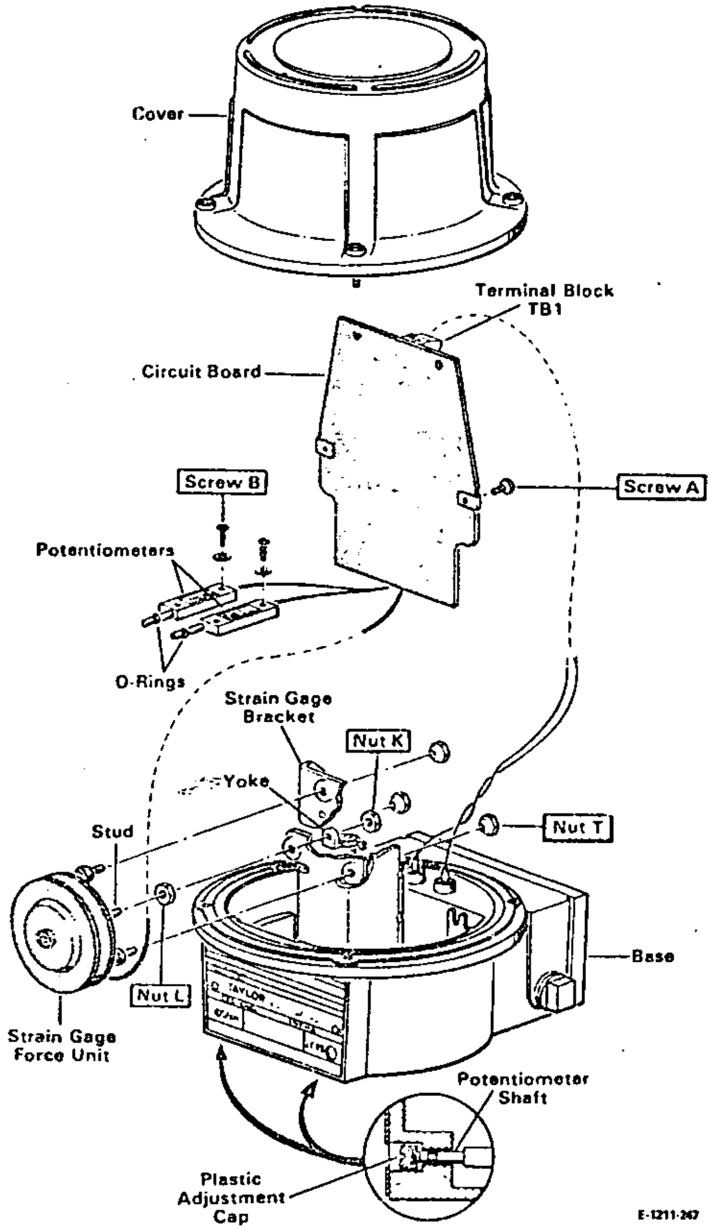


Figure 19. Replacing Electronics on Transmitter with Bolted Cover

4.1 REPLACING ELECTRONICS ASSEMBLY

4.1.1 General

The circuit board and strain gage assembly, Figure 1, must be replaced as a unit. Field replacement kits are available. The strain gage force unit and circuit board are temperature compensated together. Individual replacement strain gages or circuit boards are not available. Refer to **3.2 Troubleshooting Electronics Assembly** before replacing the electronics assembly.

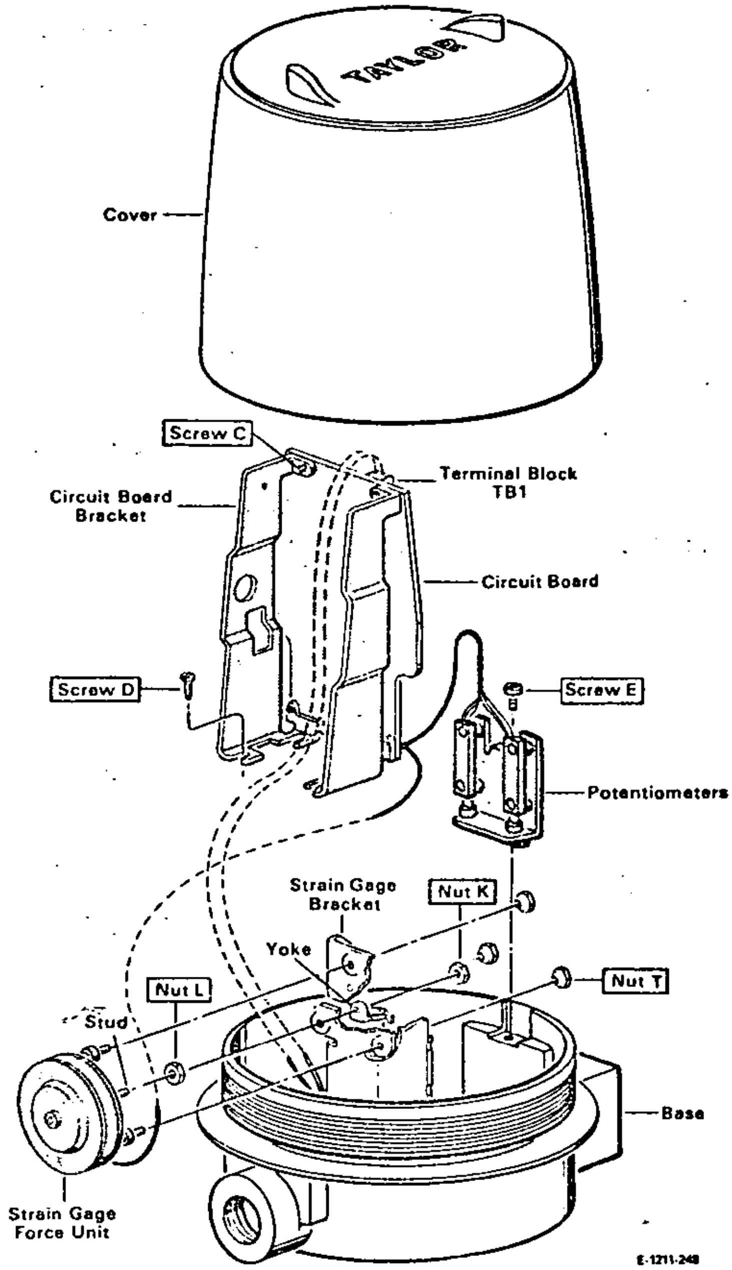


Figure 20. Replacing Electronics on Transmitter with Threaded Cover

> **WARNING**
>
> *The hermetically sealed strain gage is* **NOT** *field-repairable. Tampering with the strain gage cover, the mechanisms inside the cover, or the external strain gage wires, can interfere with transmitter performance and thus cause injury and damage property.*

4.1.2 Removing Old Electronics

1. Remove cover, Figure 19 or 20.
2. Disconnect wires from terminal block TB1 on circuit board.
3. Remove circuit board as follows:

   a. **Bolted Cover** — Loosen both screws A and lift circuit board out of base, Figure 19.

   b. **Threaded Cover** — Loosen four screws D and lift circuit board bracket out of base, Figure 20. Remove board from bracket.

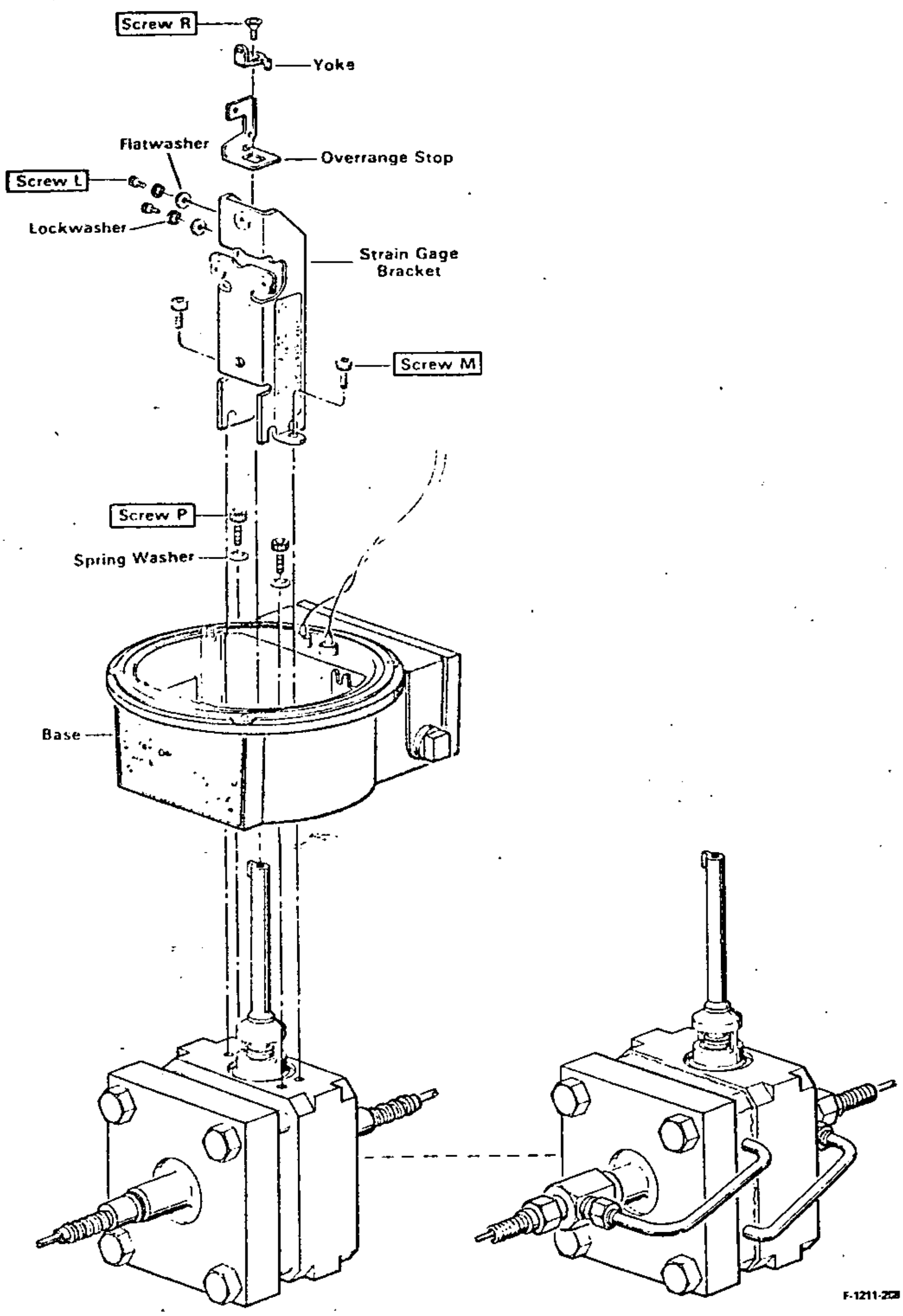


Figure 21. Replacing Measuring Element on Transmitter with Bolted Cover

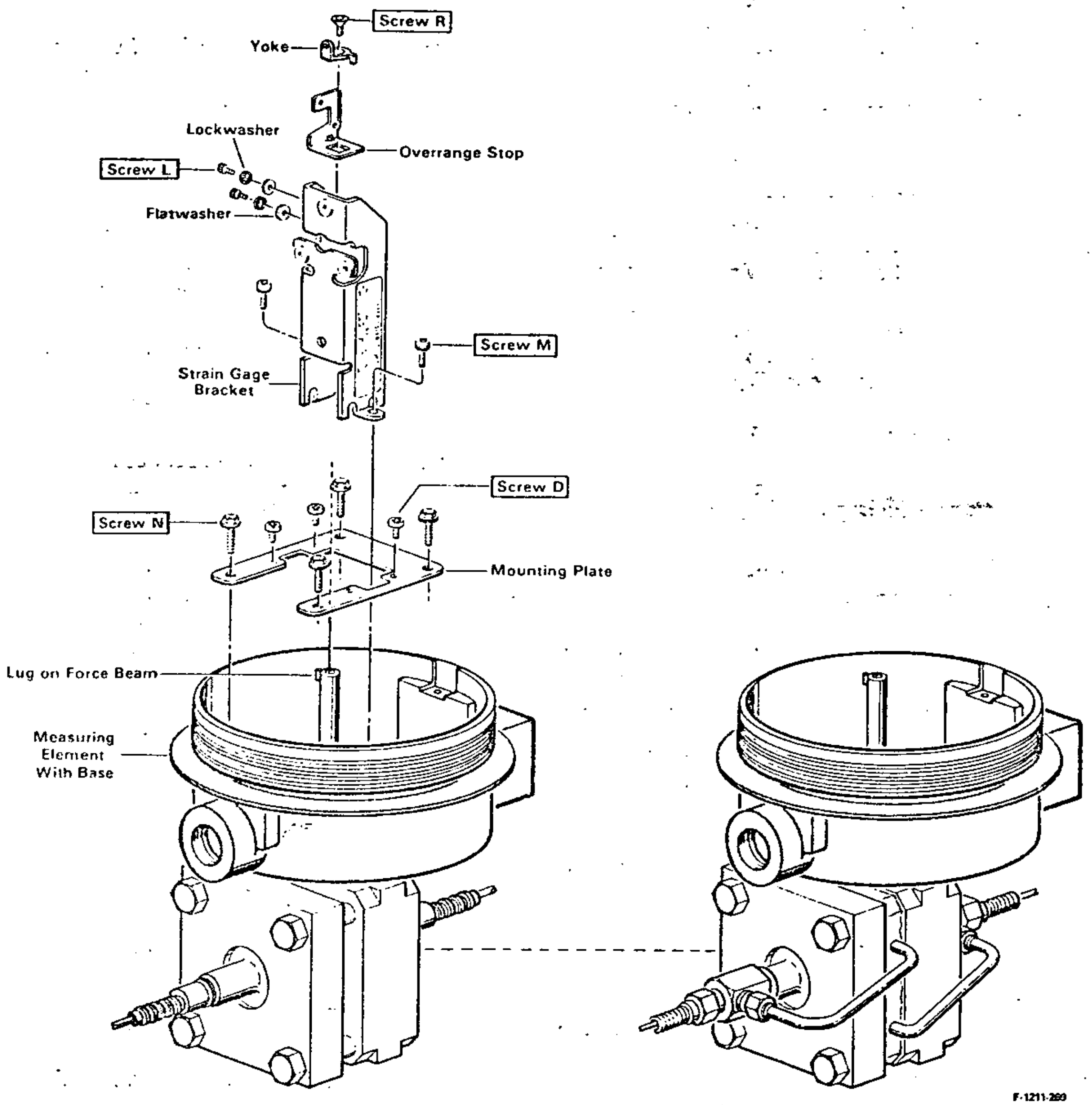


Figure 22. Replacing Measuring Element on Transmitter with Threaded Cover

9. Mount circuit board as follows:

    a. **Bolted Cover** — Mount board in base and retain with screws A. Be sure wires are not pinched in board mounting grooves.

    b. **Threaded Cover** — Mount circuit board bracket in base and retain with screws D.

10. Connect black and gray wires to terminal blocks TB1 on circuit board. Black wire connects to + (plus) terminal and gray wire connects to – (minus) terminal.

11. Connect calibration circuit, Figure 3.

12. Place **ZERO** jumper in **NORM** position, Figure 2.

13. Adjust output with strain gage in its free position. Proceed as follows:

    a. Turn **SPAN** adjustment fully clockwise (22-turn potentiometer).

    b. Remove strain gage from mounting bracket and hold strain gage in same orientation as its mounted position with nothing touching stud.

    c. Turn **ZERO** adjustment until output is 1.263V dc ±0.005. Clockwise rotation increases output.

    d. Turn **SPAN** adjustment counterclockwise until output is 1V dc ±0.002.

    e. Turn **ZERO** adjustment clockwise until output is 0.709V dc ±0.002.

    f. Allow strain gage to hang over side of base and proceed to Step 14.

14. Be sure both sides of measuring element are vented.

15. Lubricate beveled surface of three nuts T, Figure 19 or 20, with Dow Corning Molykote 505, or equivalent.

16. Insert center strain gage stud into hole in yoke and fasten strain gage to bracket with three nuts T. Tighten nuts T to a torque of 8 inch-lbs (0.9 Nm).

17. Assemble nut K on stud; do not tighten.

18. Adjust nuts K and L until output is 1V dc ±0.007, then tighten nuts. Do not overtighten. Output must be 1V dc ±0.007 after tightening.

NOTE

Be sure to replace and securely fasten cover as soon as maintenance is completed.

19. Calibrate transmitter. Refer to **2 Calibration.**

4.3 REPLACING ELECTRONIC COMPONENTS

NOTE

Because of the low signal levels in the circuitry on the circuit board, it is recommended that the circuit board be replaced with one known to be good rather than one repaired.

If it is necessary to repair a circuit board, carefully follow the procedures listed below. Use care when replacing components on the circuit board. Surface contamination, poor soldering technique, inadequate varnish coating, etc., can cause errors in circuit operation.

WARNING

Do not use a soldering iron in an area classed as hazardous by the electrical code. Explosion or fire may result; thus causing injury or property damage. Remove instrument from service for repair in a workshop. Refer to **1.1 Removing Transmitter from Service.**

Use the following procedure when replacing any component on the circuit board:

1. Remove circuit board assembly from transmitter. Refer to **4.1 Replacing Electronics Assembly.** Always handle the circuit board by the edges or by the circuit board bracket.

2. Scrape the varnish off the appropriate solder pads.

3. Unsolder and remove old component. Use a 40W soldering iron. Do not apply more heat than is necessary to melt the solder. Too much heat for too long a period of time can damage other components and the circuitry on the board.

4. At the holes where the old component was dislodged, remove all old solder from the circuit pads and the holes in the circuit board.

5. Solder new component onto the circuit board. Position component as shown in Figure 14. Use a 40W soldering iron. Do not apply more heat than is necessary. Too much heat from a larger soldering iron can damage the new component and the circuitry on the board. Also, too little heat from a lower wattage soldering iron for too long a time can do the same.

6. Remove flux from the circuit board and component leads with a toothbrush and denatured or 99% isopropyl alcohol. Clean the area at least three times. All flux must be removed from the circuit board.

7. Clean area with Freon TF[1].

[1] Manufactured by E.I. du Pont de Nemours & Co.

8. Rinse area with running de-ionized water for at least 30 seconds.

9. Bake circuit board in a clean, air-circulating oven for a minimum of 2 hours at 150°F (65.6°C).

10. Apply a uniform coat of Humiseal[1] 1A20 Polyurethane Insulating Varnish (or equivalent per MIL-1-46058B). Bare areas must be completely coated.

11. Air dry at room temperature for at least 24 hours. If a second coat is required, apply it after the first coat has dried for at least 4 hours but before it has dried for 24 hours. The varnish must be cured at room temperature; it does not cure sooner at elevated temperatures.

[1] Manufactured by Humiseal Div., Columbia Technical Corp.

NOTES

NOTICE

Information in this manual is intended only to assist our customers in the efficient operation of our equipment. Use of this manual for any other purpose is specifically prohibited and its contents are not to be reproduced in full or part without prior approval of Marketing Communications Department, Taylor Instrument Company, Division of Sybron Corporation.

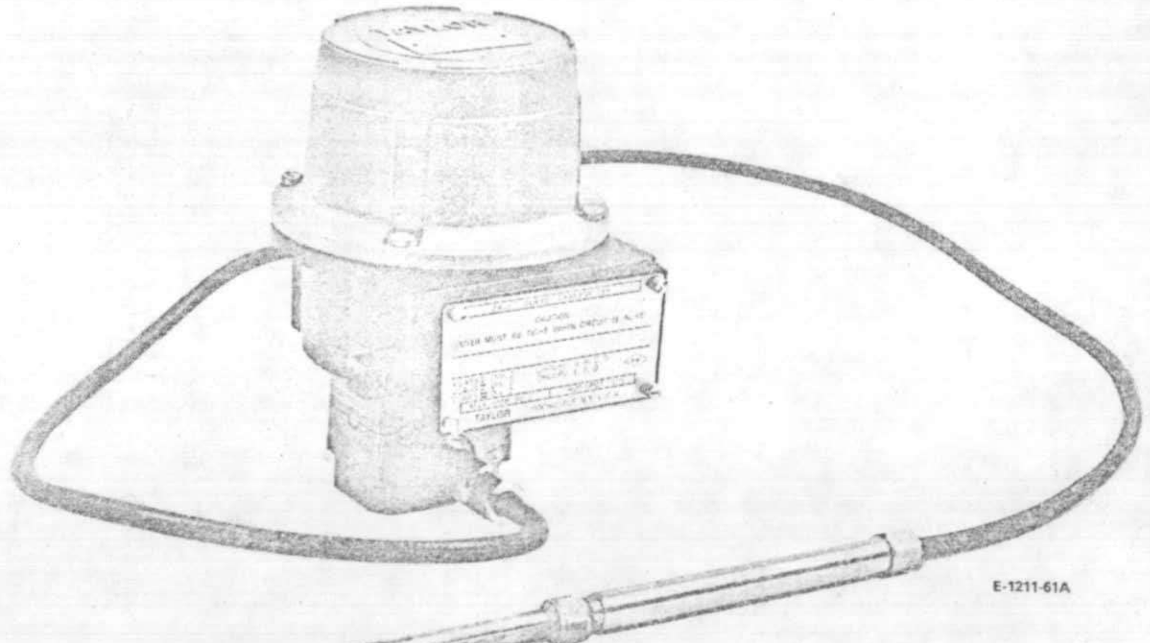
IB-12B320
Issue 1
Oct 1981

INSTRUCTIONS

GAGE PRESSURE TRANSMITTER

with Remote Seal Elements

3444T, 3445T, 3446T, and 3447T Model B



E-1211-61A

Taylor Instrument

SYBRON | Taylor

ADDENDA SHEET

Use only with Instruction IB-12B320, Issue 1.

Page 5: Add the following information.

3447T — Transmitter for Extruder Applications
Span adj from 2500 to 8,000 psi
(17 500 to 55 000 kPa)

MEASURING ELEMENT ACTUATION
F — Gage Pressure

ELECTRICAL CODE
10 — General Purpose
Taylor Standard
21 — U.S. Division 2 — See Table 1
USA
83 — Yugoslavian Safety
Commission Approval
84 — Canadian Intrinsic Safety — See Table 1
CSA Approval
88 — Australian Intrinsic Safety
SAA Approval
99 — Electrical Code described by
Accessory (147) — See Table 2

SEAL ELEMENT DIAPHRAGM MATERIAL
2 — Type 316L SST
3 — Hastelloy-C[1]

0 - Type 316L SST per NACE Standard MR-01-75 (1980 Rev)

Page 11: Substitute the following for the corresponding information on page 11.

2.2 ELECTRICAL CONNECTIONS

WARNING
Do NOT *make electrical connections unless the electrical code designation stamped on the transmitter data plate agrees with the classification of the area in which the transmitter is to be installed. Failure to comply with this warning can result in explosion and fire; leading to injury and property damage.*

2.2.1 General

The transmitter is designed to be part of a two-wire system. The 4 to 20 mA dc output signal and the dc power to the transmitter are carried by the same pair of wires. The transmitter does not contain a power supply. The necessary power supply can be separate from the instrument load or built in as shown in the connection diagram in the back of this manual.

The nominal power supply voltage is 24V dc. The supply voltage at the transmitter terminals must be between the limits of 13 and 36V dc. The output load limit depends on the supply voltage as shown in Table 6.

2.2.2 All Installations Except European Flameproof

Run wiring through the electrical connection hole in the transmitter housing, Figures 2, 3, 4, and 5. If the transmitter has an external terminal box, Figure 6, run wiring through one of the connection holes in the box. All connection holes are threaded to accept a conduit connection. Always plug any unused connection hole.

Transmitters which have BASEEFA, CENELEC or SAA electrical code approval are supplied with a cable gland installed in the electrical connection hole, Figure 2. The gland provides for the required sealing of wiring entering the housing.

Make connections to the transmitter terminals as shown on the connection diagram in the back of this manual. For intrinsically safe applications, be sure to note the intrinsic safety barrier requirements shown on the connection diagram.

2.2.3 European Flameproof Installations

Transmitters which are approved for use in European Flameproof code areas are identified by the Electrical Code digits 42 in the instrument catalog number

ADDENDA SHEET

(refer to **1.3 Serial and Catalog Numbers**). These transmitters have an external terminal box with an earth terminal and cover lock, Figure 6A.

Run wiring through the 3/4-inch Int NPT connection hole in the terminal box, and make connections as shown on the connection diagram in the back of this manual. Wiring must enter the connection hole through a BASEEFA approved flameproof fitting. Use an approved Hawke fitting, or equivalent.

Hawke flameproof fittings are manufactured by Hawke Cable Glands Limited, Oxford Street West, Ashton-under-Lyne, Lancashire OL7 ONA, England. Two approved fittings for this connection are:

- Hawke Type 501/453/T, size 0, for armored cable
- Hawke Type 501/454, size 0, for unarmored cable

2.2.4 Shunting Diode

The transmitter may have an optional shunting diode(s) connected between terminals R and M, R1 and M or R2 and M. Transmitters with the diode are identified by the Electrical Connection Suffix digits 02, 03, 04, 05, 07, or 08 in the catalog number. Refer to the schematic diagram in the back of this manual.

The diode(s) is connected to shunt an external output meter, and provides a signal path so that the transmitter will continue to operate if the meter is removed from the circuit. Do not remove the shunting diode when connecting an external meter.

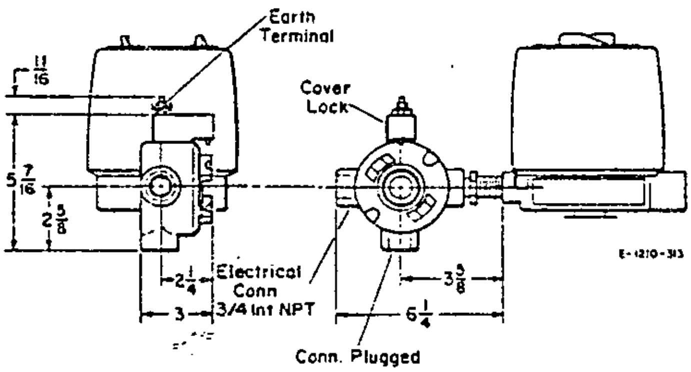


Figure 6A. Mounting Dimensions for European Flameproof Electrical Connection

NOTICE

Use of **DANGER**, **WARNING**, **CAUTION** and NOTE

This publication includes **DANGER**, **WARNING**, **CAUTION** and NOTE information where appropriate to point out safety related or other important information.

DANGER — Hazards which will result in severe personal injury or death.

WARNING — Hazards which could result in personal injury.

CAUTION — Hazards which could result in equipment or property damage.

NOTE — Alerts user to pertinent facts and conditions.

Although **DANGER** and **WARNING** hazards are related to personal injury, and **CAUTION** hazards are associated with equipment or property damage, it should be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process system performance leading to personal injury or death. Therefore, comply fully with all **DANGER**, **WARNING** and **CAUTION** notices.

Prepared by:
MARKETING COMMUNICATIONS DEPARTMENT
TAYLOR INSTRUMENT COMPANY • DIVISION OF SYBRON CORPORATION
95 Ames Street, Rochester, New York 14601 U.S.A. 716-235-5000

Printed in U.S.A. TP-9433

TABLE OF CONTENTS

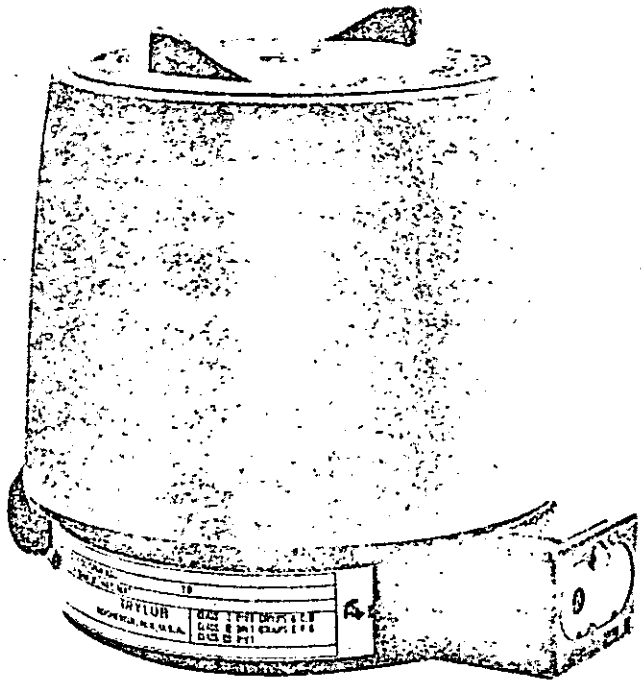
Ref A — Refer to Seal Element Section, IB-12B927
Ref B — Refer to Maintenance Section, IB-12B958

ILLUSTRATIONS

TABLES

1

INTRODUCTION



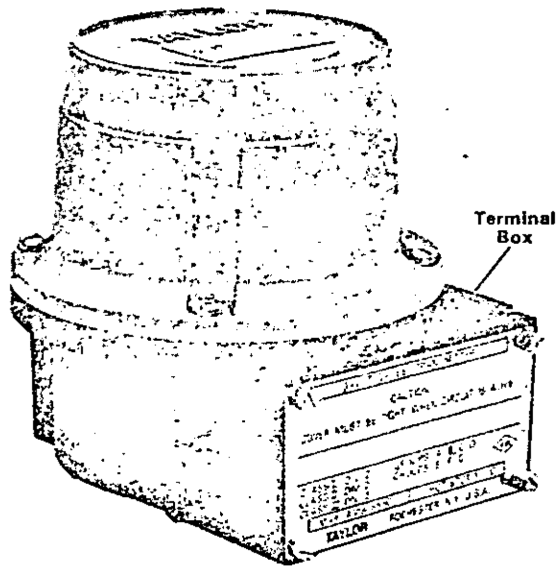


Figure 1. Transmitter Housings

1.1 DESCRIPTION

The Taylor 3444T, 3445T, 3446T, and 3447T Gage Pressure Transmitters with remote seal elements are instruments which measure gage pressure and transmit a proportional 4 to 20 mA output signal. The remote seal element limits process contact to the seal element surface.

Several seal element forms are available. They provide connection to 1/2-inch threaded pipe, 1-1/2 inch ANSI flanges, and various special fittings.

The transmitters are available in high range forms; and are capable of measuring gage pressure spans from 200 to 20,000 psig (1400 to 140 000 kPa).

A resistance strain gage bridge circuit converts the gage pressure measurement to an electrical signal. The strain gage is hermetically sealed to protect the bridge circuit from moisture, corrosive environments, and mechanical damage. The electrical signal is amplified and converted to a 4 to 20 mA dc signal for transmission to another instrument.

The transmitters are designed to operate as part of a two-wire system. They receive power (+24V dc) from the same pair of wires over which the output signal is transmitted.

The span of each transmitter is continuously adjustable. The span and zero adjustments are accessible from the outside of the instrument. All adjustments to span and zero respond electronically.

The transmitter housing is low copper content, die-cast aluminum. The cover can be either bolted or threaded, Figure 1. The bolted cover is for use in General Purpose or Division 2 electrical code areas and for intrinsically safe applications in Division 1 areas. The threaded cover is for use in Division 1 electrical code areas. The housing provides radio frequency interference (RFI) protection; and is waterproof.

An optional surge protector, Accessory (339), protects the transmitter electronics against high-voltage surges which are often induced by lightning. On transmitters with a bolted cover, the surge protector accessory is inside the housing. On transmitters with a threaded cover, the accessory is located in an external terminal box, Figure 6.

Under a two-year warranty, the circuit board/sealed strain gage assembly or the measuring element is replaceable through a Repair-By-Exchange Plan.

1.2 SERIAL AND CATALOG NUMBERS

The serial number stamped on the data plate consists of the catalog number and a sequential identification number. The catalog number describes the construction of the transmitter.

An X before the serial number indicates that the instrument has been built to meet a customer's special requirements.

Serial Number 3444T F 1 0 3 2 3 - 0 1 2 0 (339) - 555 B

Catalog Number:
- Basic Catalog Number — 3444T
- Measuring Element Actuation — F
- Electrical Code — 10
- Seal Element Diaphragm Material — 3
- Seal Element Trim Material — 2
- Seal Element Construction — 3
- Electrical Connection Suffix — 01
- Capillary Length — 20
- Accessories (omitted if not required) — (339)

Sequential Identification Number — 555

Model (Design Level) — B

BASIC CATALOG NUMBER

3444T — High Range Transmitter
Span adj from 250 to 1900 psi[1]
(1750 to 13 000 kPa)

3445T — Extra High Range Transmitter
Span adj from 700 to 5500 psi[2]
(4800 to 38 000 kPa)

3446T — Ultra High Range Transmitter
Span adj from 2500 to 18,000 psi
(17 500 to 125 000 kPa)

3447T — Transmitter for Extruder Applications
Span adj from 2500 to 8,000 psi
(17 500 to 55 000 kPa)

MEASURING ELEMENT ACTUATION

F — Gage Pressure

ELECTRICAL CODE

10 — General Purpose
Taylor Standard

21 — U.S. Division 2 — See Table 1
USA

24 — Canadian Division 2 — See Table 1
CSA Approval

25 — U.K. Type N Protection — See Table 2
BASEEFA Approval

41 — U.S. Division 1 — See Table 1
USA

42 — European Flameproof
CENELEC Approval

44 — Canadian Division 1 — See Table 1
CSA Approval

81 — U.S. Intrinsic Safety — See Table 1
USA

82 — European Intrinsic Safety — See Table 2
CENELEC Approval

83 — Yugoslavian Safety
Commission Approval

84 — Canadian Intrinsic Safety — See Table 1
CSA Approval

88 — Australian Intrinsic Safety
SAA Approval

99 — Electrical Code described by
Accessory (147) — See Table 2

SEAL ELEMENT DIAPHRAGM MATERIAL

2 — Type 316L SST
3 — Hastelloy-C[1]
4 — Monel
5 — Nickel
7 — Tantalum

[1]T.M. of Union Carbide Corp.

[1]250 to 1500 psi (1750 to 10 000 kPa) on 3444TF_ _ _ _3
[2]700 to 5000 psi (4800 to 35 000 kPa) on 3445TF_ _ _ _8

INTRODUCTION

Table 1. Electrical Codes for Hazardous Locations (USA and CSA)

Electrical Code No.	Hazardous Location: Class I, Div 1 Groups A	Class I, Div 1 Groups B,C,D	Class I, Div 2 Groups A	Class I, Div 2 Groups B,C,D	Class II, Div 1 Groups E,F,G	Class II, Div 2 Groups E,F,G	Class III, Div 1	Class III, Div 2
21			X	X		X		X
24			X	X		X		X
41		X		X	X	X	X	X
44		X		X	X	X	X	X
81	X	X	X	X	X	X	X	X
84	X	X	X	X	X	X	X	X

E-1211-125

Table 2. Electrical Codes for Hazardous Locations (Europe)

Catalog Number Digits: Electrical Code No.	Electrical Connection Suffix	Acc No.	Description: Type of Protection	Safety Code	Hazardous Area: Zone 0	Zone 1	Zone 2	Safety Std.	For Installation in	Approvals Authority
25	01,02,03,04,05,08	†*	N	ExN II T5			X	BS4683: Part 3: 1972	UK	BASEEFA
82	01,02,04,05	†	ia	EExia II CT5	X	X	X	EN50020 (BS5501:Part 7: 1977)	UK and other CENELEC* member states	
	08	†	ia	EExia II BT5	X	X	X			
	08	†	ib	EExib II CT5		X	X			
99	01,02,04,05,08	(147)	N	ExN II T5			X	BS4683: Part 3: 1972	UK	
	01,02,04,05	(147)	ia	EExia II CT5	X	X	X	BS5501: Part 7: 1977		
	08	(147)	ia	EExia II BT5	X	X	X			
			ib	EExib II CT5		X	X			

†Can be any accessory number except (147)

E-1211-266

*CENELEC member states: Austria, Belgium, Denmark, Finland, France, W. Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom

Note: BASEEFA or EEC certified barriers must be used with the intrinsically safe transmitters (ia and ib) as per BASEEFA certified System Diagram ISD800408 Sheet 1, page 2.

SEAL ELEMENT TRIM MATERIAL

2 — Type 316 SST[1]
3 — Hastelloy-C
4 — Monel
5 — Nickel
7 — Tantalum

SEAL ELEMENT CONSTRUCTION

1 — Diaphragm Element
Pipe connection type, 1/2" Int NPT
2 — Diaphragm Element
Welding neck type, 1/2" schedule 40 pipe
3 — Diaphragm Element
Union connection type, 2-1/8"—16 thread
4 — Diaphragm Element
Extruder type with union connection
6" lagging extension, 1/2"—20 thread
5 — Diaphragm Element
Extruder type with union connection 12-1/2" lagging extension, 1/2"—20 thread
6 — Diaphragm Element
Wafer type for 1-1/2" raised face flange
7 — Diaphragm Element
Button type
8 — Diaphragm Element
Button type with flange
9 — Diaphragm Element
Button type with union connection
1-1/2"—16 thread

CAPILLARY LENGTH

Digits indicate length in feet
01 — one foot (0.31 cm) through
20 — twenty feet (6.10 m)
99 — Special

[1]344_TF_ _ _26 is type 316L SST

ELECTRICAL CONNECTION SUFFIX
01 — Terminal block connection
02 — Terminal block with shunting diode and 2.5 ohm calibration resistor
03 — Terminal block with shunting diode, 2.5 ohm calibration resistor, and output test jack
04 — Terminal block with shunting diode, 2.5 ohm calibration resistor, and output meter with 0 to 100 linear scale
05 — Terminal block with shunting diode, 2.5 ohm calibration resistor, and output meter with 0 to 10 square-root scale
07 — External terminal box with shunting diode
08 — Terminal block with shunting diode, 2.5 ohm calibration resistor, and current meter jack across shunting diode
09 — Defined by a specific accessory number

ACCESSORIES
(94) — Blind flange; 1-1/2 inch, Class 2500 ANSI with bolts and nuts for use with Seal Element Construction Number 6
(96) — Adapter Flange for welded construction
(146) — Mounting Bracket
(147) — Data Plate indicating that transmitter satisfies requirements for both Electrical Codes 25 (U.K. Type N Protection) and 82 (European Intrinsic Safety) — See Table 2
(282) — Extra Suppression Spring
(339) — Surge Protector

EXAMPLE:
Serial Number 3444TF10323-0120(339)-555B identifies a high range transmitter with 250 to 1900 psi (1750 to 13 000 kPa) adjustable span (3444T). It is actuated by gage pressure (F) and is designed to operate in areas designated as General Purpose by the electrical code (10). The seal element diaphragm is Hastelloy-C (3), the trim is type 316L SST (2), and the seal element is the union connection type (3). The transmitter has a terminal block connection (01), a twenty-foot capillary (20), and a surge protector (339). The sequential identification number is 555 and the design level is Model B.

1.3 WETTED MATERIAL IDENTIFICATION
The following abbreviations are used on the instrument data plate to identify materials wetted by the process.

HAST — Hastelloy-C
316 — Type 316 SST
MON — Monel
TANT — Tantalum
NI — Nickel

When the instrument has more than one type wetted material, the data plate identifies the materials in the following sequence:

Process Diaphragm/Trim

1.4 FILLING MEDIUM IDENTIFICATION
The following abbreviations are stamped on the diaphragm capsule to identify the filling medium:

SI — Silicone
FL — Fluorolube

1.5 SPECIFICATIONS
SPAN*
3444T: Adj from 250 to 1900 psi (1750 to 13 000 kPa)[1]
3445T: Adj from 700 to 5500 psi (4800 to 38 000 kPa)[2]
3446T: Adj from 2500 to 18000 psi (17 500 to 125 000 kPa)
3447T: Adj from 2500 to 8000 psi (17 500 to 55 000 kPa)

CALIBRATION ACCURACY (Zero Based)
3444T: ±0.5% of span; 0.35% ultimate capability

3445T: ±0.5% of span for spans under 3000 psi (20 000 kPa); ±1.0% of span for spans above 3000 psi (20 000 kPa); 0.35% ultimate capability

3446T: ±0.5% of span for spans under 15,000 psi (103 000 kPa); ±1.0% of span for spans above 15,000 psi (103 000 kPa); ultimate capability as listed above

3447T: ±0.5% of span for spans under 5000 psi (34 500 kPa); ±1.0% of span for spans above 5000 psi (34 500 kPa); ultimate capability as listed above

RANGE LIMITS
Refer to Tables 3, 4, and 5

OUTPUT SIGNAL
4 to 20 mA dc

*The factory-calibrated span is identified on the side of the strain gage bracket.

[1]250 to 1500 psi (1750 to 10 000 kPa) on 3444TF_ _ _ _3
[2]700 to 5000 psi (4800 to 35 000 kPa) on 3445TF_ _ _ _8

Table 3. Range Limits with Zero Jumper in NORM Position

Catalog No.	Calibration	Range Limits			
		Psig		Kilopascals	
		Lower (4 mA Output)	Upper (20 mA Output)	Lower (4 mA Output)	Upper (20 mA Output)
3444T High Range	Zero Based Suppressed Zero Elevated Zero	0 0 to 475 – 14.7 to 0	250 to 1900 250 to 1900 235 to 1900	0 0 to 3250 – 100 to 0	1750 to 13 000 1750 to 13 000 1650 to 13 000
3445T Extra High Range	Zero Based Suppressed Zero Elevated Zero	0 0 to 1375 – 14.7 to 0	700 to 5500 700 to 5500 685 to 5500	0 0 to 9500 – 100 to 0	4800 to 38 000 4800 to 38 000 4700 to 38 000
3446T Ultra High Range	Zero Based Suppressed Zero Elevated Zero	0 0 to 4500 – 14.7 to 0	2500 to 18000 2500 to 18000 2485 to 18000	0 0 to 31 250 – 100 to 0	17 500 to 125 000 17 500 to 125 000 17 400 to 125 000
3447T Special	Zero Based Suppressed Zero Elevated Zero	0 0 to 2000 – 14.7 to 0	2500 to 8000 2500 to 8000 2485 to 8000	0 0 to 13 750 – 100 to 0	17 500 to 55 000 17 500 to 55 000 17 400 to 55 000

E 1211 180A

All transmitters can be continuously adjusted for any calibration listed.

Table 4. Range Limits with Zero Jumper in EL/SUPR Position

Catalog No.	Calibration	Range Limits			
		psig		kPa	
		Lower (4 mA Output)	Upper (20 mA Output)	Lower (4 mA Output)	Upper (20 mA Output)
3444T High Range	Zero Based Suppressed Zero Elevated Zero	0 0 to 1650 – 14.7 to 0	250 to 1900 250 to 1900 235 to 1900	0 0 to 11 250 – 100 to 0	1750 to 13 000 1750 to 13 000 1650 to 13 000
3445T Extra High Range	Zero Based Suppressed Zero Elevated Zero	0 0 to 4800 – 14.7 to 0	700 to 5500 700 to 5500 685 to 5500	0 0 to 33 200 – 100 to 0	4800 to 38 000 4800 to 38 000 4700 to 38 000
3446T Ultra High Range	Zero Based Suppressed Zero Elevated Zero	0 0 to 15 500 – 14.7 to 0	2500 to 18 000 2500 to 18 000 2485 to 18 000	0 0 to 107 500 – 100 to 0	17 500 to 125 000 17 500 to 125 000 17 400 to 125 000
3447T Special	Zero Based Suppressed Zero Elevated Zero	0 0 to 5500 – 14.7 to 0	2500 to 8000 2500 to 8000 2485 to 8000	0 0 to 38 000 – 100 to 0	17 500 to 55 000 17 500 to 55 000 17 400 to 55 000

All transmitters can be continuously adjusted for any calibration listed.

Table 5. Range Limits for 3444T Transmitter with Accessory (282)

Calibration	Range Limits			
	psig		kPa	
	Lower (4 mA Output)	Upper (20 mA Output)	Lower (4 mA Output)	Upper (20 mA Output)
Suppressed Zero	950 to 2600	1200 to 2900	6500 to 17 750	8650 to 20 000

OUTPUT LOAD LIMITS
Refer to Table 6

POWER SUPPLY
24V dc nominal
13V dc min; 36V dc max. across transmitter terminals

POWER CONSUMPTION
0.5W nominal
1.5W max. in overrange condition

WEIGHT†
3444T: 6.4 lbs (2.9 kg)
3445T: 6.4 lbs (2.9 kg)
3446T: 7.8 lbs (3.5 kg)
3447T: 7.8 lbs (3.5 kg)

TUBE SYSTEM FILLING MEDIUM
3444T: Silicone, DC-200 Standard
Silicone, DC-702 (Optional)
Ethyl Benzene (Optional)
Water Glycerine, WG-70 (Optional)
Water Glycerine, WG-40 (Optional)

3445T: Silicone, DC-200 Standard
Silicone, DC-702 (Optional)
Ethyl Benzene (Optional)
Water Glycerine, WG-70 (Optional)
Water Glycerine, WG-40 (Optional)
Mercury

3446T: Mercury

3447T: Mercury

WORKING PRESSURE LIMITS
Minimum

Water Glycerine, WG-70:	2.5 psia (17.22 kPa)
Water Glycerine, WG-40:	2.5 psia (17.22 kPa)
All other fills:	0 psia

Maximum

3444TF_ _ _ _1,6,7,8,9:	4,000 psig (28 000 kPa)
3444TF_ _ _ _3:	1,500 psig (10 000 kPa)
3445TF_ _ _ _7,9:	6,000 psig (40 000 kPa)
3445TF_ _ _ _8:	5,000 psig (35 000 kPa)
3446T:	20,000 psig (140 000 kPa)
3447T:	8,000 psig (55 000 kPa)

OVERRANGE PRESSURE LIMITS
Same as working pressure limits

AMBIENT TEMPERATURE LIMITS
Refer to Tables 7 and 8

STORAGE TEMPERATURE LIMITS
−65°F to 200°F (−53.9°C to 93.3°C)
For Water Glycerine filled seal element and capillary, see Table 7

SEAL ELEMENT LIMITS[1]
(without process vacuum)
Element above case —
Not to exceed zero suppression limit

Element below case at altitudes below 1000 feet (305 meters) —
15 feet (4.6 meters) max.

Element below case at altitudes above 1000 feet (305 meters) —
Reduce limit of 15 feet (4.6 meters) by 0.6 ft per 1000 ft (0.06 m per 100 m)

[1]Raising or lowering the seal element 1.2 ft (0.37 mm) results in a zero elevation or suppression of 1 psi (6.9 kPa)

† Add 3 lbs (1.4 kg) for units with threaded cover.

Table 6. Output Load Limits

Power Supply (DC Volts)	Max Transmitter Load (Ohms)*	
	Elect. Conn Suffix 01	Elect. Conn Suffix 02, 03, 04, 05, 07, 08
13	50	0
15	150	100
20	400	350
24	600	550
30	900	850
35	1150	1100

*Max load is reduced 70Ω if transmitter has a surge protector, Acc (339).

E-1211-1298

Table 7. Ambient Temperature Limits at Working Pressure above Atmospheric

Catalog Number	Tube System Filling Medium	Temperature Limits — °F At Working Pressures Above Atmospheric				Temperature Limits — °C At Working Pressures Above Atmospheric			
		Case & Capillary		Seal Element		Case & Capillary		Seal Element	
		Min	Max	Min	Max	Min	Max	Min	Max
3444T 3445T	Silicone, DC-200	−40	+185	−40	+350	−40	+85	−40	+177
	Silicone, DC-702	+40	+185	+40	+600*	+4.4	+85	+4.4	+316*
	Ethyl Benzene	−40	+185	−100	+200	−40	+85	−73	+93.3
	Water Glycerine, WG-70	+20	+185	+20	+220	−6.7	+85	−6.7	+104
	Water Glycerine, WG-40	−35	+185	−35	+200	−37	+85	−37	+93.3
3445T 3446T 3447T	Mercury	−35	+185	−35	+650**	−37	+85	−37	+343**

*400°F (204°C) for 3444TF_ _ _ _3
**750°F (399°C) for 3447T

E 1211 238

Table 8. Ambient Temperature Limits at Minimum Working Pressure

Catalog Number	Tube System Filling Medium	Temperature Limits — °F At Minimum Working Pressures				Temperature Limits — °C At Minimum Working Pressures			
		Case & Capillary		Seal Element		Case & Capillary		Seal Element	
		Min	Max	Min	Max	Min	Max	Min	Max
3444T 3445T	Silicone, DC-200	−40	+180	−40	+250	−40	+85	−40	+121
	Silicone, DC-702	+40	+180	+40	+350	−4.4	+85	+4	+177
	Ethyl Benzene	−40	+100	−100	+100	−40	+38	−73	+38
	Water Glycerine, WG-70	+20	+130	+20	+130	−6.7	+54	−6.7	+54
	Water Glycerine, WG-40	−35	+130	−35	+130	−37	+54	−37	+54
3445T 3446T 3447T	Mercury	−35	+180	−35	+650*	−37	+85	−37	+343*

**750°F (399°C) for 3447T

E 1211 239

2

INSTALLATION

2.1 MOUNTING

Refer to **2.3 Process Installation** for information on locating the transmitter for specific applications.

Carefully unpack the transmitter and uncoil the tube system.

> **CAUTION**
>
> *Do not remove the protective cover from the seal element until ready to connect it to the process.*
>
> *If the tube system filling medium is mercury, avoid mechanical shock and always keep the seal element close to the elevation of the transmitter. Lowering the element more than 30 inches below the case will damage the seal diaphragm.*

Select a mounting location where there is minimum vibration. The ambient temperature must not exceed the limits listed in Table 7 or 8.

Mount the transmitter in a vertical position with the measuring element below the case, Figures 2 through 6. Operation is not affected by mounting in other positions, but some rezeroing may be required (refer to **3.2 Field Zero Adjustment**).

> NOTE
>
> If the transmitter cannot be mounted in the recommended position, any required zero adjustment should be made prior to installation. Place the transmitter in the installation position, and check output with input adjusted to the lower range value. Refer to **Calibration.**

The transmitter can be mounted using the two 5/16-18 mounting holes in the measuring element, Figures 2 through 5. An optional mounting bracket kit, Accessory (146), provides a bracket, U-bolts, and fasteners, Figure 7. The bracket is suitable for either pipe or surface mounting. For pipe mounting, the bracket accepts 1-1/4 through 2-inch pipe and can be positioned for use on horizontal or vertical pipes, Figures 2 through 5.

2.2 ELECTRICAL CONNECTIONS

> **WARNING**
>
> *Do* **NOT** *make electrical connections unless the electrical code designation stamped on the transmitter data plate agrees with the classification of the area in which the transmitter is to be installed. Failure to comply with this warning can result in explosion and fire, leading to injury and property damage.*

2.2.1 General

The transmitter is designed to be part of a two-wire system. The 4 to 20 mA dc output signal and the 24V dc power to the transmitter are carried by the same pair of wires. The transmitter does not contain a power supply. The necessary power supply can be separate from the instrument load or built in as shown in the connection diagram located in the back of this manual.

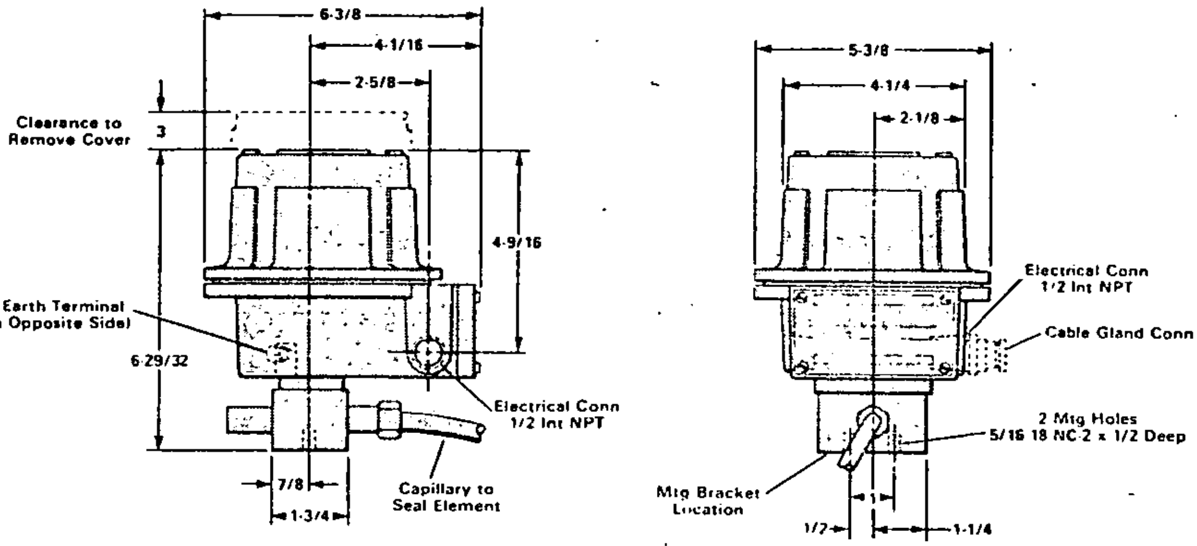
If the power supply voltage is greater than 24V dc, do not exceed 36V dc across the transmitter terminals. The output load limits of the transmitter are shown in Table 6. Conduit may be connected to the threaded connection in the transmitter base. Refer to Figures 2 through 6.

2.2.2 Shunting Diode

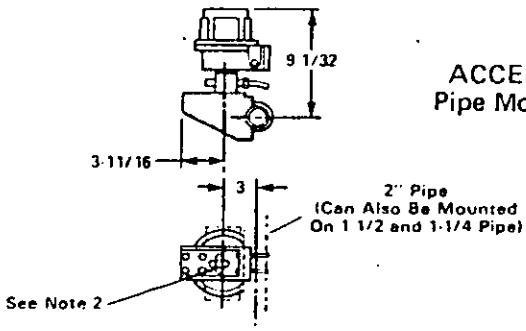
When the transmitter catalog number contains Electrical Connection Suffix digits 02, 03, 04, 05, 07, or 08, a shunting diode(s) is connected between terminals R and M in the terminal box. Refer to the schematic diagram in the back of this manual.

The diode(s) is connected to shunt an external output meter and provides a signal path if the external meter is removed from the circuit. Do not remove the shunting diode when connecting an external meter.

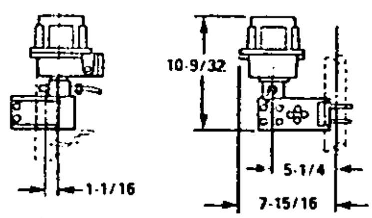
INSTALLATION



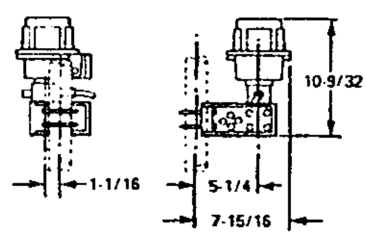
ACCESSORY (146)
Pipe Mounting Bracket



HORIZONTAL PIPE MTG



Bracket Right



Bracket Left

VERTICAL PIPE MTG

INCHES	mm	INCHES	mm
5/16	7.94	4-1/16	103.19
7/8	22.23	4-1/4	107.95
1-1/16	26.99	4-9/16	115.89
1-1/4	31.75	5-1/4	133.35
1-3/4	44.45	5-3/8	136.53
2	50.80	6-3/8	161.93
2-1/8	53.98	6-29/32	175.42
2-5/8	66.68	7-15/16	201.61
3	76.20	9-1/32	229.39
3-11/16	93.66	10-9/32	261.14

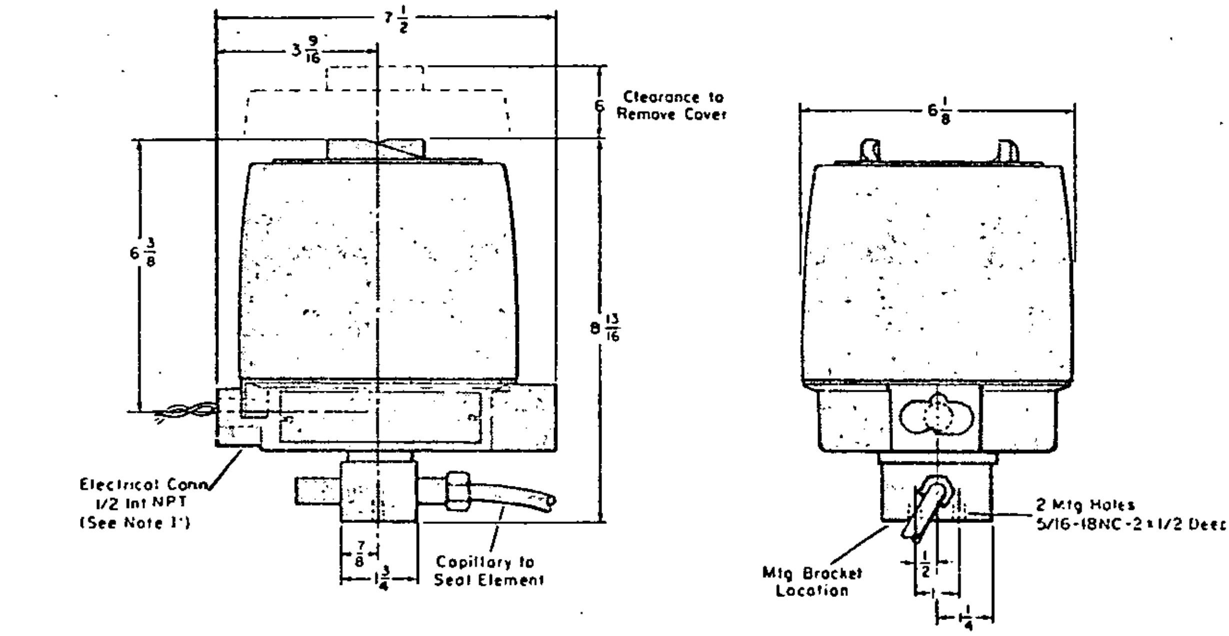
For reference only;
not for construction.

All dimensions in inches.

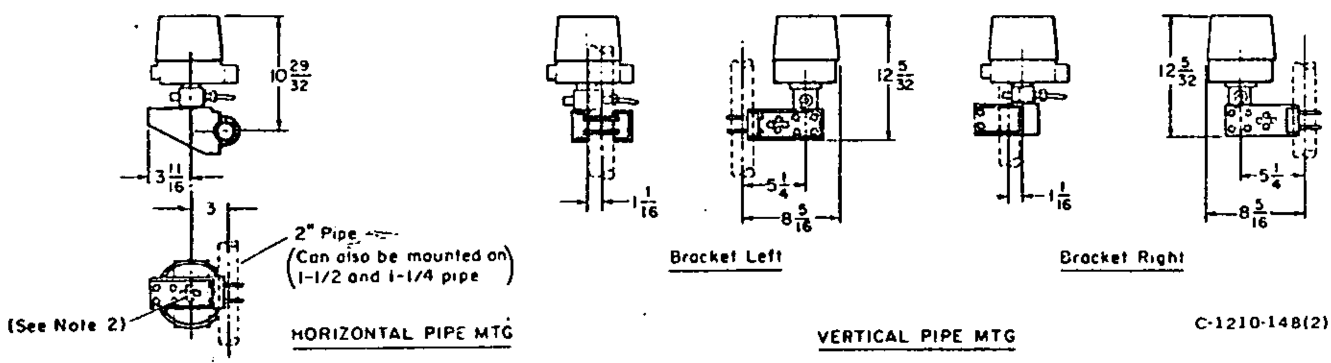
C-1211-104

Notes:
1. For electrical connection suffix 03 through 08, see Figure 6.
2. Bracket can be located in any of the four directions without dimensional change.

Figure 2. Mounting Dimensions for 3444T and 3445T Transmitters with Bolted Cover



ACCESSORY (146) Mounting Bracket



C-1210-148(2)

INCHES	mm
7/8	22.23
1-1/16	26.99
1-1/4	31.75
1-3/4	44.45
3	76.20
3-9/16	90.49
3-11/16	93.66
5-1/4	133.35
6	152.40
6-1/8	155.58
6-3/8	161.93
7-1/2	190.50
8-5/16	211.14
8-25/32	223.04
10-29/32	277.02
12-5/32	308.77
28	711.20

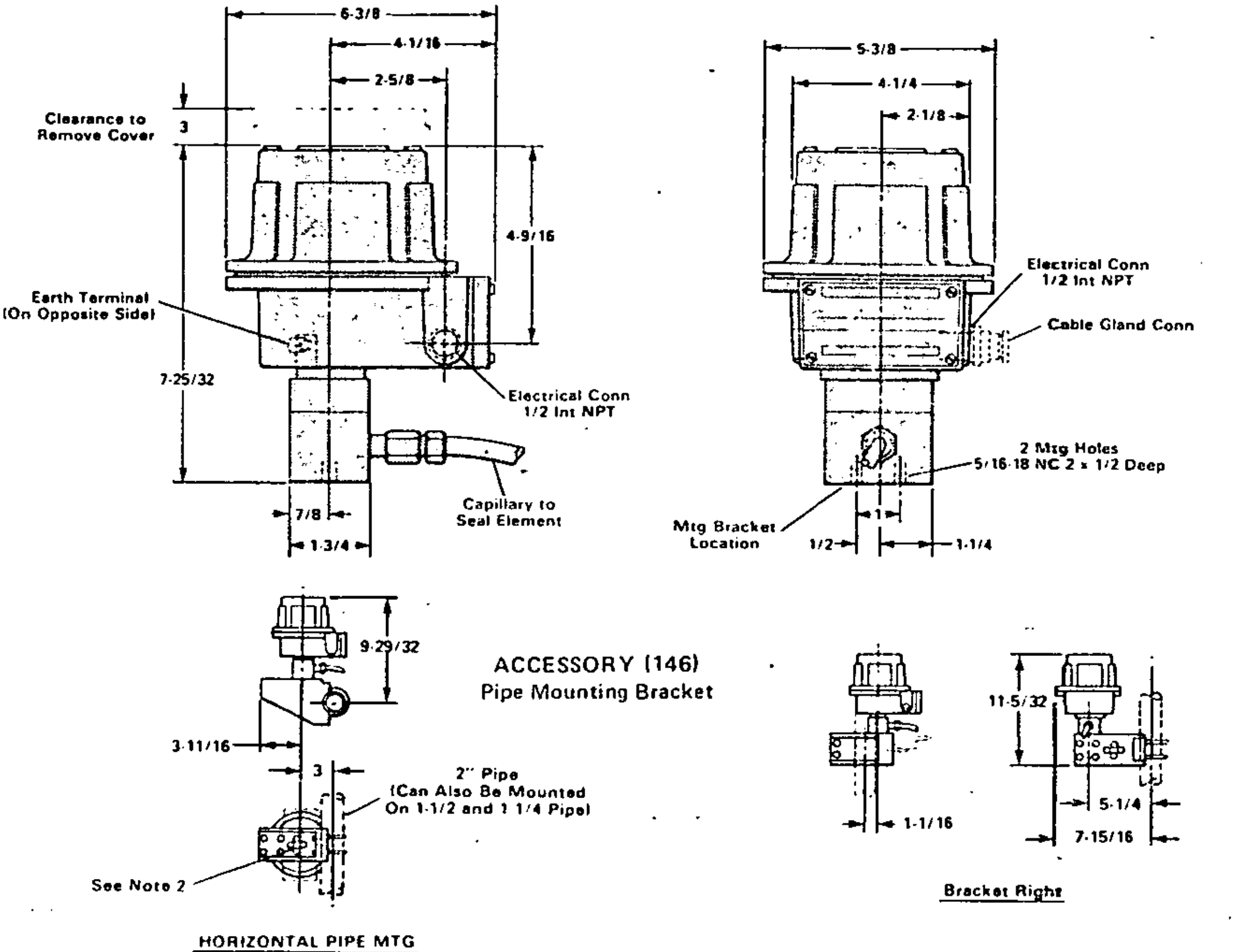
Notes:
1. For electrical connection suffix 07, see Figure 6.
2. Bracket can be located in any of the four directions without dimensional change.

All dimensions in inches.

For reference only; not for construction.

Figure 3. Mounting Dimensions for 3444T and 3445T Transmitters with Threaded Cover

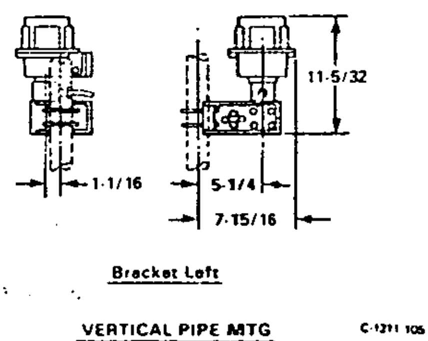
INSTALLATION



INCHES	mm	INCHES	mm
1/2	12.70	4-1/16	103.19
7/8	22.23	4-9/16	115.89
1-1/16	26.99	5-1/4	133.35
1-3/4	44.45	6-3/8	161.93
2-5/8	66.68	7-15/16	201.61
3	76.20	9-29/32	251.62
3-11/16	93.66	11-5/32	283.37

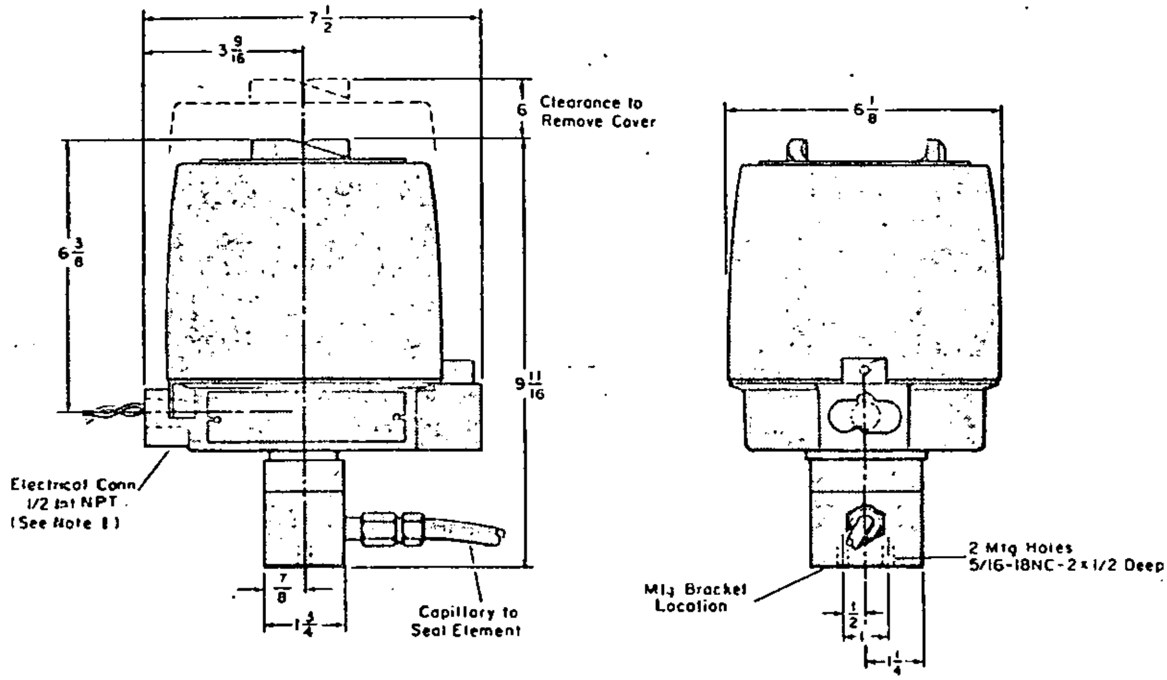
For reference only; not for construction.

All dimensions in inches.

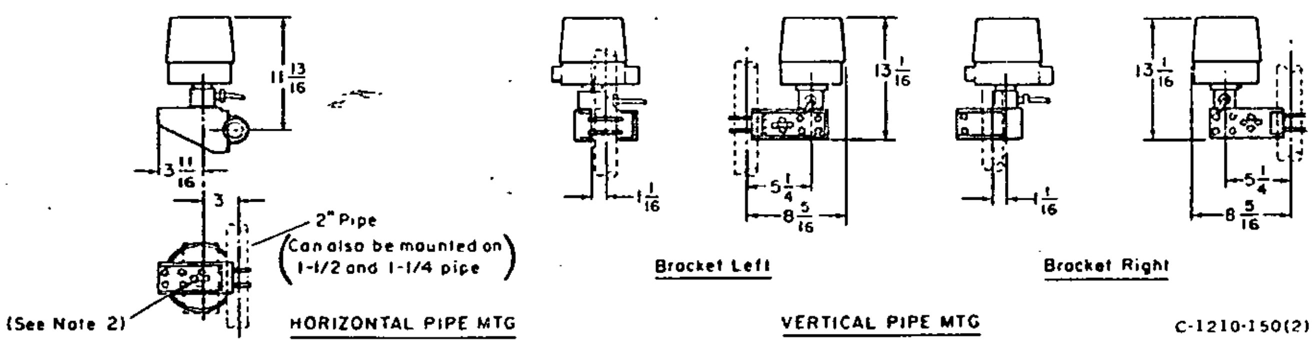


Notes:
1. For electrical connection suffix 03 through 08, see Figure 6.
2. Bracket can be located in any of the four directions without dimensional change.

Figure 4. Mounting Dimensions for 3446T and 3447T Transmitters with Bolted Cover



ACCESSORY (146) Pipe Mounting Bracket



C-1210-150(2)

Notes:
1. For electrical connection suffix 07, see Figure 6.
2. Bracket can be located in any of the four directions without dimensional change.

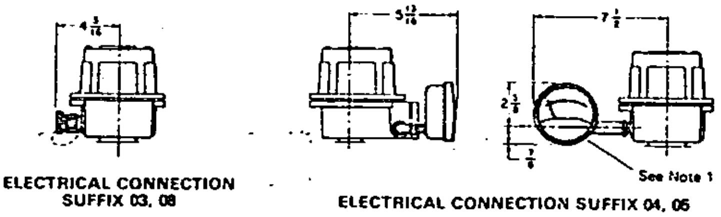
For reference only; not for construction.

All dimensions in inches.

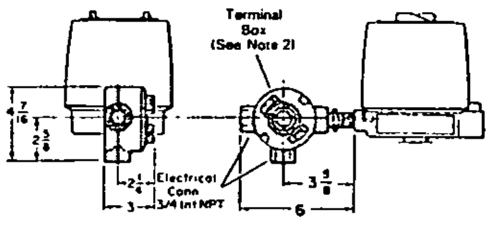
INCHES	mm
1/2	12.70
7/8	22.23
1-1/16	26.99
1-3/4	44.45
3	67.20
3-9/16	90.49
3-11/16	93.66
5-1/4	133.35
6	152.40
6-3/8	161.93
7-1/2	190.50
8-5/16	211.14
9-11/16	246.06
11-13/16	300.04
13-1/16	331.79
28	711.20

Figure 5. Mounting Dimensions for 3446T and 3447T Transmitters with Threaded Cover

INSTALLATION



INCHES	mm
7/8	22.23
2-1/4	57.15
2-5/8	66.68
3	76.20
3-5/8	92.08
4-3/16	106.36
4-7/16	112.71
5-13/16	147.64
6	152.40
7-1/2	190.50



Notes:

1. On instruments with electrical code 25, 82, or 88, output meter is mounted in electrical connection on other end of terminal box.
2. Surge protector circuit is housed in terminal box when transmitter is equipped with Accessory (339).

E-1211-243

Figure 6. Mounting Dimensions for Electrical Connection Suffix 03 through 08

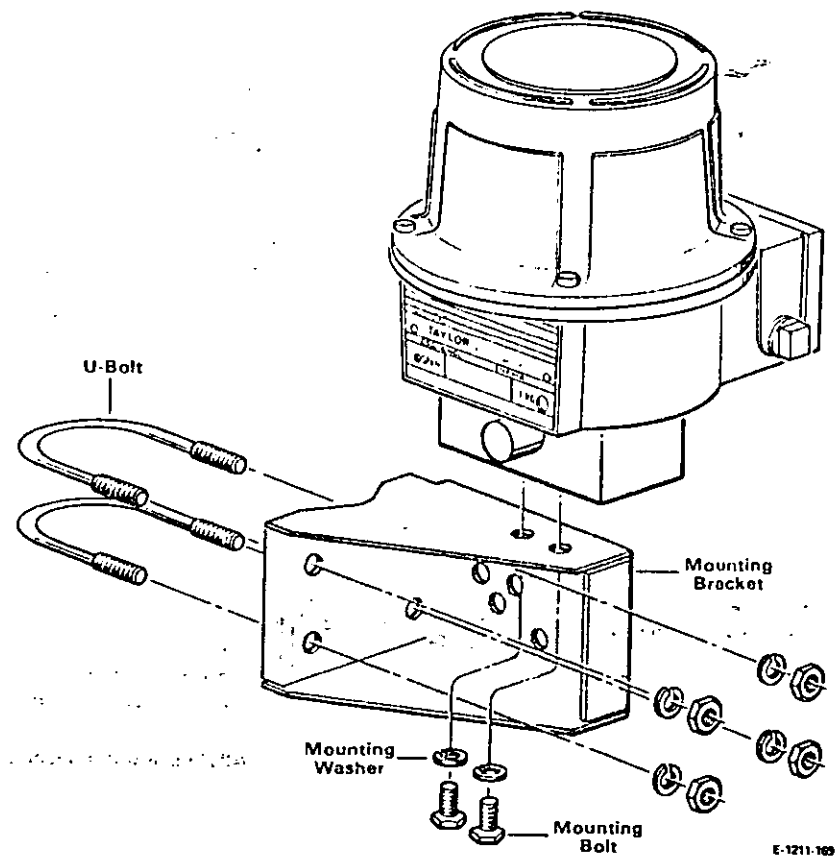


Figure 7. Assembling Optional Mounting Bracket Kit, Accessory (146)

2.3 PROCESS INSTALLATION

2.3.1 General
Installations for gage pressure measurement are shown in Figures 8 and 9. The seal element can be connected to a process pipe as shown, or to any process vessel.

The transmitter datum line is at the center of the tube system connection in the measuring element body. When the datum line is above or below the elevation of the seal element, the head pressure developed by the liquid fill in the tube system must be considered when determining range values for calibration. Refer to **2.3.4 Determining Span and Range Values.**

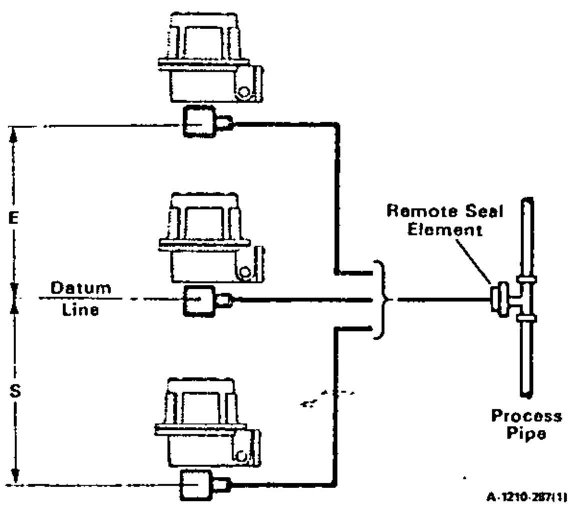


Figure 8. Pressure Service Installation

2.3.2 Pressure Service
Recommended installations for pressure service are shown in Figure 8. If the transmitter is located above the elevation of the seal element, dimension E is limited depending upon the tube system filling medium. If the filling medium is mercury, dimension E must not exceed 30 inches (762 mm). For all other filling mediums, dimension E must not exceed 30 feet (9.14 m). Connect the element to the side or top of the pipe to avoid collection of sediment on the process diaphragm.

2.3.3 Vacuum Service
When the process pressure range includes pressures below atmospheric, the transmitter datum line must be at or below the elevation of the seal element to insure that the pressure in the measuring element body is always greater than 0 psia. Recommended installations are shown in Figure 9. Connect the element to the side or top of the pipe to avoid collection of sediment on the seal element diaphragm.

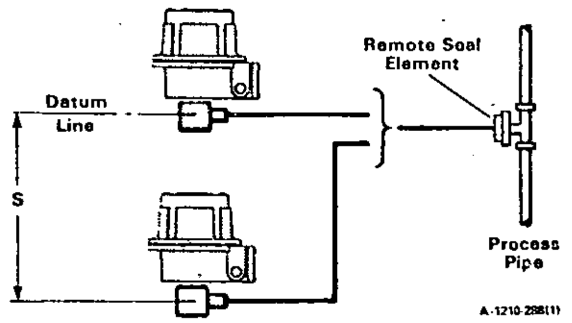


Figure 9. Vacuum Service Installation

2.3.4 Determining Span and Range Values
All transmitters are factory calibrated per customer specifications. If the application is changed, determine the required span and range values using the following information.

Span is a function of the **change** in process pressure. The range values are the end points of the span. The **lower range value** is the net pressure applied to the measuring element when the process pressure is at its **minimum** value. The **upper range value** is the net pressure applied when the process pressure is at its **maximum** value.

When the transmitter datum line, Figure 8, is at the **same** elevation as the seal element, the lower range value and upper range value are equal to the minimum and maximum process pressures, respectively.

When the transmitter datum line is **above** or **below** the seal element connection, a head pressure is developed by the liquid fill in the tube system. This pressure must be taken into account when determining range values.

> **Example:**
> U.S. Units: In the pressure service installation shown in Figure 8, assume that the process pressure varies from 150 to 350 psig, and the tube system filling medium is Silicone DC-200. The required transmitter span is 200 psi. The specific gravity of the liquid fill is 0.92, Table 9.
>
> If the transmitter is mounted 20 feet below the seal element (S = 20 feet), a

Table 9. Specific Gravity of Filling Medium

Tube System Filling Medium	Specific Gravity
Silicone, DC-200	0.92
Silicone, DC-702	1.07
Ethyl Benzene	0.87
Water Glycerine, WG-70	1.07
Water Glycerine, WG-40	1.16
Mercury	13.55

head of 20 feet of liquid is added to the minimum and maximum process pressures. The 20-ft head is equivalent to 8.0 psig (20 ft x 0.92 x 0.433 psi/ft). Thus, the lower range value is 158.0 psig and the upper range value is 358.0 psig.

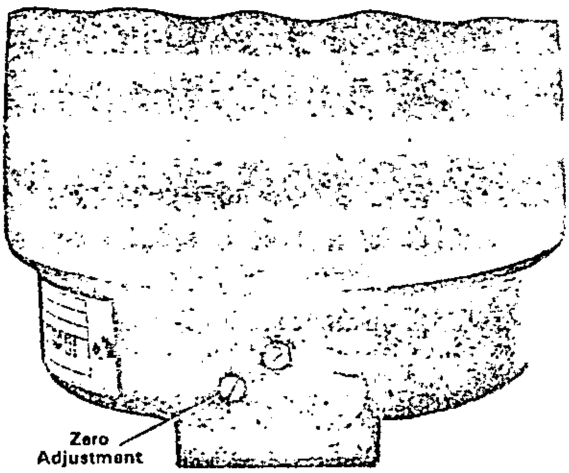
Example:
SI Units: In the pressure service installation shown in Figure 8, assume that the process pressure varies from 1000 kPa to 2400 kPa, and the tube system filling medium is Silicone DC-200. The required transmitter span is 1400 kPa. The specific gravity of the liquid fill is 0.92, Table 9.

If the transmitter is mounted 600 cm below the seal element (S = 600 cm), a head of 600 cm of liquid is added to the minimum and maximum process pressures. The 600-cm head is equivalent to 54 kPa (600 cm x 0.92 x 0.098 kPa/cm). Thus, the lower range value is 1054 kPa and the upper range value is 2454 kPa.

If the transmitter referred to in the examples is mounted above the seal element (E = 20 ft or 600 cm), the 8.0 psig (54 kPa) head pressure is subtracted from the minimum and maximum process pressures to obtain the range values.

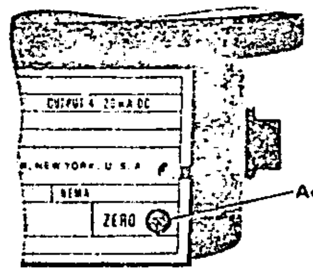
3

OPERATION



THREADED COVER

E-1211-2528



BOLTED COVER

E-1211-2538

Figure 10. Field Zero Adjustment

3.1 PUTTING INTO OPERATION

1. Make sure transmitter has been properly installed. Refer to **2 Installation.**
2. Turn on power to transmitter.

3.2 FIELD ZERO ADJUSTMENT

The zero adjustment is accessible on the outside of the housing, Figure 10. The transmitter can be zeroed while it is in operation, providing the process pressure can be precisely measured to determine the required transmitter output value. If it is not practical to measure the process pressure, the unit should be precisely zeroed prior to installation. This can be done by placing the transmitter housing and seal element in their installation position, and zeroing the output with the input adjusted to its lower range value. Refer to **Calibration, IB-12B958.**

3.3 SURGE PROTECTOR OPTION, ACCESSORY (339)

Accessory (339) provides a built-in surge protection circuit. The surge protector is designed to dissipate large quantities of electrical energy (2500V dc maximum) which have been induced in a transmission line. These large quantities of energy can be induced in the signal transmission lines by lightning discharge or by nearby electrical equipment. The dissipation of this energy prevents damage to transmitter circuitry connected to the transmission line.

The surge protector will not protect the instrument in case of a direct lightning strike. The surge protector is designed to operate and recover automatically. It does not require periodic testing or adjustment.

On transmitters with a bolted cover, the surge protector circuit is located in the terminal box in the base of the housing, Figure 1. On transmitters with a threaded cover, the surge protector circuit is located in the external terminal box, Figure 6.

4

FUNCTIONAL DESCRIPTION

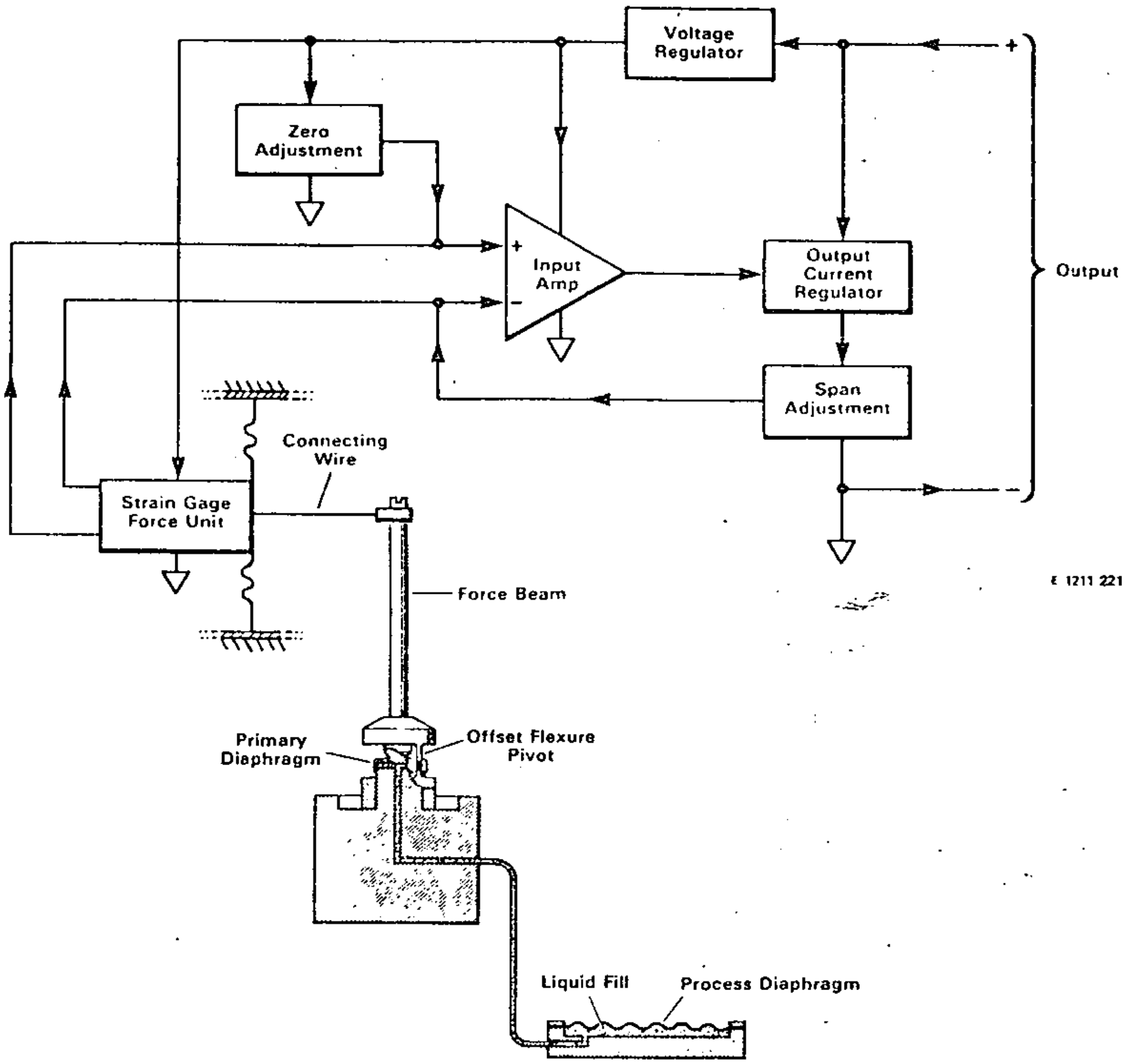


Figure 11. Simplified Diagram of Transmitter

4.1 GENERAL

A simplified diagram of the transmitter with the electronics in block diagram form is shown in Figure 11. A functional schematic of the transmitter electronics is shown in Figure 12.

An increase in process pressure increases the pressure of the liquid fill in back of the process diaphragm. This pressure increase, acting on the primary diaphragm, develops force against the bottom of the force beam. Since the flexure pivot is offset from the center of the beam, the force develops clockwise torque. The force beam, pivoting from the offset flexure, tips to the right.

This motion of the force beam is transferred to the strain gage force unit through the connecting wire. The strain gage force unit contains four strain gages connected in a bridge configuration. Movement of the force beam causes the strain gages to change resistance. This change in resistance produces a differential signal which is proportional to the input dif-

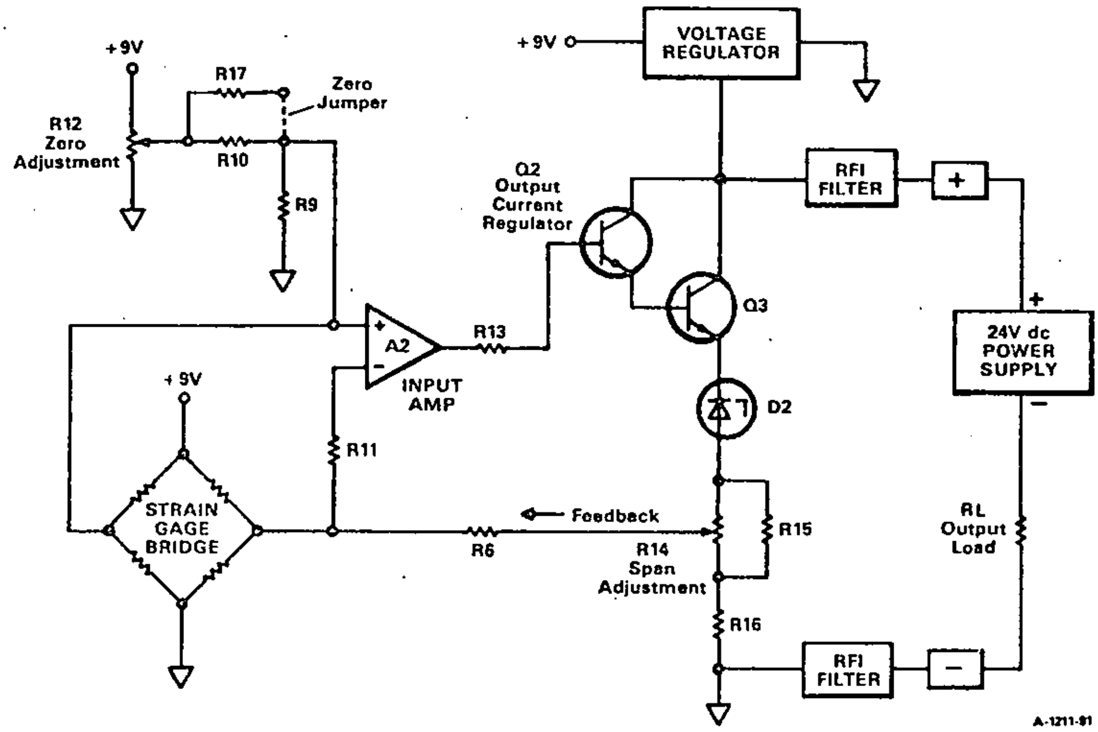


Figure 12. Functional Schematic of Transmitter Electronics

ferential pressure. This differential signal is applied to the inputs of amplifier A2, which drives the output current regulator Q2, Q3. The design of the current regulator limits the maximum output current.

One side of the bridge connects to the zero circuitry and the non-inverting input of amplifier A2. The other side of the bridge connects to the inverting input of amplifier A2 (via R11) and the span circuitry (via R6).

The span adjustment, R14, adjusts the closed loop gain of amplifier A2. It can be set to give a transmitter output current of 20 mA at the required upper range limit.

The zero adjustment, R12, can be set to give a transmitter output current of 4 mA at the required lower range limit. Most of this current is supplied by the voltage regulator circuit, minimizing the interaction between the span and zero adjustments.

A zero jumper can be positioned between R17 and R10 to provide increased zero elevation or suppression capability.

4.2 ZERO ELEVATION AND SUPPRESSION ADJUSTMENTS

Zero elevation or suppression adjustments are required when it is necessary to bias the output to compensate for the effect of initial process pressure. They can also compensate for head pressure developed when the seal element is above or below the elevation of the transmitter case. The zero elevation and suppression capability is provided by the zero adjustment, Figure 12.

When the minimum process pressure is greater than 0 psig (0 kPa), the transmitter output will be above the required zero value (4 mA) at minimum pressure. By turning the zero screw, the output can be suppressed to the required zero value. If a very large amount of suppression is required, an optional extra suppression spring, Accessory (282), provides mechanical suppression which adds to the electrical suppression capability.

When the minimum process pressure is less than 0 psig (a vacuum), the output will be below the required 4 mA zero value at minimum pressure. By turning the zero screw, the output can be elevated to the required zero value.

FUNCTIONAL DESCRIPTION

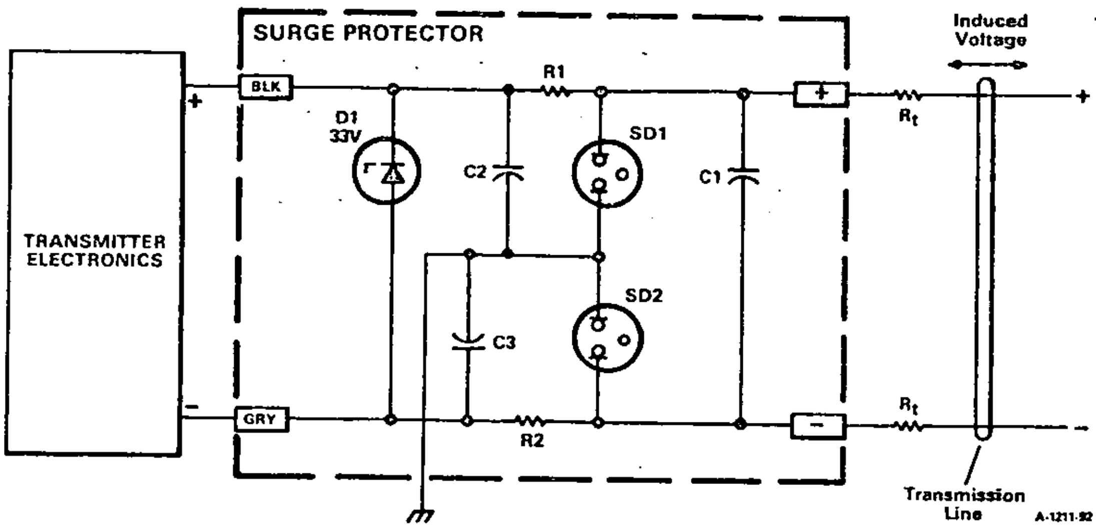


Figure 13. Functional Schematic of Optional Surge Protector, Accessory (339)

Elevation and suppression adjustments are made as part of the transmitter calibration procedure. The initial process pressures and/or head pressures are simulated by air pressure applied to the seal element.

4.3 SURGE PROTECTOR OPTION, ACCESSORY (339)

The surge protector circuit, Figure 13, protects the transmitter electronics from being damaged by high voltage surges. When a surge voltage is induced in the transmission line, the leading edge of the surge is slowed down by an r-c network consisting of resistors Rt, Figure 13, which represent the resistances of the transmission line and capacitor C1.

The time delay due to the r-c network allows surge diodes (gas discharge tubes) SD1 and SD2 time to turn on. When the surge voltage exceeds the firing voltage (approximately 90V dc) of the surge diodes, the diodes conduct and short the surge voltage to ground. The surge diodes conduct either transversely from line-to-line or longitudinally from line-to-ground. If only one surge diode fired or one fired ahead of the other, the voltage surge would continue toward the protected instrument circuitry. Then, the voltage surge would be slowed further by r-c networks R1 and C2 or R2 and C3 until Zener diode D1 conducts. The Zener diode conducts only transversely from line-to-line. It will limit the maximum voltage applied to the protected transmitter circuit at the Zener voltage. Resistors R1 and R2 limit the current flow through the Zener diode.

NOTES

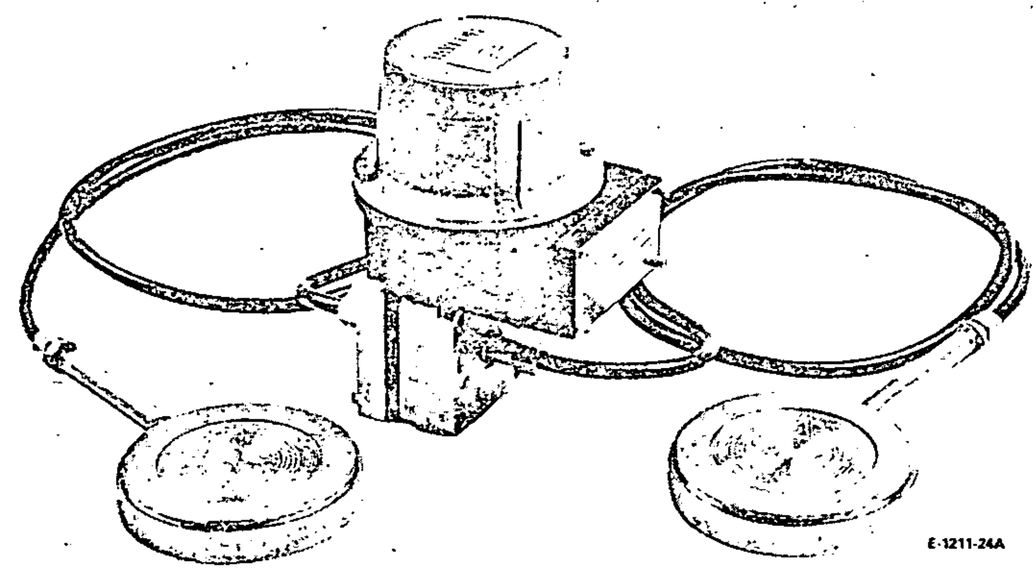
IB-12B229
Issue 2
Oct 1981

INSTRUCTIONS

DIFFERENTIAL PRESSURE TRANSMITTER

with Remote Seal Elements

3423T and 3424T Model B



E-1211-24A

Taylor Instrument

SYBRON | Taylor

NOTICE

Use of **DANGER, WARNING, CAUTION** and NOTE

This publication includes **DANGER, WARNING, CAUTION** and NOTE information where appropriate to point out safety related or other important information.

DANGER — Hazards which will result in severe personal injury or death.

WARNING — Hazards which could result in personal injury.

CAUTION — Hazards which could result in equipment or property damage.

NOTE — Alerts user to pertinent facts and conditions.

Although **DANGER** and **WARNING** hazards are related to personal injury, and **CAUTION** hazards are associated with equipment or property damage, it should be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process system performance leading to personal injury or death. Therefore, comply fully with all **DANGER, WARNING** and **CAUTION** notices.

Prepared by:
MARKETING COMMUNICATIONS DEPARTMENT
TAYLOR INSTRUMENT COMPANY • DIVISION OF SYBRON CORPORATION
95 Ames Street, Rochester, New York 14601 U.S.A. 716-235-5000

ADDENDA SHEET

Use only with Instruction IB-12B229, Issue 1.

Page 5: Add the following information.

MEASURING ELEMENT ACTUATION
D — Differential Pressure

ELECTRICAL CODE
10 — General Purpose
Taylor Standard
21 — U.S. Division 2 — See Table 1
USA
24 — Canadian Division 2 — See Table 1
CSA Approval
25 — U.K. Type N Protection — See Table 2
BASEEFA Approval
88 — Australian Intrinsic Safety
SAA Approval
99 — Electrical Code described by
Accessory (147) — See Table 2

WETTED MATERIAL
16 — Hastelloy-C[1] diaphragm and
type 316 SST Trim
26 — Type 316 SST[2]
36 — Hastelloy-C
46 — Monel
56 — Nickel
76 — Tantelum
99 — Special
06 — Type 316 SST * per NACE Standard MR-01-75 (1980 Rev)

*Type 316 L when seal element is water type (Seal Element Construction Digit 3).

Page 10: Substitute the following for the corresponding information on page 10.

2.3 ELECTRICAL CONNECTIONS

WARNING
Do **NOT** *make electrical connections unless the electrical code designation stamped on the transmitter data plate agrees with the classification of the area in which the transmitter is to be installed. Failure to comply with this warning can result in explosion and fire; leading to injury and property damage.*

2.3.1 General

The transmitter is designed to be part of a two-wire system. The 4 to 20 mA dc output signal and the dc power to the transmitter are carried by the same pair of wires. The transmitter does not contain a power supply. The necessary power supply can be separate from the instrument load or built in as shown in the connection diagram in the back of this manual.

The nominal power supply voltage is 24V dc. The supply voltage at the transmitter terminals must be between the limits of 13 and 36V dc. The output load limit depends on the supply voltage as shown in Table 5.

2.3.2 All Installations Except European Flameproof

Run wiring through the electrical connection hole in the transmitter housing, Figures 2 and 3. If the transmitter has an external terminal box, Figure 3, run wiring through one of the connection holes in the box. All connection holes are threaded to accept a conduit connection. Always plug any unused connection hole.

Transmitters which have BASEEFA, CENELEC or SAA electrical code approval are supplied with a cable gland installed in the electrical connection hole, Figure 2. The gland provides for the required sealing of wiring entering the housing.

Make connections to the transmitter terminals as shown on the connection diagram in the back of this manual. For intrinsically safe applications, be sure to note the intrinsic safety barrier requirements shown on the connection diagram.

ADDENDA SHEET

2.3.3 European Flameproof Installations

Transmitters which are approved for use in European Flameproof code areas are identified by the Electrical Code digits 42 in the instrument catalog number (refer to **1.3 Serial and Catalog Numbers**). These transmitters have an external terminal box with an earth terminal and cover lock, Figure 3A.

Run wiring through the 3/4-inch Int NPT connection hole in the terminal box, and make connections as shown on the connection diagram in the back of this manual. Wiring must enter the connection hole through a BASEEFA approved flameproof fitting. Use an approved Hawke fitting, or equivalent.

Hawke flameproof fittings are manufactured by Hawke Cable Glands Limited, Oxford Street West, Ashton-under-Lyne, Lancashire OL7 ONA, England. Two approved fittings for this connection are:

- Hawke Type 501/453/T, size 0, for armored cable
- Hawke Type 501/454, size 0, for unarmored cable

2.3.4 Shunting Diode

The transmitter may have an optional shunting diode(s) connected between terminals R and M, R1 and M or R2 and M. Transmitters with the diode are identified by the Electrical Connection Suffix digits 02, 03, 04, 05, 07, or 08 in the catalog number. Refer to the schematic diagram in the back of this manual.

The diode(s) is connected to shunt an external output meter, and provides a signal path so that the transmitter will continue to operate if the meter is removed from the circuit. Do not remove the shunting diode when connecting an external meter.

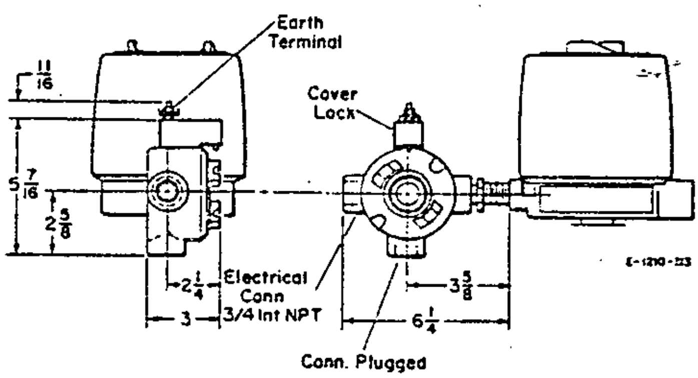


Figure 3A. Mounting Dimensions for European Flameproof Electrical Connection

TABLE OF CONTENTS

Ref A — Refer to Seal Element Section, IB-12B924
Ref B — Refer to Process Installation, IB-12B925

ILLUSTRATIONS

TABLES

1 INTRODUCTION

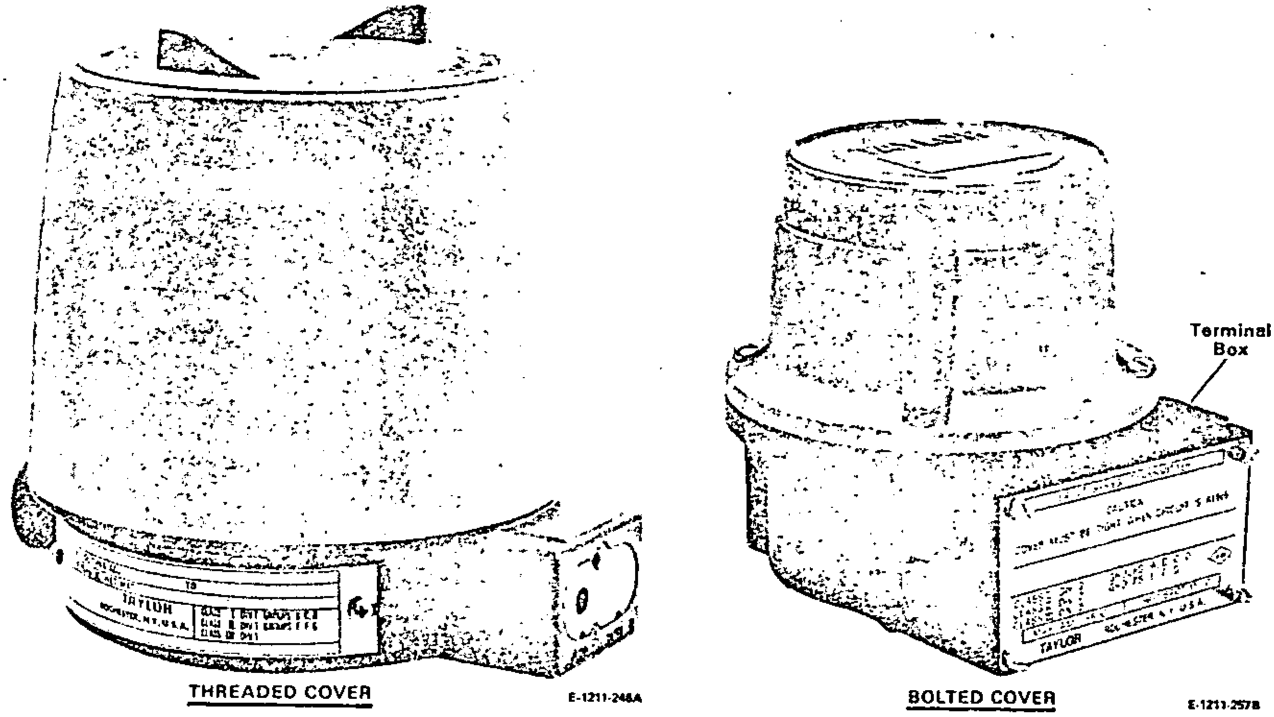


Figure 1. Transmitter Housings

1.1 DESCRIPTION

The Taylor 3423T and 3424T Differential Pressure Transmitters with remote seal elements are instruments which measure process differential pressure and transmit a proportional 4 to 20 mA dc electrical output signal.

Several seal element types are available. They provide process connection to chemical tees, 3-inch ANSI flanges, or 1/2-inch welding necks. An extended diaphragm element, suitable for connection to a 3-inch flanged tank nozzle or flanged tee, permits the process diaphragm to be located flush with the inside of a tank or pipe.

The transmitters are available in medium and high range forms, providing capability for measuring differential spans from 25 to 650 inches of water (6 to 160 kPa) at operating pressures ranging from full vacuum to 1500 psig (10 000 kPa).

A resistance strain gage bridge circuit converts the differential pressure measurement to an electrical signal. The strain gage is hermetically sealed to protect the bridge circuit from moisture, corrosive environments, and mechanical damage. The electrical signal is amplified and converted to a 4 to 20 mA dc signal for transmission to another instrument.

The transmitters are designed to operate as part of a two-wire system. They receive power (+24V dc) from the same pair of wires over which the output signal is transmitted.

The span of each transmitter is continuously adjustable. The span and zero adjustments are accessible from the outside of the instrument. All adjustments to span and zero respond electronically.

The transmitter housing is low copper content, die-cast aluminum. The cover can be either bolted or threaded, Figure 1. The bolted cover is for use in General Purpose or Division 2 electrical code areas and for intrinsically safe applications in Division 1 areas. The threaded cover is for use in Division 1 electrical code areas. The housing provides radio frequency interference (RFI) protection; and is waterproof.

An optional surge protector, Accessory (339), protects the transmitter electronics against high-voltage surges which are often induced by lightning. On transmitters with a bolted cover, the surge protector accessory is inside the housing. On transmitters with a threaded cover, the accessory is located in an external terminal box, Figure 3.

Under a two-year warranty, the circuit board/sealed strain gage assembly or the measuring element is replaceable through a Repair-By-Exchange Plan.

1.2 SERIAL AND CATALOG NUMBERS

The serial number stamped on the data plate consists of the catalog number and a sequential identification number. The catalog number describes the construction of the transmitter.

An X before the serial number indicates that the instrument has been built to meet a customer's special requirements.

Serial Number 3423T D 10 26 3 - 01 00 15 (339) - 555 B

Catalog Number
- Basic Catalog Number
- Measuring Element Actuation
- Electrical Code
- Wetted Material
- Seal Element Construction
- Electrical Connection Suffix
- Extended Diaphragm Length
- Capillary Length
- Accessories (omitted if not required)

Sequential Identification Number

Model (Design Level)

BASIC CATALOG NUMBER

3423T — Medium Range Transmitter
Span adj from 25 to 200 in. water
(6 to 50 kPa)

3424T — High Range Transmitter
Span adj from 200 to 650 in. water
(50 to 160 kPa)

MEASURING ELEMENT ACTUATION

D — Differential Pressure

ELECTRICAL CODE

10 — General Purpose
Taylor Standard

21 — U.S. Division 2 — See Table 1
USA

24 — Canadian Division 2 — See Table 1
CSA Approval

25 — U.K. Type N Protection — See Table 2
BASEEFA Approval

41 — U.S. Division 1 — See Table 1
USA

42 — European Flameproof
CENELEC Approval

44 — Canadian Division 1 — See Table 1
CSA Approval

81 — U.S. Intrinsic Safety — See Table 1
USA

82 — European Intrinsic Safety — See Table 2
CENELEC Approval

83 — Yugoslavian Safety
Commission Approval

84 — Canadian Intrinsic Safety — See Table 1
CSA Approval

88 — Australian Intrinsic Safety
SAA Approval

99 — Electrical Code described by
Accessory (147) — See Table 2

WETTED MATERIAL

16 — Hastelloy-C[1] diaphragm and
type 316 SST

26 — Type 316 SST[2]

36 — Hastelloy-C

46 — Monel

56 — Nickel

76 — Tantalum

99 — Special

[1]T.M. of Union Carbide Corp.

[2]For 342_TD__263-___, type 316L SST

INTRODUCTION

Table 1. Electrical Codes for Hazardous Locations (USA and CSA)

Electrical Code No.	Hazardous Location: Class I, Div 1 Groups A	Class I, Div 1 Groups B,C,D	Class I, Div 2 Groups A	Class I, Div 2 Groups B,C,D	Class II, Div 1 Groups E,F,G	Class II, Div 2 Groups E,F,G	Class III, Div 1	Class III, Div 2
21			X	X		X		X
24			X	X		X		X
41		X		X	X	X	X	X
44		X		X	X	X	X	X
81	X	X	X	X	X	X	X	X
84	X	X	X	X	X	X	X	X

E-1211-125

Table 2. Electrical Codes for Hazardous Locations (Europe)

Catalog Number Digits: Electrical Code No.	Electrical Connection Suffix	Acc No.	Description: Type of Protection	Safety Code	Hazardous Area: Zone 0	Zone 1	Zone 2	Safety Std.	For Installation in	Approvals Authority
25	01,02,03,04,05,08	†	N	ExN II T5			X	BS4683: Part 3: 1972	UK	BASEEFA
82	01,02,04,05	†	ia	EExia II CT5	X	X	X	EN50020 (BS5501:Part 7: 1977)	UK and other CENELEC* member states	
	08	†	ia	EExia II BT5	X	X	X			
	08	†	ib	EExib II CT5		X	X			
99	01,02,04,05,08	(147)	N	ExN II T5			X	BS4683: Part 3: 1972	UK	
	01,02,04,05	(147)	ia	EExia II CT5	X	X	X	BS5501: Part 7: 1977		
	08	(147)	ia	EExia II BT5	X	X	X			
			ib	EExib II CT5		X	X			

†Can be any accessory number except (147)

E-1211-266

*CENELEC member states: Austria, Belgium, Denmark, Finland, France, W. Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom

Note: BASEEFA or EEC certified barriers must be used with the intrinsically safe transmitters (ia and ib) as per BASEEFA certified System Diagram ISD800408 Sheet 1, page 2.

SEAL ELEMENT CONSTRUCTION

1 — Diaphragm Element
Chemical Tee Type

3 — Diaphragm Element
Wafer Type for use with 3-inch ANSI flanges

4 — Diaphragm Element
Welding Neck Type, 1/2 inch schedule 40 pipe

7 — Diaphragm Element
Extended Type with 3-inch, Class 150 ANSI raised face flange

8 — Diaphragm Element
Extended Type with 3-inch, Class 300 ANSI raised face flange

ELECTRICAL CONNECTION SUFFIX

01 — Terminal block connection

02 — Terminal block with shunting diode and 2.5 ohm calibration resistor

03 — Terminal block with shunting diode, 2.5 ohm calibration resistor, and output test jack

04 — Terminal block with shunting diode, 2.5 ohm calibration resistor, and output meter with 0 to 100 linear scale

05 — Terminal block with shunting diode, 2.5 ohm calibration resistor, and output meter with 0 to 10 square-root scale

07 — External terminal box with shunting diode

08 — Terminal block with shunting diode, 2.5 ohm calibration resistor, and current meter jack across shunting diode

EXTENDED DIAPHRAGM LENGTH
00 — No extension
02 — 2 inches (5.1 cm)
04 — 4 inches (10.2 cm)
06 — 6 inches (15.2 cm)
09 — Special

CAPILLARY LENGTH
Digits indicate length in feet:
05 through 35 — 5 through 35 feet (1.52 m through 10.67 m)
99 — Special

ACCESSORIES
(129) — 3-inch, Class 150 ANSI raised face slip-on flange with stud bolts and nuts for use with Seal Element Construction No. 3.
(130) — 3-inch, Class 300 ANSI raised face slip-on flange with stud bolts and nuts for use with Seal Element Construction No. 3.
(131) — 3-inch, Class 600 ANSI raised face slip-on flange with stud bolts and nuts for use with Seal Element Construction No. 3.
(132) — 3-inch, Class 900 ANSI raised face slip-on flange with stud bolts and nuts for use with Seal Element Construction No. 3.
(146) — Mounting Bracket
(147) — Data Plate indicating that transmitter satisfies requirements for both Electrical Codes 25 (U.K. Type N Protection) and 82 (European Intrinsic Safety) — See Table 2
(339) — Surge Protector

EXAMPLE:
Serial Number 3423TD10263-010015(339)-555B identifies a medium range transmitter (3423T) adjustable from 25 to 200 inches of water (6 to 50 kPa), and actuated by differential pressure (D). It is designed to operate in areas designated as general purpose by the electrical code (10). The process wetted material is type 316 SST (26), the seal element construction is the wafer type for use with 3-inch ANSI flanges (3), and the transmitter has a terminal block connection (01). The diaphragm is not extended (00), and capillary length is 15 feet (15). The transmitter has a surge protector (339). The sequential identification number is 555, and the design level is Model B.

1.3 WETTED MATERIAL IDENTIFICATION

The following abbreviations are used on the instrument data plate to identify materials wetted by the process.

HAST — Hastelloy-C
316 — Type 316 SST
MON — Monel
TANT — Tantalum
NI — Nickel

When the instrument has more than one type wetted material, the data plate identifies the materials in the following sequence:

Process Diaphragm — Trim

1.4 SPECIFICATIONS

SPAN*
3423T: Adj from 25 to 200 in. water (6 to 50 kPa)
3424T: Adj from 200 to 650 in. water (50 to 160 kPa)

CALIBRATION ACCURACY (Zero Based)
±0.5% of span [0.25% ultimate capability to 150 in. water (0.37 kPa) span; ±0.5% ultimate capability over 150 in. water (37 kPa) span]

RANGE LIMITS
Refer to Tables 3 and 4

WORKING PRESSURE LIMITS
Minimum
0 psia at 300°F (149°C) maximum when seal elements are at or above elevation of transmitter[1]

Maximum

3423T, 3424TD_ _ _ _1:	300 psig (2000 kPa)
3423T, 3424TD_ _ _ _3:	Same as rating for ANSI flange but not to exceed 1500 psig (10 000 kPa)
3423T, 3424TD_ _ _ _4:	1500 psig (10 000 kPa) to 400°F (204°C)
3423T, 3424TD_ _564:	1000 psig (7 000 kPa) to 400°F (204°C)

*The factory-calibrated span is identified on the side of the strain gage bracket.

[1]On vacuum service installations, seal element can be located below transmitter when minimum process pressure is above 0 psia. Refer to Process Installation for limits.

INTRODUCTION

Table 3. Range Limits with Zero Jumper in NORM Position

Catalog No.	Calibration	Range Limits			
		Inches of Water		Kilopascals	
		Lower (4 mA Output)	Upper (20 mA Output)	Lower (4 mA Output)	Upper (20 mA Output)
3423T Medium Range	Zero Based	0	+25 to +200	0	+6 to +50
	Suppressed Zero	0 to +50	+25 to +200	0 to +12	+6 to +50
	Elevated Zero	−50 to 0	−25 to +200	−12 to 0	−6 to +50
	Center Zero	−50 to 12.5	+12.5 to +50	−12 to −3	+3 to +12
3424T High Range	Zero Based	0	+200 to +650	0	+50 to +160
	Suppressed Zero	0 to +160	+200 to +650	0 to +40	+50 to +160
	Elevated Zero	−160 to 0	+40 to +650	−40 to 0	+10 to +160
	Center Zero	−160 to −100	+100 to +160	−40 to −25	+25 to +40

All transmitters can be continuously adjusted for any calibration listed.

E-1211-200

Table 4. Range Limits with Zero Jumper in EL/SUPR Postion

Catalog No.	Calibration	Range Limits			
		Inches of Water		Kilopascals	
		Lower (4 mA Output)	Upper (20 mA Output)	Lower (4 mA Output)	Upper (20 mA Output)
3423T Medium Range	Zero Based	0	+25 to +200	0	+6 to +50
	Suppressed Zero	0 to +175	+25 to +200	0 to +44	+6 to +50
	Elevated Zero	−170 to 0	−145 to +200	−42 to 0	−36 to +50
	Center Zero	−100 to −12.5	+12.5 to +100	−25 to −3	+3 to +25
3424T High Range	Zero Based	0	+200 to +650	0	+50 to +160
	Suppressed Zero	0 to +450	+200 to +650	0 to 110	+50 to +160
	Elevated Zero	−650 to 0	0 to +650	−160 to 0	0 to +160
	Center Zero	−325 to −100	+100 to +325	−80 to −25	+25 to +80

All transmitters can be continuously adjusted for any calibration listed.

E-1211-201

3423T, 3424TD_ _ _ _ _7,8: Class 150 Flange
at 100°F (38°C)
is 275 psig
(1900 kPa)
at 400°F (204°C)
is 180 psig
(1240 kPa)
Class 300 Flange
at 100°F (38°C)
is 720 psig
(5000 kPa)
at 400°F (204°C)
is 665 psig
(4580 kPa)

OUTPUT SIGNAL
4 to 20 mA dc

OUTPUT LOAD LIMITS — Refer to Table 5

POWER SUPPLY
24V dc nominal
13V dc min, 36V dc max. across transmitter terminals

Table 5. Output Load Limits

Power Supply (DC Volts)	Max Transmitter Load (Ohms)*	
	Elect. Conn Suffix 01	Elect. Conn Suffix 02, 03, 04, 05, 07, 08
13	50	0
15	150	100
20	400	350
24	600	550
30	900	850
35	1150	1100

*Max load is reduced 70Ω if transmitter has a surge protector, Acc (339).

E-1211-1298

POWER CONSUMPTION
0.5W nominal
1.5W max. in overrange condition

WEIGHT[1] (Less seal elements)
3423T: 10.9 lbs (4.9 kg)
3424T: 8.9 lbs (4.0 kg)

AMBIENT TEMPERATURE LIMITS
Housing and Measuring Element:
−40°F (−40°C) min,
+185°F (85°C) max.
Capillary:
−40°F (−40°C) min,
+180°F (82°C) max.
Seal Elements:
−40°F (−40°C) min,
+400°F (204°C) max.

[1]Add 3 lbs (1.4 kg) for units with threaded cover.

STORAGE TEMPERATURE LIMITS
−65°F (−54°C) min,
+200°F (93°C) max.

SEAL ELEMENT ELEVATION
Minimum Pressure — 0 psia:
Elements must be at or above elevation of transmitter

Minimum Pressure — Atmospheric:
Elements can be above or below elevation of transmitter

If element is below, limits are as follows:
3423T: 31 ft (9.5 m) max.
3424T: 30 ft (9.1 m) max.
[If transmitter is more than 1000 ft (305 m) above sea level, reduce limit by 1.2 ft (36.6 cm) per 1000 ft (305 m) of altitude]

2

INSTALLATION

2.1 MOUNTING

Refer to **Process Installation Section, IB-12B925,** for information on locating the transmitter for specific applications.

Carefully unpack the transmitter and uncoil the tube system.

> **CAUTION**
>
> *The process diaphragms will be damaged if the seal elements are lowered too far below the transmitter, especially when used on vacuum service. Refer to* **1.4 Specifications.**
>
> *Do not remove the protective covers from the seal elements until ready to connect them to the process.*

Select a mounting location where there is minimum vibration. Ambient temperature must not exceed the limits listed under **1.4 Specifications.**

Mount the transmitter with the measuring element below the case as shown in Figures 2 and 3. Operation is not affected by mounting in other positions but some rezeroing will be required. Refer to **3.2 Field Zero Adjustment.**

The transmitter can be mounted using the two 5/16-18 mounting holes in the measuring element, Figures 2 and 3.

An optional mounting bracket kit, Accessory (146), provides a bracket, U-bolts, spacer, and fasteners, Figure 4. The bracket is suitable for either pipe or surface mounting. For pipe mounting, the bracket accepts 1-1/4 through 2-inch pipe and can be positioned for use on horizontal or vertical pipes, Figures 2 and 3.

2.2 PROCESS CONNECTIONS

Refer to **Process Installation Section** for information on locating the transmitter for specific applications.

2.3 ELECTRICAL CONNECTIONS

> **WARNING**
>
> *Do* **NOT** *make electrical connections unless the electrical code designation stamped on the transmitter data plate agrees with the classification of the area in which the transmitter is to be installed. Failure to comply with this warning can result in explosion and fire; leading to injury and property damage.*

2.3.1 General

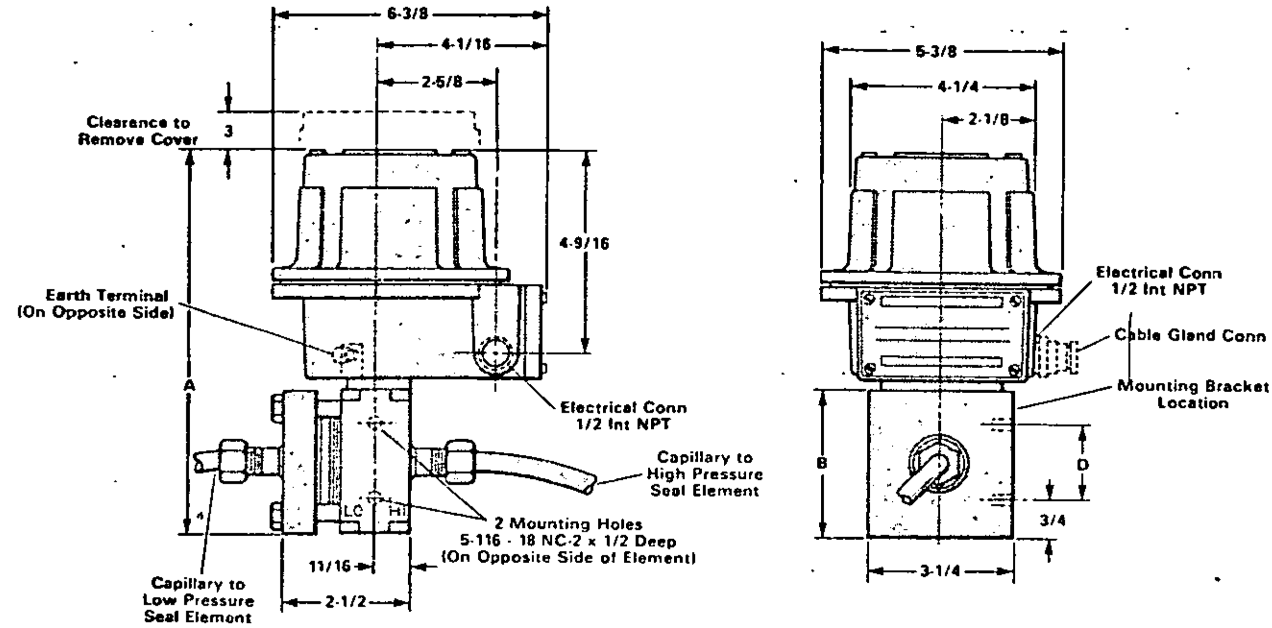
The transmitter is designed to be part of a two-wire system. The 4 to 20 mA dc output signal and the 24V dc power to the transmitter are carried by the same pair of wires. The transmitter does not contain a power supply. The necessary power supply can be separate from the instrument load or built in as shown in the connection diagram located in the back of this manual.

If the power supply voltage is greater than 24V dc, do not exceed 36V dc across the transmitter terminals. The output load limits of the transmitter are shown in Table 6. Conduit may be connected to the threaded connection in the transmitter base. Refer to Figures 2 and 3.

2.3.2 Shunting Diode

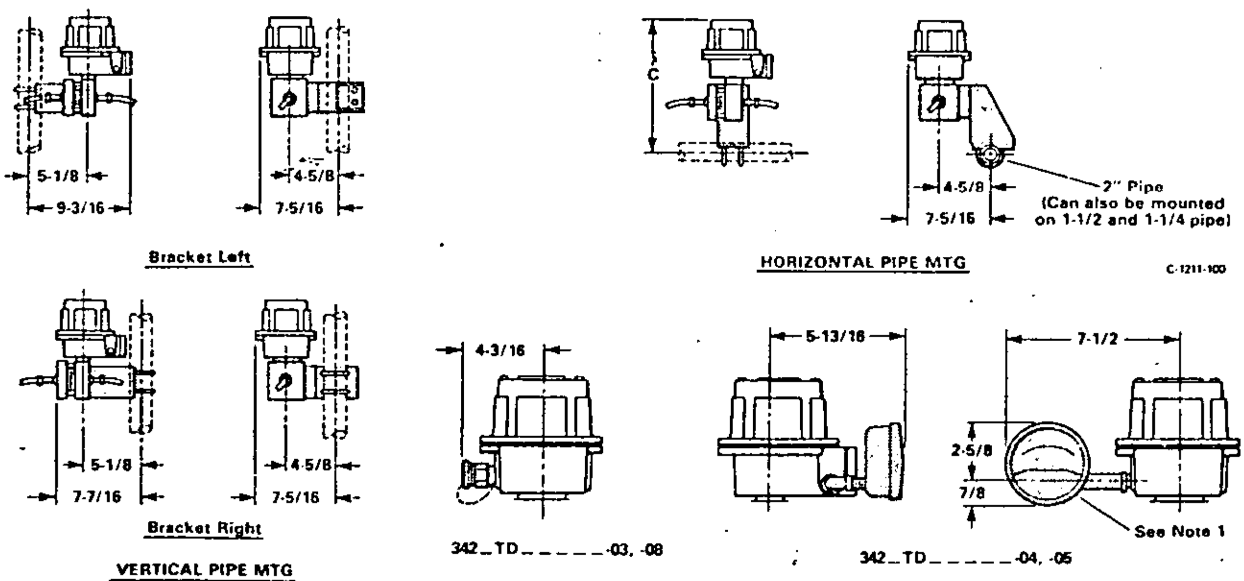
When the transmitter catalog number contains Electrical Connection Suffix digits 02, 03, 04, 05, 07, or 08, a shunting diode(s) is connected between terminals R and M in the terminal box. Refer to the schematic diagram in the back of this manual.

The diode(s) is connected to shunt an external output meter and provides a signal path if the external meter is removed from the circuit. Do not remove the shunting diode when connecting an external output meter.



CATALOG NO.	A	B	C	D
3423T	8-23/32	3-7/32	12-3/16	1-3/4
3424T	7-3/4	2-1/4	12-7/16	3/4

ACCESSORY NO. (146) Pipe Mtg Bracket



Notes:
1. On instruments with electrical code 25, 82, or 88, output meter is mounted in electrical connection on other end of terminal box.
2. Capillary from transmitter to seal element is the same length for both elements.

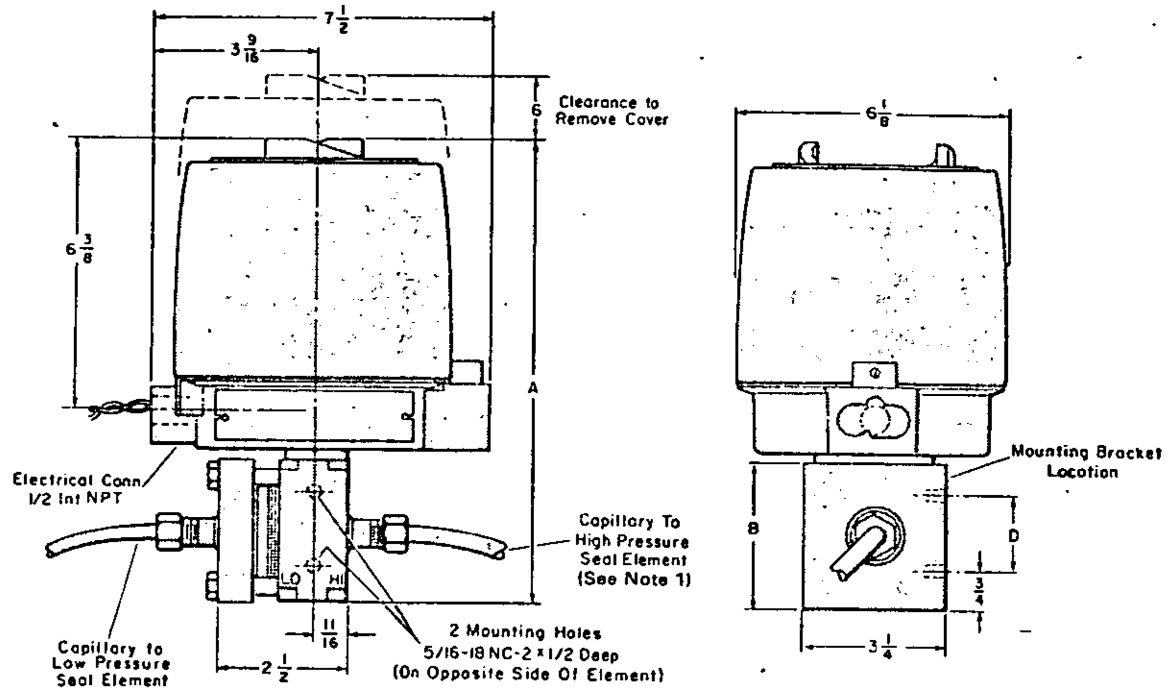
For reference only; not for construction

All dimensions in inches.

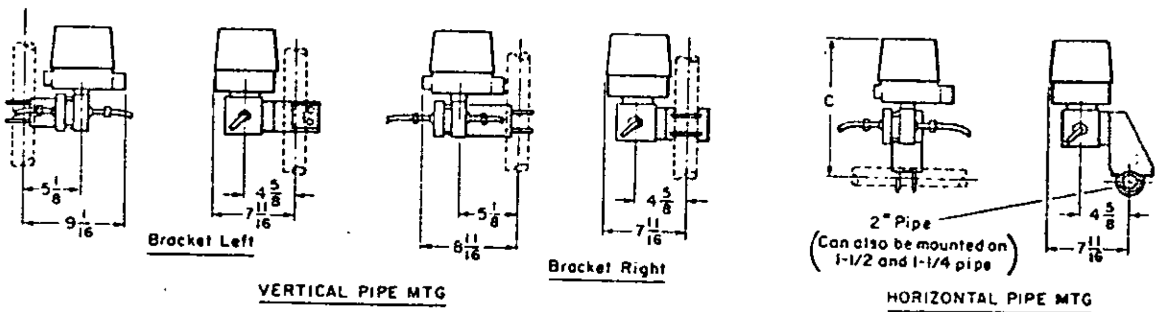
INCHES	mm	INCHES	mm
1/2	12.70	4-5/8	117.48
11/16	17.46	5-1/8	130.18
3/4	19.05	5-3/8	136.53
1-3/4	44.45	5-13/16	147.64
2-1/8	53.98	6-3/8	161.93
2-1/4	57.15	7-5/16	185.74
2-1/2	63.50	7-7/16	188.91
2-5/8	66.68	7-1/2	190.50
3	76.20	7-3/4	196.85
3-7/32	81.76	8-5/32	207.17
3-1/4	82.55	8-23/32	221.46
4-1/16	103.19	9-3/16	233.36
4-3/16	106.36	12-3/16	309.56
4-1/4	107.95	12-7/16	315.91
4-9/16	115.89	12-1/2	317.50

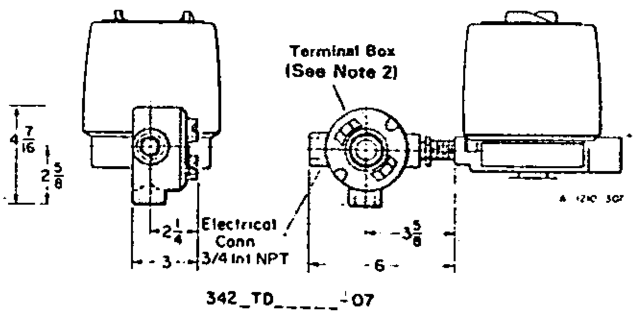
Figure 2. Mounting Dimensions for Transmitter with Bolted Cover

INSTALLATION



ACCESSORY NO. (146) Pipe Mtg Bracket





342_TD_ _ _ _ _-07

CATALOG NO.		A	B	C	D
	3423T	10-5/8	3-7/32	14-3/32	1-3/4
	3424T	9-21/32	2-1/4	14-11/32	3/4

INCHES	mm	INCHES	mm
5/16	7.94	5-1/8	130.18
1/2	12.70	6	152.40
11/16	17.46	6-1/8	155.58
3/4	19.05	6-3/8	161.93
7/8	22.23	7-1/2	190.50
15/16	23.81	7-11/16	195.26
1-3/4	44.45	8-1/4	209.55
2-1/4	57.15	8-11/16	220.66
2-1/2	63.50	9-1/16	230.19
2-5/8	66.68	9-21/32	245.27
3	76.20	10-5/8	269.88
3-1/4	82.55	12-1/2	317.50
3-1/2	88.90	14-3/32	357.98
3-9/16	90.49	14-11/32	364.33
4-7/16	112.71	28	711.20
4-5/8	117.48		

For reference only;
not for construction

All dimensions in inches.

Notes:
1. Capillary from transmitter to seal element is the same length for both elements.
2. Surge protector circuit is housed in terminal box when transmitter is equipped with Accessory (333).

Figure 3. Mounting Dimensions for Transmitter with Threaded Cover

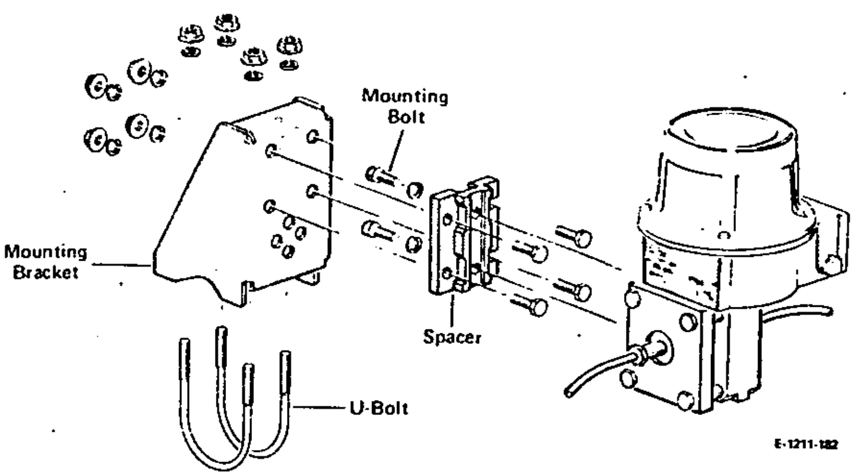


Figure 4. Assembling Optional Mounting Bracket Kit, Accessory (146)

3

OPERATION

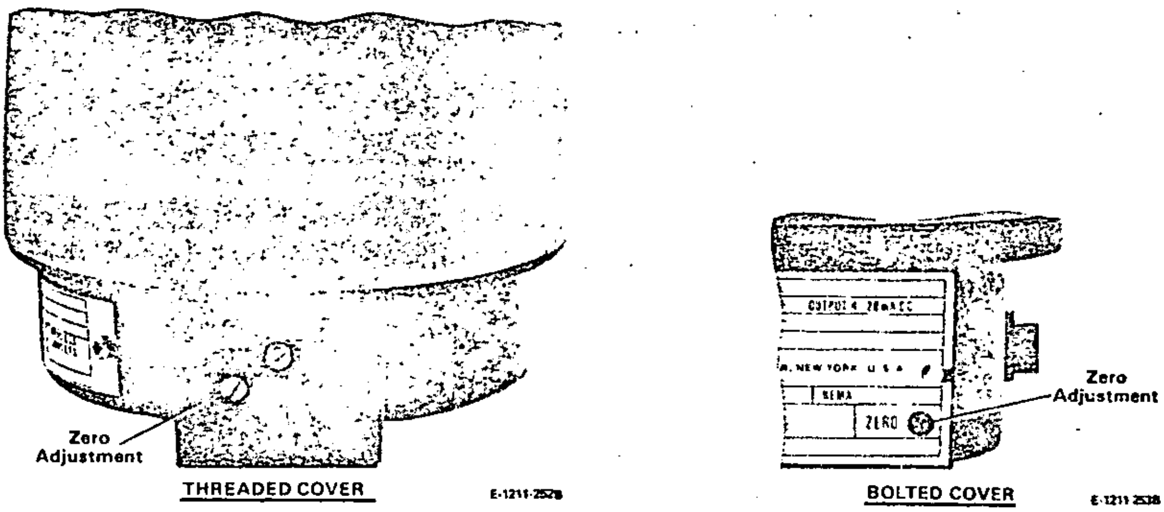


Figure 5. Field Zero Adjustment

3.1 PUTTING INTO OPERATION

This section describes start-up of the transmitter assuming that it has been installed as recommended in the **Process Installation Section.**

Turn on power to transmitter, then use the following procedure under **3.2 Field Zero Adjustment.**

3.2 FIELD ZERO ADJUSTMENT

3.2.1 Flow Installations

1. Shut off flow to obtain zero differential across measuring element.

2. Output should be 4 mA dc with flow shut off.

   If it is not, turn **ZERO** adjustment, Figure 5, to obtain required output. Clockwise rotation increases output.

3.2.2 Liquid Level Installations

1. Bring liquid up to minimum level or to a known reference level.

2. Determine the required output using the applicable following equation:

   a. Using U.S. Units: (1)

$$\text{Out} = 16\left[\frac{(\text{Ref Level} - \text{Min Level})\, G_t}{\text{Span}}\right] + 4$$

where Out = Output in milliamperes

Min Level = Lowest level to be measured, inches above datum line

Ref Level = Any known level between minimum and maximum, inches above datum line

G_t = Specific gravity of liquid in tank

Span = Transmitter span setting, inches of water

b. Using SI Units: (2)

$$\text{Out} = 16\left[\frac{(\text{Ref Level} - \text{Min Level})\,(G_t)\,(C)}{\text{Span}}\right] + 4$$

where Out = Output in milliamperes
Min Level = Lowest level to be measured, centimeters above datum line
Ref Level = Any known level between minimum and maximum, centimeters above datum line
G_t = Specific gravity of liquid in tank
C = 0.098 (kilopascal conversion constant, kPa/cm)
Span = Transmitter span setting, kPa

NOTE

Transmitter datum line is at center of the **HI** side process diaphragm.

3. If output does not agree with value calculated in Step 2, turn **ZERO** adjustment, Figure 5, to obtain required output. Clockwise rotation increases output.

3.3 SURGE PROTECTOR OPTION, ACCESSORY (339)

Accessory (339) provides a built-in surge protection circuit. The surge protector is designed to dissipate large quantities of electrical energy (2500V dc maximum) which have been induced in a transmission line. These large quantities of energy can be induced in the signal transmission lines by lightning discharge or by nearby electrical equipment. The dissipation of this energy prevents damage to transmitter circuitry connected to the transmission linew

The surge protector will not protect the instrument in case of a direct lightning strike. The surge protector is designed to operate and recover automatically. It does not require periodic testing or adjustment.

On transmitters with a bolted cover, the surge protector circuit is located in the terminal box in the base of the housing, Figure 1. On transmitters with a threaded cover, the surge protector circuit is located in the external terminal box, Figure 3.

4

FUNCTIONAL DESCRIPTION

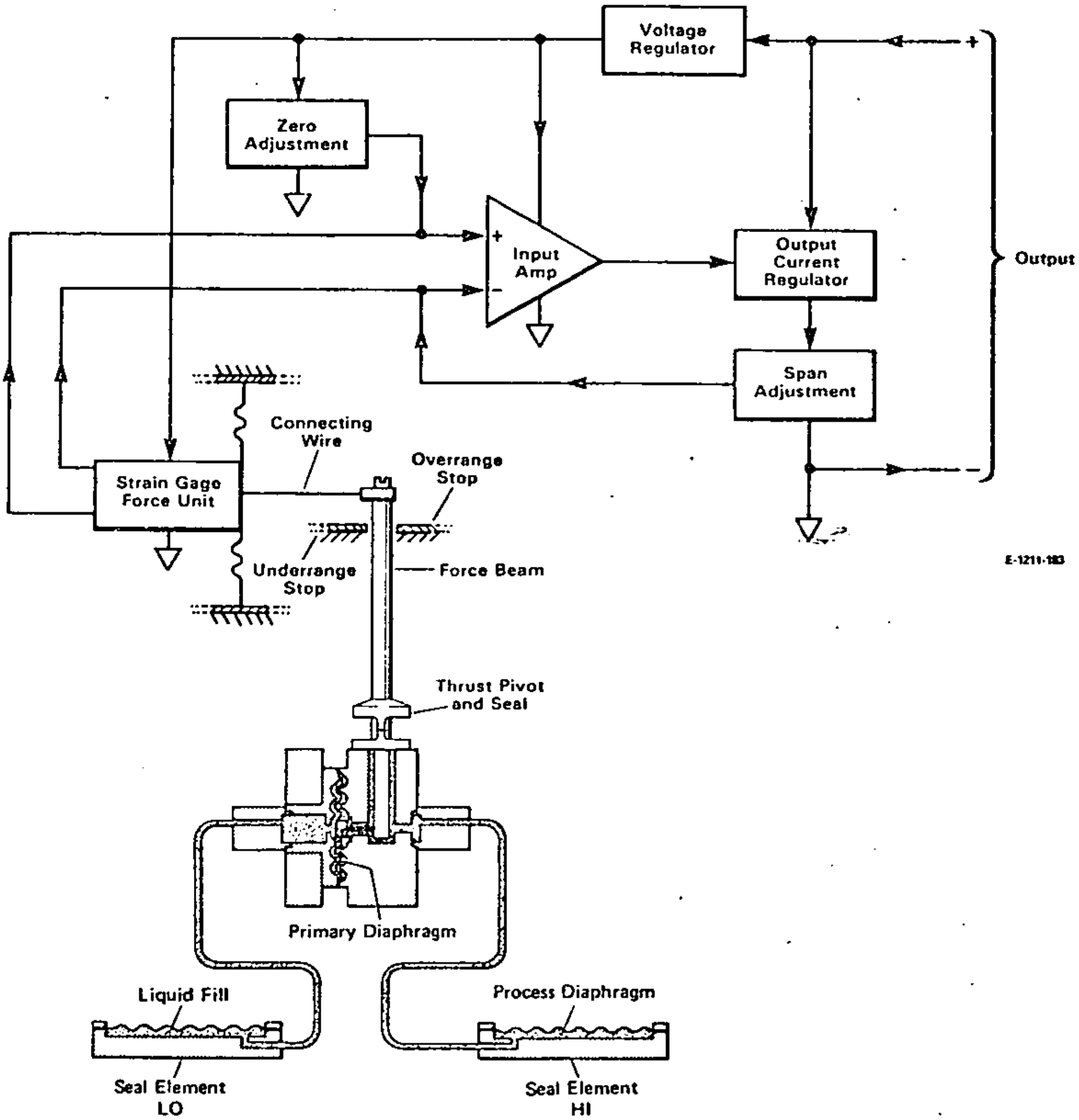


Figure 6. Simplified Diagram of Transmitter

4.1 GENERAL

A simplified diagram of the transmitter with the electronics in block diagram form is shown in Figure 6. A functional schematic of the transmitter electronics is shown in Figure 7.

An increase in differential pressure, acting on the process diaphragm, is transferred through the liquid fill to the primary diaphragm. Force is developed which causes the force beam to pivot around the thrust pivot and seal. The motion of the force beam

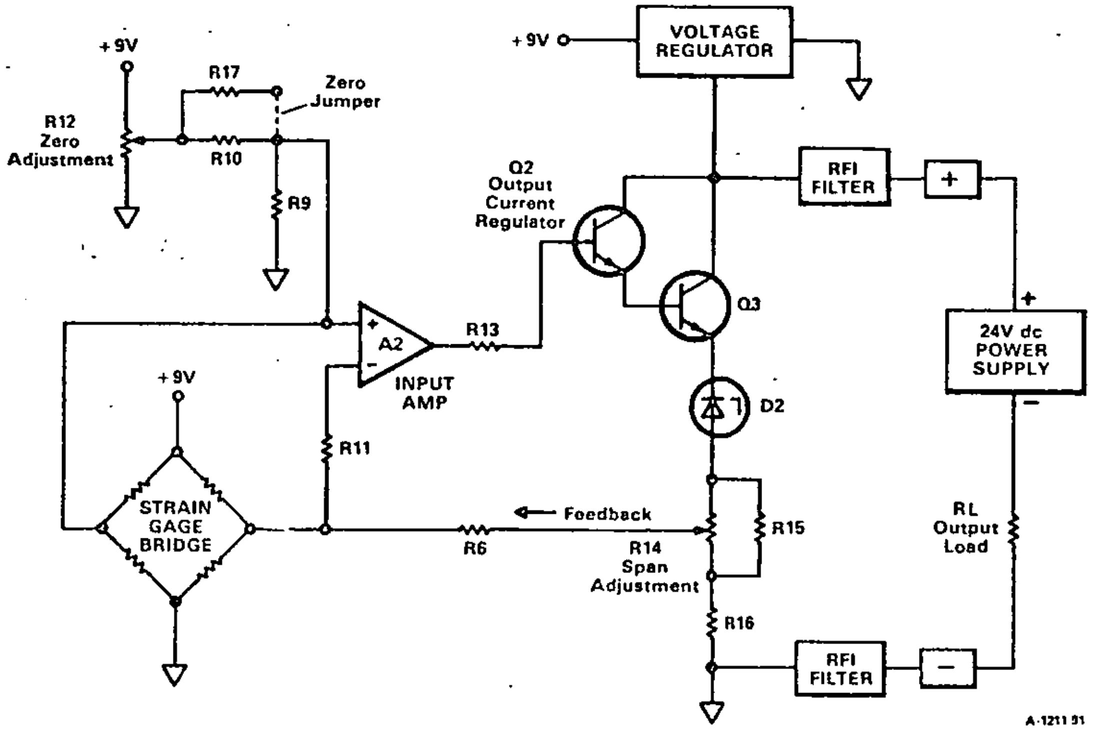


Figure 7. Functional Schematic of Transmitter Electronics

is transferred to the strain gage force unit through the connecting wire. The strain gage force unit contains four strain gages connected in a bridge configuration. Movement of the force beam causes the strain gages to change resistance. This change in resistance produces a differential signal which is proportional to the input differential pressure. This differential signal is applied to the inputs of amplifier A2, which drives the output current regulator Q2, Q3. The design of the current regulator limits the maximum output current.

One side of the bridge connects to the zero circuitry and the non-inverting input of amplifier A2. The other side of the bridge connects to the inverting input of amplifier A2 (via R11) and the span circuitry (via R6).

The span adjustment, R14, adjusts the closed loop gain of amplifier A2. It can be set to give a transmitter output current of 20 mA at the required upper range limit of the input.

The zero adjustment, R12, can be set to give a transmitter output current of 4 mA at the required lower range limit. Most of this current is supplied by the voltage regulator circuit, minimizing the interaction between the span and zero adjustments.

A zero jumper can be positioned between R17 and R10 to provide increased zero elevation or suppression capability.

4.2 ZERO ELEVATION AND SUPPRESSION ADJUSTMENTS

Zero elevation or suppression adjustments are required when it is necessary to bias the output to compensate for the effect of initial head pressures which are often encountered in liquid level applications. The initial head pressure is developed by a difference in elevation between the seal elements or by a column of process liquid which remains constant as the tank level changes. The zero elevation and suppression capability is provided by the zero adjustment, Figure 7.

When the LO side seal element is located above the HI side seal element, as in a liquid level installation, the difference in elevation produces an initial head pressure which is applied to the low side of the primary diaphragm. This causes the output to be below the required zero value (4 mA) at minimum level. By turning the zero screw, the output can be elevated to the required zero value.

If the LO side seal element is located below the HI side seal element, initial output will be above the re-

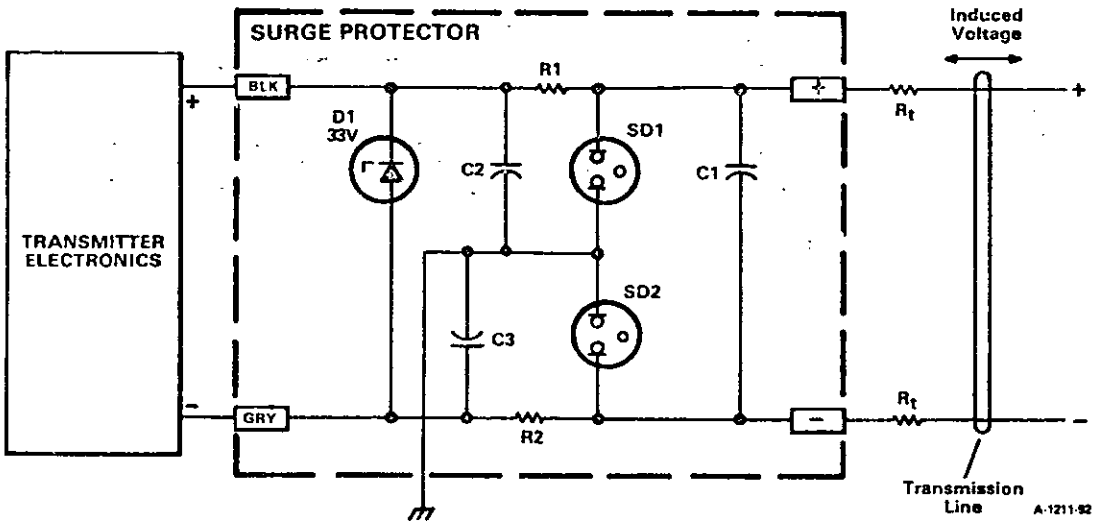


Figure 8. Functional Schematic of Optional Surge Protector, Accessory (339)

quired zero value (4 mA). By turning the zero screw, the output can be suppressed to the required zero value.

Elevation or suppression adjustments are made as part of the transmitter calibration procedure. The head pressures are simulated by calibration pressures applied to the high or low side of the measuring element.

4.3 SURGE PROTECTOR OPTION, ACCESSORY (339)

The surge protector circuit, Figure 8, protects the transmitter electronics from being damaged by high voltage surges. When a surge voltage is induced in the transmission line, the leading edge of the surge is slowed down by an r-c network consisting of resistors Rt, Figure 8, which represent the resistances of the transmission line and capacitor C1.

The time delay due to the r-c network allows surge diodes (gas discharge tubes) SD1 and SD2 time to turn on. When the surge voltage exceeds the firing voltage (approximately 90V dc) of the surge diodes, the diodes conduct and short the surge voltage to ground. The surge diodes conduct either transversely from line-to-line or longitudinally from line-to-ground. If only one surge diode fired or one fired ahead of the other, the voltage surge would continue toward the protected instrument circuitry. Then, the voltage surge would be slowed further by r-c networks R1 and C2 or R2 and C3 until Zener diode D1 conducts. The Zener diode conducts only transversely from line-to-line. It will limit the maximum voltage applied to the protected transmitter circuit at the Zener voltage. Resistors R1 and R2 limit the current flow through the Zener diode.

15

KEYSTONE

FIGURE

9-18-T BUTTERFLY VALVES

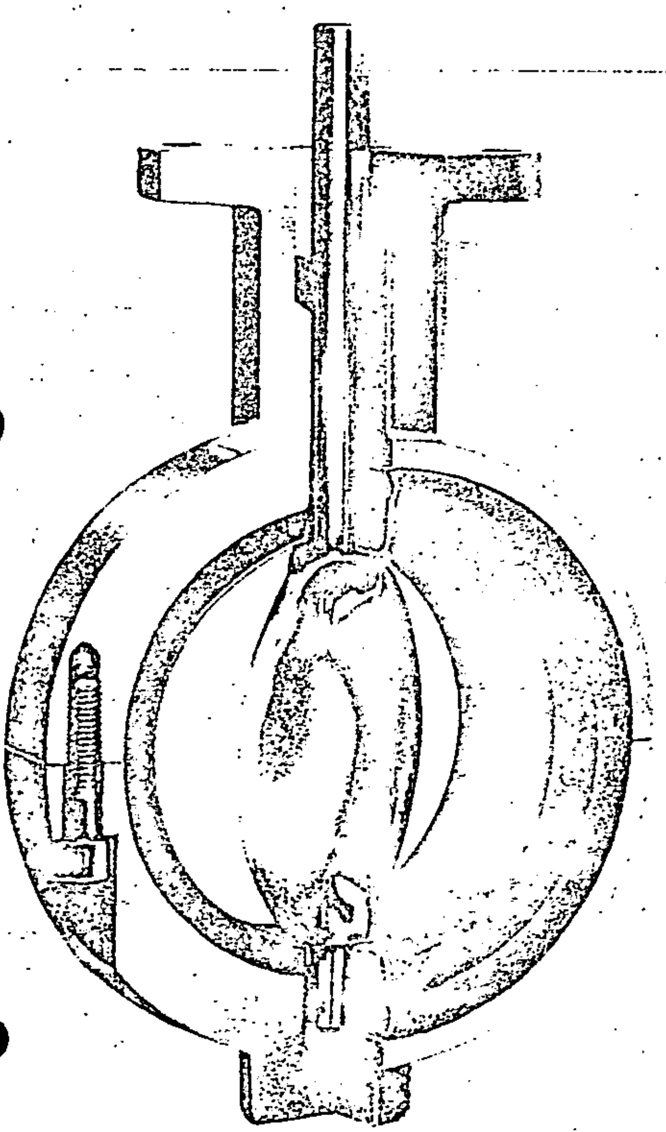
TYPE: Teflon lined wafer butterfly valve with stainless steel disc and molded teflon resilient backed seat.

SIZE: 50 - 500 mm.

RATING: 10 bar tight shut-off.

GENERAL APPLICATION: This new valve, oriented to the chemical processing industry, offers an improved design for services, where elastomers are unsuitable.

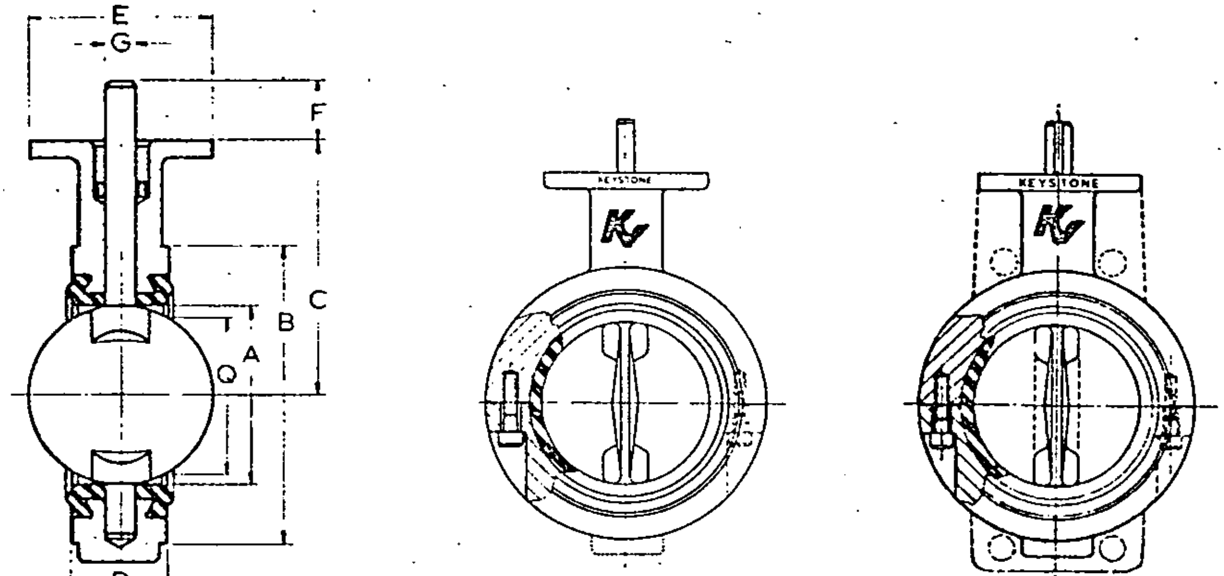
The main feature of this valve combines the resiliency of the rubber back-up material and the chemical resistance of the teflon lined seat.



FEATURES

- **ONE-PIECE WAFER THIN DISC- STEM** for high strength and absolutely positive disc control, provides the very minimum obstruction to flow.
- **THE ROUNDED POLISHED DISC AND HUB EDGE** gives full concentric seating and maximum seat life.
- **SEAT DESIGN** has the famous Keystone dove-tail retention.
  No bonding is required. The rubber material offers resilient back-up to the teflon covering for positive sealing at the rated pressure.
- **THE INTEGRALLY MOLDED TEFLON SEAT LINER** extends over seat face to make contact with line flange to provide the seal, eliminating all requirements for gasketing.
- **PRIMARY SEAL** formed by the seat/shaft/hub contact exceeds the pressure rating of the valve.
  Body is totally isolated from flowing medium.
- **DROP-TIGHT SHUT-OFF** is assured by factory test of every valve to full rating.
- **SECONDARY SHAFT SEAL** is self adjusting.
- **TOP-BUSHING** absorbs operator side thrust.
- **TOP-PLATES** are standardized for operator interchangeability.

KEYSTONE FIGURE 9-18-T BUTTERFLY VALVES



DN 50-250

DN 300-500

VALVE DIMENSIONS

SIZE mm	A mm	B mm	C mm	D mm	E mm	F mm	G mm	Q mm	WEIGHT kg
50	51	109	108	41	102	32	14,3	33	3,0
65	64	129	122	44	102	32	14,3	48	3,5
80	76	144	132	44	102	32	14,3	64	4,0
100	102	164	152	51	102	32	15,9	90	5,5
125	127	194	152	53	102	32	19,0	117	7,2
150	146	220	173	53	102	32	19,0	138	8,5
200	197	275	211	64	152	32	22,2	188	15,0
250	248	330	229	64	152	32	28,6	241	20,5
300	298	377	308	76	152	51	28,6	290	31,0
350	337	429	305	76	152	51	28,6	328	40,0
400	387	489	329	102	152	51	41,3	373	56,0
450	438	546	368	108	203	57	47,6	424	92,0
500	489	600	403	127	203	57	47,6	473	112,0

STANDARD MATERIAL SPECIFICATION

	Figure 9-18-T	Available on special order
Body	Cast iron	Aluminium, Ductile iron
Body screws	Steel	
Disc	Stainless steel	
Shaft	Stainless steel	
Seat	Teflon	
Packing	EPDM	
Bushing	Polyacetal	

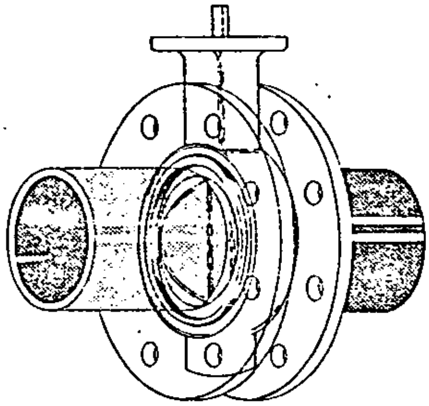
Other materials or combinations of materials are available on special order.

RE SENTATIVE:

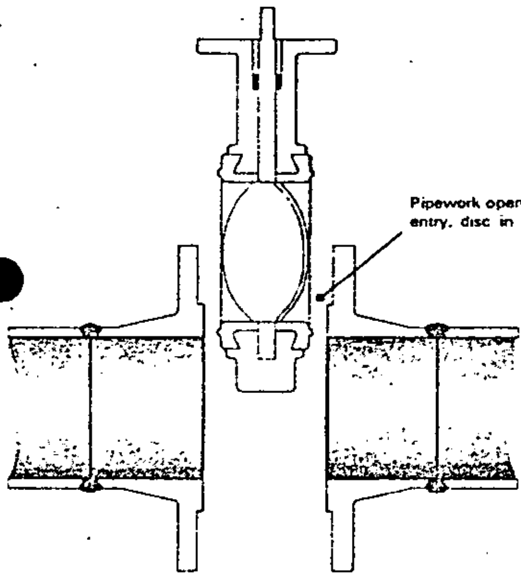
OPERATORS: MANUAL, PNEUMATIC AND ELECTRIC OPERATORS AVAILABLE FOR ALL SIZES.

KEYSTONE

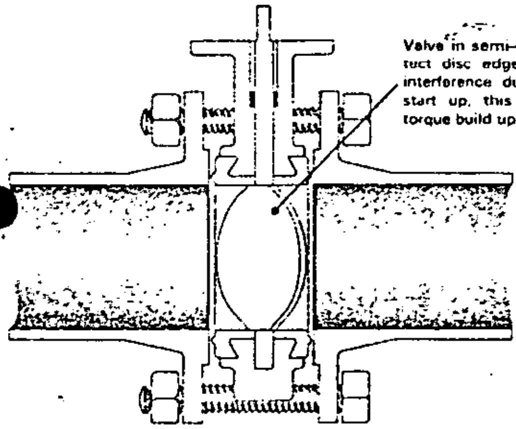
WAFER-STYLE BUTTERFLY VALVE
INSTALLATION FIG. 9



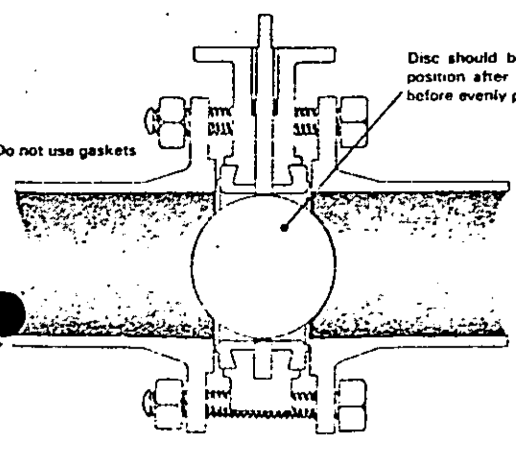
PROPER INSTALLATION PROCEDURE



Pipework opened to allow valve free entry, disc in semi-closed position.



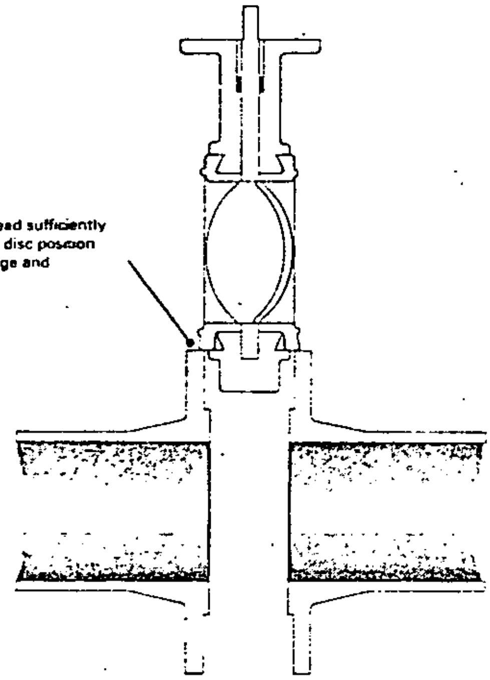
Valve in semi-open position to protect disc edge and reduce rubber interference during installation and start up, this helps reduce initial torque build up.



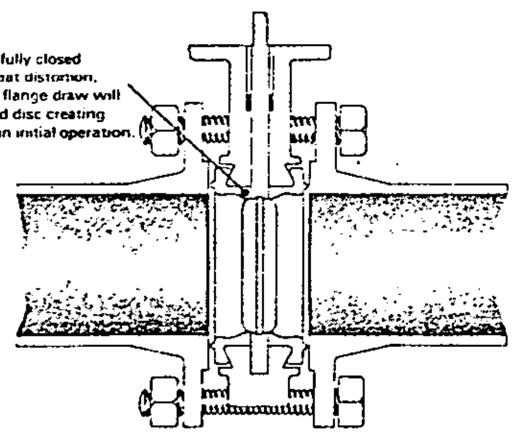
Disc should be turned to full open position after flange alignment and before evenly pulling up flange bolts.

Do not use gaskets

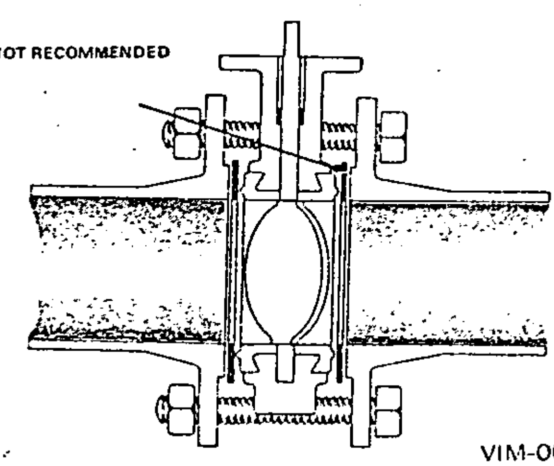
IMPROPER TECHNIQUES



Pipework not spread sufficiently could tear rubber, disc position open will foul flange and score disc edge.



Disc as shown in fully closed position causes seat distortion, then subjected to flange draw will close rubber round disc creating excessive torque in initial operation.



GASKETS NOT RECOMMENDED

KEYSTONE VALVE (EUROPA) B.V.

BREDA, THE NETHERLANDS

INSTALLATION AND MAINTENANCE INSTRUCTIONS

FIGURE 9 BUTTERFLY VALVE

Flange and Pipe Compatability. Fig. 9 valve is designed for use with the most common DIN and ANSI Flange standards, as specified by the purchaser.
Valves produced to meet installation requirements of one standard may not be suitable with another standard.
Flanges have to meet following requirements:

— The mating inside diameter should be:
  minimum : The valve Q-Dimension + adequate disc clearance.
  maximum : The outside diameter (OD) of standard pipe for the nominal size (Iso-recommendation R336).

— If the flange (or pipe) is provided with a raised face, the diameter of this shall be at least 10 mm larger than the YY-dimension of the valve.

— The bolt pattern shall allow centering of the valve in the line either by the inscribed circle of the bolts touching the body-OD or by drilled holes in the lugs of the larger valves.

— The bolt-pattern must clear the hubs of the valve.
  The use of the flange-gaskets should be avoided since it might damage the valve. The Keystone seat-face design eliminates the need for gaskets.

Installation in the Pipe-Line (Information)
Fig. 9 valve will control flow equally in either direction.
The recommended installation-position is the shaft horizontal and the lower disc-edge opening downstream. (Especially for slurry service and media with a tendency for sedimentation).
A valve is no crow-bar. Do not use the valve to spread the flanges. Seatdamage during installation or in operation might be the result.
Do not use flange-gaskets!
The valve can be installed in the pipe-line either with or without the actuator mounted on top of the valve. Make sure that you can turn the disc by hand so you can feel a mismatch, resulting in a disc touching the adjacent piping.

Installation in the Pipe-Line (Procedure).
In an existing system.

1. Check whether the flange distance meets the valve face-to-face dimension. Spread with adequate tooling the flanges for easy insertion of the valve.
2. Insert some flange-bolts in the flanges, to help you bear the valve after insertion.
3. Close the valve, so far, that the disc-edge is at least 10 mm within the body.
4. Insert the valve between the flanges, center the valve body and insert all flange-bolts.
5. Open the valve completely. (The disc is in line with the paralell flats or keyway in the stem).
6. Maintain the valve to flange alignment while gradually removing the flange-spreaders and tightening the flange-bolts handtight.
7. Slowly close the valve clockwise to check for adequate disc clearance.
8. Return the disc to full open position and cross-tighten all bolting to the proper torque.

In new systems.

1. With the disc in near-closed position center each mating flange with the valve body. Span the body with some flange-bolts and tighten the bolts.
2. Use the flange-valve-flange assembly for fit-up and centering to the pipe.
3. Tack-weld the flanges to the pipe.
4. Remove the bolting and the valve from between the flanges.
   Important: Do not finish-weld the flanges to the pipe with the valve bolted between the flanges as this will result in serious heat-damage to the seat.
5. Finish-weld the flanges to the pipe and allow the flanges to cool completely.
6. Install the valve now according to the procedure for installing in existing systems.

Maintenance.
Routine maintenance or lubrication is not required

Removing the valve from the pipe-line.

1. Turn the disc to nearly closed position (The disc is in line with the paralell flats or keyway in the stem).
2. Loosen all flange bolts and remove the bolts which prevent removing the valve.
3. Spread the flanges with adequate tooling, and remove the valve.

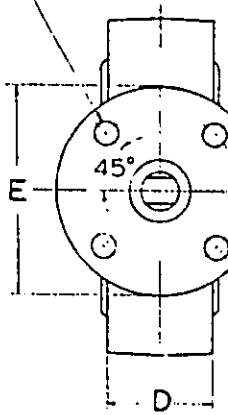
Valve disassembly.

1. Turn the disc to almost open position.
2. Remove actuator.
3. Remove the two body-screws.
4. Remove the lower part of the body. This is more or less held by the seat dove-tail. Use two screwdrivers in the body-splits to separate them and pull the bottom-part off with a twisting motion.
5. Pull the disc-stem and seat out of the body toppart.
6. Remove bushing and packing from the body toppart.
7. To remove the disc-stem from the seat, deform the seat into a long „oval" sufficient to clear the end of the short stem, move the short stem-end out of the seat-bore, and pull the long end from the seat stem hole, using a twisting motion.

Note: If you have complaints to make, mention the serial number on the valve tag-plate.

Valve assembly.

1. Clean all parts. If possible use silicone-oil on the disc-stem to facilitate assembly. If the valve has to be provided with a teflon-seat preheat this seat during half an hour in nearly boiling water to ease assembly.
2. Insert the long stem-end of the disc-stem into a seat stem-hole using a twisting motion.
3. Deform the seat into a long „oval" sufficient to clear the end of the short stem. With the disc-stem simulating an open position, move the short stem-end into the elongated seat-bore and assemble the short stem-end into the other seat stem-hole by releasing the distorted seat.
4. Push the long stem-end of the disc-stem/seat unit into the body toppart. Push the seat dove-tail in place.
5. Assemble the packing and bushing.
6. Assemble the bottom part of the body. Over one body split a little rectangular is casted which indicates in which position the bottom part has to be mounted. Install the body screws and tighten securely. Take care that body parts are aligned completely.



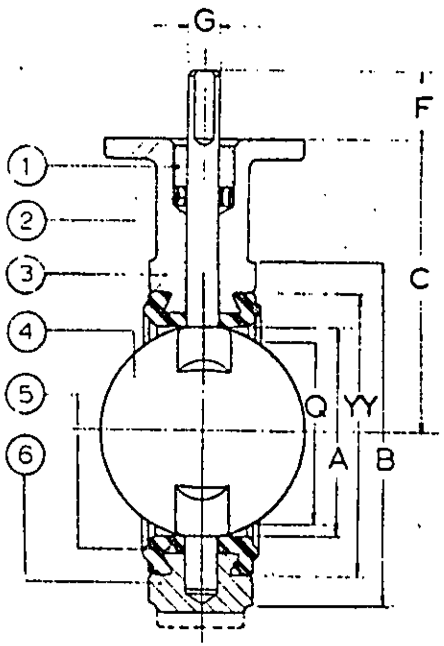
VALVE DIMENSIONS

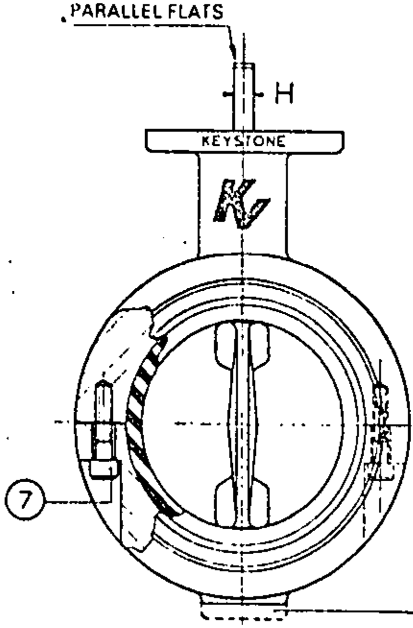
VALVE SIZE mm	VALVE SIZE inch	SHAFT DIAM. mm	SHAFT DIAM. inch	A	B	C	D	YY	Q	WEIGHT kg	E	F	G mm	G inch	H mm	H inch	BOLT CIRCLE	NO HOLES	HOLE DIAM.
50	2	14,3	9/16	51	109	108	41	86	33	3.0	102	32	14,3	9/16	9.5	3/8	82	4	11
65	2 1/2	14.3	9/16	64	129	122	44	97	48	3.5	102	32	14.3	9/16	9.5	3/8	82	4	11
80	3	14.3	9/16	76	144	132	44	113	64	4,0	102	32	14.3	9/16	9.5	3/8	82	4	11
100	4	15.9	5/8	102	164	152	51	144	90	5.5	102	32	15,9	5/8	11.1	7/16	82	4	11
125	5	19.0	3/4	127	194	152	53	167	117	7.2	102	32	19.0	3/4	12.7	1/2	82	4	11
150	6	19.0	3/4	148	220	173	53	195	138	8.5	102	32	19.0	3/4	12.7	1/2	82	4	11
200	8	22.2	7/8	197	275	211	64	262	188	16.0	162	32	22.2	7/8	15.9	5/8	127	4	14

ALL DIMENSIONS IN mm.

NO.	NAME
1	BUSHING
2	SHAFT SEAL
3	UPPER BODY
4	DISC STEM
5	SEAT
6	LOWER BODY
7	BODY SCREWS

SPECIFY SIZE, FIGURE NUMBER, PART NAME & MATERIAL WHEN ORDERING PARTS





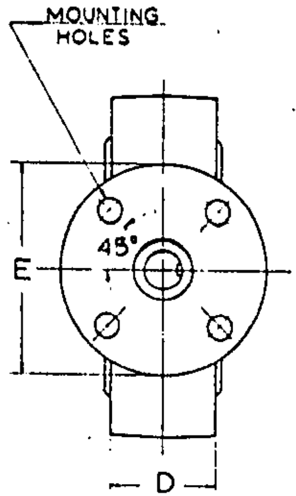
NOTES:

1. VALVE RATED AT 10 BAR PRESSURE DIFFERENTIAL IN THE CLOSED POSITION.
2. SUITABLE FOR MOUNTING BETWEEN DIN PN. 10 DRILLED FLANGES. (OTHER FLANGES ON REQUEST)
3. "Q" IS THE DISC CHORDAL DIMENSION AT FACE OF VALVE, FOR DISC CLEARANCE INTO PIPE, FITTING OR EQUIPMENT.
4. TOP-PLATE MOUNTING FOR HANDLE THROTTLE PLATES, KEYSTONE GEAR OPERATORS, OR POWER ACTUATORS.
5. ON PIECE DISC-STEM REQUIRES TWO PIECE BOLTED BODY.

50-200 mm FIG. 9
RUBBER SEATED
STANDARD PATTERN

KEYSTONE

009 01/4

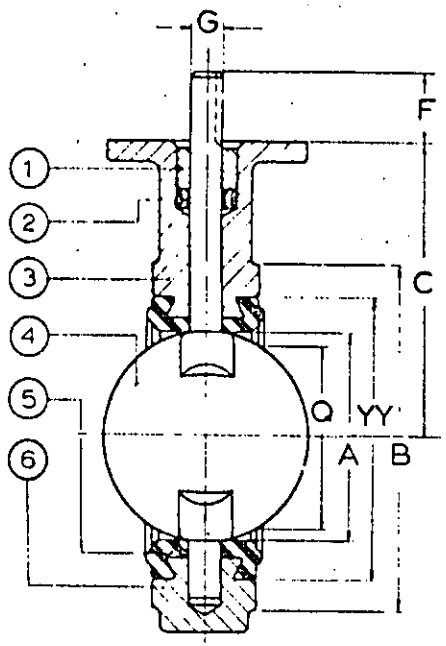


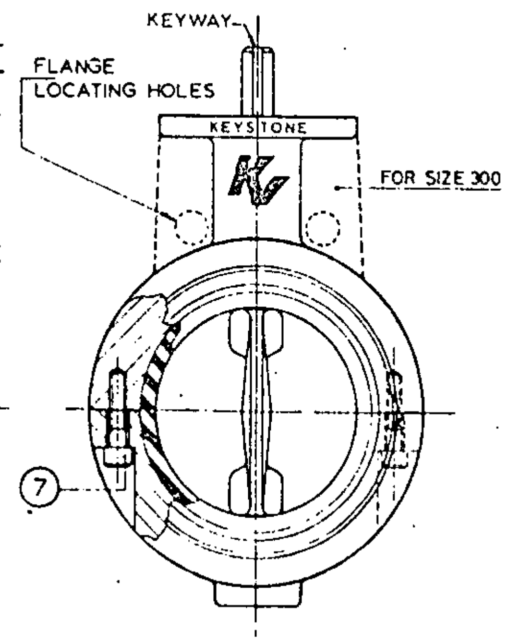
VALVE DIMENSIONS																		
SHAFT DIAM		VALVE SIZE		A	B	C	D	YY	Q	WEIGHT kg	E	F	G		KEY-SIZE		BOLT CIRCLE	NO. HOLES	HOLE DIAM
mm	inch	mm	inch										mm	inch	mm	inch			
250	10	28,6	$1\frac{1}{8}$	248	330	229	64	303	241	20,5	152	32	28,6	$1\frac{1}{8}$	6,4x6,4	$\frac{1}{4}$x$\frac{1}{4}$	127	4	14
300	12	28,6	$1\frac{1}{8}$	298	377	308	76	352	290	31,0	162	51	28,6	$1\frac{1}{8}$	6,4x6,4	$\frac{1}{4}$x$\frac{1}{4}$	127	4	14

ALL DIMENSIONS IN mm.

NO.	NAME
1	BUSHING
2	SHAFT SEAL
3	UPPER BODY
4	DISC-STEM
5	SEAT
6	LOWER BODY
7	BODY SCREWS

SPECIFY SIZE, FIGURE NUMBER, PART NAME & MATERIAL WHEN ORDERING PARTS.





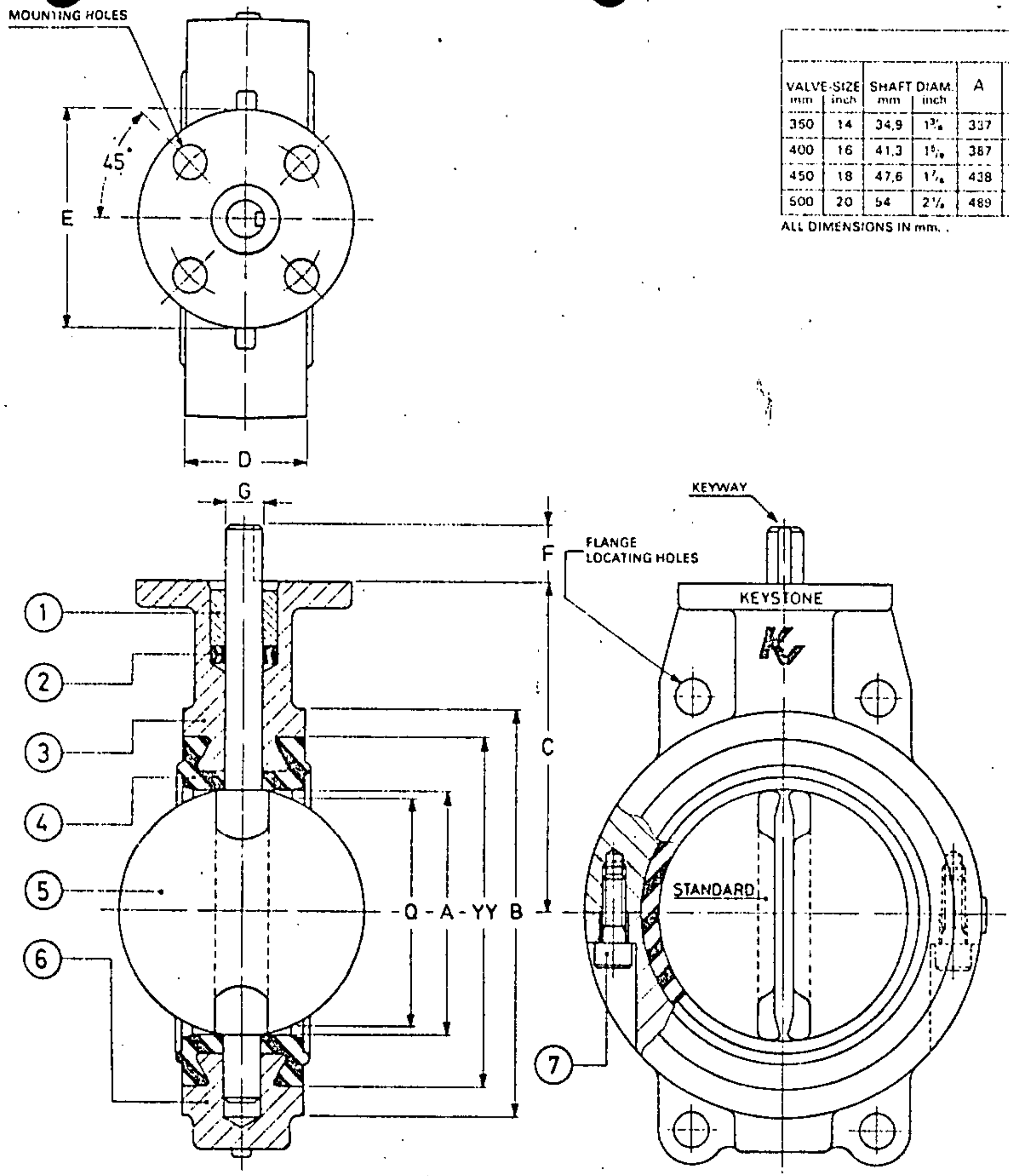
NOTES:

1. VALVE RATED AT 10 BAR PRESSURE DIFFERENTIAL IN THE CLOSED POSITION.
2. SUITABLE FOR MOUNTING BETWEEN DIN PN. 10 DRILLED FLANGES (OTHER FLANGES ON REQUEST)
3. "Q" IS THE DISC CHORDAL DIMENSION AT FACE OF VALVE, FOR DISC CLEARANCE INTO PIPE, FITTING OR EQUIPMENT.
4. TOP-PLATE MOUNTING FOR HANDLE THROTTLE PLATES, KEYSTONE GEAR OPERATORS, OR POWER ACTUATORS.
5. ON PIECE DISC-STEM REQUIRES TWO PIECE BOLTED BODY.

250-300 mm FIG. 9
RUBBER SEATED
STANDARD PATTERN

KEYSTONE

009-02/2



VALVE DIMENSIONS																			
VALVE-SIZE mm	VALVE-SIZE inch	SHAFT DIAM. mm	SHAFT DIAM. inch	A	B	C	D	YY	Q	WEIGHT kg	E	F	G mm	G mm	KEY-SIZE mm	KEY-SIZE inch	BOLT CIRCLE	NO. HOLES	HOLE DIAM.
350	14	34,9	1 3/8	337	429	305	76	402	328	40,0	152	51	28,6	1 1/8	6,4x6,4	1/4 x 1/4	127	4	14
400	16	41,3	1 5/8	387	489	329	102	462	373	56.0	152	51	41,3	1 5/8	12,7x9,5	1/2 x 3/8	127	4	14
450	18	47,6	1 7/8	438	546	368	108	519	424	92 0	203	57	47,6	1 7/8	12,7x9,5	1/2 x 3/8	165	4	21
500	20	54	2 1/8	489	600	403	127	573	473	112,0	203	57	47,6	1 7/8	12,7x9,5	1/2 x 3/8	165	4	21

ALL DIMENSIONS IN mm.

NO.	NAME
1	BUSHING
2	SHAFT SEAL
3	UPPER BODY
4	SEAT
5	DISC STEM
6	LOWER BODY
7	BODY SCREWS

SPECIFY SIZE, FIGURE NUMBER, PART NAME & MATERIAL WHEN ORDERING PARTS.

NOTES:

1. VALVE RATED AT 10 BAR PRESSURE DIFFERENTIAL IN THE CLOSED POSITION.
2. SUITABLE FOR MOUNTING BETWEEN DIN PN. 10 DRILLED FLANGES. (OTHER FLANGES ON REQUEST).
3. "Q" IS THE DISC CHORDAL DIMENSION AT FACE OF VALVE, FOR DISC CLEARANCE INTO PIPE, FITTING OR EQUIPMENT.
4. TOP PLATE MOUNTING FOR HANDLE THROTTLE PLATES, KEYSTONE GEAR OPERATORS, OR POWER ACTUATORS.
5. ON PIECE DISC-STEM REQUIRES TWO PIECE BOLTED BODY.
6. DOTTED LINE INDICATES DISC-STEM OF DUCTILE IRON AND STAINLESS STEEL.

350-500 mm FIG. 9
RUBBER SEATED
STANDARD PATTERN

KEYSTONE

009-03/5

KEYSTONE

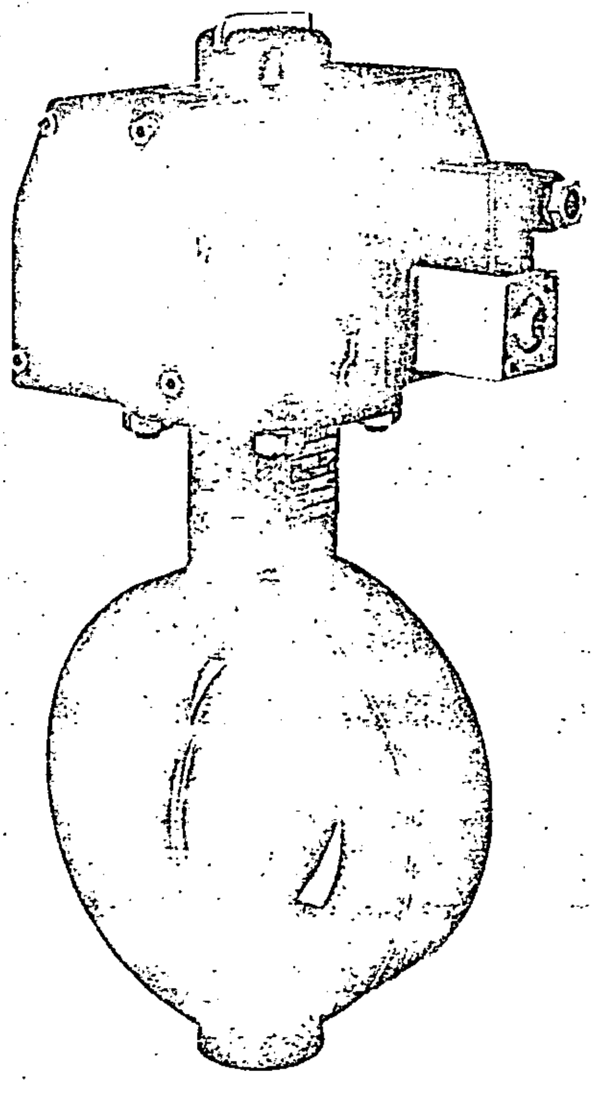
TYPE: Compact pneumatic rotary actuator set for 90° rotation.

RATING: Maximum pressure up to 9 bars.

RANGE: Operating pressure range: Air to air 1.5-8.0 bars
Spring to air 4.0-8.0 bars.

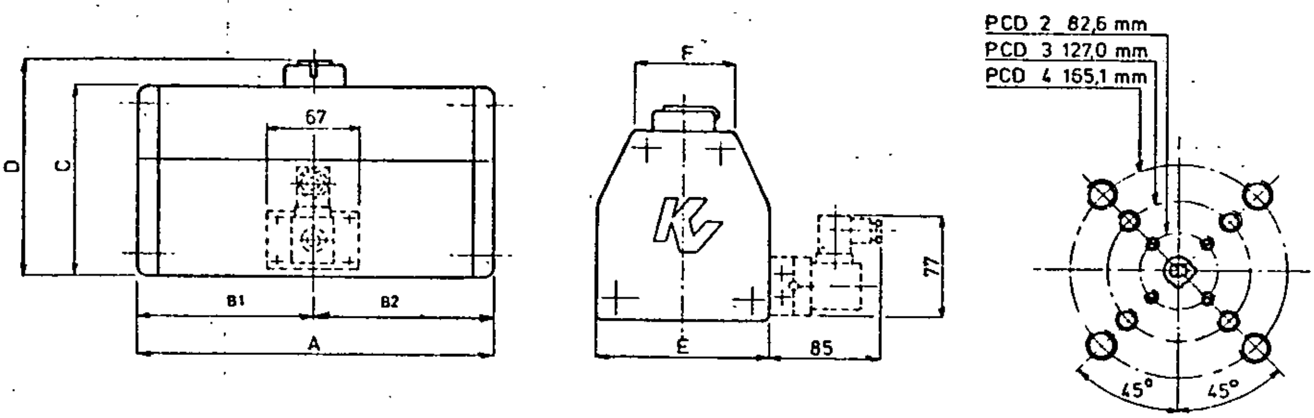
GENERAL APPLICATION: Specially designed for direct mounting on Keystone Butterfly Valves to ensure reliable remote operation under the most severe working conditions. Also suitable for remote control of other quarter turn devices.

FIGURE 790 PNEUMATIC ACTUATORS



FEATURES:

- **RACK AND PINION** system guarantees a constant output torque during a complete valve cycle thus making it more suitable for throttling control applications. Type 790-100 and 790-140 have scotch yoke mechanism.
- **HOUSING** is deep black hard-anodized aluminium making the actuators suitable for corrosive surroundings, including salt spray environments.
- **ACETAL LUBRICATED** output shaft supports. Bearings provide longer life with a minimum of maintenance.
- **Because of the simple piston drive concept,** this actuator requires less dynamic seals in operation than the more popular types currently available. This means less chance for air leakage.
- **DIRECT MOUNTING** to Keystone butterfly valves eliminates specially made adaptations and guarantees proper alignment with the valve-stem. This reduces assembly time and possible damage through bad installation.
- **NO EXTERNAL PIPING.**
- **UNIQUE MANUAL OVERRIDE** system for emergency operation has been built into the position indicator knob.
- **Available in two basic models.**
  — air to air operation
  — air to spring operation.
- **STANDARD** Keystone accessories available as easy build on modules without special brackets
  — 4-Way Solenoid valve
  — Limitswitch box
  — Positioner



ACTUATED DIMENSIONS IN MM										
Action	Type	A	B1	B2	C	D	E	F	Weight kg	Suitable for valve size mm
Air	790-003	133	89	45	103	125	86	52	2,5	40-100
to	790-006	178	89	89	103	125	86	52	3,0	40-100
Air	790-012	218	109	109	127	147	111	83	6,0	65-150
	790-018	216	142	74	175	196	152	89	9,3	65-300
	790-036	284	142	142	175	196	152	89	13,0	65-300
	790-070	401	263	138	216	239	203	114	26,0	200-600
	790-140	526	263	263	216	239	203	114	35,0	200-600
	790-280									
Air	790-003S	210	165	45	103	125	86	52	4,0	40-100
	790-006S	330	165	165	103	125	86	52	6,1	40-100
Spring	790-012S	388	194	194	127	147	111	83	11,5	65-150
	790-018S	305	231	74	175	196	152	89	14,8	65-300
	790-036S	462	231	231	175	196	152	89	25,5	65-300
	790-070S	604	466	138	216	239	203	114	42,0	200-600
	790-140S	932	466	466	216	239	203	114	67,0	200-600
	790-280S									

RATED OUTPUT TORQUES IN NM						
	AIRSUPPLY IN BAR					
Type	3	4	5	6	7	8
790-003	18	25	31	37	43	49
790-006	37	49	62	74	86	98
790-012	74	98	123	148	172	197
790-018	108	142	179	215	258	290
790-036	221	295	369	443	516	590
790-070	400	525	666	799	864	929
790-140	861	1148	1435	1722	1894	2022
790-280						
790-003S			14	17	24	30
790-006S			29	35	48	61
790-012S			58	70	96	122
790-018S			85	102	145	178
790-036S			174	209	289	355
790-070S			420	504	671	830
790-140S			897	[illegible]	1152	[illegible]
790-280S						

Start

End

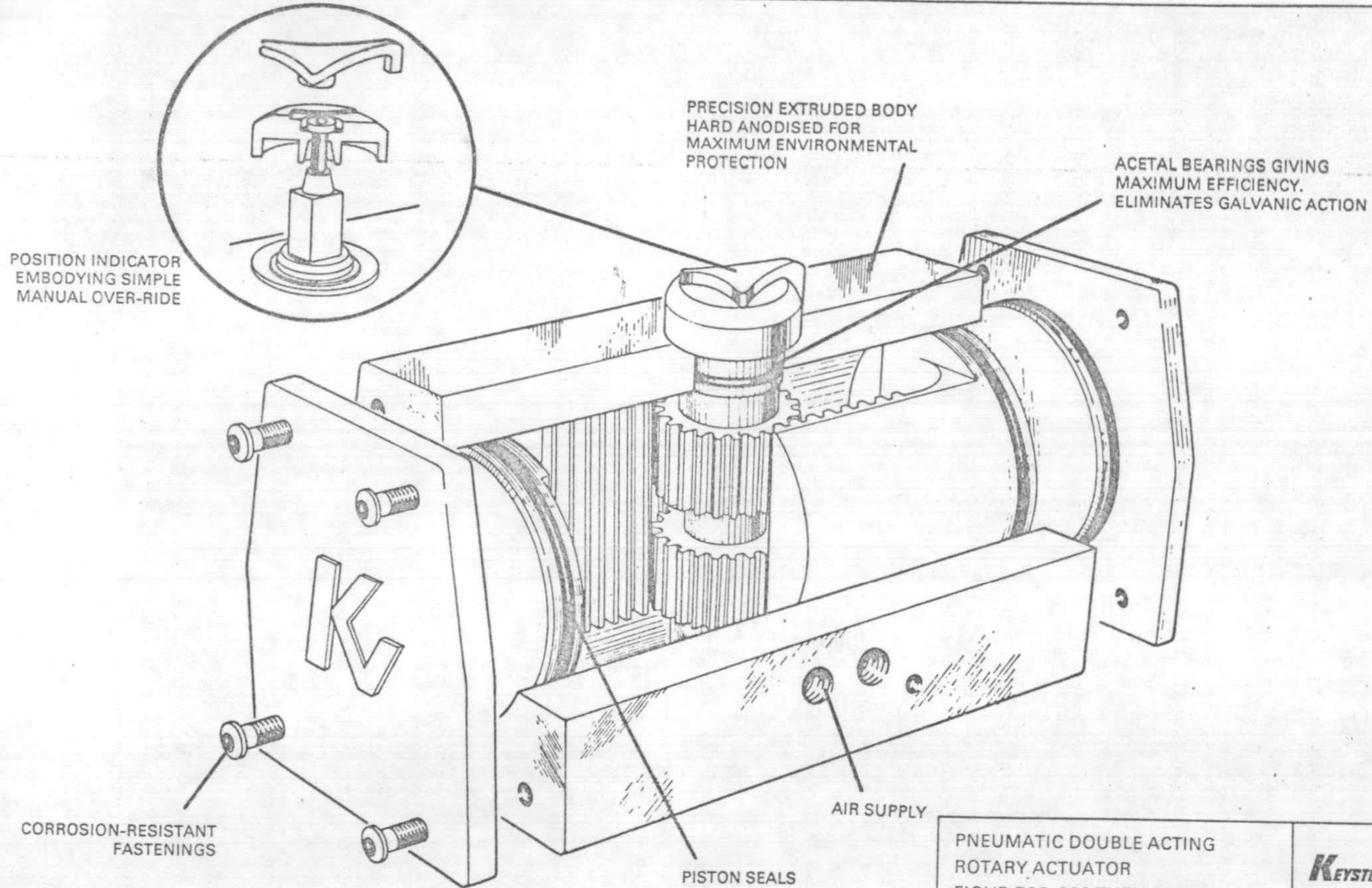
ACTUATION MOUNTING FLANGE			
Actuator	Shafthole	Mounting flange	Bolts
790-003 (S)	19,0 x 12,7 (Flats)	2	4 x M10
790-006 (S)	19,0 x 12,7 (Flats)	2	4 x M10
790-012 (S)	19,0 x 12,7 (Flats)	2	4 x M10
790-018 (S)	ø 28,6 (Key)	2+3	4 x M10/4 x M12
790-036 (S)	ø 28,6 (Key)	2+3	4 x M10/4 x M12
790-070 (S)	ø 47,6 und ø 57,3 (Key)	3+4	4 x M12/4 x M16
790-140 (S)	ø 47,6 und ø 57,3 (Key)	3+4	4 x M12/4 x M16

Notes:
1) Standard spring 80
2) The rated output torques include a safety factor.

Figure 790 – Pneumatic Actuator

Keystone datasheet 790-010

May change without notice.

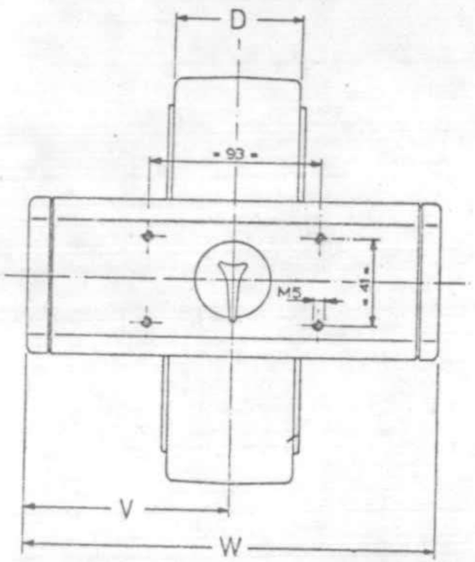


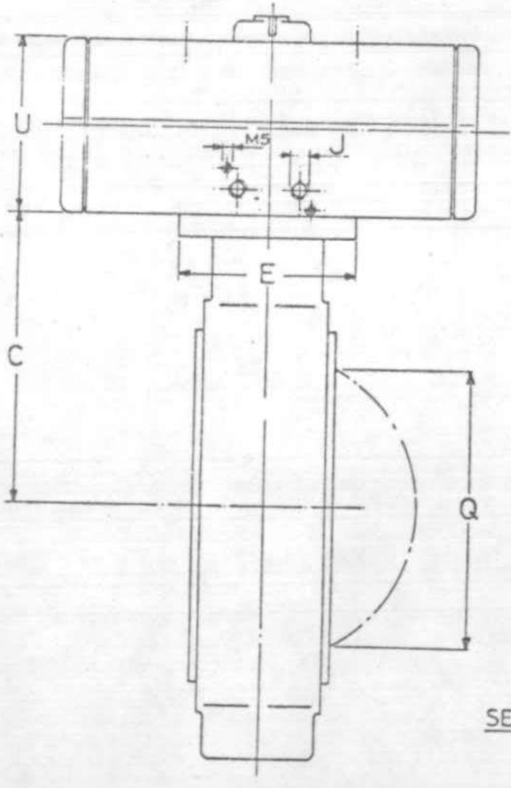
PNEUMATIC DOUBLE ACTING
ROTARY ACTUATOR
FIGUR 790-003 THRU 790-036

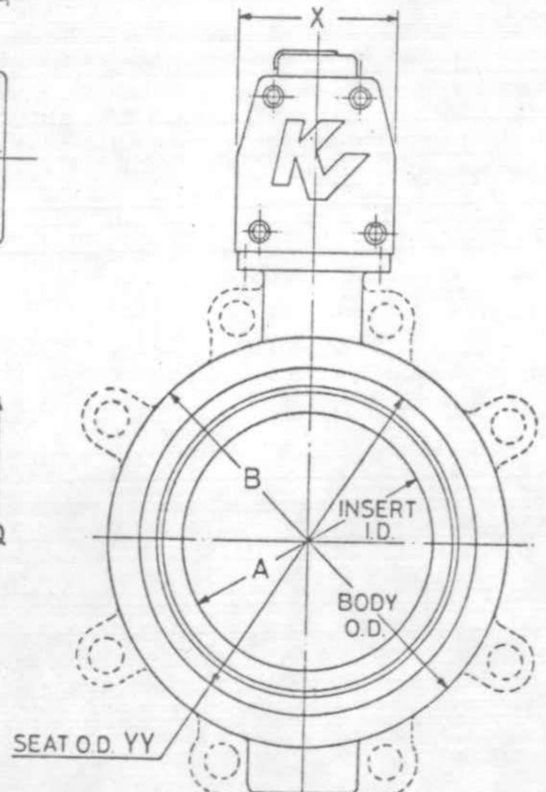
KEYSTONE

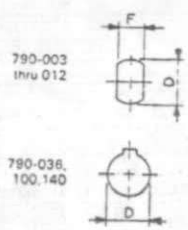
790-11/2

International patents applied for.









ACTUATOR OUTPUT SHAFTBORE

ACTUATOR TYPE	D DIA		F FLAT	
FIG. 790	mm	inch	mm	inch
003/006/ 012	19,0	¾	12,7	½
036*	28,6	1⅛	—	—
100** 140**	47,6	1⅞	—	—
100*** 140***	57,3	2¼	—	—

* KEYSIZE 6,4 x 6,4 (¼" x ¼")
** KEYSIZE 12,7 x 9,5 (½" x ⅜") FOR 200, 250, 300, 350, 450, 500 mm
*** KEYSIZE 12,7 x 9,5 (½" x ⅜") ONLY FOR 400 mm.

AVAILABLE ACCESSOIRES:
1. LIMIT SWITCHBOX
2. SOLENOID VALVE
3. POSITION

VALVE DIMENSIONS — FIG. 9, 10 & 12

VALVE-SIZE mm	VALVE-SIZE inch	A	B	C	D	E	YY	Q	WEIGHT kg FIG. 9	WEIGHT kg FIG. 12
25	1	30	62	79	29	57	50	10	0,7	—
40	1½	44	82	94	30	57	67	30	1,1	—
50	2	51	109	108	41	102	86	33	3,0	3,5
65	2½	64	129	122	44	102	97	48	3,5	4,4
80	3	76	144	132	44	102	113	64	4,0	4,8
100	4	102	164	152	51	102	144	90	5,5	7,8
125	5	127	194	152	53	102	167	117	7,2	9,7
150	6	146	220	173	53	102	195	138	8,5	11,4
200	8	197	275	211	64	152	252	188	15,0	19,4
250	10	248	330	229	64	152	303	241	20,5	27,0
300	12	298	377	308	76	152	352	290	31,0	40,0
350	14	337	429	305	76	152	402	328	40,0	50,0
400	16	387	489	329	102	152	462	373	56,0	81,0
450	18	438	546	368	108	203	519	424	92,0	101,0
500	20	489	600	403	127	203	573	473	112,0	154,0

ALL DIMENSIONS IN mm.

ACTUATOR DIMENSIONS

ACTUATOR	VALVE SIZE RANGE mm	VALVE SIZE RANGE inch	OUTPUT AT 6 BAR IN Nm	J bsp	U	V	W	X	WEIGHT kg.
790-003	25- 50	1-2	38	¼"	104	89	135	86	2,5
790-006	65-100	2½-4	75	¼"	104	89	178	86	3,0
790-012	125-150	5-6	150	¼"	127	109	218	112	6,0
790-036	125-300	5-12	450	¼"	175	141	282	152	13,0
790-100	200-400	8-16	950	¼"	216	243	411	203	28,0
790-140	200-500	8-20	1950	¼"	216	288	577	203	44,5

ALL DIMENSIONS IN mm.

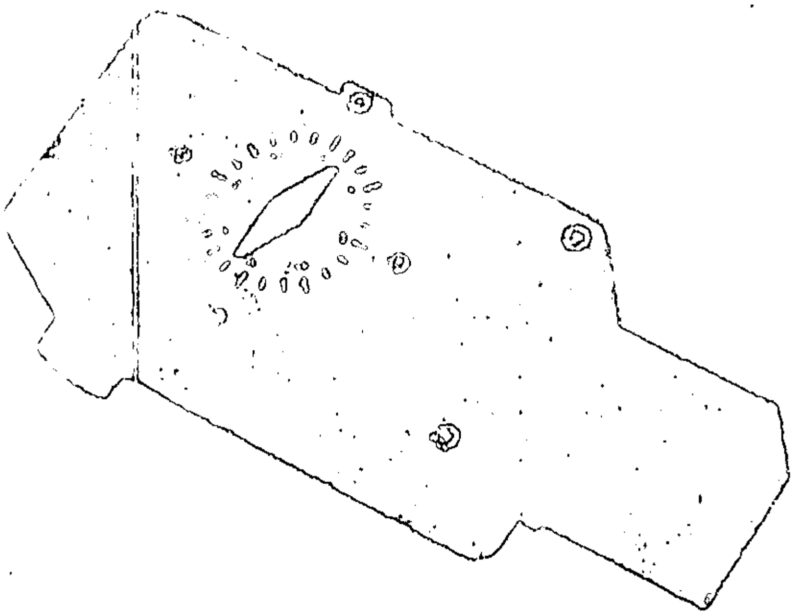
NOTES:
1. STANDARD ACTUATOR MOUNTING AS SHOWN.
2. ACTUATOR RATING: 1,5 BAR - 8,0 BAR AT —40°C TO 80°C.
3. 90° OPERATION PROVIDED.
4. FIG. 9 - 10 & 12 RATED AT 10 BAR PRESSURE DIFFERENTIAL IN THE CLOSED POSITION.
5. BROKEN OUTLINE DENOTES FIG. 12 BODY WITH TAPPED LUGS.
6. "Q" IS THE DISC CHORDAL DIMENSION AT FACE OF VALVE FOR DISC CLEARANCE INTO PIPE FITTING OR EQUIPMENT.
7. MOUNTING FIG. 790-003 ON 25-40 mm USE SPECIAL ADAPTERPLATE DIMENSION NOT INDICATED.

FIG. 790 DOUBLE ACTING PNEUMATIC ROTARY ACTUATOR FOR RUBBER SEATED VALVES

KEYSTONE

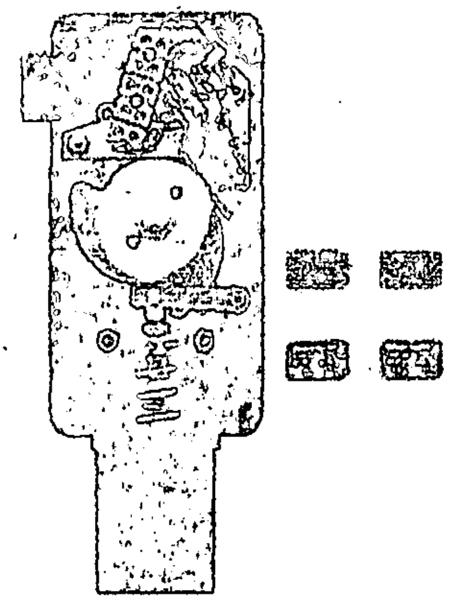
790-01/5

KEYSTONE controls



Operating and Setting Instructions
Rotary Pneumatic Positioner

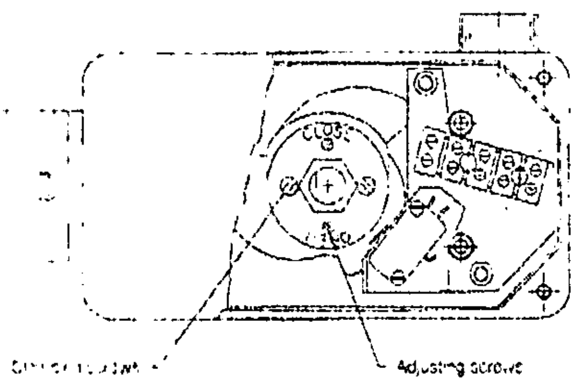
Pneumatic positioner Figure 793



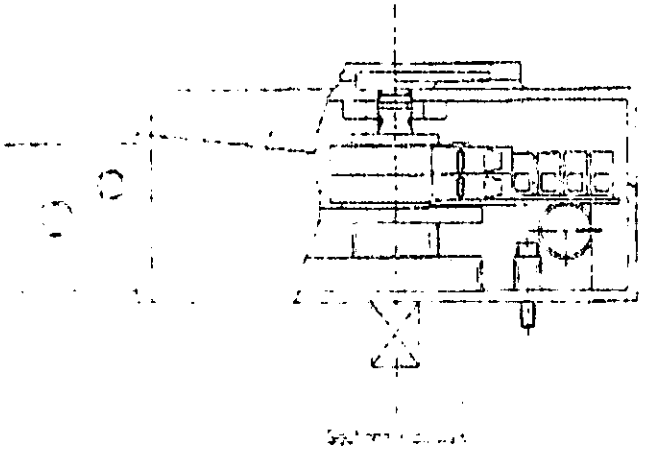
Static performance

Hysteresis	:	< 1,5%
Repeatability	:	< 0,5%
Linearity	:	< 1,0%
Supply Pressure Effect		Minimal
Sensitivity	:	< 1,0%
Power Amplification		2 5% deviation gives full differentia
Air Consumption	:	0,6 cfm 916 99 'm) at balance with 60 PSIG (4 bar) supply
	:	1 2 seconds per 100 cubic in. (1 64 Litres) of Actuator Displacement
Weight		4 lb (1,85 kg)
Supply Pressure		30-120 psig (150 psig max.) 2-8 25 bar g (10 bar g max.)
Signal Ranges	:	3-15 psi (0,2 to 1,0 bar) over 90° movement - CAM 1 3-15 psi (0.2 to 1,0 bar) over 65° movement - CAM 2 3-9 psi (0.2 to 0.6 bar) OR 9-15 psi (0,6 to 1,0 bar) over 65° movement - CAM 3 CAM Characteristics - Linear (other available on request)
Temperature Range	:	-20°C to +70°C

IP65 rated when switches enclosed.



Sectional plan view



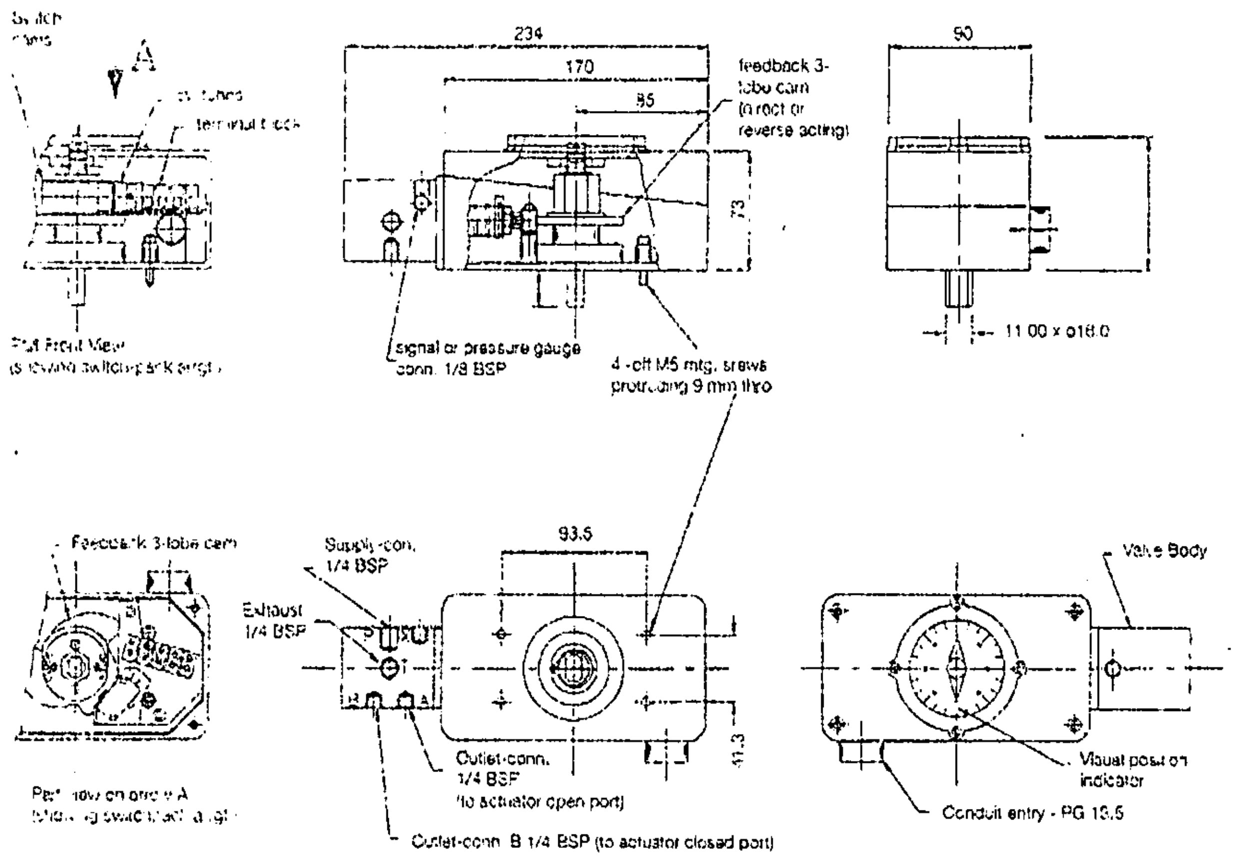
Retrofit procedure

1. Remove positioner cover.
2. Remove circlip from top of camshaft
3. Remove spacer from camshaft.
4. Fit cam assembly onto hexagon camshaft with adjusting and clamping screws towards the outboard end
   Note: The assembly has been made with a tight fit onto the hexagon shaft in order to eliminate any backlash. It may be necessary to drive the assembly over the shaft. To do this, use the original spacer as a drift and rive the assembly over the shaft using a light hammer.
5. Fit the microswitch/terminal plate as shown using the two M5 hexagon socket cap screws.
6. Set the cams in accordance with the procedure
7. Re fit the cover.

Cam setting procedure

1. Release both clamping screws by turning each screw approximately 1,5 turns anti-clockwise.
2. Operate positioner/actuator to close position.
3. Adjust "CLOSE" adjusting screw by turning clockwise until lower cam just triggers the lower switch.
4. Operate positioner to open position
5. Adjust "OPEN" adjusting screw by turning anti-clockwise until upper cam just triggers the upper switch
6. Tighten both clamping screws to lock the cams in the set position.
7. Operate the positioner/actuator open and closed to check the cam operation and re-adjust if necessary

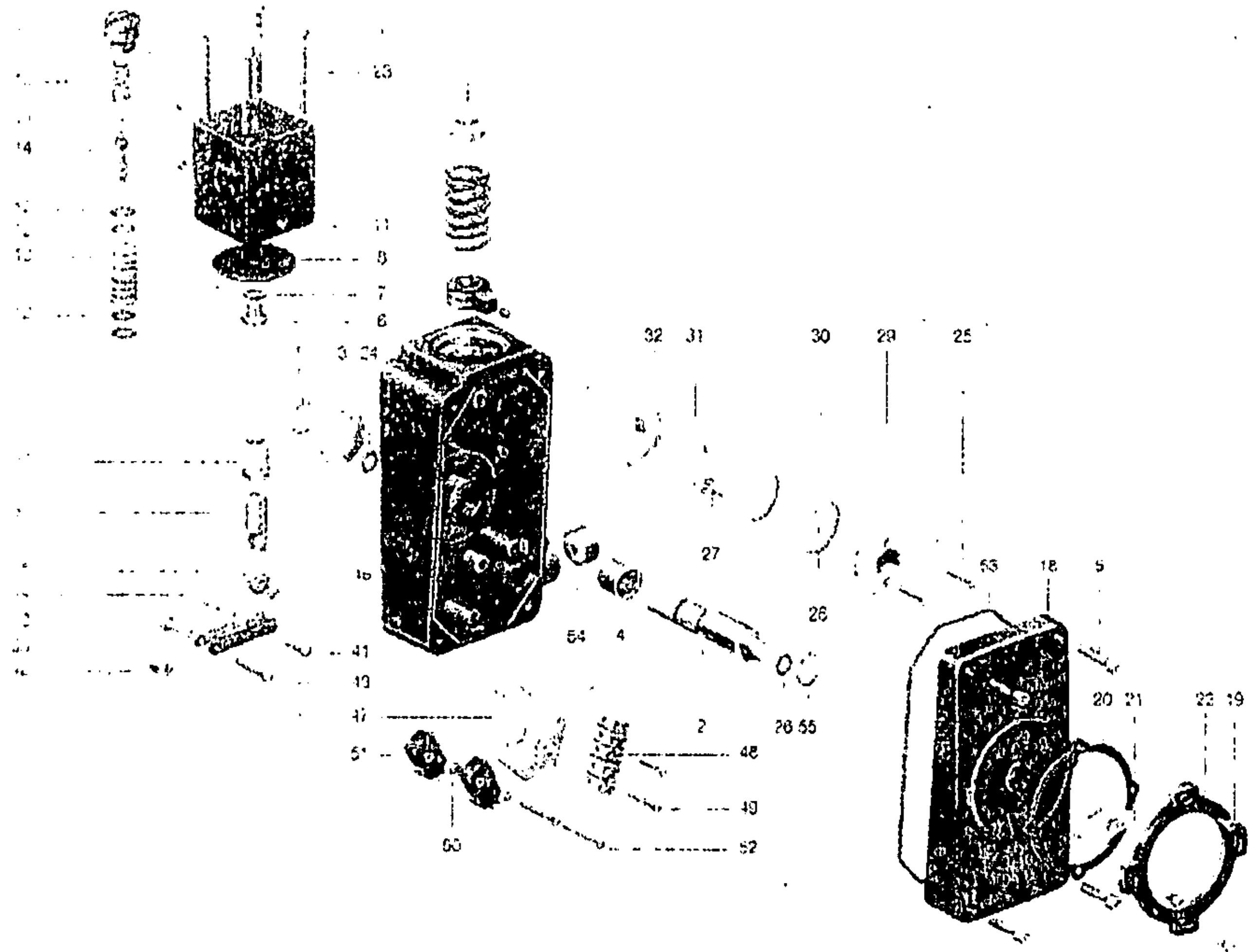
Pneumatic positioner Figure 793



Designation of connections: A & B - Working Lines P - Compressed Air Connection T- Exhaust Point X - Control Line

Input signal	single range	3 - 15 psi (0.2 - 1.0 bar) standard
	split range	3 - 9 psi (0.2 - 0.6 bar) 9 - 15 psi (0.6 - 1.0 bar).
	cam characteristics	linear
	3 - lobe cam	curve 1, range: 3 - 15 psi = 90° movement.
		curve 2, range: 3 - 9 psi or 9 - 15 psi = 65° movement.
		curve 3, range. 3 - 15 psi = 65° movement.
		other characteristics on request.
Supply	media	compressed air or gas, dry, dust and oil free with 5 filter element to inlet.
	supply pressure	30 - 100 psi (150 psi max.) 2 - 8 bar (10 bar max.)
	air consumption	0.6 cfm in balanced condition with 60 psi (4 bar) supply.
Environmental mounting and connections	environmental temperature	-5° to +160°F (-20° to +70°C).
	mounting position	as required. No limitations.
	mounting kit	universal mounting kit for Fig 790/798 series actuators.
	air connections	supply and output 1/4" BSP, signal 1/8" BSP
Materials of construction	housing	anodised aluminium alloy (stainless steel optional).
	diaphragm	nitrile rubber
	valve spool	stainless steel
	cover	anodised aluminium alloy (stainless steel optional).
Weight		1.85kg (4 lb.)
Options	gauges	instrument air 0 - 30 psi (0 - 2 bar) - 1 off.
		supply air 0 - 150 psi (0 - 8 bar) - 2 off
	integral limit switches	single pole double throw 10A 240V AC
		inductive proximity sensors type NT2-V3-N.

Pneumatic positioner figure 793



[illegible]	Circlip	1	Spring steel	30	Cam	2	Nylon-minlon
[illegible]	Shaft	1	Stainless steel 303S21	31	Locking plate	1	Stainless steel 303S21
[illegible]	Washer	1	Stainless steel 303S21	32	Feedback cam	1	Glass reinforced acetal resin
[illegible]	Bearing needle roller	1	-	33	Body	1	Pressure die cast Aluminium LM24
5	Captive screw	9	Stainless steel A2				
6	Bolt diaphragm clamp	1	Stainless steel 303S21				
7	Washer	1	Acetal-black	34	Feedback spring	1	Stainless steel 302S25
[illegible]	Diaphragm	1	Neoprene	35	Screw grub	1	Stainless steel A2
[illegible]	Base cap feedback spring	1	Stainless steel 303S21	36	Feedback spring rate adjuster	1	Acetal
[illegible]	Pin-spool pivot	1	Stainless steel 302/303				
11	Valve body	1	Aluminium HE30	37	Adjuster-zero feedback spring	1	Stainless steel 303S21
[illegible]	O-ring	4	Nitrile				
13	Cartridge	1	Stainless steel	38	Locator-small bearing	1	Stainless steel 303S21
14	Spool	1	Stainless steel 303S21	39	Arm-feedback	1	Stainless steel 304S15
[illegible]	Locator-spool bias spring	1	Brass CZ121	40	Bush-feedback arm	1	Stainless steel 303S21
15	Spring-spool bias	1	Stainless steel 302S25	41	Pin-small bearing	1	Stainless steel 303S21
[illegible]	Endcap	1	Aluminium 201FC1	42	Spacer-support feedback arm	1	Acetal
[illegible]	Cover	1	Pressure die cast Aluminium LM24				
				43	Socket head cap screw	1	Stainless steel A2
18	Socket head cap screw	4	Stainless steel A2	44	Circlip	1	Spring steel
[illegible]	Gasket	1	Nitrile	45	Washer-small bearing	2	Nylon
[illegible]	Position indicator	1	Acetal-yellow	46	Bearing needle roller	1	-
[illegible]	Position indicator cover	1	Polycarbonate-black Acrylic insert	47	Switch mounting plate	1	Steel
				48	Terminal block	1	Bakelite
[illegible]	Socket head cap screw	4	Stainless steel A2	49	Screw pan head	2	Steel
[illegible]	O-ring	1	Nitrile	50	Spacer	2	Nylon
[illegible]	Pan head screw	2	Spring steel	51	Microswitch-V9 or V3	2	-
[illegible]	O ring	1	Steel	52	Screw pan head	2	Steel
[illegible]	Screw-adjustment close	1	Stainless steel A2	53	O-ring	1	Nitrile
28	Screw-adjustment open	1	Stainless steel A2	54	Plug	1	Steel
[illegible]	[illegible] sleeve	1	Nylon-minlon	55	Circlip	1	Spring steel

Pneumatic positioner Figure 793

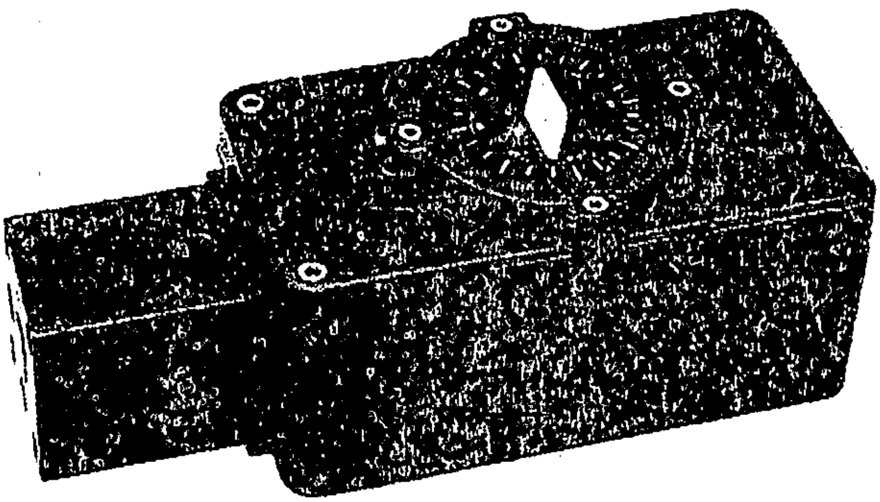
tyco
Flow Control

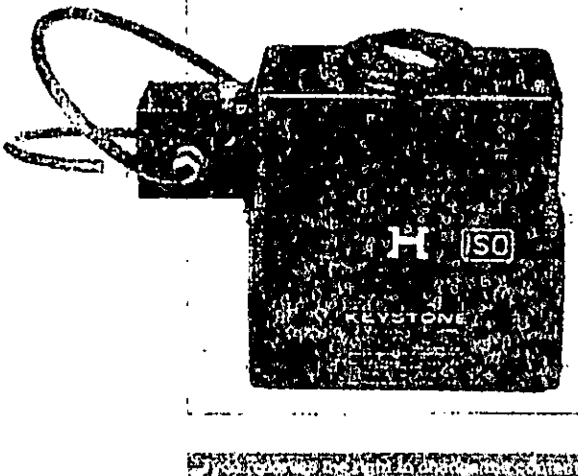
KEYSTONE

A pneumatic positioner with the unique option of either proximity or electric integral limitswitches. The positioner, in line with other of the Keystone accessories, is suitable for direct mounting to the range of pneumatic actuators.

Features

- Compact design - mounted directly and axially to the actuator stem, by means of standard kit
- Clockwise or counter-clockwise models.
- No external springs, all vulnerable parts completely enclosed.
- Highly visual local indication of actuator position
- Stable positioning characteristics are provided for both small and large actuators
- Good vibration resistant characteristics
- Action (direct or reverse) is easily reversed in the field by turning cam and reversing air connection.
- Feedback linear, via 3 lobe cam.
- Customised cam profiling is possible to give special characterisation.
- Span and zero adjustment
- Usable for double-acting or single-acting service
- Unaffected by normal supply pressure fluctuations



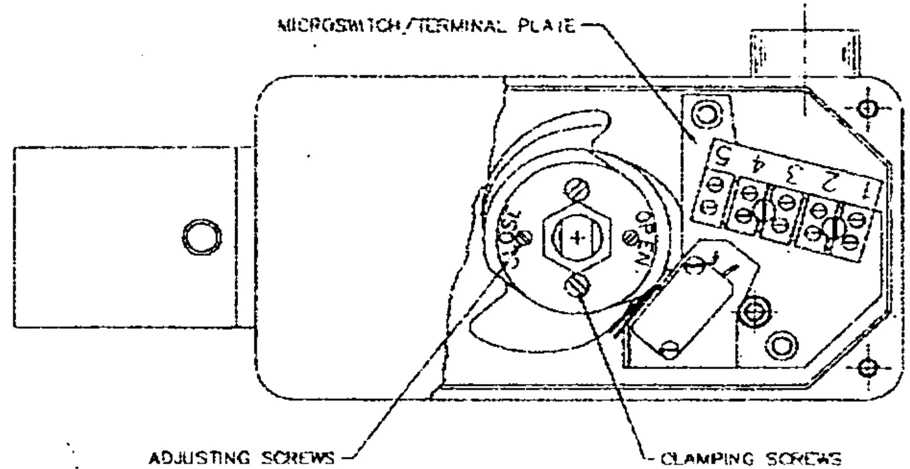


General application

The Keystone positioner is designed for the proportional operation of 1/4 turn rotary actuators, it is generally coupled axially to the shaft of the actuator, the indicator gives visual position of the final control element The action is based on a force balance principle.

Camsetting procedure

1.
Release both clamping screws by turning each screw approximately 1.5 turns anticlockwise
2.
Operate the positioner/actuator to the CLOSE position
3.
Adjust the CLOSE adjusting screw by turning it clockwise until the lower cam just operates the lower switch
4.
Operate the positioner to the OPEN position.
5
Adjust the OPEN adjusting screw by turning it anti clockwise until the upper cam just operates the upper switch
6.
Tighten both clamping screws to lock the cams in the set position
7.
Operate the positioner/actuator to both the OPEN and CLOSED positions, checking the cam operation, and re-adjust if necessary



SECTIONAL PLAN VIEW

Retrofit procedure

1. Remove positioner cover.
2. Remove circlip from top of camshaft
3. Remove spacer from camshaft.
4. Fit cam assembly onto hexagon camshaft with adjusting screws towards the outboard end.
   Note:- The assembly has been made with a tight fit onto the hexagon shaft in order to eliminate any backlash. It may be necessary to drive the assembly over the shaft. To do this, use the original spacer as a drift and drive the assembly over the shaft using a light hammer.
5. Fit the microswitch/terminal plate as shown, using the two M5 hexagon socket cap screws.
6. Set the cams in accordance with the procedure
7. Re-fit the cover.

Keystone reserves the right to change product designs and specifications without notice

Keystone/Tyco Valves & Controls, 91 Meiklewood Road, Drumoyne,
GLASGOW G51 4DU.
Tel: (0141) 810 3121. Fax. (0141) 810 4724. 10th Aug. 1998 (Rev 04)

A **tyco** INTERNATIONAL LTD. COMPANY

Mounting to Figure 799 and 756 series actuators

1

For standard direct action operation (increasing signal to open actuator), ensure that the actuator is in its CLOSED (fully clockwise) position and that the flats on top of the positioner shaft are at right angles to the longitudinal axis of the positioner.

For reverse action (increasing signal to close actuator), ensure that the actuator is in its OPEN (fully anti-clockwise) position and that the flats on top of the positioner shaft are parallel to the longitudinal axis of the positioner.

2

Fit the positioner to the top face of the actuator, using the correct mounting kit, so that the longitudinal axis of the positioner is parallel to the actuator cylinder axis.

3

Ensure that the feedback cam in the positioner is correctly fitted with the correct range profile bearing against the feedback arm roller.
(Positioners are stocked to suit 3-15 psig and direct action)

For direct action ensure that anti-clockwise rotation of the positioner shaft will cause the cam to compress the spring.

For reverse operation, ensure that clockwise rotation of the positioner shaft will cause the cam to compress the spring.

4

Connect the air ports as shown in Fig.1 for direct action and in Fig.2 for reverse action.

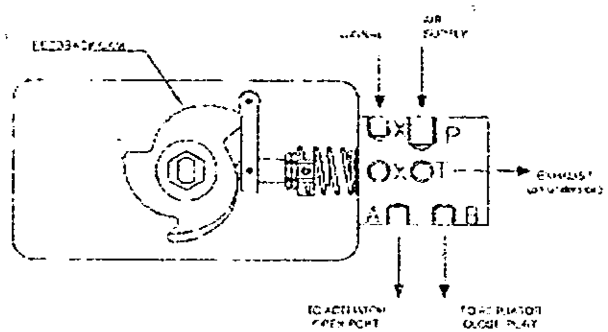


FIG.1 - Direct Operation

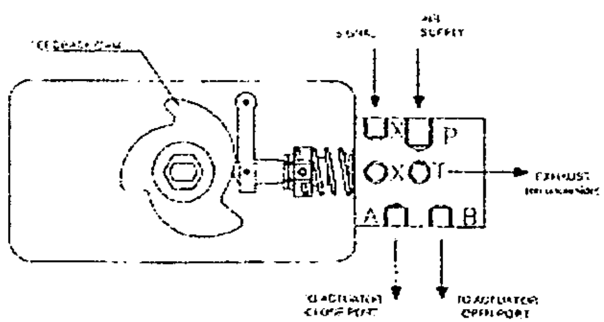


FIG. 2 - Reverse Operation

Setting procedure

In most cases the positioner will be pre-set prior to leaving the factory. If readjustment is necessary follow the following instructions.

1.

With the positioner correctly mounted to the actuator and cover removed, connect the air supply and signal to the positioner.

2.

Apply a signal of approximately 9 psig and gradually reduce this to 3 psig. If the actuator just reaches the CLOSED position as the signal reduces to 3 psig, no adjustment is necessary.

3.

If the actuator does not close fully at 3 psig, turn the hexagon zero adjusting nut 1/6 of a turn clockwise and repeat step 2. Continue until zero is correctly achieved.

4.

If the actuator reaches the CLOSED position before the signal reduces to 3 psig, turn the hexagon zero adjusting nut 1/6 of a turn anti-clockwise and repeat step 2. Continue until zero is correctly achieved.

5.

Gradually increase the signal to 15 psig. If the actuator just reaches the OPEN position as the signal reaches 15 psig, then no adjustment is necessary.

6.

If the actuator does not reach the OPEN position at 15 psig, this is indicative of the spring rate being too high. Loosen the grubscrew in the range adjustment collar, (see Fig.3), hold the collar stationary using a hexagon socket wrench, and turn the spring slightly clockwise. This will move the actuator even further away from fully OPEN and the zero adjusting screw must be used to achieve fully OPEN.

7.

Conversely, if the actuator reached OPEN position before 15 psig, turn the spring slightly anti-clockwise with respect to the rate adjusting collar. Again re-adjust the zero screw to achieve exact fully OPEN.
The zero and range settings are highly interactive and steps 2 to 7 must be repeated until zero and span are acceptable.

NOTE
In steps 3 to 7, clockwise and anti-clockwise rotations are as viewed from the adjusting nut end of the spring.

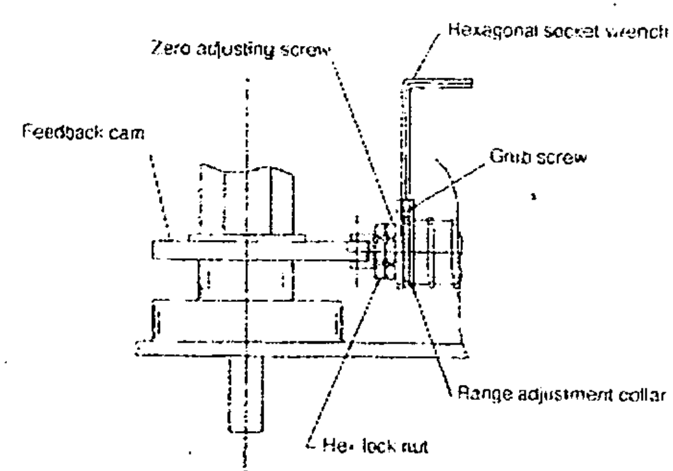


FIG.3

Switch details

Micro-switch details

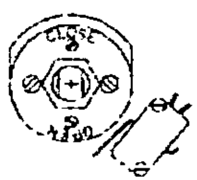
Standard V9 type, single pole double throw (SPDT).
Switch ratings as table below:

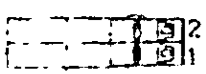
VOLTAGE (Volts)	RESISTIVE LOAD (Amps)	TUNGSTEN LAMP LOAD (Amps) NC	TUNGSTEN LAMP LOAD (Amps) NO	INDUCTIVE LOAD (Amps)
AC				
125	10	2	1	10
250	10	1.5	1	10
DC				
Up to 15	15	3	1.5	15
30	10	3	1.5	10
50	3	0.8	0.8	2.5
75	1	0.6	0.6	0.5
125	0.5	0.5	0.5	0.07
250	0.25	0.25	0.25	0.03

Proximity switch details

Type:	Pepperl & Fuchs NJ2-V3-N or as specified
Quantity	2 switches per unit
Sensing distance:	2mm maximum (metal face). NB. Separate amplifier required.
Supply:	8 V DC (Ri approx. 1kOhm)
Temperature range:	-25°C to +70°C
Repetition:	<0.01mm
Hysteresis	≤0.05mm Typ 3%
Output:	Sensor absent - 3mA or above Sensor present - 1mA or below Switching rate - 1kHz maximum.

Switch identification

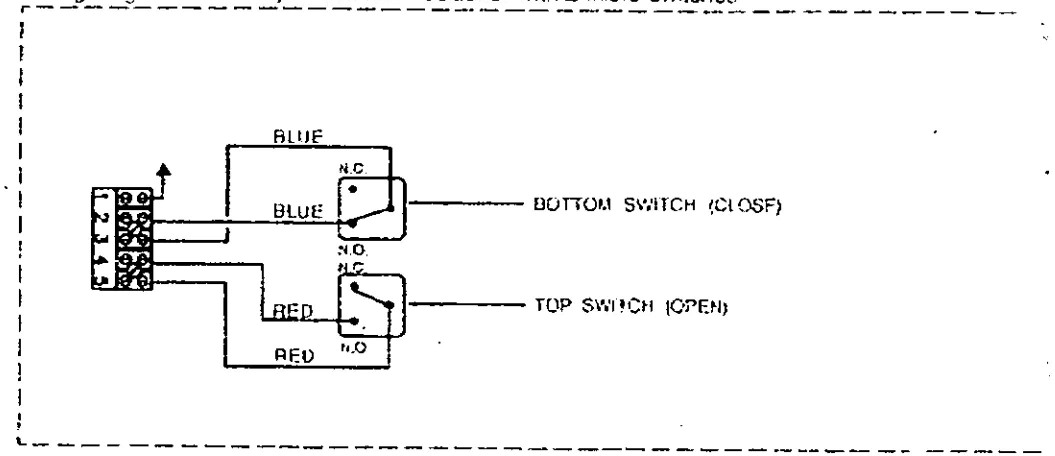




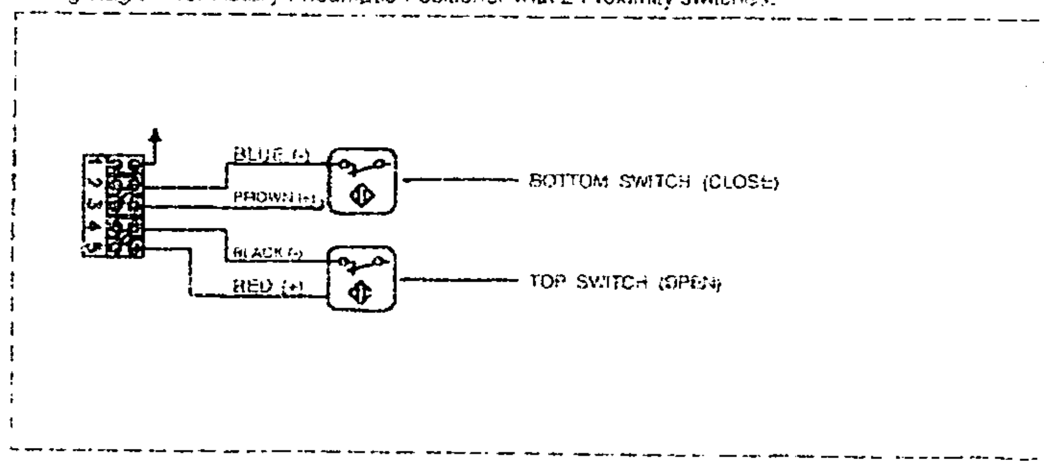
SWITCH NUMBER	SWITCH FUNCTION
1	CLOSE LIMIT
2	OPEN LIMIT

Wiring diagrams

Wiring diagram for Rotary Pneumatic Positioner with 2 micro-switches



Wiring diagram for Rotary Pneumatic Positioner with 2 Proximity switches.



Cover Fitting

Ensure that the actuator is in the position corresponding to minimum signal ie. CLOSED for direct operation (see Fig 4) and OPEN for reverse operation (see Fig 5)

1.
Remove the position indicator cover and position indicator from the main cover

2.
Fit the main cover over the shaft and secure to the body using a captive screw in each corner.

3.
Fit the position indicator to the double 'D' at the top of the shaft.

4.
Fit the position indicator cover to the positioner cover so that the zero degree markings are disposed along the transverse axis of the positioner. Before finally securing the position indicator cover, ensure that the cover is positioned so that the arrow indicates the exact position of the actuator.

Warning! - When Pressure Gauge is not required, fit hex head socket screw from mounting kit using proprietary non hardening sealing compound or tape. If there is a requirement to remove the socket screw for future application, an applied torque of 200 lbf/ins should not be exceeded.

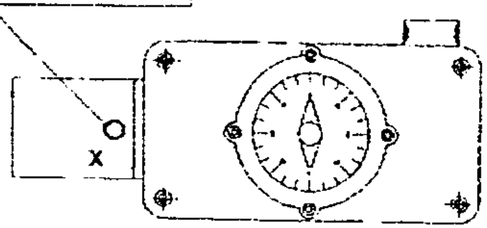


FIG.4 - Direct Operation

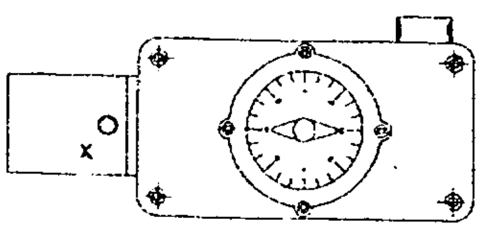
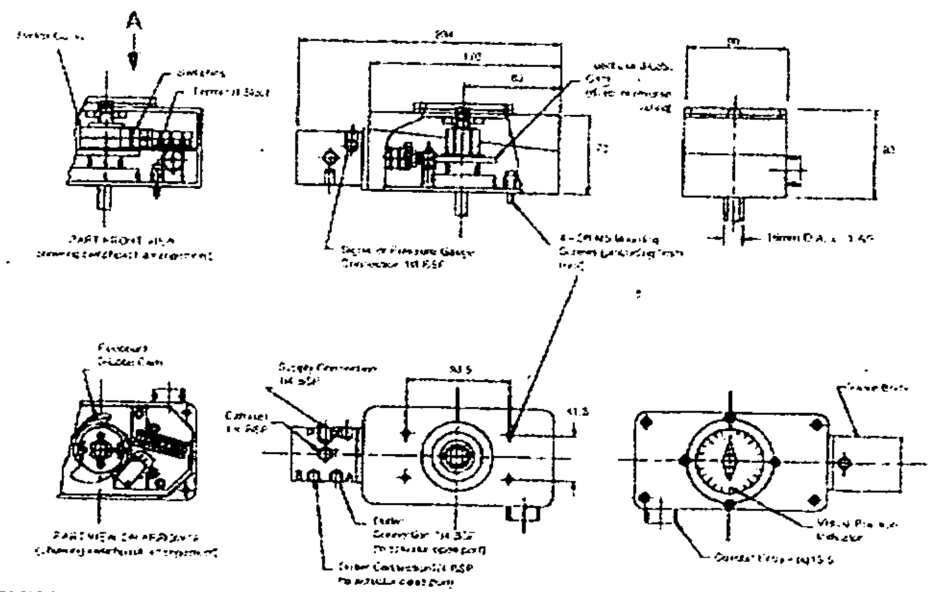


FIG.5 - Reverse Operation

Technical data

Input signal	single range split range cam characteristics	3 - 15 psi (0.2 - 1.0 bar) standard 3 - 9 psi (0.2 - 0.6 bar) or 9 - 15 psi (0.6 - 1.0 bar) linear 3 - lobe cam curve 1, range 3 - 15 psi - 90° movement curve 2, range 3 - 9 psi or 9 - 15 psi - 65° movement curve 3, range 3 - 15 psi - 60° movement other characteristics on request
Supply	media supply pressure air consumption	compressed air or gas, dry, dust and oil free with 5 Micron filter element to inlet 30 - 100 psi (150 psi max.) 2 - 8 bar (10 bar max 0.6 cfm in balanced condition with 60 psi (4 bar) supply.
Environmental mounting and connections	environmental temperature mounting position mounting kit air connections	-5 °F to +160 °F (-20 °C to +70 °C). as required. No limitations. universal mounting kit for Fig.790/796 series actuators. supply and output 1/4" BSP, signal 1/8" BSP.
Materials of construction	housing diaphragm valve spool cover	anodised aluminium alloy (stainless steel optional nitrile rubber stainless steel anodised aluminium alloy (stainless steel optional)
Weight		4lb (1.95kg)
Options	gauges integral limit switches	instrument air 0 - 30 psi (0 - 2 bar) - 1 off supply air 0 - 150 psi (0 - 8 bar) - 2 off. single pole double throw type V3, 10A 240V AC proximity sensors Pepperl & Fuchs type NJ2-V3-N



DESIGNATION OF CONNECTIONS:- A & B = Working Lines, P = Compressed Air Connection, T = Exhaust Point, X = Control Line.

16

VALMET INSTRUMENT WORKS

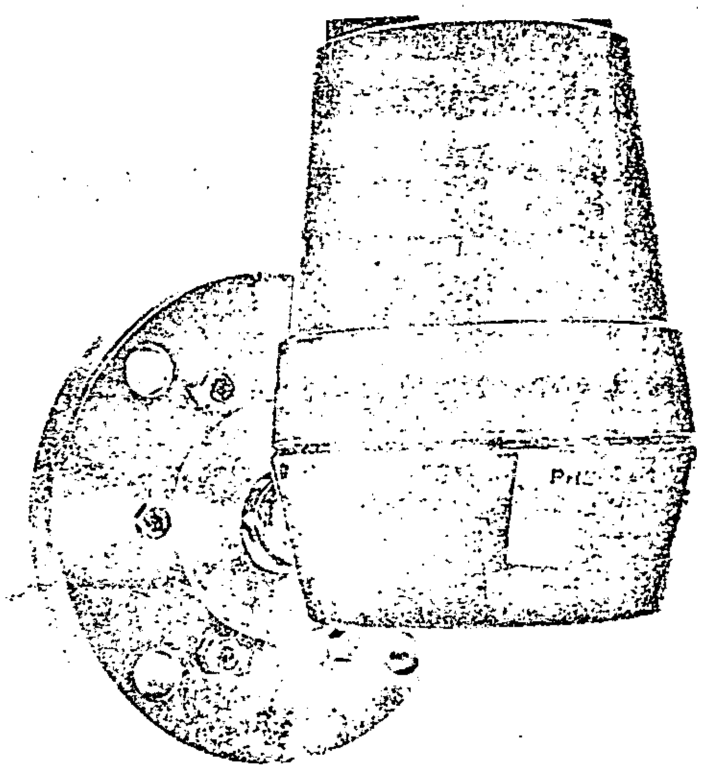
PRESS-AIR L

Pneumatic Pressure Transmitter

BL520A

1977 - 11 - 01

OPERATING AND INSTALLATION INSTRUCTIONS



PRESS-AIR L 80

CONTENTS

VALMET Oy, INSTRUMENT WORKS, BOX 237, FI-33101 TAMPERE 10, FINLAND
TEL. INT. +358 31 650 522, TELEX 22258 valln sf

1. APPLICATION

The PRESS-AIR L flange type pressure transmitter is used for level measurements in open vessels. Equipped with an auxiliary flange the transmitter can be used for measuring also other types of small pressures.

The transmitter converts the pressure acting on its measuring diaphragm into a pneumatic standard signal of 0.2 to 1.0 bar or 3 to 15 psi:

2. TECHNICAL SPECIFICATION

Measuring ranges:	
PRESS-AIR L 40	0 → 0.2 to 2.5 bar
PRESS-AIR L 80	0 → 40 to 600 mbar
Range elevation	Max. elevation = max. range minus span
Output signal	0.2 to 1.0 bar or 3 to 15 psi
Supply pressure	1.4 bar or 20 psi
Max. operating temperature	
- ambient	+60 °C
- process fluid	+100 °C
Output air capacity	
- with injector restriction	4 litres/min (at STP)
- with pressure amplifier	25 litres/min (at STP)
Steady-state air consumption	
- with injector restriction	5 litres/min (at STP)
- with pressure amplifier	7 litres/min (at STP)
Accuracy (without elevation spring)	
- nominal error	1.0 %
- non-linearity	±0.5 %
- hysteresis	0.5 %
- dead band	0.1 %
Effect of ambient temperature change on zero	
- minimum range	0.1 %/°C
- maximum range	0.02 %/°C
Effect of 0.1 bar change in supply pressure on zero	1.0 %
Materials	
- flange and diaphragm	Acid-resistant steel AISI 316
- transmitter section	Light alloy, steel and brass
- case	Cast light alloy, epoxy powder painted
Dimensions	See fig. 2 "Dimensions"
Connections	
- process	DIN flange NS80 NP10
- signal tubes	NPSF 1/4 female thread, Δ supply, 0 output
Weight	7.6 kg

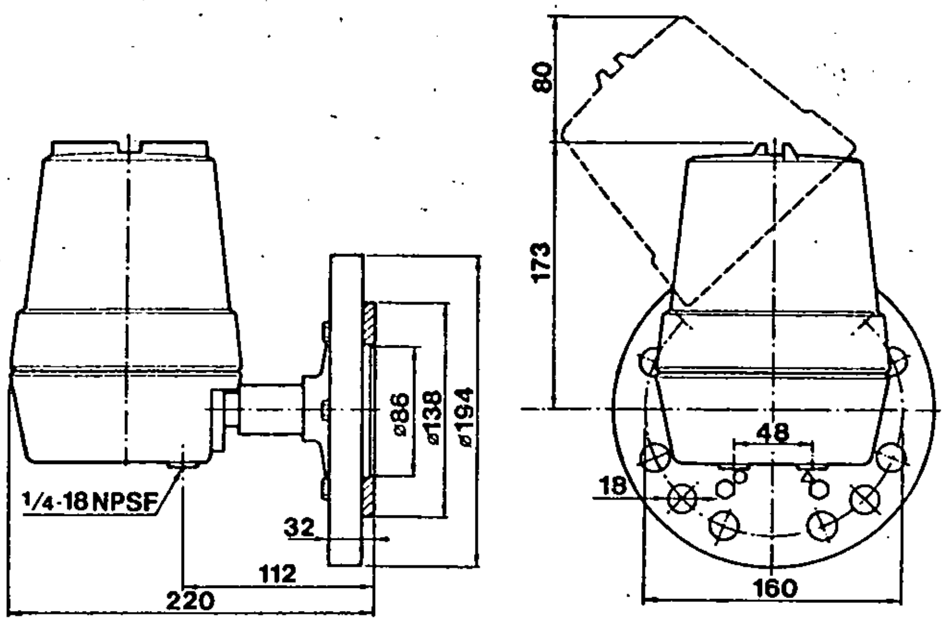


Figure 2 - Dimensions

3. PRINCIPLE OF OPERATION (Fig. 3)

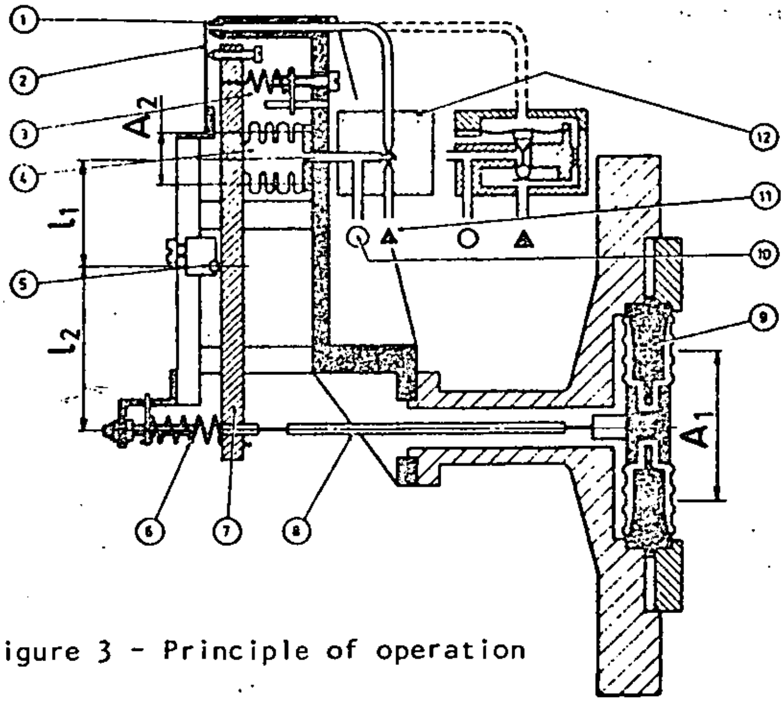


Figure 3 - Principle of operation

The transmitter operates on the force balance principle.
The measuring element consists of an oil-filled twin-diaphragm cell (9).
A pressure acting on the diaphragm generates a force which acts on the lower end of feedback lever 7 through rod 8. Adjustment bearing 5 serves as the fulcrum of the feedback lever. Feedback bellows 4 acts on the upper end of the lever.
As the pressure to be measured increases, flapper 2 approaches nozzle 1, causing the nozzle pressure to increase. Supply pressure 11 is taken to the nozzle through injector restriction 12. Nozzle pressure is amplified in the injector restriction and taken to output connection 10 and feedback bellows 4.
Output pressure increases until the force of the feedback bellows overcomes the force of the diaphragm cell. Also zero adjusting spring 3 and range elevation spring 6 affect the reaching of a state of equilibrium.

Measuring range span can be changed by adjusting lever ratio $l_1 : l_2$.

It is possible to use a pressure amplifier in place of the injector restriction.

4. INSTALLATION

The transmitter flange is fixed on the side of a vessel or pipe. Standard adjustment has been carried out with the transmitter in vertical position. Therefore, if the transmitter is mounted in some other position, a checking adjustment should be carried out in the operating position.

The transmitter flange is attached to an NS80 NP10 counter-flange, for example DIN 2633 welded flange or DIN 2643 collar flange.

Dimensions of the sealing ring between the flanges are ⌀ 140 mm/⌀ 86 mm. Four M16 or 5/8" bolts are required for mounting the transmitter.

For connecting the signal tubes the bottom of the unit is provided with NPSF 1/4 female threads that accept connectors equipped with, for example, NPT 1/4 thread. Designations: Δ supply, 0 output.

Range elevation device

If the zero level in the vessel differs from the level of the measuring diaphragm (fig. 4), the hydrostatic pressure between the two levels must be overcome by means of a range elevation device.
If the transmitter is not equipped with a range elevation device when delivered, the device is easy to install later in the following manner (fig. 5): Mount the elevation device in position in such a manner that the end of spring 16 is inserted into hole 15 in part 13. Secure the device with screws 17. Remove plug 24 (fig. 7) at the bottom of the pneumatic section of the unit, and tighten the spring in position with screw 14 through the plug hole.

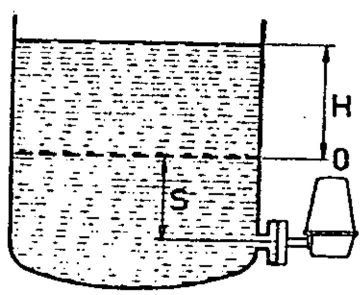


Figure 4 - H = Span
0 = Range zero level
S = Range elevation

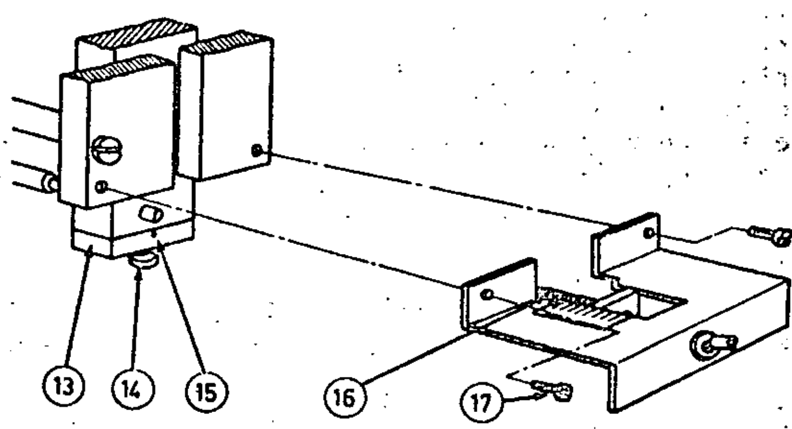


Figure 5

5. ADJUSTMENT

Before delivery, the transmitter is either provided with basic adjustment or adjusted for the desired range as specified in the order.
If the transmitter has been disassembled for, for example, maintenance purposes, adjustment is carried out starting from section A. When checking the range adjustment or when adjusting the unit for a new range, start from section C.

The adjustment requires two pressure reducers and two manometers (fig. 6a) or a VALMET AIR-TEST testing unit (fig. 6b).

An NS80 blind flange, which has a connector for a pressure tube, is fastened with sealing against the diaphragm cell of the transmitter. After tightening the retaining bolts between the flanges, check the tightness of screws 26.

A. Basic adjustment

1. Remove plug 24. Loosen the two retaining screws of part 13 through the plug hole in such a manner that rod 8 is able to move freely.
2. Loosen locking screw 21, and move adjustment bearing 5 with the adjusting screw to the max. range in accordance with the approximate value scale. Tighten screw 21.
3. Adjust feedback lever 7 and cover plate 20 parallel with each other by placing a 6.0 mm thick piece of metal between the upper part of the cover plate and the feedback lever. Press the feedback lever against the adjustment bearing and the piece of metal, and adjust flapper adjusting screw 18 for 0.2 bar or 3 psi output pressure. Do not turn adjusting screw 18 after this.
4. Remove the piece of metal mentioned above, and adjust zero adjusting screw 25 for 0.2 bar or 3 psi output pressure.
5. Fasten rod 8 by tightening the screws in part 13. Set the output pressure to 0.2 bar or 3 psi by means of the zero adjusting screw.

B. Pressure test

With adjustment bearing 5 in its lowest position, i.e. at maximum range, apply an overload pressure to the diaphragm cell:
PRESS-AIR L 40: 6.0 bar
PRESS-AIR L 80: 1.5 bar

These pressures correspond to approximately 2.5-fold overloads. Reduce the pressure to zero and raise it back to full value. Repeat this a few times. If the output pressure deviates from 0.2 bar or 3 psi while diaphragm pressure is at zero, rectify the error by means of the zero adjusting screw.
After this, apply a few more overpressure impulses to the diaphragm cell. If the output pressure still changes by more than 0.02 bar or 0.3 psi, the diaphragm cell should be replaced. The error may be caused also by a fault in the injector restriction or pressure amplifier.

C. Measuring range adjustment

Without range elevation spring:

1. Loosen locking screw 21, and move adjustment bearing 5 with adjusting screw 19 to the desired measuring range in accordance with the approximate value scale. Tighten screw 21.

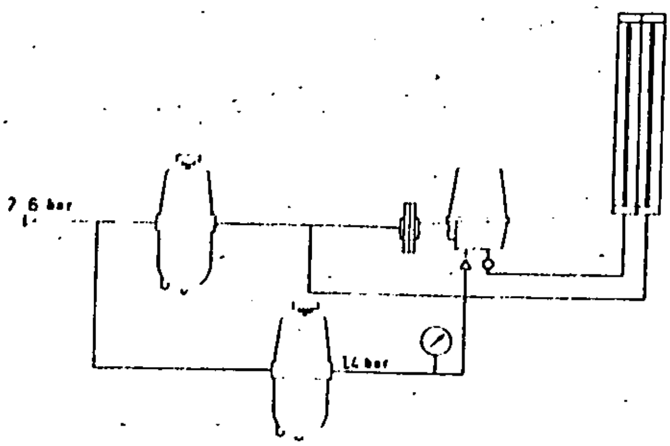


Figure 6a

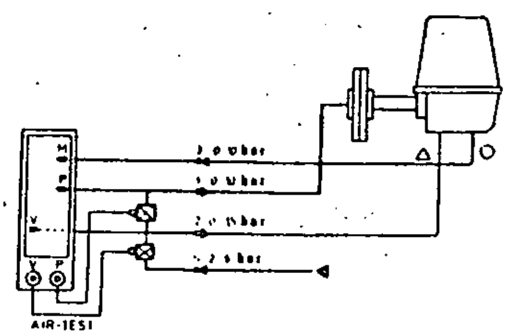


Figure 6b

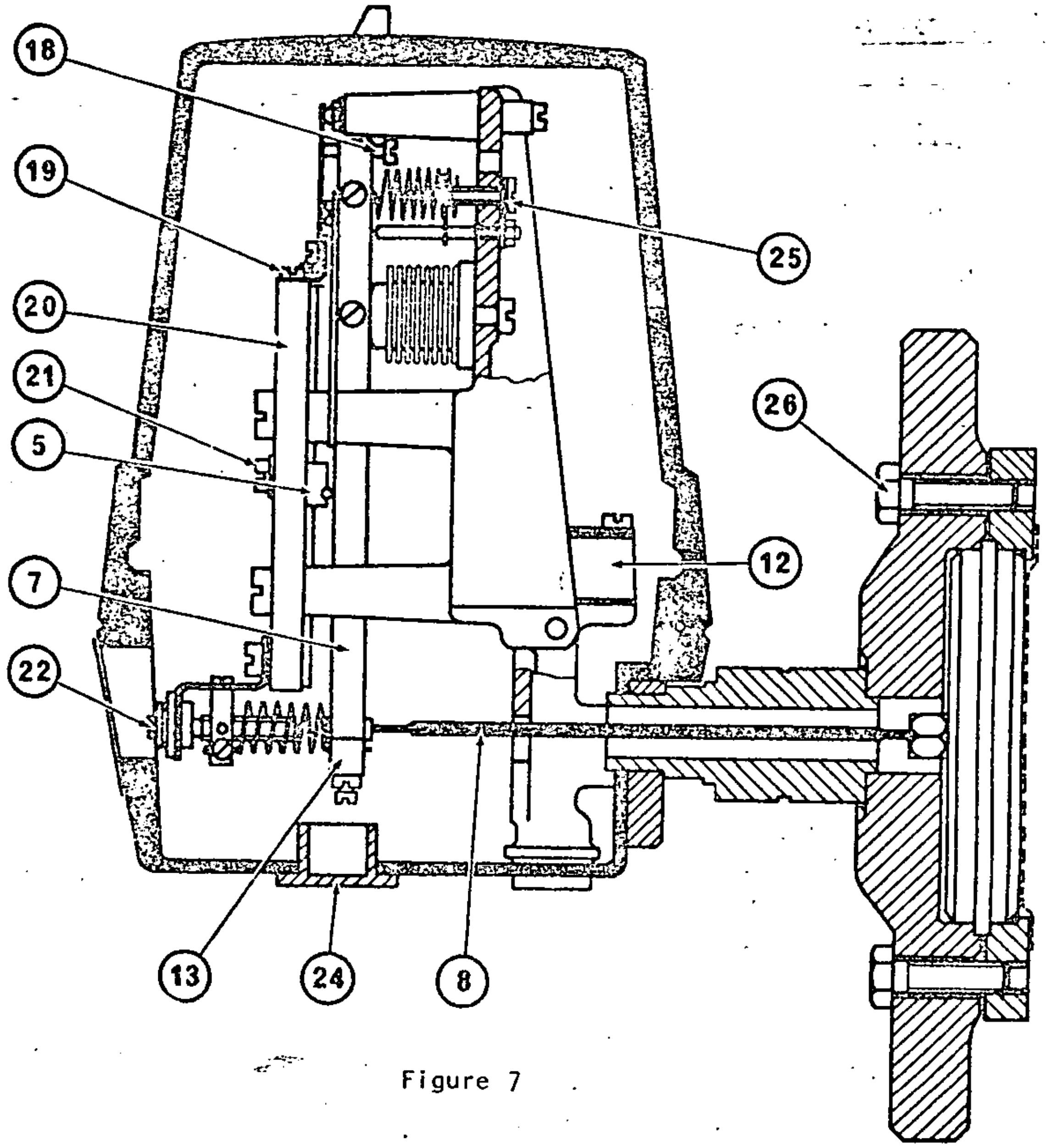


Figure 7

2. With diaphragm pressure at zero, adjust zero adjusting screw 25 for 0.2 bar or 3 psi output pressure. If the adjustment of the zero adjusting screw is not sufficient, alter the fastening of rod 8: loosen the retaining screws of part 13 and adjust the zero adjusting screw for 0.2 bar or 3 psi output pressure. Then tighten the retaining screws of part 13.
3. Adjust the diaphragm cell pressure to correspond to the upper-range value of the desired measuring range.
4. Move adjustment bearing 5 until the output pressure is 1.0 bar or 15 psi.
5. Adjustments 2 and 4 affect each other. For this reason they must be repeated until the desired accuracy reached.

With range elevation spring:

1. Loosen locking screw 21, and move adjustment bearing 5 with adjusting screw 19 to the desired range in accordance with the approximate value scale. Tighten screw 21.
2. Adjust the diaphragm pressure to value S (fig. 4) corresponding to the zero point of the range. Adjust screw 22 in the elevation device for 0.2 bar or 3 psi output pressure.
3. Increase the diaphragm pressure by the amount of pressure H (fig. 4) corresponding to range span. Total pressure is thus S + H. Move adjustment bearing 5 until the output pressure is 1.0 bar or 15 psi.
4. Adjustments 2 and 3 affect each other. For this reason they must be repeated until the desired accuracy is reached. In the final stage the adjustment in step 2 is carried out by means of zero adjusting screw 25.

6. MAINTENANCE

Servicing should be carried out at regular intervals. Air ducts are washed with benzine and O rings are checked. Dried or damaged seals are replaced. Before reassembly the O rings are lubricated lightly with silicone grease to ensure tightness. Make sure that the nozzle tip is undamaged and straight, and that the flapper surface is smooth. If there are any pitch-like formations on the flapper, remove them with benzine. The nozzle tip can be straightened in the following manner: Place a piece of fine-grade water sanding paper (e.g. no. C 400) between the nozzle and the flapper. Press the flapper lightly towards the nozzle and withdraw the sanding paper. If this has no effect, the parts in question should be replaced. The flapper can be removed by undoing the two retaining screws at its lower edge. Unscrew the nozzle with a 6 mm wrench.

The body of the injector restriction consists of a metal block. The actual restriction is located at the bottom of this body section, which has to be removed to be able to clean the restriction. Draw out the restriction by means of an M3 screw. Remove any pitch formations with benzine. After cleaning, lubricate the O rings lightly with silicone grease, insert the restriction in position, and fasten the body section.
A 1.2 mm nozzle is used with injector restriction. If the restriction is replaced with a pressure amplifier, the nozzle must be changed for a 0.5 mm one. After changing the nozzle it is necessary to check the adjustment.

Maintenance and checking of operation of the pressure amplifier are described in instruction leaflet G410 A.

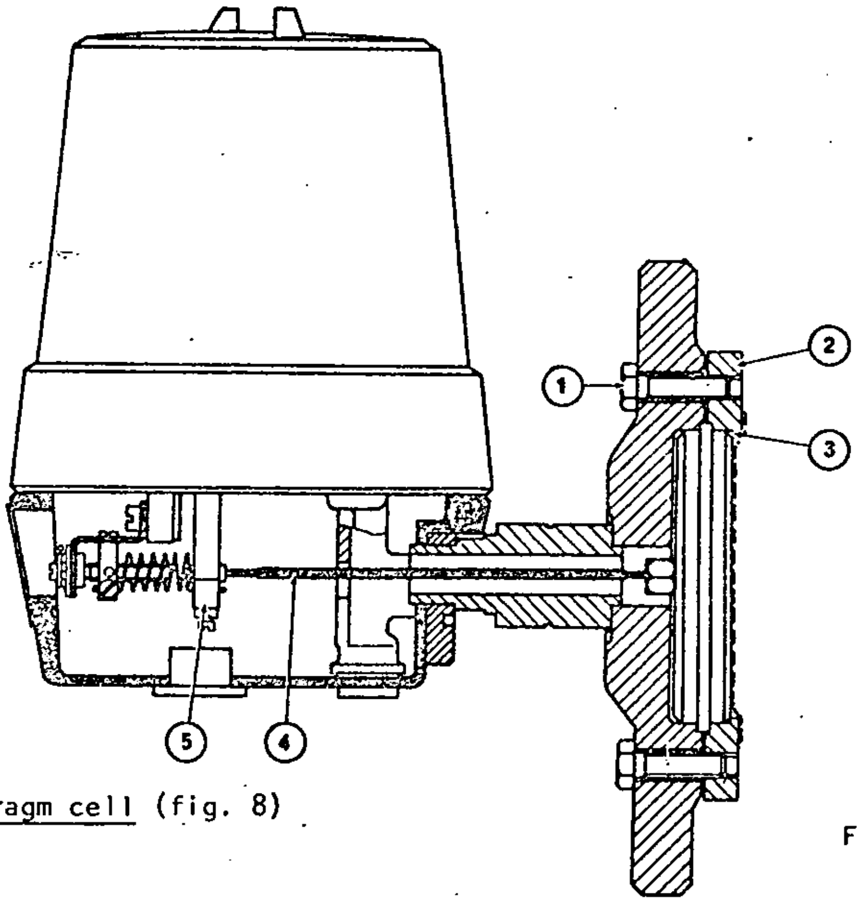


Figure 8

Replacing the diaphragm cell (fig. 8)

Procedure:

1. Loosen the two retaining screws of part 5.
2. Undo screws 1.
3. Remove the diaphragm cell retaining ring 2 and withdraw the diaphragm cell with its connecting rod 4.
4. Unscrew the rod from the diaphragm cell.
5. Reassemble the unit in reverse order. To ensure tightness, replace PTFE seal 3 with a new one.
6. Check the adjustment and re-fasten part 5 finally.

VALMET

17

Series 240

Pneumatic Control Valves Type 241-1 and Type 241-7
Globe Valve Type 241 with Micro-trim Element

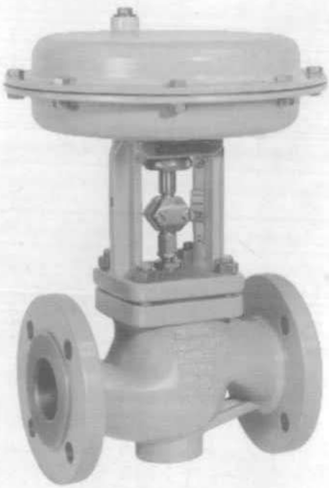


Fig. 1 · Type 241-1 Control Valve

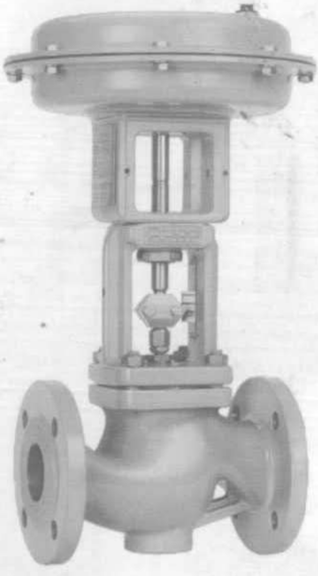


Fig. 2 · Type 241-7 Control Valve

1. Design and principle of operation

The Type 241-1 and Type 241-7 Pneumatic Control Valves each consist of a single-seated Type 241 Globe Valve and either a Type 271 or Type 3277 Pneumatic Actuator (second for integral positioner attachment).

Because of their modular-assembly design, the actuators can be exchanged, and the standard version can be retrofitted to a version with either an extension bonnet (insulating section) or bellows seal bonnet (metal bellows seal).

Edition February 1996

Mounting and operating instructions

The process medium flows through the valve in the direction indicated by the arrow. In this process, the closure member, valve plug (3), is adjusted in response to signal pressure changes (bench range) acting on the diaphragm of the actuator. The valve plug (3) and attached actuator stem (8.1) are connected via the stem connector (7) and sealed by means of a spring-loaded PTFE V-ring packing (4.2).

Depending on how the compression springs are arranged in the actuator (top or bottom, resp.), the spring force opens or closes the valve whenever pressure on the diaphragm is reduced or the air supply fails. There are two **fail-safe actions**:

- **Actuator stem "extends"**
- **Actuator stem "retracts"**

Depending on the valve action, the valve opens (flow-to-open) or closes (flow-to-close), resp. as increasing signal pressure overcomes the force exerted by the springs.

For the valve version having a **micro-trim element**, this element is installed in the valve body instead of the usual seat/plug combination.

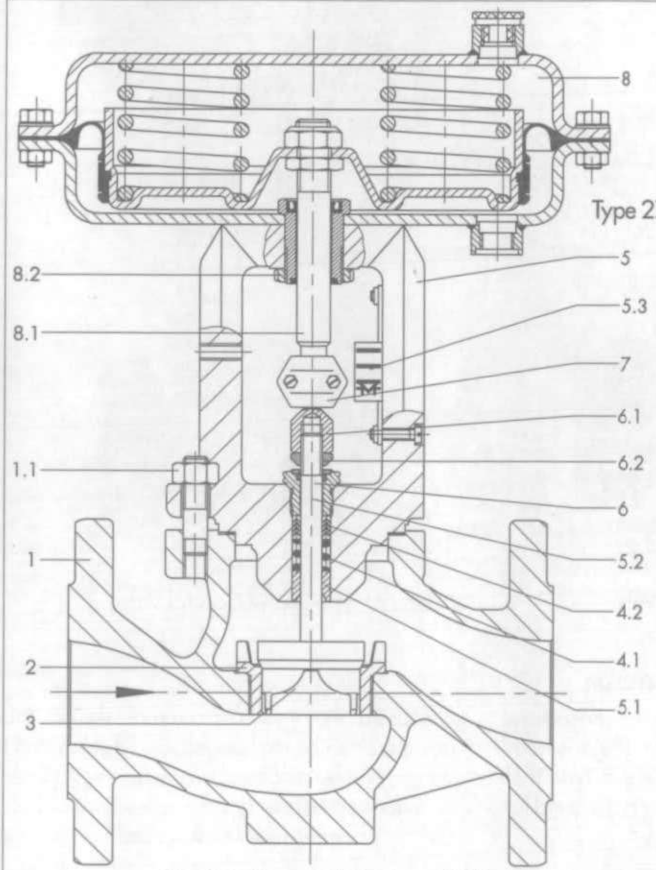


Fig. 3.1 · Type 241-1 Control Valve

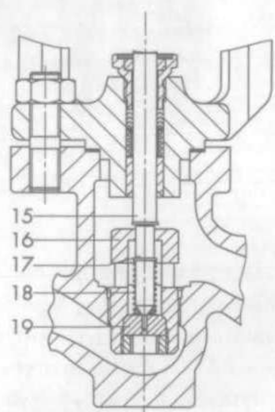


Fig. 3.2 · Micro-trim element

15 Plug stem
16 Valve plug
17 Seat body
18 Spring
19 Seat nut

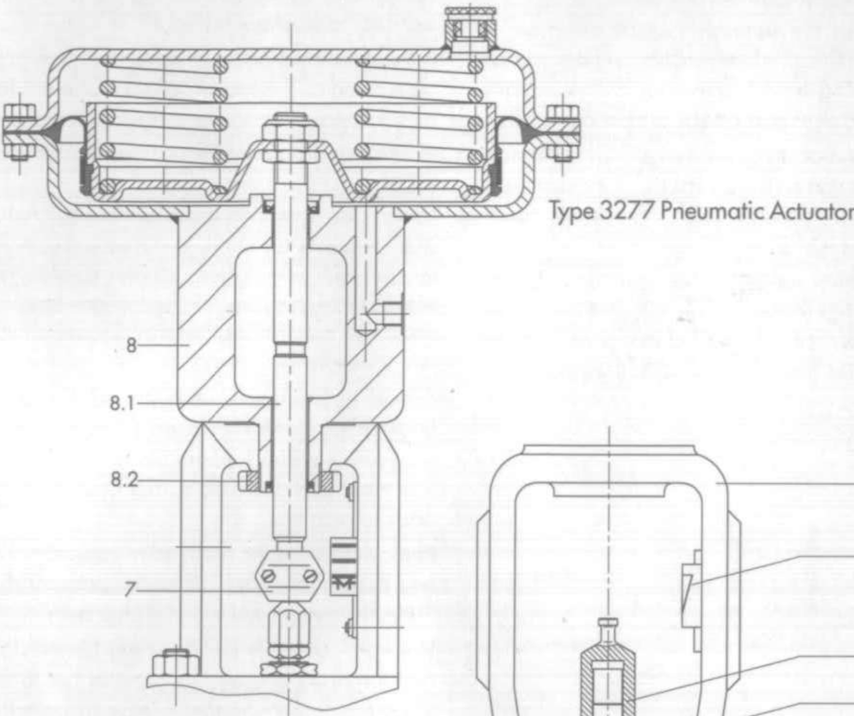
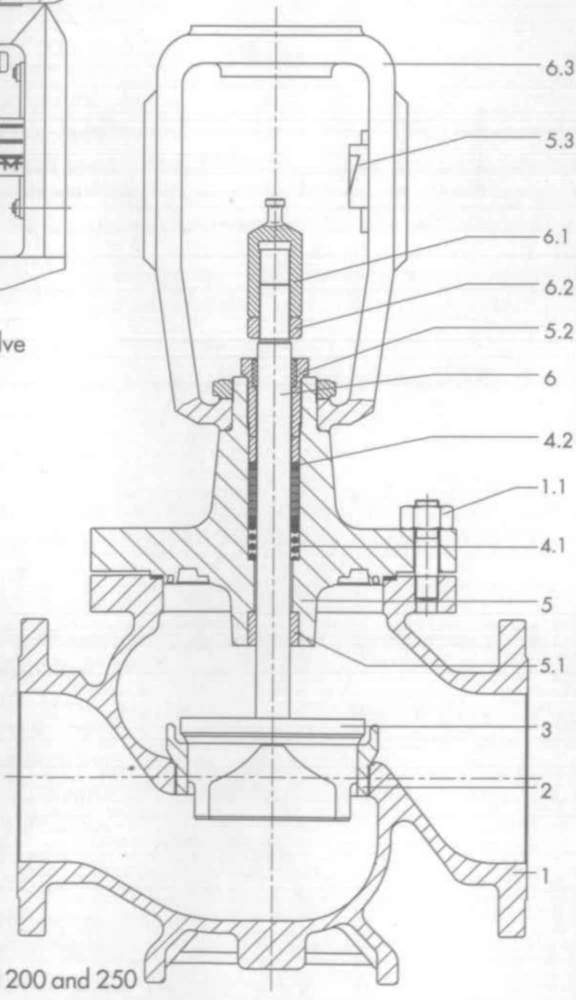


Fig. 3.3 · Type 241-7 Control Valve



1. Valve body
1.1 Bonnet nuts
2 Valve seat
3 Valve plug
4.1 Packing spring
4.2 Stuffing box packing
5 Valve bonnet
5.1 Guide bushing
5.2 Threaded bushing
5.3 Travel indicator
6 Plug stem
6.1 Coupling nut
6.2 Locknut
6.3 Yoke (sizes DN 200 and 250)
7 Stem connector (coupling)
8 Pneumatic actuator
8.1 Actuator stem
8.2 Annular (clamping) nut for actuator

Fig. 3.4 · Control Valve, sizes DN 200 and 250

1.1 Exchanging the actuators

Instead of the standard actuator version, a model with an additional handwheel can be mounted to the valve. In addition, electrically operated actuators can be attached as well.

Pneumatic actuator models exhibiting different sizes can be used in place of the standard pneumatic actuator (with or without handwheel drive).

If the travel range of the actuator is larger than that of the valve, the actuator spring assembly will be pre-loaded ex-factory, ensuring that the travels correlate as they should.

2. Assembling/disassembling the valve and actuator; adjustments (Fig. 3)

If the valve and actuator have not been preassembled at the factory or if a different (or larger) version is to be used instead of the original model, proceed as instructed below:

NOTE

When disassembling actuator version "Actuator stem extends" and, in particular, using a version with pre-loaded actuator springs, always apply pressure to the bottom loading pressure connection before disassembling the actuator!

Loosen both the locknut (6.2) and the coupling nut (6.1) on the valve. Press the valve plug with the attached plug stem firmly in the seat ring. Then, turn down both the coupling and the locknut.

Remove the clamps of the stem connector (7) and the annular nut (8.2) on the actuator (8). Slide the annular nut over the plug stem.

Place the actuator on the valve bonnet (5), and thread tight using the annular nut (8.2). On the actuator's nameplate, read both the bench range (or pre-loaded range) and the actuator action (e.g., 0.2 to 1 bar and "Actuator stem extends").

The lower value of the signal range corresponds to the lower-range value (start) to be adjusted. The upper value corresponds to the upper-range value (end) to be adjusted.

Version: Actuator stem "extends ":

Apply the loading pressure which corresponds to the lower-range value (e.g., 0.2 bar) to the bottom diaphragm chamber .

Version: Actuator stem "retracts":

Apply the loading pressure which corresponds to the upper-range value (e.g., 1 bar) to the top diaphragm chamber .

Manually turn the coupling nut (6.1) until it contacts the actuator stem (8.1). Then, turn a quarter revolution further, and retain the position using the locknut (6.2).

Attach the stem connector clamps (7), and tightly screw together. Align the travel indicator scale (5.3) in line with the coupling tip.

2.1 Pre-loading the springs for actuator action: Actuator stem "extends"

In order to obtain increased thrusts for these actuators, up to 25 % (actuator effective areas 80 to 240 cm^2 = 12.5 %) of their travel or signal pressure span can be pre-loaded when adjusting the actuator springs.

If a pre-tension of, for example, 12.5 % is desired for a signal range between 0.2 and 1 bar, the signal range is shifted upward 0.1 bar from 0.3 to 1.1 bar (here, 0.1 bar corresponds to 12.5 %).

In the adjustment procedure of the valve, the lower-range value is now to be adjusted to 0.3 bar as required.

Always mark the new signal range from 0.3 to 1.1 bar as the pre-loaded signal range on the nameplate!

2.2 Pre-loaded actuator springs ex-factory

An adhesive label identifies actuators which have been pre-loaded (without the attached valve) by the manufacturer. Moreover, such a case can easily be seen by three extended bolts and nuts (Fig. 5) on the bottom diaphragm case. These bolts and nuts allow the pre-tensioned actuator springs to be uniformly released, in a criss-cross pattern, when disassembling the actuator.

3. Installation

3.1 Mounting position

There is no prescribed mounting position. However, for valves sizes DN 100 or above, install the actuator vertically upright in order to facilitate any maintenance required.

Always install the valve free of stress! If necessary, support piping near the process connections. Never attach the braces to the valve or actuator!

Thoroughly flush the pipe prior to installing the valve.

3.2 Loading pressure connection

For actuator action "Actuator stem extends", connect the loading pressure to the bottom diaphragm case. For actuator action "Actuator stem retracts", connect it to the top case.

NOTE: For Type 3277 Linear Actuator (for integral positioner attachment), the bottom loading pressure connection is located laterally on the yoke which is attached to the bottom diaphragm case.

3.3 Strainer, bypass line

We recommend that a SAMSON strainer (Strainer Type 2) be installed upstream of the valve body.

To enable maintenance without disrupting operation, good practice calls for a shut-off valve to be installed both upstream of the strainer and downstream of the valve. In addition, a bypass line is recommended.

3.4 Bellows test connection (Fig. 8)

For the bellows seal version, a test (inspection) connection (G 1/8) is located at the top flange, used to inspect and monitor the effectiveness of the bellows sealing. We recommend especially for liquids and steams that a suitable leakage indicator (e.g., contact-making pressure gauge, runoff in an open tank or inspection glass) be connected.

4. Operation

4.1 Reversing the actuator action (Figs. 4 and 5)

When disassembling the control valve, first remove pressure from the corresponding section of the plant.
Recommendation: Drain the pipe, and remove the valve.

If the actuator action need be reversed, proceed as instructed below:

Separate the actuator (8) from the valve. For this purpose, perform the following for actuator action: Actuator stem "extends": First apply a pressure which exceeds the lower-range value to the actuator (see nameplate).

Loosen the coupling clamps connecting the actuator stem and the plug stem, and unthread the annular nut (8.2). Lift the actuator off the valve.

4.1.1 Reversing the actuator action from Actuator stem "extends" to "retracts"

Unscrew the hexagonal bolts and nuts (8.10) connecting both diaphragm cases.

Take special care with actuators whose springs have been pre-loaded at the factory! (Distinguished by the extended bolts and nuts on the bottom diaphragm case.)

To proceed, first unturn the short bolts, then, slowly and uniformly and, in a criss-cross pattern, loosen the long bolts and nuts until the actuator springs are relieved of tension.

Lift off the top diaphragm case.

Remove the actuator springs (8.3). Pull the actuator stem (8.1), diaphragm plate (8.7) and diaphragm (8.4) out of the bottom diaphragm case (8.6). Unthread the upper nut (8.8), counter holding the other lower nut (8.9) and not damaging the diaphragm stem. Turn over the diaphragm plate along with the diaphragm, and thread on the nut again. Apply lubricant to the actuator stem (order no.: 8150-0043). Place the diaphragm plate in the top diaphragm case (8.5), install the actuator springs (8.3), and slide the bottom diaphragm case (8.6) over the actuator stem (8.1). Bolt together both diaphragm cases again.

For the Type 271 Pneumatic Actuator, screw the vent plug (9) out of the top diaphragm case (8.5) and into the bottom diaphragm case (8.6).

For the Type 3277 Pneumatic Actuator for integral positioner attachment, screw the vent plug (9) out of the top diaphragm case.

The actuator springs, now pressing upward against the diaphragm, open the valve by way of the actuator stem (8.1) and the attached valve plug. The loading pressure is introduced to the top diaphragm chamber via the top loading pressure connection (10). If the signal pressure increases, it closes the valve, overpowering the force exerted by the actuator springs.

Mount the actuator to the valve as instructed in section 2.

4.1.2 Reversing the actuator action from Actuator stem "retracts" to "extends"

Unscrew the hexagonal nuts and bolts connecting both diaphragm cases. Lift off the top diaphragm case.

Pull the actuator stem (8.1), diaphragm plate (8.7) and diaphragm (8.4) out of the bottom diaphragm case (8.6). Remove the actuator springs (8.3). Unthread the upper nut (8.8), counter holding the other lower nut (8.9) and not damaging the actuator stem.

Turn over the diaphragm plate along with the diaphragm, and thread on the nut again. Push the actuator stem (8.1) through the bottom diaphragm case (8.6), and install the actuator spring (8.3). Attach the top diaphragm case (8.5). Bolt together both diaphragm cases again. Unscrew the vent plug (9) and screw into the top diaphragm case (8.5) (Type 271 Linear Actuator). For the Type 3277 Pneumatic Actuator, screw a vent plug in the top diaphragm case.

The actuator springs, now pressing downward against the diaphragm, close the valve by way of the actuator stem and the plug stem. The loading pressure is introduced to the bottom diaphragm case via the bottom loading pressure connection. If the signal pressure increases, it opens the valve, overpowering the force exerted by the actuator springs. Mount actuator to the valve as instructed in section 2.

Further details regarding the pneumatic actuator can be found in the following "Mounting and operating instructions":

- **EB 8310 E** (Type 3271 Pneumatic Actuator)
- **EB 8311 E** (Type 3277 Linear Actuator for integral positioner attachment).

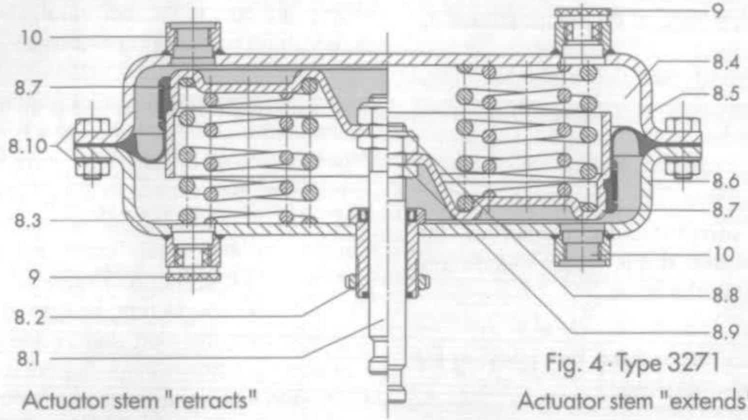
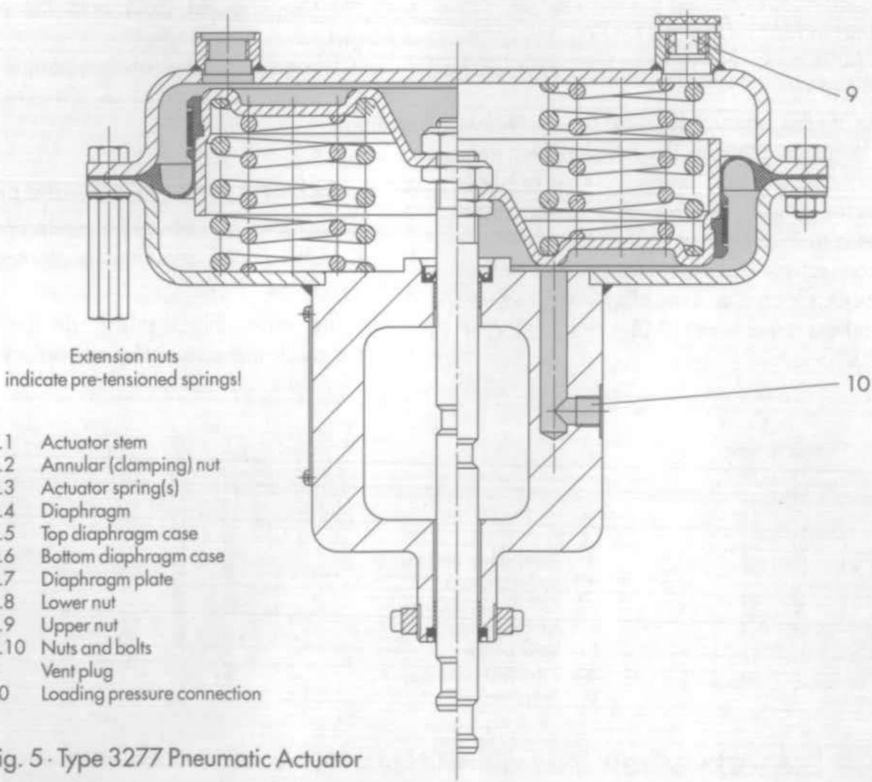


Fig. 4 · Type 3271



8.1 Actuator stem
8.2 Annular (clamping) nut
8.3 Actuator spring(s)
8.4 Diaphragm
8.5 Top diaphragm case
8.6 Bottom diaphragm case
8.7 Diaphragm plate
8.8 Lower nut
8.9 Upper nut
8.10 Nuts and bolts
9 Vent plug
10 Loading pressure connection

Fig. 5 · Type 3277 Pneumatic Actuator

5. Faults and how to correct

If external leakage occurs, the cause may be contributable to a faulty stuffing box or, as regards the bellows version, also a defective metal bellows.

If the valve does not tightly seal, impervious shut-off can be impaired by dirt or other foreign particles lodged between the valve seat and valve plug (or by damaged sealing edges).

We recommend that the parts be disassembled, thoroughly cleaned and, if necessary, replaced.

⚠ **When disassembling the control valve, first relieve the pressure from the corresponding section of the plant and drain. Recommendation: Remove the valve.**

5.1 Replacing the stuffing box packing for standard valve versions

If the valve leaks around the stuffing box, this is good indication that the stuffing box packing (4.2) need be replaced as instructed below:

Separate the actuator (8) from the valve. For this purpose, perform the following for version: Actuator stem "extends". First apply a pressure which exceeds the lower-range value to the actuator (see nameplate).

Disconnect the coupling clamps connecting the actuator stem and the plug stem, and unthread the annular nut (8.2). Lift the actuator off the valve.

Remove the associated nuts (1.1, 6.1 and 6.2).

Remove the valve bonnet (5), and unscrew the threaded bushing (5.2). Press out damaged stuffing box packing (4.2) using the plug stem (6). Pull out the valve plug (3) along with the plug stem (6). Remove the packing washer (4.3) and the packing spring (4.1), and clean the packing chamber.

Apply lubricant to the individual parts of the new stuffing box packing and also to the plug stem (order no.: 8150-0111).

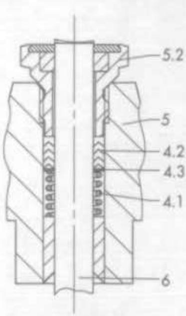
Insert the plug stem (6) along with the attached valve plug (3) in the valve bonnet (5). Place the valve bonnet on the valve body (1) again, and secure the bolts using the hexagonal nuts (1.1) (note the tightening torque according to the table). Install the packing spring (4.1) and the packing washer (4.3), and slide the new stuffing box packing (4.2) carefully over the plug stem in the packing compartment. Screw in the threaded bushing (5.2), and turn tight. Screw the locknut (6.2) and the coupling nut (6.1) onto the plug stem (6).

Mount the actuator to the valve and adjust the lower or upper-range value as instructed in section 2.

5.2 Replacing the valve seat and valve plug

If the valve leaks, the reason preventing positive shut-off may be impurities or damaged sealing edges.

In the first case, thoroughly clean the associated parts. In the second case, replace.



4 Stuffing box packing
4.1 Packing spring
4.2 PTFE V-ring packing
4.3 Packing washer
5 Valve bonnet
5.2 Threaded bushing
6 Plug stem

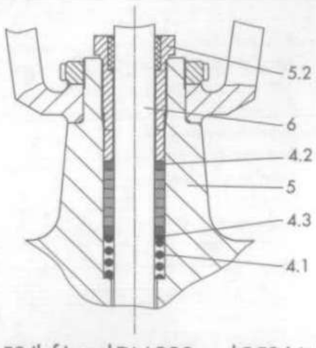


Fig. 6 · Replacing the stuffing box packing, sizes DN 15 to 150 (left) and DN 200 and 250 (right)

5.2.1 Valve plug

It is good practice to also replace the stuffing box packing (4.2) when adding the valve plug. Replace the plug as instructed below (see Fig. 3). Perform the same steps as instructed in section 5.1. However, install a new plug with attached plug stem in place of the old one. The worn plug can possibly be used again after it has been re-worked (see section 5.2.1.1). Apply lubricant to the plug stem prior to inserting (order no. 8150-0111).

5.2.1.1 Re-working the valve plug

Slight damages on the sealing edges of the valve plug can be corrected by re-turning.

For valve plugs with soft sealing, re-working is possible only up to dimension **x**, and only for valves with a seat bore above 12 mm (Fig. 7).

With seat bores of 63 or above, the entire sealing ring can be replaced should it be necessary (the plug parts are screwed together).

5.2.2 Valve seat

Replace the valve seat (2) as instructed below:

Unthread the hexagonal nuts (1.1), and lift the valve bonnet (5), plug stem (6) and actuator (8) off the valve body (1). Unscrew the valve seat (2) using the appropriate seat wrench tool (see table), and apply lubricant to the new valve seat (or possibly the old valve seat after re-working or thorough cleaning) on both the thread and the sealing conus (order no. 8150-0119) and screw in.

Place the valve bonnet (5) on the valve body again, and secure the bolts using the hexagonal nuts (1.1). The table lists the tightening torques for the seat rings and nuts holding the body flange (permissible deviation ±10 %).

Version with micro-trim element (Fig. 3.2)

In this version, the complete micro-trim element can be unscrewed from the valve body using a socket wrench (width across flats SW 27) and subsequently taken apart for cleaning purposes.

If the individual parts are damaged, the micro-trim element should be completely replaced.

SAMSON seat wrench tool

More details and information on the assembly procedure can be found in publication WA 029.

Seat bore mm	12	24...48	63...80	100...200
x (max.) mm	0.5	1.0	2.0	2.5

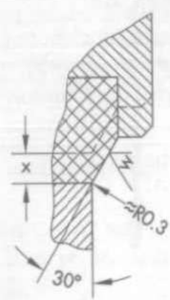


Fig. 7 · Valve plug with soft sealing

Table Seat wrench and tightening torques

Nominal size DN	Seat wrench Order no.	Seat thread mm	Torque Nm	Nuts (1.1) and bolts (5.4)	Torque Nm
15...25	9110-2403	M 32 x 1.5	170	4x M10	10
32...50	9110-2464	M 58 x 1.5	500	4x M12	30
65 and 80	9110-2467	M 90 x 1.5	1050	4x M16	60
100	9110-2471	M 110 x 1.5	1550	4x M20	100
125	9110-4075	M 125 x 1.5	1900	8x M16	60
150	9110-4076	M 152 x 1.5	2600	8x M20	100
200 and 250	0900-0172	M 230 x 3	4500	8x M27	390

5.3 Replacing the stuffing box packing, valve plug, valve seat and bellows (for valves with extension bonnet or bellows seal bonnet)

(Figs. 3 and 8). See also sections 5.1 and 5.2.

Separate the actuator (8) from the valve. For this purpose, perform the following for version: Actuator stem "extends". First apply a pressure which exceeds the lower-rang value to the actuator (see nameplate).

Loosen the coupling clamps connecting the actuator stem and the plug stem, and unthread the annular nut (8.2). Lift the actuator off the valve.

Remove the nuts (6.1 and 6.2) and bolts (5.4). Unloosen the threaded bushing (5.2). Remove the valve bonnet (5).

NOTE

When removing the valve bonnet, take extra care not to damage the stuffing box packing (4.2) by the thread of the plug stem extension (6.3). Always remove the stuffing box packing from the bonnet, and check whether it is suitable for further use.

Remove the hexagonal nuts (1.1). Remove the intermediate piece (12), plug stem (6) and valve plug (3) from the valve body (1).

5.3.1 Stuffing box packing

(Figs. 2, 6 and 8)

Replace as instructed in section 5.1. To push out, a suitable tool can be used instead of the plug stem.

5.3.2 Valve plug

Sizes DN 15 to 150

Unscrewing the plug stem (6) from the plug stem extension (6.3) requires that two nuts (for counter holding) be screwed to the protruding thread of the extension. In order to prevent damage with the bellows version, always make sure that no torque is transmitted to the bellows which is screwed to the intermediate piece.

We advise the use of a SAMSON assembly pliers (Fig. 8.2), in which the plug stems with 10 and 16 mm Ø can be clamped in the vice.

Apply lubricant to either the new or old, reworked valve plug (3) (order no. 8150-0111). Check whether the two locking washers (6.4) are still confined to the plug stem extension (6.3). Then, screw the plug stem tight in the plug stem extension (6.3) (tightening torque 50 Nm for Ø 10, 80 Nm for Ø 16 mm).

Sizes DN 200 and 250:

Remove the hexagonal screws (3.3), straining ring (3.5) and flange (3.6). Unscrew the valve plug from the plug stem using a suitable tool, preventing distortion of the plug stem (this is a part with the bellows). Assemble the new valve plug in reverse order.

Parts 3.5, 3.6 and 3.7 are omitted for the extension bonnet version, whereby the valve plug (3) and plug stem (6) are one part.

5.3.3 Valve seat

Replace as instructed in section 5.2.2.

5.3.4 Bellows

Sizes DN 15 to 150:

Unscrew the valve plug (3) along with the attached plug stem (6) from the plug stem extension (6.3), considering section 5.3.2. Unthread the nut (6.5) using the SAMSON socket wrench tool (order no.: 9250-0677.72). Pull the metal bellows (6.6) along with welded plug stem extension out of the intermediate piece (12). Clean the sealing surfaces on the intermediate piece. Push the replacement bellows in the intermediate piece, and tightly thread on the nut (6.5). Check whether the two locking washers (6.4) are still situated in the plug stem (6). Apply lubricant (order no. 8150-0119) to the thread of the plug stem, and screw the plug stem tightly in the plug stem extension (6.3) (tightening torque 50 Nm for 10, 80 Nm for 16 mm).

Sizes DN 200 and 250:

Unscrew the valve plug (3) from the plug stem as instructed in section 5.3.2, and pull out the metal bellows (6.6) together with the plug stem (6) upwards out of the intermediate piece (12).

Replace the sealing ring (6.7), and insert the new plug stem with metal bellows section (6.6).

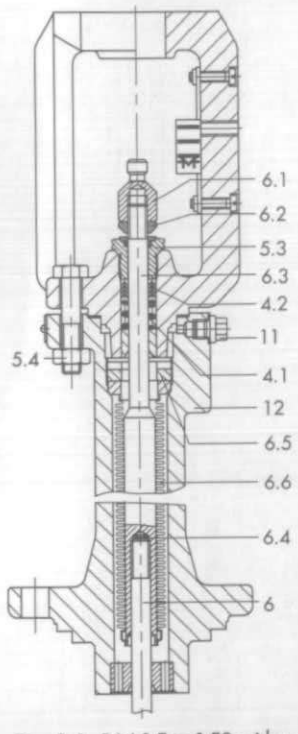
Screw on the valve plug, and secure using the straining ring (3.5), flange (3.6) and screws (3.7).

5.3.5 Re-assembling

Place the intermediate piece (12) on the valve body (1), and secure using the hexagonal nuts (1.1).

Place the valve bonnet (5) on the intermediate piece, and secure using the bolts (5.4) and nuts. Tighten the threaded bushing (5.2). Screw both the locknut (6.2) and the coupling nut (6.1) onto the plug stem extension (6.3).

Mount the actuator to the valve, and adjust the lower and upper-range value as instructed in section 2.



1.1 Nuts
3 Valve plug
3.5 Straining (tension) ring
3.6 Flange
3.7 Screws
4.2 Stuffing box packing
5 Valve bonnet
5.2 Threaded bushing
5.4 Bolts
6 Plug stem
6.1 Coupling nut
6.2 Locknut
6.3 Plug stem extension
6.4 Locking washers
DN 15 to 80 order no. 8382-2317
DN 100 to 150 order no. 8382-2321
6.5 Nut (sizes DN 15 to 150)
6.6 Metal bellows
6.7 Sealing ring (DN 200 and 250)
6.8 Sealing ring (DN 200 and 250)
11 Bellows test connection
12 Intermediate piece

Fig. 8.1 · DN 15 to 150 with metal bellows, no bellows (6.6) with extension bonnet

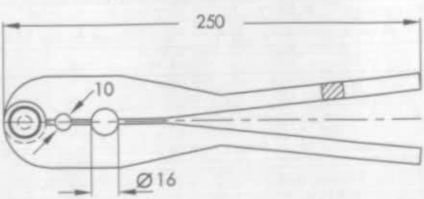


Fig. 8.2 · Clamping tool, tong order no. 9129-1995

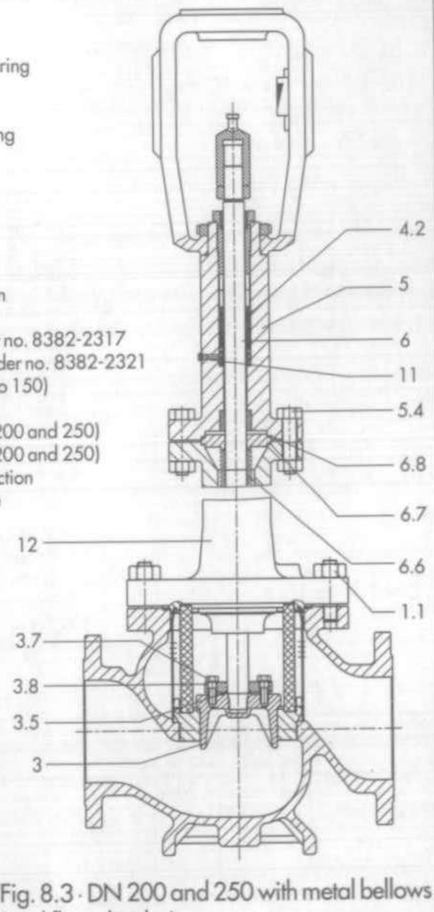


Fig. 8.3 · DN 200 and 250 with metal bellows (and flow divider)
no bellows (6.6) with extension bonnet

5.4 Replacing the stuffing box packing (or sealing ring) for balanced valve plug (Fig. 9)

After unthreading the hexagonal nuts (1.1), remove both the actuator (8) and the valve bonnet (5) from the valve body.

For this purpose, perform the following for version: Actuator stem "extends". First apply a pressure which exceeds the lower value of the signal range to the actuator (see name-plate).

Remove the stem connector (7) and the associated nuts (6.1 and 6.2). Pull the plug stem and the valve plug (3) out of the valve bonnet.

5.4.1 Size DN 40

Unscrew the threaded bushing (5.2). Remove the stuffing box packing (4.2), packing washer (4.3) and the packing spring (4.1). Push out bushing (3.2), and replace the stuffing box packing (3.1). Clean the bore in the valve bonnet. Apply lubricant to the bushing (3.2) (order no. 8150-0111), and press in. Also apply lubricant to the plug stem (6) and the effective areas of the packing (3.1).

For further assembly, proceed as instructed in section 2.

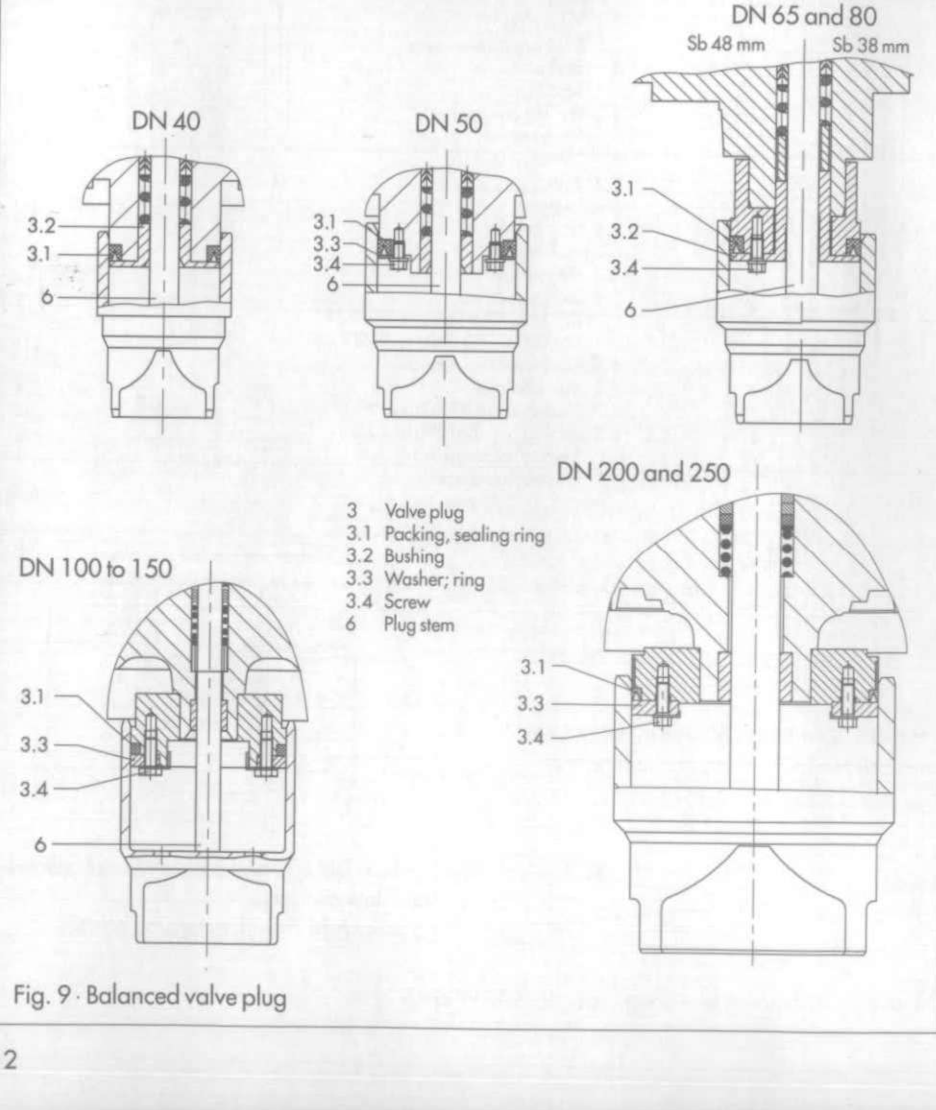


Fig. 9 · Balanced valve plug

5.4.2 Sizes DN 50 to 150

Remove the screw (3.4), screw retention and washer (3.3). Replace the stuffing box packing (3.1). Insert the washer (3.3). Insert the screw (3.4) and retention, and screw tight. Apply lubricant to the plug stem (6) and the effective areas of the stuffing box packing (3.1) (order no. 8150-0111). For further assembly, proceed as instructed in section 2.

5.4.3 Sizes DN 200 and 250

Remove the screw (3.4) along with the retention. Lift off the ring (3.3), and replace the stuffing box packing or sealing ring (3.1). Insert the ring (3.3). Insert the screw (3.4) along with retention, and screw tight.
Apply lubricant to the plug stem (6) and effective areas of the stuffing box packing (3.1) (order no. 8150-0111).

For further assembly, proceed as instructed in section 2.

6. Identifying mark of the guide bushing, valve seat and valve plug

6.1 Guide bushing

Material identification:

- No groove on the plane surface:
  Stainless steel: DIN-WN 1.4305
- Sharp recessed groove:
  Stainless steel: DIN-WN 1.4571
- Flat recessed groove:
  Material: Hastelloy

6.2 Valve seat

The **material number** is either stamped in or engraved.
When Stellited, "st" is stamped in.

6.3 Valve plug

Material identification:

- No groove below the connecting thread:
  Stainless steel: DIN-WN 1.4006
- Sharp recessed groove below the connect ing thread:
  Stainless steel: DIN-WN 1 .4571
- Two sharp recessed grooves:
  Stainless steel: DIN-WN 1.4301
- Flat recessed groove below the connecting thread:
  Material: Hastelloy

For other materials, either the material number or designation is engraved.
The **K_{vs} value and characteristic** are engraved on the valve plug.
When **Stellited, "st"** is engraved.

7. Description of the nameplate

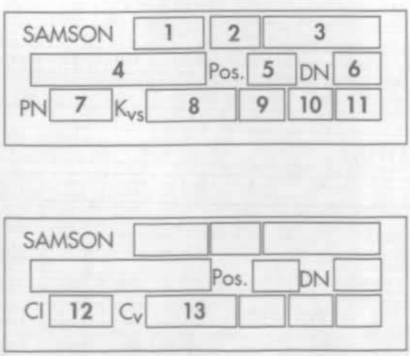


Fig. 10 · Nameplate on control valve

1 Type designation
2 Modification index
3 Material
4 Order no. (pos.) and modification index
5 Item. no. of order
6 Nominal size DN
7 Nominal pressure PN
8 K_{vs} value
9 Characteristic:
GL EQUAL PERCENT., **LN** LINEAR
10 Sealing:
ME METAL, **PT** SOFT
11 **D** Pressure balancing
1 or **3** flow divider

ANSI version

12 ANSI Class (pressure rating)
13 Cv value (K_{vs} x 1.17)

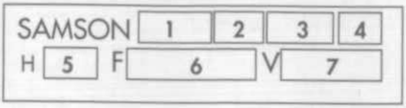


Fig. 11 · Nameplate on Type 271 Actuator

1 Type designation
2 Modification index
3 Effective diaphragm area
4 Actuator action:
FA Actuator stem "extends"
FE Actuator stem "retracts"
5 Travel
6 Bench range (spring range)
7 Bench range with "pre-tensioned" springs

8. Dimensions in mm and weights

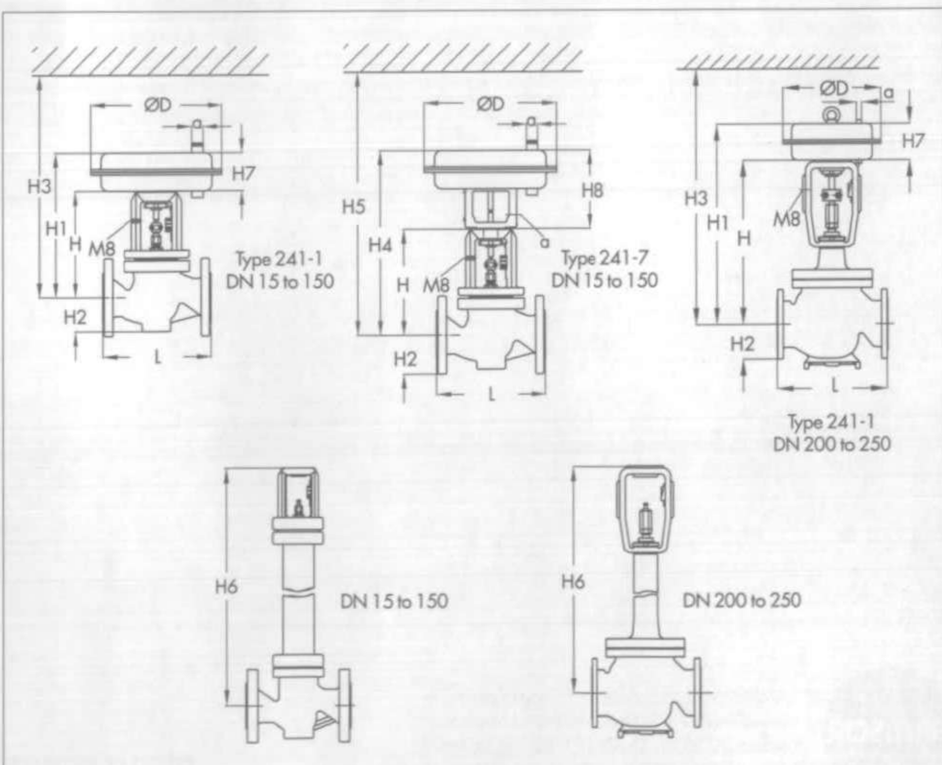
Standard version														
Nominal size	DN	15	20	25	32	40	50	65	80	100	125	150	200	250
Length L		130	150	160	180	200	230	290	310	350	400	480	600	730
Height H1 with actuator cm^2	80	285						325						
	120	290												
	240	285						325						
	350	305						345						
	700	355						395		485	495 / 515[1]	525 / 550[1]		
	1400												1002	
	2100												1433	
	2800												1426	
H with actuator	≤700	220						260		350	360 / 380[1]	390 / 415[1]		
	1400												805	
	≤2100												1060	
H2	approx.	40			72			98		118	144	175	235	260
H4 with actuator	120													
	240	385						425						
	350	405						445						
	700	455						495		585	595 / 615[1]	625 / 650[1]		
Weight of valve without actuator approx. kg		5	5	7	11	12	15	24	30	42	80	120	330	380

[1] Body material cast iron GG 25

Version with extension bonnet or bellows seal bonnet, sizes DN 15 to 150												
DN		15	20	25	32	40	50	65	80	100	125	150
Height H6	Short/with bellows	405			395			435		635	625 / 645[1]	655 / 680[1]
	Long/long w. bellows	710			700			740		875	865	985
Weight Appr. kg	Short/with bellows	8	9	10	17	18	21	32	38	60	105	150
	Long/long w. bellows	12	13	14	21	22	25	36	42	68	113	158

Version with extension bonnet or bellows seal bonnet, sizes DN 200 and 250							
Version with:		Extension bonnet			Bellows seal bonnet		
Actuator effective area cm^2		1400	2100	2800	1400	2100	2800
Height H6 with:	DN 200 DN 250	1250	1480		1453	1687	
Weight approx. kg	DN 200	380	400	400	390	410	410
	DN 250	430	450	450	440	460	460

Pneumatic actuator									
Actuator size cm^2		80	120	240	350	700	1400	2100	2800
Diameter D		150	168	240	280	390	530	670	770
Height H7		62	70	62	82	134	197	373	366
Height H8		163	157	163	183	235	298	374	467
H3 for actuator disassembly		430	430	430	460	695	1815	2375	2368
H5 for actuator disassembly		530	530	530	560	795			
Loading pressure connection **a**		G (NPT) 1/4	G (NPT) 1/8	G (NPT) 1/4	G (NPT) 3/8		G3/4	G1	
Weight Type 271 approx. kg	Without / with handwheel	2	2	5	8	22	70	280	350
				9	13	27	12	330	400
Weight Type 3277 approx. kg	Without / with handwheel		3.2	9	12	26			
				12	17	31			



10. Customer inquiries

Always specify the following important information (see also nameplate):

1. Order number
2. Type, product number, nominal size and valve version
3. Pressure and temperature of the process medium
4. Rate of flow in m^3/h
5. Bench range (e.g., signal range 0.2 to 1 bar) of the respective actuator
6. Indication whether or not a strainer is installed
7. Installation drawing

SAMSON
SAMSON AG · MESS- UND REGELTECHNIK
Weismüllerstraße 3 · D-60314 Frankfurt am Main
Postfach 10 19 01 · D-60019 Frankfurt am Main
Telefon (0 69) 4 00 90 · Telefax (0 69) 4 00 95 07

S/C 11.96

Series 240
Globe Valve Type 241

SAMSON

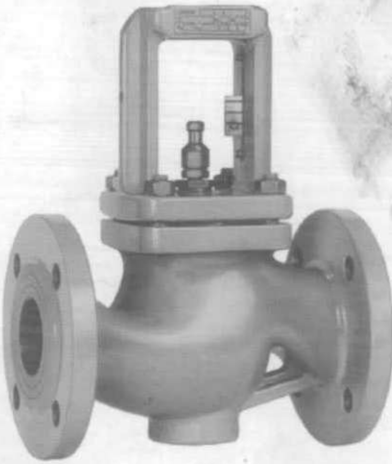


Fig. 1 · Type 241 Globe Valve

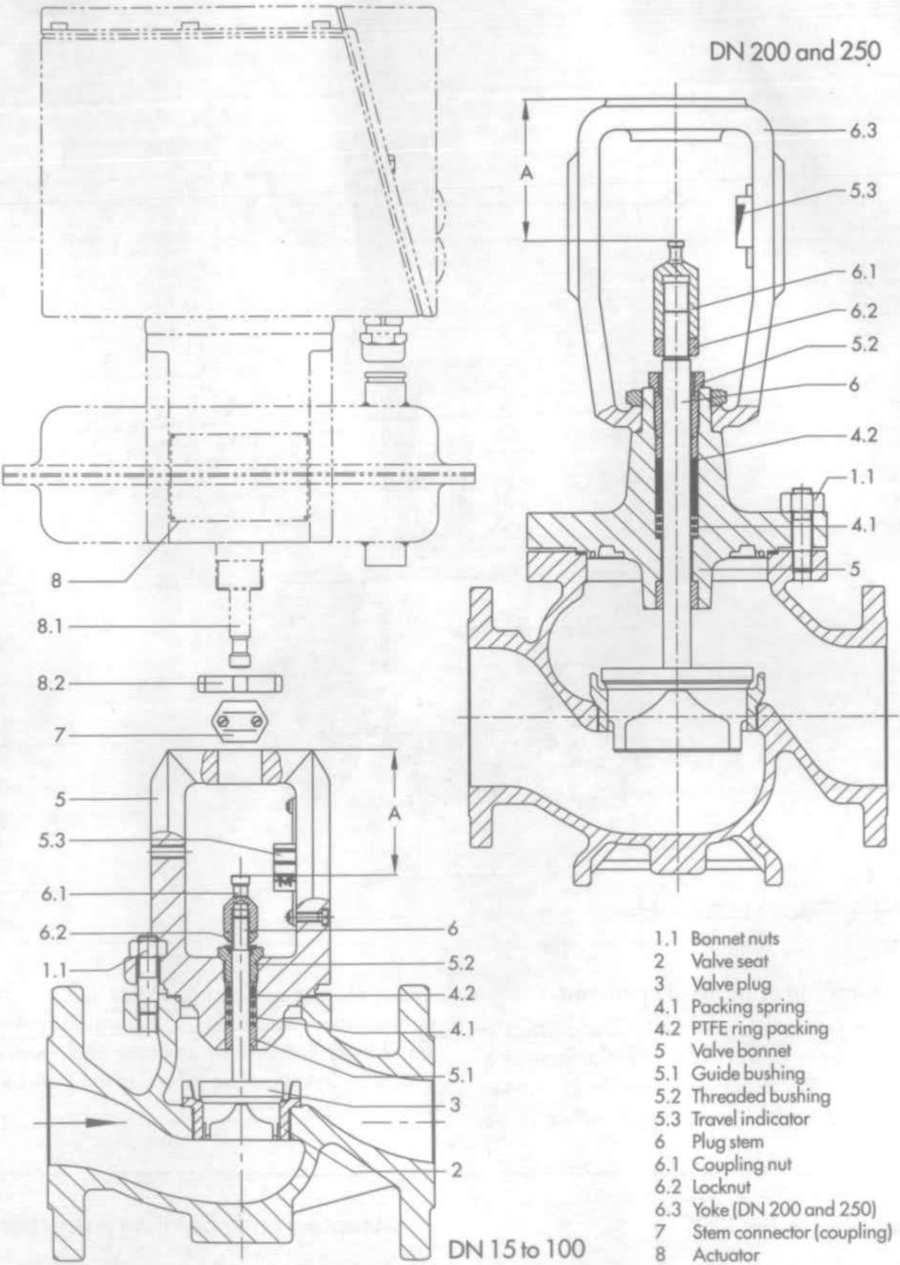
1. Design and principle of operation

The single-seated Type 241 Globe Valve is designed according to the modular-assembly principle. This valve subassembly, combined with an actuator subassembly (either pneumatic, electric or hand-operated), forms the control valve assembly. An extension bonnet (insulating section) or bellows seal bonnet (metal bellows) can be added to the standard valve version.

Edition November 1995

Mounting and operating instructions

Travel adjustment	15 to 80	100 to 150	200 a. 250
Dimension A for closed valve	75 ±0.1	90 ±0.1	165 (225)



1.1 Bonnet nuts
2 Valve seat
3 Valve plug
4.1 Packing spring
4.2 PTFE ring packing
5 Valve bonnet
5.1 Guide bushing
5.2 Threaded bushing
5.3 Travel indicator
6 Plug stem
6.1 Coupling nut
6.2 Locknut
6.3 Yoke (DN 200 and 250)
7 Stem connector (coupling)
8 Actuator
8.1 Actuator stem
8.2 Nut

Fig. 2 · Sectional drawings of Type 241 Globe Valve

The process medium flows through the valve in the direction indicated by the arrow. In this process, the closure member, the valve plug (3), is adjusted in response to signal pressure changes acting on the diaphragm of the actuator.

The valve plug (3) and attached actuator stem (8.1) are connected via the stem connector (7) and sealed by means of a spring-loaded PTFE ring packing (4.2).

2. Installation

2.1 Assembling the valve and actuator, making adjustments

NOTE
When assembling, always observe the "Mounting and operating instructions" of the actuator selected.

2.1.1 Travel adjustment

When the valve and actuator are delivered as separate subassemblies, dimension A (from the top edge of the coupling nut to the top edge of the valve bonnet) is adjusted according to the table presented in Fig. 2. Always check this dimension when assembling.

2.2 Mounting position

There is no prescribed mounting position. However, always note the limitations pertaining to the actuator in use.

Otherwise, it is good practice to install the actuator vertically upright for valve sizes DN 100 and above, facilitating any maintenance required.

Install the valve free of stress! If necessary, support piping near the process connections.

Never attach braces to the valve or the actuator!

Thoroughly flush through the line prior to installing the valve!

2.3 Strainer, bypass line

We recommend that a SAMSON Type 2 Strainer be installed upstream of the valve body.

In order to avoid disrupting plant operation when servicing, we also recommend that a shut-off valve be installed both upstream of the strainer and downstream of the valve. A bypass line is also recommended.

2.4 Bellows test connection (Fig. 5.1)

In order to check the bellows for leakage, the metal bellows version contains a bellows test connection (G 1/8) on the top flange. Especially for liquids and steam we recommend that a suitable leakage indicator (such as a contact-making pressure gauge, run-off in an open pan or sight glass) be connected.

3. Operating

Observe the operating notes of the actuator being used. They can be found in the corresponding operating manual.

4. Troubleshooting

IMPORTANT:
When performing any type of servicing, remove the actuator from the valve! For this purpose, remove the stem connector (7) and nut (8.2), and lift the actuator off the valve.

If external leakage occurs, the reason may be a defective stuffing box or, when equipped with a bellows, the metal bellows.

If the valve does not tightly seal, the reason preventing positive shut-off may be dirt or other foreign matter lodged between the valve seat and the valve plug. Another reason may be damaged sealing edges.

It is good practice to remove the parts, clean them thoroughly and, when necessary, replace.

⚠ **When assembling the valve, always remove pressure from the corresponding part of the plant! Recommendation: Remove the device.**

4.1 Replacing the stuffing box packing for standard valve versions

If the valve leaks around the stuffing box, replace its ring packing (4.2) as instructed below:

Remove the nuts (1.1, 6.1 and 6.2)

Lift off the valve bonnet (5). Unscrew the threaded bushing (5.2). Press out the damaged ring packing (4.2) with the aid of the plug stem (6). Pull out the valve plug (3) with attached plug stem (6). Remove the packing washer (4.3) and the packing spring (4.1), and clean the packing chamber.

Apply lubricant (**order number: 8150-0112** to the individual parts of the new packing and to the plug stem.

Insert the plug stem (6) with attached plug (3) in the valve bonnet (5). Place the valve bonnet on the valve body again, and secure with the nuts (1.1), noting the tightening torques according to the table. Install the packing spring (4.1) and the packing washer (4.3), and carefully slide the new packing (4.2) over the plug stem and into the packing chamber.

Thread in and tighten the threaded bushing (5.2). Screw the locknut (6.2) and the coupling nut (6.1) onto plug stem (6), and adjust dimension A according to the table in Fig. 2.

4.2 Replacing the valve seat the valve plug

If the valve does not tightly seal, the reason preventing tighte shut-off may be contributable to impurities or damaged sealing edges.

In the case of impurities, thoroughly clean the parts. In the second case, replace.

4.2.1 Valve plug

We recommend that the PTFE ring packing (4.2) also be replaced when renewing the valve plug.

Replace the valve plug as instructed below (Fig. 2):

Perform the same steps as instructed in section 4.1. However, install a new plug with attached plug stem in place of the old, worn valve plug. The old plug may still be suitable for used after it has been re-worked (see section 4.2.1.1). Apply lubricant (**order number: 8150-0112**) to the plug stem prior inserting!

4.2.1.1 Re-working the valve plug

Minor damage on the sealing edges of the plug can often be corrected by re-turning.

Re-working plugs with soft sealing is only possible up to dimension x, and only for

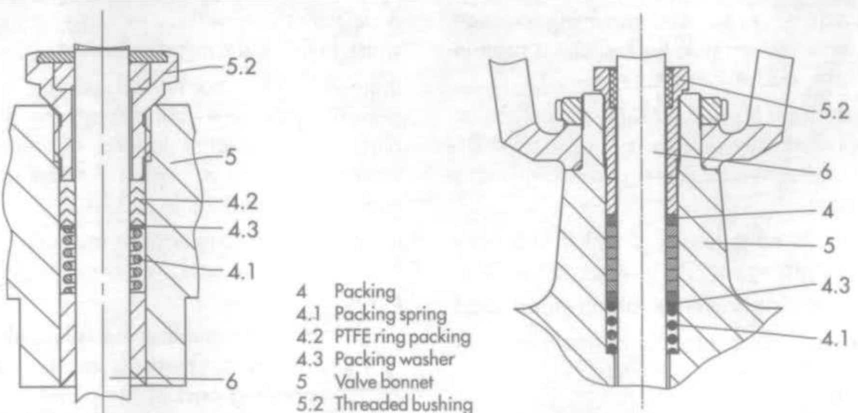


Fig. 3 · Exchanging the stuffing box packing DN 15 to 150 (left) and DN 200 and 250 (right) valves having a seat bore larger than 12 mm (Fig. 4).

If necessary, the entire sealing ring can be exchanged for seat bores 63 or greater (the plug parts are screwed together).

4.2.2 Valve seat

Replace the valve seat (2) as instructed below:

Unthread the nuts (1.1), and lift the valve bonnet (5) with plug stem (6) and actuator (8) from the valve body (1). Unscrew the seat (2) using the appropriate seat wrench tool (see table), and apply lubricant (**order number 8150-0119**) to the thread or sealing conus of either the new valve seat (or to the old seat again following re-working or thorough cleaning!), and screw in. Place the valve bonnet (5) again on the valve body, and secure using the nuts (1.1), noting the tightening torques for the seat rings and nuts of the body flange as listed in the tables (permissible deviation ±10 %).

SAMSON seat wrench tool

Further details and notes important to assembling can be found in the publication WA 029

Seat bore mm	12	24 to 48	63 to 80	100 to 200
x (max.) mm	0.5	1.0	2.0	2.5

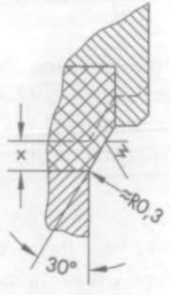


Fig. 4 · Plug with soft sealing

Table Seat wrench and tightening torque

Nominal size DN	Seat wrench Order number	Seat thread mm	Tightening torque Nm	Nuts (1.1) and bolts (5.4)	Torque Nm
15 to 25	9110-2403	M32 x 1.5	170	4 x M10	10
32 to 50	9110-2464	M58 x 1.5	500	4 x M12	30
65 and 80	9110-2467	M90 x 1.5	1050	4 x M16	60
100	9110-2471	M110 x 1.5	1550	4 x M20	100
125	9110-4075	M125 x 1.5	1900	8 x M16	60
150	9110-4076	M152 x 1.5	2600	8 x M20	100
200 and 250	0900-0172	M230 x 3	4500	8 x M27	390

4.3 Replacing the stuffing box packing, valve plug, valve seat and bellows for valves with

(Figs. 3 and 5). See also sections 4.1 and 4.2.

Remove the nuts (6.1 and 6.2) and bolts (5.4). Unloosen the threaded bushing (5.2). Lift off the valve bonnet (5).

CAUTION

When removing the valve bonnet, make sure that the thread of the plug stem extension (6.3) does not damage the PTFE ring packing (4.2)!

Always remove the packing from the valve bonnet, and check whether suitable for re-use.

Remove the nuts (1.1); lift the intermediate piece (12) with plug stem (6) and plug (3) off the valve body.

4.3.1 Stuffing box packing

(Figs. 2, 3 and 5)

Replace as instructed in section 4.1. To push the packing out, a suitable tool can be used in place of the plug stem.

4.3.2 Valve plug

Sizes DN 15 to 150:

Unscrewing the valve plug (6) from the plug stem extension (6.3) requires that two nuts, for counter-holding, be screwed onto the protruding thread of the extension. In order to prevent damage when working with the bellows version, always make certain that no torque is transmitted to the bellows, this of which is screwed to the intermediate piece.

We recommend the use a SAMSON assembly pliers (Fig. 5.2), permitting plug stems with 10 and 16 mm Ø to be clamped in a vice.

Apply lubricant (**order number: 8150-0112**) to the new or old, re-worked valve plug (3) plug stem (6).

Check whether the two locking washers (6.4) are still situated in the plug stem (6). Then, firmly screw the plug stem in the plug stem extension (6.3). (Torque 50 Nm for Ø 10, 80 Nm for Ø 16 mm).

Sizes DN 200 and 250:

Remove the hexagonal screws, tension ring (3.5) and flange (3.6). Unscrew the plug from the plug stem. Use a stuiable tool in order to prevent the plug stem (the part with the bellows) from turning. Assemble the new valve plug in the reverse sequence.

Parts 3.5, 3.6 and 3.7 are omitted for the extension bonnet version. The valve plug (3) and plug stem (6) are one part.

4.3.3 Valve seat

Replace as instructed in section 4.2.2.

4.3.4 Metal bellows

Sizes DN 15 to 150:

Unscrew the valve plug (3) with attached plug stem from the plug stem extension (6.3), considering section 4.3.2.

Unthread the nut (6.5) using the SAMSOM wrench tool (**order number: 9250-0677.72**). Pull the metal bellows (6.6) with welded on plug stem extension out of the intermediate piece (12).

Clean the sealing surfaces on the intermediate piece. Slide a new bellows in the intermediate piece, and firmly thread on the nut (6.5). Check whether the two locking washers (6.4) are still situated in the plug stem extension.

Apply lubricant (**order number: 8150-0119**) to the thread of the plug stem, and firmly screw the plug stem in the plug stem extension (6.3). (Torque 50 Nm for 10, 80 Nm for 16 mm).

Sizes DN 200 and 250:

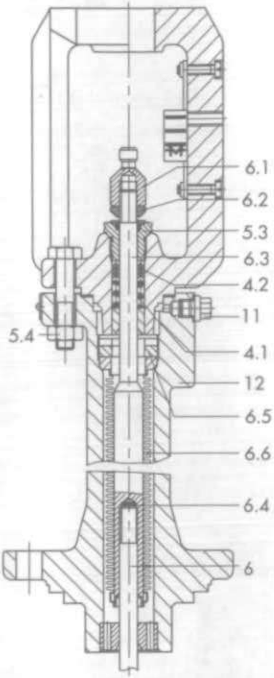
Unscrew the plug (3) from the plug stem according to section 4.3.2, and pull the metal bellows (6.6), together with the plug stem (6), upwards out of the intermediate piece (12).

Replace the sealing ring (6.7), and insert the new plug stem with metal bellows (6.6). Screw on the plug, and secure with the tension ring (3.5), flange (3.6) and screws (3.7).

4.3.5 Re-assembling

Place the intermediate piece (12) on the valve body, and secure using the nuts (1.1).

Place the valve bonnet (5) on the intermediate piece, and secure using the bolts (5.4) and nuts. Tighten the threaded bushing (5.2). Screw the locknut (6.2) and the coupling nut (6.1) onto the plug stem extension (6.3). Adjust dimension A according to Fig. 2.



1.1 Bonnet nuts
3 Valve plug
3.5 Tension ring
3.6 Flange
3.7 Screws
4.2 PTFE ring packing
5 Valve bonnet
5.2 Threaded bushing
5.4 Bolts
6 Plug stem
6.1 Coupling nut
6.2 Locknut
6.3 Extended plug stem
6.4 Locking washers
DN 15 to 80
Order number: 8382-2317
DN 100 to 150
Order number: 8382-2321
6.5 Nut (DN 15 to 150)
6.6 Metal bellows
6.7 Sealing ring (DN 200 and 250)
6.8 Sealing ring (DN 200 and 250)
11 Bellows test connection
12 Intermediate piece

Fig. 5.1 · DN 15 to 150 with metal bellows; with the extension bonnet (insulating section), the metal bellows (6.6) is omitted

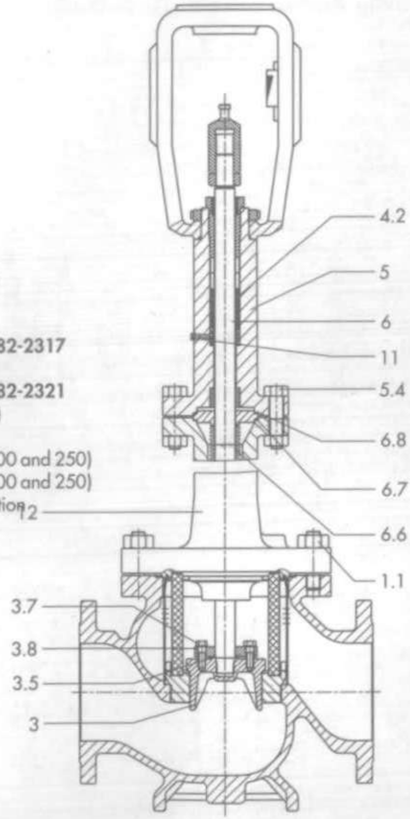


Fig. 5.3 · DN 200 and 250 with metal bellows (and flow disturber); with the extension bonnet (insulating section) the metal bellows (6.6) is omitted

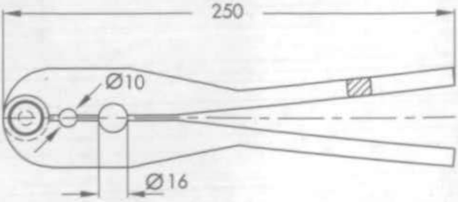


Fig. 5.2 · Tongs tool order number: 9129-1995

4.4 Replacing the packing (or sealing ring) for balanced valve plugs (Fig. 6)

Remove the stem connector (7) and the nuts (6.1 and 6.2). Pull the plug stem with attached plug (3) out of the valve bonnet.

4.4.1 Size DN 40 only

Unscrew the threaded bushing (5.2). Remove the PTFE ring packing (4.2), packing washer (4.3) and packing spring (4.1). Push out the bushing (3.2), and replace the packing (3.1).

Clean the bore in the valve bonnet. Apply lubricant (**order number 8150-0112**) to the bushing (3.2), and press in.

Also apply lubricant (**order number 8150-0112**) to the plug stem (6) and contacting (running) surface of the packing (3.1).

4.4.2 Sizes DN 50 to 150

Remove the screw (3.4) with locking device and packing washer (3.3). Replace the packing (3.1). Insert the packing washer (3.3). In-

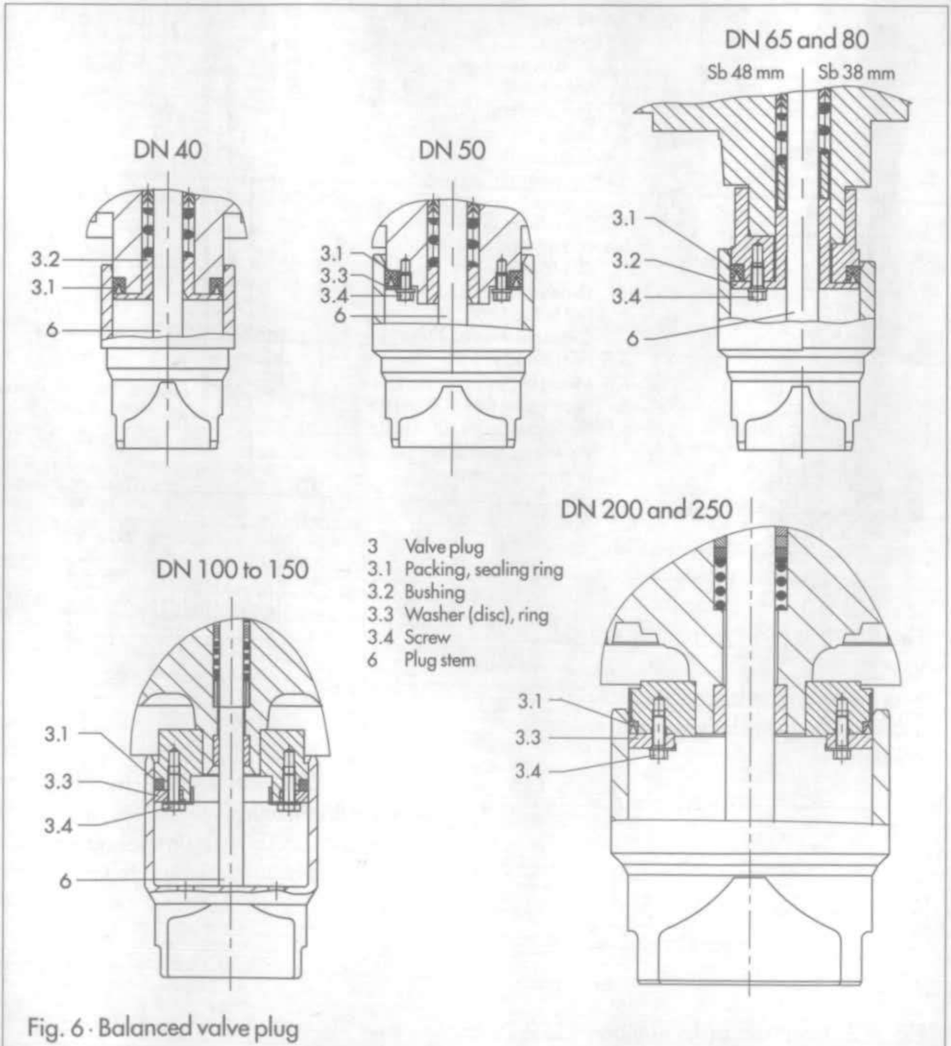


Fig. 6 · Balanced valve plug

stall the screw (3.4) with locking device, and screw in tight. Apply lubricant (**order number: 8150-0112**) to the plug stem (6) and the contacting surface of the packing (3.1).

4.4.3 Sizes DN 200 and 250

Remove the screw (3.4) with locking device. Lift off the ring (3.3), and replace the packing or sealing ring (3.1). Insert the ring (3.3). Insert the screw (3.4) with locking device, and screw in tight.

Apply lubricant (**order number: 8150-0112**) to the plug stem (6) and the contacting surface of the packing (3.1).

5. Identification marking of the guide bushing, valve seat and valve plug

5.1 Guide bushing

Material identification:

- No groove on the plane surface:
  Material: DIN-WN 1.4305
- Sharp recessed groove:
  Material: DIN-WN 1.4571
- Flat recessed groove:
  Material: Hastelloy

5.2 Valve seat

The **material number** is either stamped in or engraved.

When Stellited, "**st**" is stamped in.

5.3 Valve plug

Material identification:

- No groove below the connecting thread:
  Material: DIN-WN 1.4006
- Sharp recessed groove below the connecting thread:
  Material: DIN-WN 1.4571
- Two sharp recessed grooves:
  Material: DIN-WN 1.4301
- Flat recessed groove below the connecting thread
  Material: Hastelloy

For other materials, either the material number or the designation is engraved.

The **K_{vs} value and characteristic** are engraved on the valve plug.

When **Stellited, "st"** is engraved.

6. Description of the nameplate

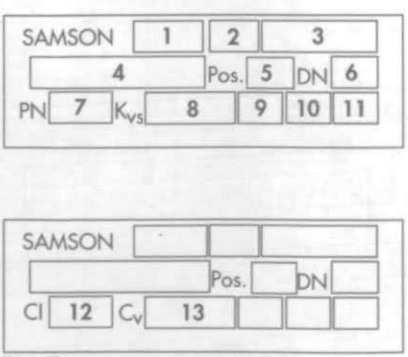


Fig. 7
Nameplate on valve

1 Type designation
2 Modification index
3 Material
4 Order no. (pos.) and modification index
5 Item. no. of order
6 Nominal size DN
7 Nominal pressure PN
8 K_{vs} value
9 Characteristic:
GL EQUAL PERCENT., **LN** LINEAR
10 Sealing:
ME METAL, **PT** SOFT
11 **D** Pressure balancing
1 or **3** flow divider

ANSI version

12 ANSI Class (pressure rating)
13 Cv value (K_{vs} x 1.17)

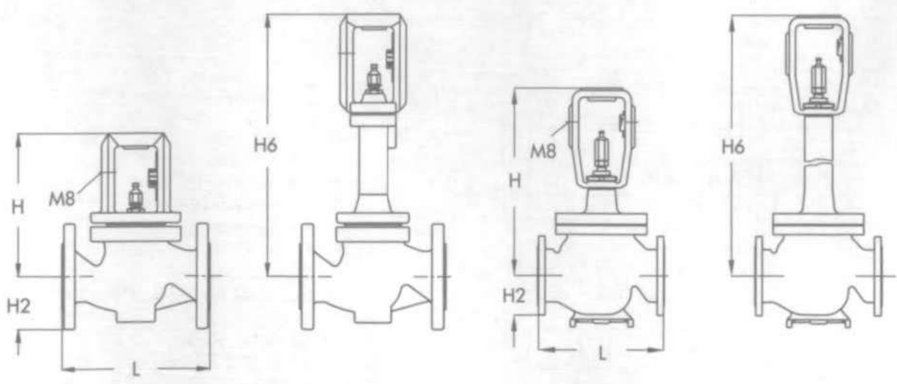
7. Dimensions in mm and weights

Standard version													
Nominal size DN	15	20	25	32	40	50	65	80	100	125	150	200	250
Length L	130	150	160	180	200	230	290	310	350	400	480	600	730
H with actuator	220						260		350	360	390	805 für Actuator 1400 cm^2	
										380[1]	415[1]	1060 für Actuator 2800 cm^2	
H2 approx.	40			72			98		118	144	175	235	260
Weight, approx. kg	5	5	7	11	12	15	24	30	42	80	120	330	380

Version with extension bonnet or bellows seal bonnet (intermediate piece) for sizes DN 15 to 150												
Nominal size DN		15	20	25	32	40	50	65	80	100	125	150
Height H6	Short/with bellows	405			395			435		635	625	655
											645[1]	680[1]
	Long/long with bellows	710			700			740		875	865	985
Weight, approx kg	Short/with bellows	8	9	10	17	18	21	32	38	60	105	150
	Long/long with bellows	12	13	14	21	22	25	36	42	68	113	158

Version with extension bonnet or bellows seal bonnet (intermediate piece) for sizes DN 200 and 250							
Version with:		Extension bonnet			Bellows seal bonnet		
Actuator cm^2		1400	2100	2800	1400	2100	2800
Height H6 with:	DN 200	1250	1480		1453	1687	
	DN 250						
Weight, approx. kg	DN 200	380	400	400	390	410	410
	DN 250	430	450	450	440	460	460

[1] Body material cast iron GG 25



DN 15 to 150

DN 200 and 250

8. Customer inquiries

(Always specify the following important information!)

1. Order number (stamped on the nameplate)
2. Type, product number, nominal size and version of the valve
3. Pressure and temperature of the liquid
4. Rate of flow in m^3/h
5. Indication whether a strainer is installed
6. Installation drawing

SAMSON CONTROLS (LONDON) LTD.
50, Holmethorpe Avenue · GB-Redhill, Surrey RH1 2NL (London)
Telephone (0 17 37) 76 63 91/2/3 · Tx. 885 085
Telefax (0 17 37) 76 54 72

Pneumatic Valve Positioner

Pneumatic motion transmitter

Type 765

SAMSON

SAMSON CONTROLS

REDHILL 66391

1. Construction and mode of operation

The pneumatic positioner assures a preselected relationship between the valve stem position (controlled variable) and the controller output signal (signal input). It compares the output signal of a pneumatic or electropneumatic control device to the control valve position and controls the output pressure connected to the pneumatic actuator.

The positioner essentially consists of a lever with shaft and measurement spring, the diaphragm and the pneumatic control system with nozzle, flapper plate and amplifier.

The type 765-1 version has additional manometers for output pressure and input pressure.

Figure 1: Type 765

The positioner operates on the force balance principle. The controlled variable x is the position of the final control element, particularly the stroke of a control valve. The input w is the output signal of a pneumatic controller. The output y of the positioner is the air pressure p_{st}.

For every position of the valve there is a corresponding torsion of the measuring spring (3). Whenever the actuator or valve stem plate (20) and the pin (1.1) move, the lever (1) and other transfer elements (2.1, 2.2, 3.1) cause the spring (3) to rotate and the spring torsion is altered.

The input, a signal (p_e) in the standard pneumatic range, produces a force on the diaphragm (4) which is balanced by the torsion load of the spring (3). If the signal p_e changes, then the feeler pin (5.1) moves. The flapper plate (6) follows this motion and influences the nozzle (7).

The supply air is piped to the pneumatic amplifier (8) and flows via the X_p-throttle (9) and the nozzle (7) against the flapper plate (6). A change in either the signal input or the actuator position causes a pressure change before and after the amplifier. The output pressure p_{st} controlled by the amplifier (8) flows through the adjustable volume throttle (10) to the pneumatic actuator. Adjustable needle valves (9 and 10) are used for optimization and stabilization of the position-control-loop.

The lever (1) and the measuring spring (3) contained within the positioner are adaptable to the desired valve stroke and the span of the input signal.

Edition November 1979

Mounting and operating instruction

EB 8106 E

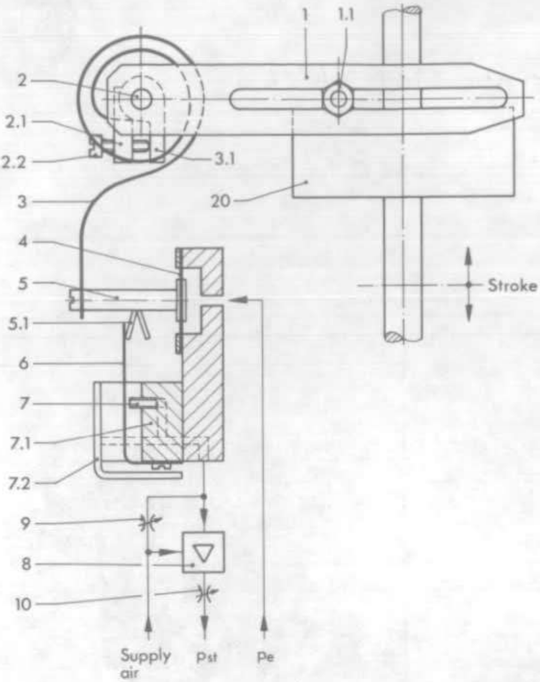
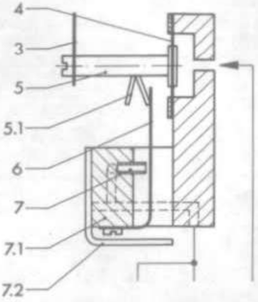


Figure 2: Schematic of the positioner



2.1 Mounting positions of nozzle and flapper for "direct action" ≫

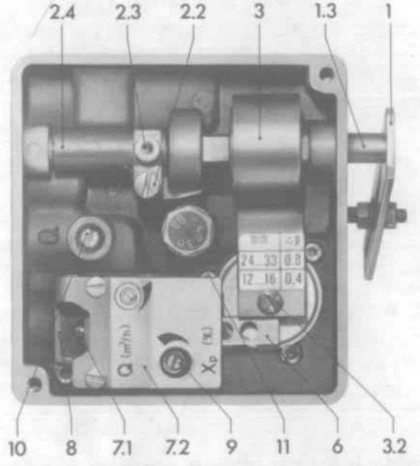


Figure 3: Positioner without cover

Legends for figure 2 and 3

1.	Lever for valve stroke
1.1	Pin
1.3	Spacer bush
2	Shaft
2.2	Zero adjusting screw
2.3	Attachment screw
2.4	Take off device
3	Measurement spring
3.1	Take off ring
3.2	Screw
4	Diaphragm
5	Coupling
5.1	Feeler pin
6	Flapper plate
7	Nozzle
7.1	Nozzle block with operating direction symbol
7.2	Cover plate
8	Amplifier
9	Xp-adjustment
10	Volume adjustment
11	Mounting screw
20	Plate (attached to valve stem)

2. Attachment

The attachment parts with the product number 1.400-5745 is used for attachment of the positioner to cast frame valves and the attachment kit with the product number 1.400-5747, which additionally contains a mount with hose clamps, is required for rod valves (spacer bolts).
Before actual attachment of the positioner, the coordination of the positioner and actuator must be laid down, as the positioner is fitted either to the right or left of the valve. Please note the corresponding illustrations 7 to 10 in section 4.1.

2.1 Attachment to cast frame type valve (figures 4 and 5)

Screw the plate (20) with screws (21) (in the case of figure 5, additionally with washer) to the coupling clamp (22) of the valve. Unscrew the cover of the positioner and attach the device to the frame of the valve with mounting screw (11).

2.2 Attachment to rod type valve (figure 6)

Screw plate (20) with screw (21) in off-centre position on the travel indicator (24) of the valve stem (23).
Place the mount (28) onto rod (27). Place the opened clamps (26) around the mount and rod and slightly tighten these. Shift the mount until the plate centre (20) and mount hold are flashed at half valve stroke. Secure the clamps and mount the positioner with attachment screw (11) to the mount.

2.3 Housing cover

After attachment of the positioner, make sure that, when the valve is fitted, the vent stopper on the housing points downwards.

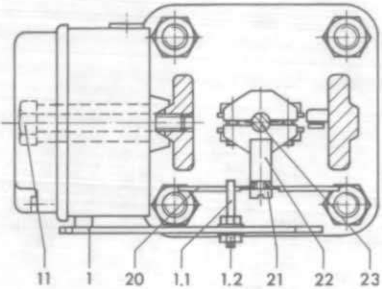


Figure 4: Attachment in the case of cast frame version (e.g. type 240) Valve DN 15...80 with actuator 80 or 240 cm^2 and DN 100...150 with 700 cm^2

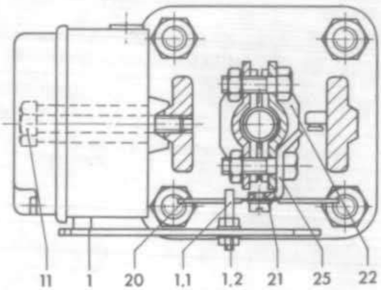
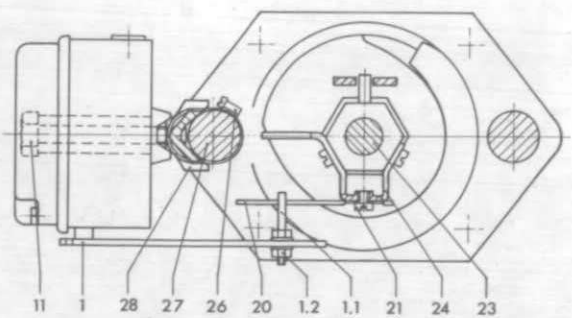


Figure 5: Attachment in the case of cast frame version (e.g. type 240) Valve DN 15...80 with actuator 350 cm^2 and DN 20...80 with 700 cm^2



1	Lever
1.1	Pin
1.2	Nut
11	Mounting screw
20	Plate
21	Screw
22	Coupling
23	Valve stem
24	Travel indicator
25	Indicator
26	Hose clamp
27	Valve rod (stabled)
28	Mount

Figure 6: Attachment in the case of rod type valve (e.g. type 201)

3. Air connections

The air connections are designed in the form of hose with NPT 1/4" thread. The normal types of screw connections for metal and copper pipes or for plastic hoses can be used. Before connection of the air-lines, blow through these well. The output pressure is conveyed to the upper or underside of the actuator in accordance with figures 7 to 10.

4. Operation

4.1 Coordination of positioner and actuator

The position of attachment is dependent on the type of actuator, of input signal and of the operating direction. The mounting of the positioner has to be arranged according to Fig. 7 to 10.
Each subsequent conversion such as, fo example reversing of operating direction of the positioner or reversing of the actuator, "spring opening" to "spring closing" actuator or vice versa, also means an alteration of the positioner's place of attachment.

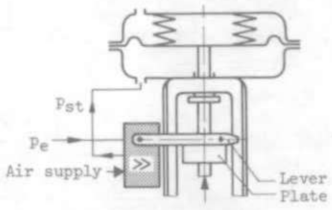


Figure 7: "Spring closing" actuator attached on the left, operating direction ≫

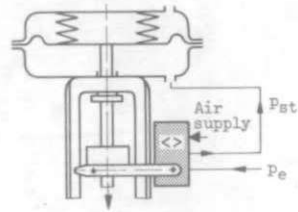


Figure 8: "Spring closing" actuator attached to the right, operating direction <>

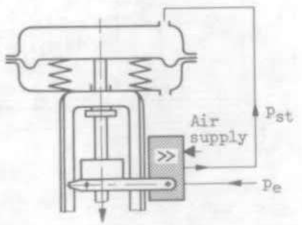


Figure 9: "Spring opening" actuator attached to the right, operating direction ≫

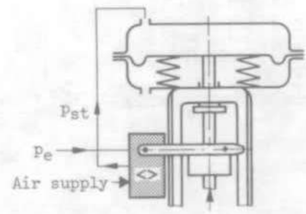


Figure 10: "Spring opening" actuator attached to the left, operating direction <>

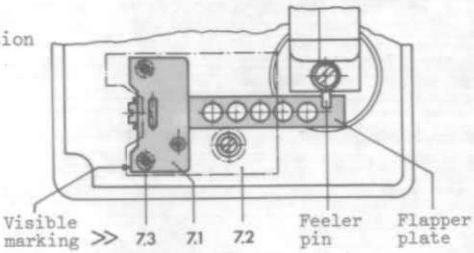
4.1.1 Determination and reversion of the operating direction (figures 7 to 10 and figure 11)

For an increase in the input pressure p_e (signal input), the output pressure p_{st} may increase (direct action ≫) or may decrease (reverse action <>). This is exactly the same for a decreasing input signal p_e; in the case of direct action ≫, a decreasing output pressure is obtained and an increasing output pressure is obtained in the case of reverse action <>.
There are lateral markings for the operating direction (≫ and <>) ont the nozzle block (7.1). One of the two markings is covered by the angular tab of the covering plate (7.2) with the result that the visible marking indicates which operating direction has been set.
If the desired operating direction (figures 7 to 10) does not agree with the visible marking or if the operating direction is to be altered, proceed as follows: unscrew both screws (7.3) of the covering plate whilst holding the nozzle block. Remove the cover plate.

Once again place the nozzle block (7.1) in position shifted by 180° and secure this. It is absolutely necessary to ensure the correct position of the nozzle block with the flapper plate to the feeler pin of the coupling (5) as shown in figure 11. If, after laying down coordination, the operating direction is to be reversed, the positioner must be screwed onto the other side of the valve. Ensure correct positioning of lever (1) and plate (20) (figures 7 to 10).

Increasing/increasing operating direction
Flapper plate below the feeler pin

7.1 Nozzle block
7.2 Cover plate
7.3 Screw



Increasing/decreasing operating direction
Flapper plate above the feeler pin

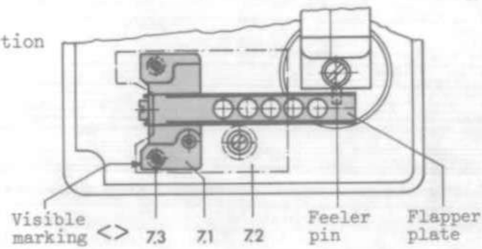


Figure 11: Reversal of the nozzle block

4.2 Beginning of operation and signal input span

Each positioner contains a measurement spring (1,2 or 3) which can be adapted to the desired valve stroke and the span of the input signal. The lettering inside of the cover specifies the relationship of the valve stroke and the signal input span Δ p. Normaly this is 0.8 bar. A signal input span of 0.4 bar is only required for split range operation. The range can be altered by subsequently replacing (section 4.5) the measurement spring.
When adjusting the positioner, the stroke must be adapted to the signal input and vice versa. In the case of a signal input span Δp of 0.8 bar (e.g. from 0.2...1 bar), the stroke must also pass through its complete range of 0...100%. The beginning of operation is then at 0.2 and the end value at 1 bar. During split range operation, the actuator operates with the lower signal input span Δp of 0.4 bar. In this case, the beginning of operation is either at 0.2 bar or at 0.6 bar and, accordingly, the end value is at 0.6 or 1 bar.
The beginning of operation is set with the screw (2.2), the signal input span and thus the end value is set with pin (1.1). For adjustment, the control signal input E must be linked to a compressed air source with a maximum of 1.5 bar via a signal pressure regulator and a control manometer and the supply air input Z must be linked to an air supply.

4.2.1 Adjusting the beginning of operation (e.g. 0.2 bar)
(Refer also to section 4.3)

Adjust the input pressure to a 0.2 bar beginning of operation by the signal pressure regulator. Turn screw (2.2) until the valve stem thus begins to move from its rest position (observe the valve stem with travel indicator). Remove the input pressure from the regulator and slowly increase once again. Check whether the valve stem begins to move at exactly 0.2 bar and, if necessary, correct this.

4.2.2 Adjusting the signal input range (e.g. 0.2...1 bar) or the stroke (0...100%)

Once the beginning of operation has been adjusted, increase the input pressure with regulator to 1 bar. At the end value of exactly 1 bar, the valve stem must be at a standstill and must thus have passed through 100% stroke. If the end value is not correct, the pin (1.1) must be shifted as follows for correction:

Shift to the lever end $\longrightarrow$ stroke increases
Shift to the point of rotation $\longrightarrow$ stroke decreases

After correction, remove the input pressure and increase this once again. First of all check the beginning of operation and then the end value. Repeat correction until both values are correct.

4.3 Adjustment of the P-band (Xp)

The Xp-throttle (9) is normally set to a lower value (open approximately 1 rotation). In the case of unstable behaviour of the position control loop, the range must be increased. However, remember that the end value of the signal input is also altered by means of subsequent correction. Therefore, after this, the beginning of operation and the end value must be checked and, if necessary, correct it.

4.4 Adjustment of the volume (Q)

In order to enable better adaptation of the positioner to the dynamic behaviour of smaller actuators, the air output capacity can be accordingly reduced from its maximum value by means of the volume throttle (10).

4.5 Replacement of the measurement spring (figure 3)

If the range is to be altered or converted to split range operation, the measurement spring must be replaced as follows:
First of all unscrew screw (3.2) from the measurement spring, then release the screw (2.3) and remove the lever with shaft.
Replace the measurement spring, then place the lever with shaft through the measurement spring and bush with zero point adjustment (2.4). Secure the measurement spring with screw (3.2). Shift the bush and shaft towards each other so that the screw (2.3) meets the flattened part of the shaft. Secure screw (2.3); there should be a play of 0.1...0,2 mm between the lever (1), the spacer bush (1.3), the measurement spring (3) and the housing.

5. Use of the positioner as pneumatic motion transmitter (figure 12)

In this application, the travel of a controlled valve or another device is measured and converted into an output signal (p_A) from 0.2...1 bar or 1...0.2 bar. Refer to figure 12 for attachment.

Note: The visible marking of operating direction on the nozzle block must always be set to reverse action <>.

The relation of 0...100% valve travel to the output signal 0.2...1 bar (or 1...0.2 bar) is laid down during the setting of beginning of operation (screw 2.2) and end value (pin 1.1). Operations then correspond with those in sections 4.2.1. and 4.2.2.

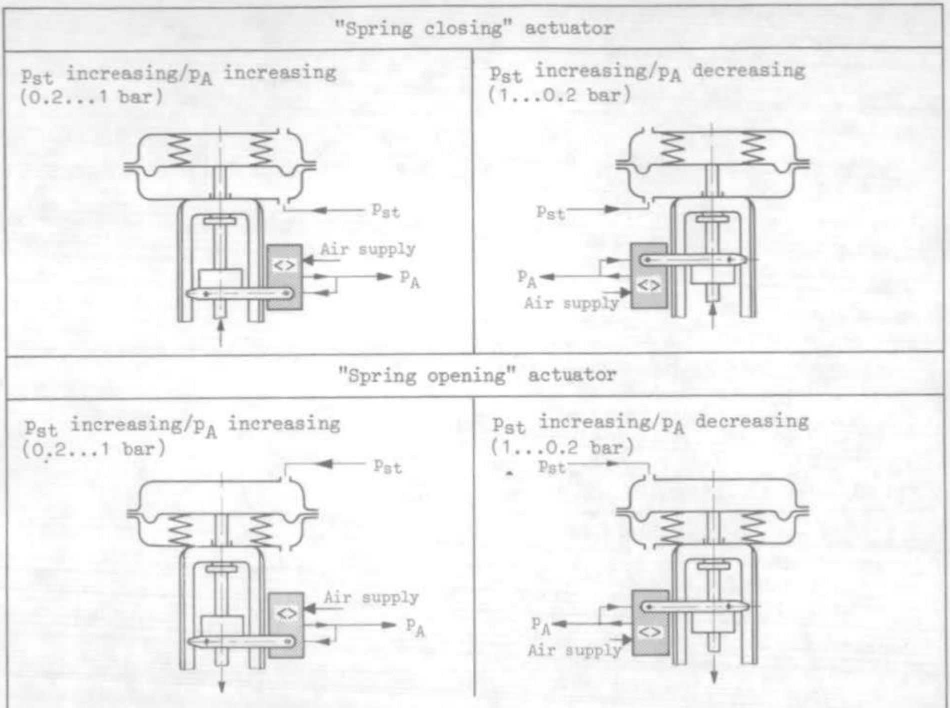


Figure 12: Pneumatic motion transmitter

6. Attachment of two devices (as positioner and motion transmitter)

If two devices are to be attached, first of all the place of attachment of the positioner must be laid down in accordance with figures 7 to 10.
It is then only possible to attach the motion transmitter to the other side of the valve. If the relationship of the input pressure p_{st} to the output signal p_A (figure 12) does not agree with the required relationship, the motion transmitter must be shifted by 180°. The valve travel is then transferred via plate (20) from the attached assembly to the other side of the valve stem (refer to figure 13, figures 4 and 5). In order to enable attachment of the plate to the valve stem, the coupling (22) must be removed and the clamp without stay must be replaced by a clamp with stay (refer to section 7.2.1) for the order number).

If the coupling consists of clamps without stays with a indicator (figure 5), an additional indicator (order number 0.200-0074) must be mounted for the second plate.

Proceed in accordance with sections 4.2.1, 4.2.2 and 5 for adjustment of the positioner and pneumatic motion transmitter.

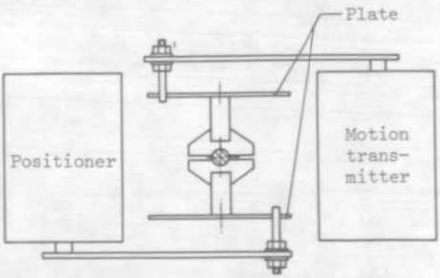


Figure 13: Schematic for attachment

7. Accessories, attachment parts

7.1 Accessories

	order number
Measurement spring 1 0.2...1 bar	1190-0736
Measurement spring 2 0.2...0,6 or 0,6...1 bar (split range) as well as for 0.2...1 bar	1190-0737
Measurement spring 3 0.2...0,6 or 0,6...1 bar (split range)	1190-0738
Lever I 157 mm	1190-2983
Lever II 210 mm	1190-3916
Manometer attachment block with manometer (bar)	1400-5748

7.2 Attachment components

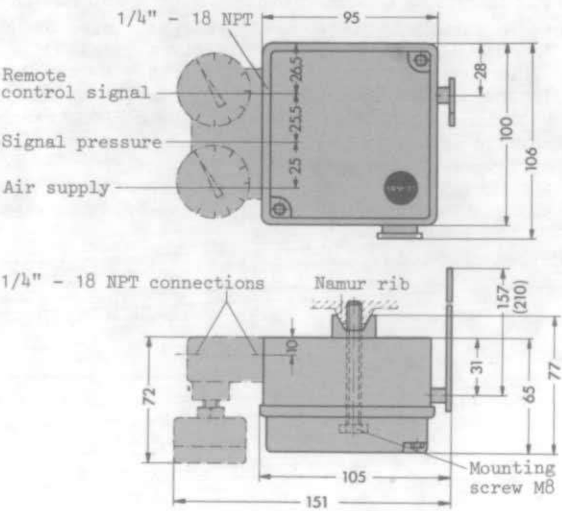
Attachment kit for cast frame valves in accordance with Namur	1400-5745
Attachment kit for cast frame and rod type valves rod diameter 18...32 mm in accordance with Namur	1400-5747

7.2.1 Additional attachment parts

Clamp with stay for 80 and 240 cm^2 actuator	0.300-0324
Clamp with stay for 350 and 700 cm^2 actuator	0.300-0524
Indicator	0.200-0074

8. Dimensions in mm

Air connections
Supply, input and output pressure connections: NPT 1/4"



SAMSON AG
MESS- UND REGELTECHNIK
D 6000 Frankfurt 1 · Telefon (0611) 40091
Weismüllerstraße 3 · Telex 417288 samsd
Postfach 4147

Series 240

Pneumatic Control Valve Type 241-1

1. Construction and Mode of Operation

The Type 241-1 Pneumatic Control Valve comprises a Type 241 Single-Ported Globe Valve and a Type 271 Pneumatic Actuator. By means of the modular assembly type the actuators are exchangeable and the Standard version can be completed to a version with insulating section or a version with additional metal bellows seal.
The medium flows through the valve as indicated by the arrow. The position of the plug (3) is changed by the signal pressure acting on the diaphragm of the actuator.
The valve plug stem (6) with the attached plug is connected to the stem (8.1) of the actuator via the coupling (7) and is sealed by means of the spring-loaded PTFE-V-ring packing (4.2).
Depending on the position of the springs inside the actuator they open or close the valve when the pressure acting on the diaphragm is reduced or upon air failure. The valve closes or opens with increasing pressure against the force of the springs.

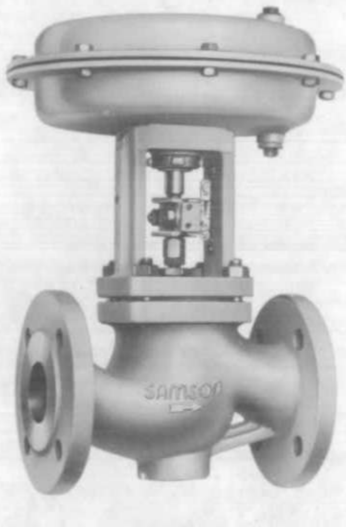


Fig. 1 · Type 241-1

1.1 Possibilities of exchanging the Actuator

The Type 241 Valve can be equipped with a Type 271 Pneumatic Actuator (with or without handwheel), a Type 273 Hand-operated Actuator, or an Electric Actuator.
A pneumatic actuator (with or without handwheel) can be exchanged for a pneumatic actuator of different effective area in the case of nominal valve sizes of 15 to 80 mm. Tables 1 and 2 indicate which valve can be combined with which actuator.
If the actuator (80 or 240 cm^2) for valves DN 15 to 80 mm is exchanged for a larger actuator (350 or 700 cm^2), also the coupling nut (6.1)and the coupling (7) must be exchanged. The new coupling to be installed is supplied with the new actuator (it is part of the actuator). The new coupling nut (having a top diameter of 16 mm) and the pointer required in addition are included in an extra package (Product No. 1.400-5510) attached to the actuators 350 cm^2 and 700 cm^2.

Edition August 1980

Mounting and operating instruction

Table of contents

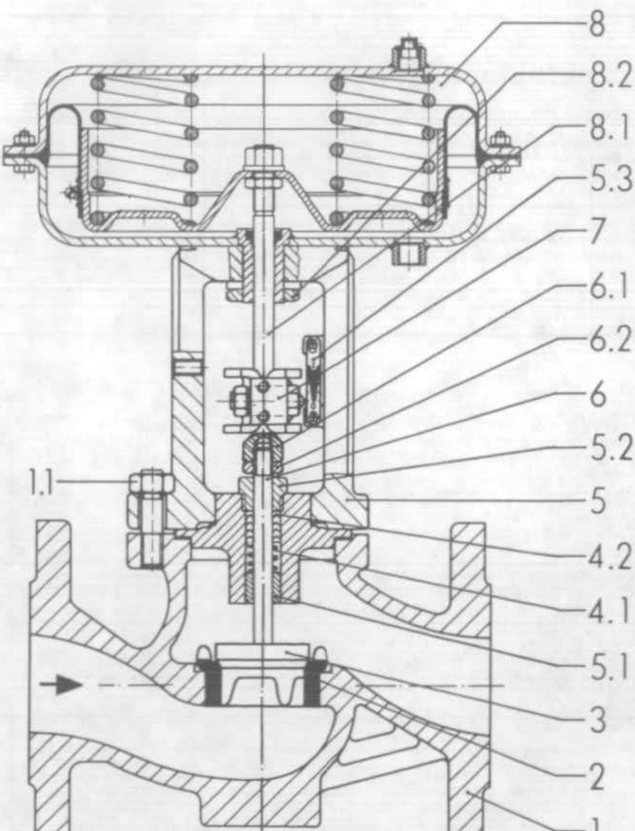
Table 1 Possibilities of exchanging the actuator for standard-version valves

valve DN	Pneumatic Actuator Type 271 (with or without handwheel)
15...80	80 und 240 cm^2 for travel 15 mm
	350 cm^2 for travel 15 mm
20...80	700 cm^2 for travel 15 mm
100...150	700 cm^2 for travel 30 mm

In the case of nominal valve sizes of 15 to 25 mm and a k_{vs} value of 0.1 to 1.0 a 350 cm^2 actuator is not required.

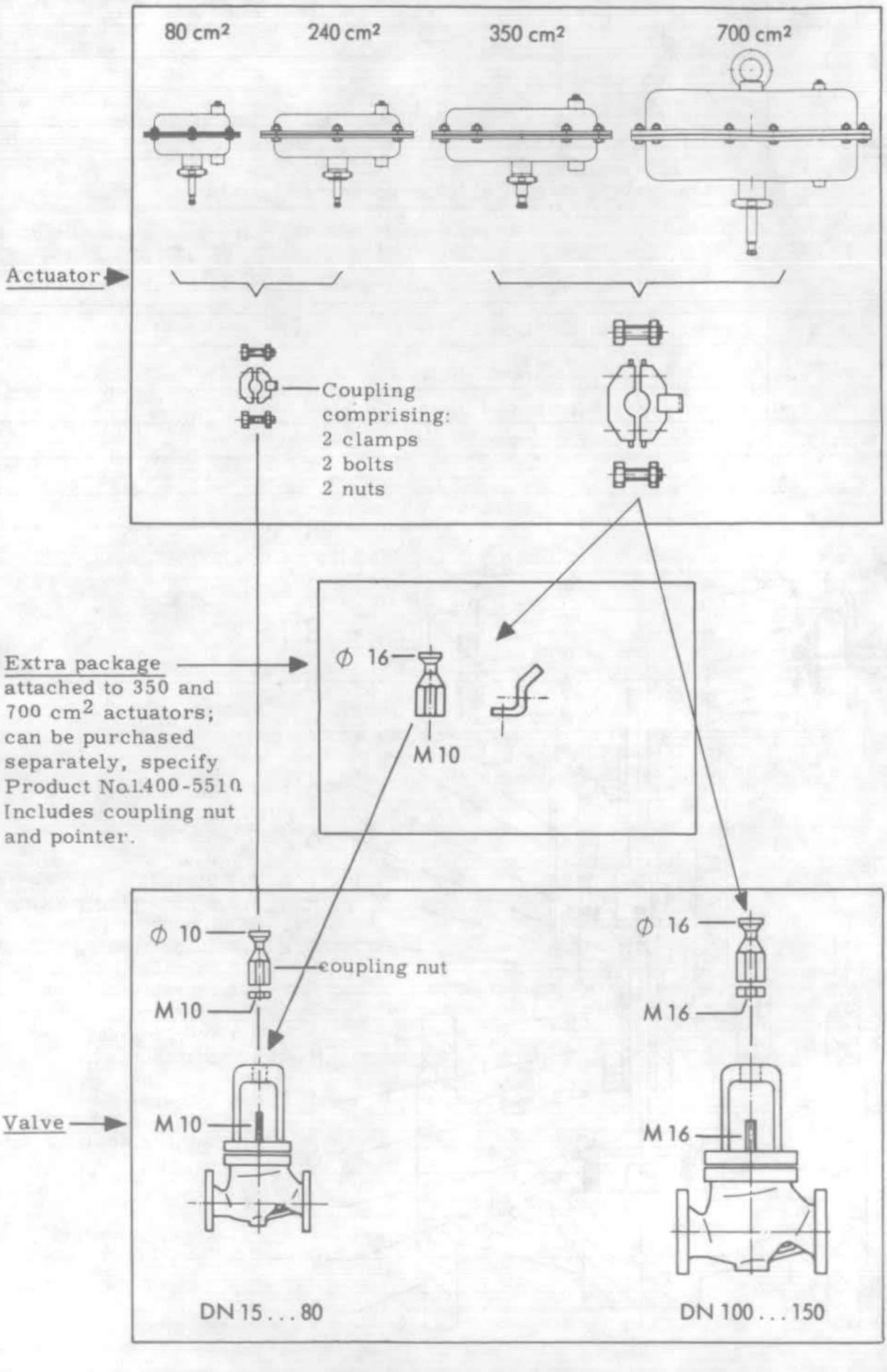
Table 2 Possibilities of exchanging the actuators for valves with balanced plug.

Valve DN	Pneumatic Actuator Type 271 (with or without handwheel)
25...80	80 und 240 cm^2 for travel 15 mm
	350 cm^2 for travel 15 mm
100...150	700 cm^2 for travel 30 mm



1 Valve body
1.1 Nuts
2 Seat
3 Plug
4.1 Spring
4.2 PTFE-V-ring packing
5 Bonnet
5.1 Guide bushing
5.2 Threaded bushing
5.3 Travel indicator
6 Plug stem
6.1 Coupling nut
6.2 Lock nut
7 Coupling
8 Actuator
8.1 Actuator stem
8.2 Nut for actuator

Fig. 2 · Sectional view Type 241-1



Assembly of the various valves and actuators with their couplings

2. Assembly of valve and actuator

If the valve and the actuator have not been assembled already by the manufacturer, or if the original actuator of a valve is to be exchanged for an actuator of a different version, assembly shall be effected as described below.

Caution:

In the case of valves with "spring closing" actuator apply actuator with signal pressure prior disassembly that the plug removes from seat.

2.1 Type 271 Pneumatic Actuator with or without manual adjustment

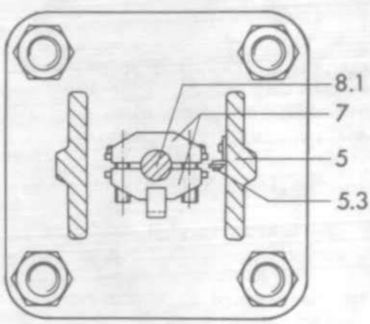
(Figs. 2 and 3, Tables 1 and 2)

2.1.1. Actuator with 80 and 240 cm^2 diaphragm on DN 15 to 80 valves and actuator with 700 cm^2 diaphragm on DN 100 to 150 valves

Remove clamps of coupling (7) and nut (8.2) from the actuator (8). Place actuator (8) on bonnet (5), attach and tighten nut (8.2). Attach the two clamps of the coupling (7) to the actuator stem (8.1) and nut (6.1) as shown in Fig. 3 and screw together using the two hex head bolts and nuts that are part of the coupling.

2.1.2 Actuator with 350 cm^2 diaphragm on DN 15 to 80 valves

Remove clamps of coupling (7) and nut (8.2) from the actuator (8). Remove coupling nut (6.1) from valve and replace by coupling nut from the extra package. Place actuator (8) on bonnet (5), attach and tighten nut (8.2). Attach the two clamps of the coupling (7) to actuator stem (8.1) and nut (6.1) as shown in Fig. 4. Place pointer (6.3) form the etra package on the right-hand clamps so that its tip points to the travel indicator (5.3) and screw together using the two hex head bolts and nuts that are part of the coupling.



5 Bonnet
5.3 Travel indicator
6.3 Pointer
7 Coupling
8.1 Actuator stem

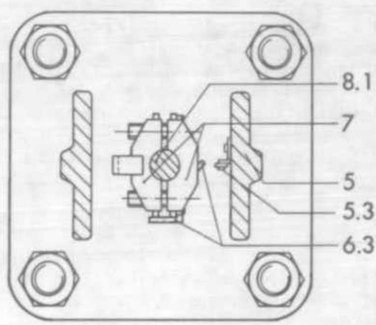


Fig. 3 · (top view)

Position of coupling of DN 15 to 80 valves with 80 and 240 cm^2 actuator, and of DN 100 to 150 valves with 700 cm^2 actuator.

Fig. 4 · (top view)

Position of coupling and pointer of DN 15 to 80 valves with 350 cm^2 actuator, and DN 20 to 80 valves with 700 cm^2 actuator.

2.1.3 Actuator with 700 cm^2 diaphragm on DN 20 to 80 valve

A) Valve with "spring closing" actuator

Remove clamps of coupling (7)and nut (8.2) from the actuator (8). Remove coupling nut (6.1) from valve and replace by coupling nut from the extra package. Apply a signal pressure to the diaphragm of actuator (8) (air connection at lower actuator case). Reduce signal pressure until actuator stem (8.1) contacts nut (6.2). Attach the two clamps of the coupling (7) to the actuator stem (8.1) and nut (6.1) as shown in Fig. 4. Place pointer (6.3) from the extra package on the right-hand clamp so that its tip points to the travel indicator (5.3) and screw together using the two hex head bolts and nuts that are part of the coupling.

B) Valve with "spring opening" actuator

Remove clamps of coupling (7) and nut (8.2) from the actuator (8). Remove coupling nut (6.1) from valve and replace by coupling nut from the extra package. Place actuator (8) on beonnet (5), attach and tighten nut (8.2). Apply signal pressure to the diaphragm (air connection at upper actuator case) until actuator stem (8.1) contacts nut (6.1). Further assembly as described in A), second section.

3. Valve adjustment

When the valve is supplied assembled completely with the actuator, the signal pressure range has been adjusted by the manufacturer in compliance with the actuator signal pressure range (indicated on the actuator nameplate or on the tag attached to the valve).

3.1 Position of the low-nois plug

Valves having a seat bore of 38 mm or greater are equipped with low-noise plugs (asymmetrical plug configuration). In order to achieve optimum efficiency, the plug should be installed as shown in Fig. 5. Subsequent checking is possible by removing the bonnet (5).

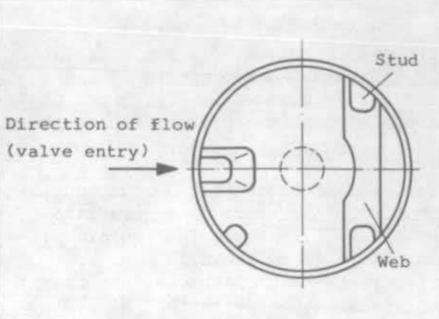
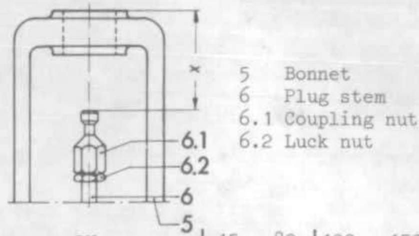


Fig. 5 · Position of the asymmetrical low-noise plug



DN	15...80	100...150
x in mm (at closing valve)	75 + 0,1	90 ± 0,2

Fig. 6 · Travel adjustment

3.2 Travel adjustment (Fig. 6)

When valve and actuator are supplied separately, the dimension x has been adjusted according to Table Fig. 6. When the actuator is mounted on the valve so adjusted, a zero shift of up to ± 5% of the signal pressure range may occur due to the actuator manufacturing tolerances.We, therefore, recommend to check dimension x upon assembly of valve and actuator using Table in Fig. 6 and, if necessary, adjust the coupling nut (6.1) as follows:

Loosen lock nut (6.2), adjust coupling nut (6.1) in compliance with dimension x and tighten lock nut again.
Caution: The dimensions specified in the table are applicable only if the springs have not been pretensioned. In the case of an actuator with pretensioned springs, adjust valve as described in section 3.3.2
If a more precise adjustment of the signal pressure lower-range or upper-range values is required, the valve will have to be adjusted as described in section 3.3

3.3 Adjustment of the signal lower-range value (valve with "spring closing" actuator) or the signal pressure upper-range value (valve with "spring opening" actuator) (Fig. 2)

Example: Signal pressure range 0,2 to 1 bar

3.3.1 Valve with "spring closing" actuator

Loosen coupling (7) and lock nut (6.2). Apply signal pressure to the actuator (8) (air connection at lower actuator case). Reduce signal pressure until the pressure gauge indicates the desired signal pressure lower-range value (0,2 bar). Turn manually nut (6.1) until it contacts the actuator stem (8.1). Tighten lock nut (6.2) and screws of coupling (7).

3.3.2 Valve with "spring closing" actuator with pretensioned springs

In the case of DN 15 to 80 spring pretension may amount to approx. 15% of the nominal travel or the signal pressure span; resp. in the case of DN 100 to 150 approx. 25%. If, for instance, a pretension of 0,1 bar is desired with the signal pressure range being 0,2 to 1 bar, the signal pressure lower-range value is shifted to 0,3 bar. Adjustment shall be accomplished in compliance with section 3.3.1.

3.3.3 Valve with "spring opening" actuator

Loosen coupling (7) and lock nut (6.2). Apply the signal pressure to the actuator (8) (air connection at upper actuator case). Increase signal pressure until the pressure gauge indicates the desired signal pressure upper-range value (1 bar). Turn manually nut (6.1) until it contacts the actuator stem and the plug sealing edge contacts the seat sealing edge. Tighten lock nut (6.2) and screws of coupling (7).

4. Mounting

4.1 Mounting position

The valve assembly may be mounted in any desired position. The valve must be installed free of stress. If necessary, support the piping near the point of connection. Never attach supports to the valve or the diaphragm actuator.
Flush pipe thoroughly prior to installing the valve.

4.2 Signal pressure piping

Connect signal pressure pipe to the lower actuator case of valves with "spring closing" actuator and to the upper actuator case of valves with "spring opening" actuator.
With an effective diaphragm area of 80 and 240 cm^2:
Threaded connection R 1/4".
With an effective diaphragm area of 350 and 700 cm^2:
Threaded connection R 3/8".

4.3 Strainer, by-pass line

It is recommended to install a SAMSON Strainer Type 2 ahead of the control valve. For the maintenance of the control valve without interrupting process operations, it is recommended to install a by-pass line with shutoff valves.

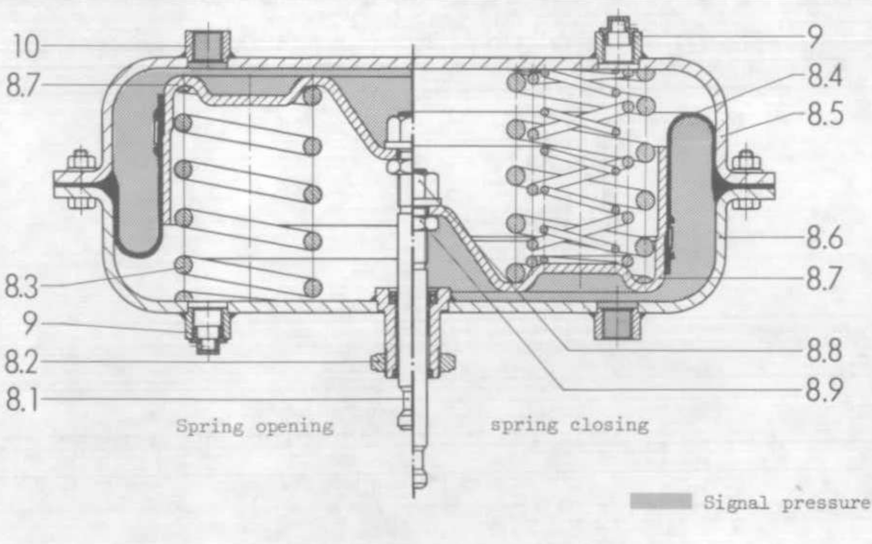
4.4 Test connection (Fig. 11)

The version with metal bellows seal is provided with a test connection (11) at its top flange for checking the replaceable stainless steel bellows (6.6). It is recommended mainly for fluids and vapours to connect there a suitable leakage warning (as contact pressure switch, run off into a open pot or inspection glass).

5. Operation

5.1 Reversal of actuator action

If actuator action should be reversed carry out as described below. (no additional components or special tools are required for this).Remove coupling (7) and nut (8.2) and lift actuator off the bonnet (5).



8.1 Actuator stem
8.2 Nut
8.3 Springs
8.4 Diaphragm
8.5 Upper diaphragm case
8.6 Lower diaphragm case
8.7 Diaphragm plate
8.8 Nut
8.9 Nut
9 Vent plug
10 Signal pressure connection

Fig. 7 · Sectional view of actuator

5.1.1 Valve with "spring closing" actuator to valve with "spring opening" actuator
Unscrew screws and nuts of actuator and remove upper diaphragm case (8.5). Take out springs (8.3) and withdraw actuator stem (8.1) with diaphragm plate (8.7) and diaphragm (8.4) from lower case (8.6). Unscrew nut (8.8) while holding the nut (8.9) so as not to damage the actuator stem (8.1) Turn over diaphragm plate with diaphragm and replace nut. Grease actuator stem with lubricant (Ordering No. 8.160-0119).

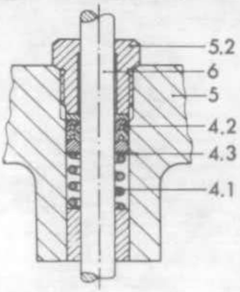
Put diaphragm plate (8.7) into upper case insert springs and push lower diaphragm case over actuator stem (8.1). Screw cases together again, and unscrew vent plug (9) from upper case and screw it into the lower case.

The springs, which now exert a force against the diaphragm plate from lower side open the valve through actuator stem and valve stem. The signal pressure is transferred through the upper connection (10) into the upper diaphragm chamber. If the signal pressure rises, ist closes the valve against the force of the springs. Assemble actuator and valve as described in section 2.

5.1.2 Valve with "spring opening" actuator to valve with "spring closing" actuator
Unscrew screws and nuts of actuator and remove upper diaphragm case (8.5) withdraw actuator stem (8.1) with diaphragm plate (8.7) and diaphragm (8.4) from lower case (8.6). Take out springs (8.3). Unscrew nut (8.8) while holding the nut (8.9) so as not to damage the actuator stem. Turn diaphragm plate and diaphragm over and replace nut. Push actuator stem (8.1) through lower diaphragm case and insert springs. Replace upper diaphragm case. Screw cases together again, and unscrew vent plut (9) from lower case and screw it into the upper case.
The springs, which now exert a force against the diaphragm from above, thus close the valve through the actuator stem and valve stem. The control pressure is transferred through the lower connection into the lower diaphragm chamber. If the control pressure rises, it opens the valve against the force of the springs
Assemble actuator and valve as described in section 2.
For further details see the mounting and operating instruction for the pneumatic actuator EB 8075/8085.

6. Troubleshooting

6.1 Replacement of the stuffing box packing of valves in standard version
If there is a leak at the valve stuffing box the packing (4.2) shall be replaced as follows:
Remove coupling (7) and nut (8.2) and lift actuator (8) off the bonnet (5).



4.1 Spring
4.2 Packing
4.3 Disk
5 Bonnet
5.2 Threaded bushing
6 Plug stem

Fig. 8 · Replacement of the stuffing box packing

Caution:
In the case of valves with "spring closing" apply actuator with signal pressure prior disassembly that the plug removes from seat.
Remove nuts (1.1, 6.1 and 6.2), bonnet (5) and unscrew threaded bushing (5.2). Push out the defect packing (4.2) using the plug stem (6). Pull out plug with plug stem. Remove disc (4.3) and spring (4.1) and clean packing chamber.
Gease the components of the new packing (4.2) and plug stem with lubricant (9.1) (see section 9).
Install plug stem (6) with plug into bonnet (5). Place bonnet again on valve body and attach with nuts (1.1). Install spring (4.1) and disc (4.3) and slip new packing carefully over the plug stem into the packing chamber. Apply and tighten firmly threaded bushing (5.2). Screw lock nut (6.2) and nut (6.1) on plug stem.
Install actuator as described in section 2. Adjust signal pressure lower-range value or upper-range value as described in section 3.3.

6.2 Replacement of plug and/or seat:

If the value does not shut off properly, the cause may be:

a) Tight shutoff is prevented by dirt or foreign matter between seat and plug.

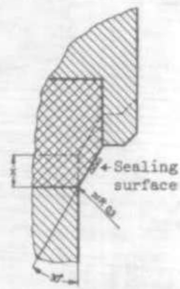
b) Sealing edges of plug and/or seat are defect.

6.2.1 Plug

It is recommended to replace the stuffing box packing (4.2) when replacing the plug. Replace plug as follows (see Fig. 2):
Carry out the procedure described in section 6.1. Replace old plug by a new plug (3) with plug stem (6). Perhaps the old plug can be used again after it has been reworked (see section 6.2.1.1). Grease plug stem (6) with lubricant (9.1) (see section 9) prior to installation. In the case of an asymmetrical plug bear in mind the mounting position (see section 3)!

6.2.1.1 Reworking the plug

Minor defects at the sealing edges of the plug can be removed by reworking.
In the case of soft-seat plugs reworking is possible only up to dimension x and only with valves having a seat bore of more than 12 mm (Fig. 9).



seat bor Ø	x (max.)
12	0,5 mm
24... 48	1,5 mm
63...130	3,0 mm

Fig. 9 · Reworking a soft-seat plug

6.2.2 Seat

Replace seat (2) as follows: Unscrew nut (1.1) and lift bonnet (5) together with plug stem (6) and actuator (8) off the body. Unscrew seat using the proper seat wrench (see Table 3). Apply lubricant 9.2 (see section 9) to new seat (or the old seat following reworking or thorough cleaning) at thread and at the sealing cone, and screw in. Place bonnet (5) on body again and fasten by means of nuts (1.1).

Table 3

Seat wrench for DN	Product-No.
15... 25	9.110-1644
32... 50	9.110-1653
65... 80	9.110-1661
100	9.110-1668
125... 150	1.230-1822

Table 4

Seat thread	Torque
M 32 x 1,5	180 Nm
M 58 x 1,5	590 Nm
M 90 x 1,5	1400 Nm
M 110 x 1,5	2030 Nm
M 125 x 1,5	2240 Nm
M 152 x 1,5	2520 Nm

Table 5

DN	Screws	Torque
15...25	4 x M 10	20 Nm
32...50	4 x M 12	35 Nm
65...80	4 x M 16	90 Nm
100	4 x M 20	170 Nm
125	8 x M 16	90 Nm
150	8 x M 20	170 Nm

6.3 Replacement of stuffing box packing, plug, seat, and bellows of valves with insulating section or metal bellows seal

(Figs. 2,10 and 11)- See also section 6.1 and 6.2
Remove coupling (7) and nut (8.2). Lift actuator (8) off bonnet (5).
Remove nuts (6.1, 6.2) and bolts (5.4). Loosen threaded bushing and remove bonnet.
Caution: When removing the bonnet, make sure that the stuffing box packing (4.2) will not be damaged by the thread of the plug stem extension (6.3). Remove packing in any case from bonnet and check whether it is still fit for further use. Remove nuts (1.1); remove intermediate section (12) with plug stem (6) and plug (3) from body (1).

6.3.1 Stuffing box packing

Replace as described in section 6.1. For pushing out another tool may be used in place of the plug stem.

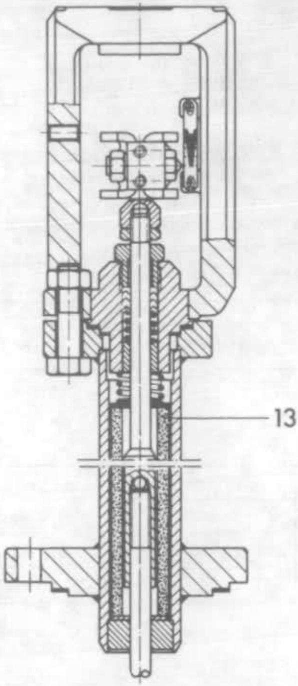


Fig. 10 · Insulating section

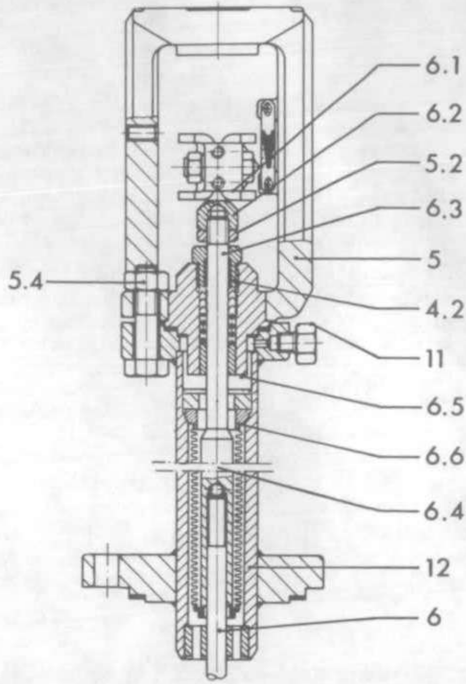
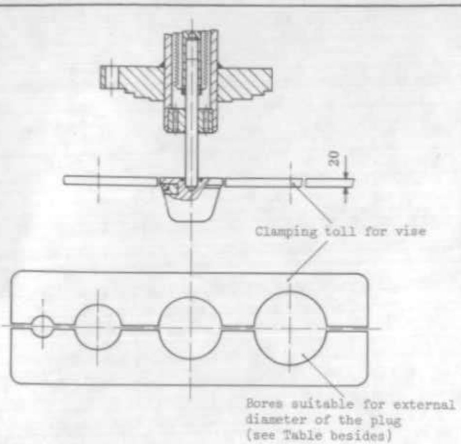


Fig. 11 · Metal bellows seal

4.2 Packing
5 Bonnet
5.2 Threated bushing
5.4 Screws
6 Plug stem
6.1 Coupling nut
6.3 Plug stem extension
6.4 Ball
6.5 Nut
6.6 Metal bellows
11 Test connection
12 Intermediate section
13 Insulating section

6.3.2 Plug

For screwing out the plug it is necessary to screw two lock nuts on the exposed thread of the extension for counterholding. When valves with metal bellows seal are involved it is absolutely necessary to ensure that no torque is transferred to the bellows which is screwed together with the plug stem extension. It is recommended to prepare a clamping tool (Fig. 12) for the vise and use it.
Caution, the sealing edge of the plug must'nt be damaged.
Grease plug stem (6) of new or old, reworked plug (3) with lubricant 9.1 (see section 9). Check whether ball (6.4) is still located in the plug stem (6); subsequently, screw the plug stem firmly into plug stem extension.
Caution : If a standard valve version is to be converted into a version with metal bellows seal or insulation section at a later date, the plug stem (6) must be bored as shown in Fig. 13 to accomodate the ball (6.4).



Seat bor	me-seal	PTFE-seal
3	10	10 (12)*
6	10	10 (14)*
12	14	10 (16)*
24	27	29
31	34	36
38	41	42
48	51	52
63	66	67
80	83	84
100	103	106
110	113	116
130	133	136

* Do not clamp this plugs at the external Diameter

Fig. 12 · Clamping tool and table external diameter of the plug

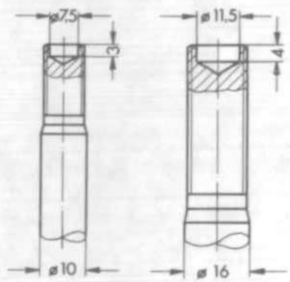


Fig. 13 · Boring of plug stem for version with metal bellows seal or insulation section.

6.3.3 Seat

Replace as described in section 6.2.2

6.3.4 Bellows

Unscrew plug (3) with plug stem (6) from plug stem extension (6.3), see section 6.3.2. Unscrew nut (6.5) using SAMSON-socket wrench (Product No. 9.250-0677.72). Pull bellows (6.6) with welded-on plug stem extension (6.3) from intermediate section. Clean sealing surfaces of intermediate section. Slip new bellows into intermediate section and screw in firmly nut (6.5). Check whether ball (6.4) is still located in the plug stem (6). Grease plug stem thread with lubricant 9.2 (see section 9) and screw plug stem firmly into the plug stem extension (6.3).

6.3.5 Assembly

Place intermediate section (12) on body (1) and fasten with nuts (1.1). Place bonnet (5) on intermediate section and fasten with bolts (5.4) and nuts. Tighten threaded bushing (5.2). Screw lock nut (6.2) and nut (6.1) on plug stem extension (6.3). Attach actuator as described in section 2. Adjust actuator as described in section 2.

6.4 Replacement of sealing of balances plugs

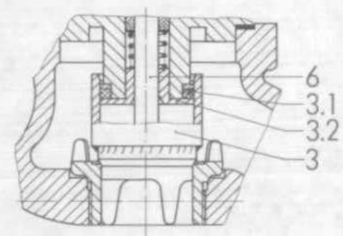
Remove actuator (8) and bonnet (5) after Tunscrewing nuts (1.1). Remove coupling (7) and nuts (6.1 and 6.2). Push out plug stem (6) with plug (3) from bonnet.

6.4.1 Nominal sizes 25 to 40 mm (Fig. 14)

Unscrew threaded bushing (5.2). Remove packing (4.2), disc (4.3) and spring (4.1). Push out bushing (3.2) and replace sealing ring (3.1). Clean bor in bonnet (5). Grease bushing (3.2) with lubricant (9.1) (see section 9) and press in. Also, grease plug stem (6) and contact surface of sealing ring (3.1) with lubricant 9.1. Then proced as described in section 2.

6.4.2 Nominal sizes 50 to 150 mm (Fig. 15)

Remove screw (3.4), serrated lock washer and disc (3.3). Replace sealing ring (3.1). Install disc (3.3), attach screw (3.4) with serrated lock washer and screw in firmly. Grease plug stem (6) and contact surface of sealing ring (3.1) with lubricant 9.1. Then proceed as described in section 2.



3 Plug
3.1 Sealing ring
3.2 Bushing
3.3 Disc
3.4 Screw
6 Plug stem

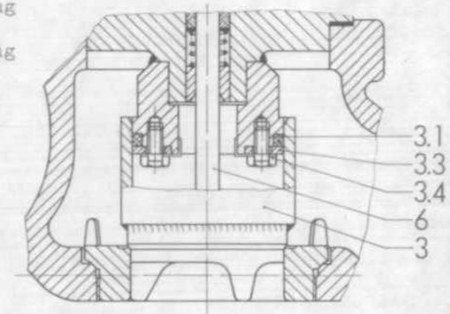


Fig. 14
Balanced plug DN 25...40

Fig. 15
Balanced plug DN 50 or 65...150

7. Sign of guide bushing (5.1) and threaded bushing (5.2), seat (2) and plug (3)

7.1 Guide - and threaded bushing

no groove at plane surface	Material : 1.4006
V shrap cutted out groove	Material : 1.4571
⊔ plane cutted out groove	Material : Hastelloy

7.2 Seat

1.1 Sign of material: Material-No. is staved in or engraved
1.2 For stellited seats "st" is engraved

7.3 Plug

1.1 Sign of material

no groove below threaded connection	Material: 1.4006
V sharp cutted out groove	Material: 1.4571
⊔ plane cutted out groove	Material: Hastelloy

other materials: material number or designation are engraved.

1.2 k_{vs}-value and characteristic (glp or lin) are engraved.
1.3 For stellited plugs "st" is engraved behind k_{vs}-value and characteristic (glp or lin).

8. Description of Nameplate

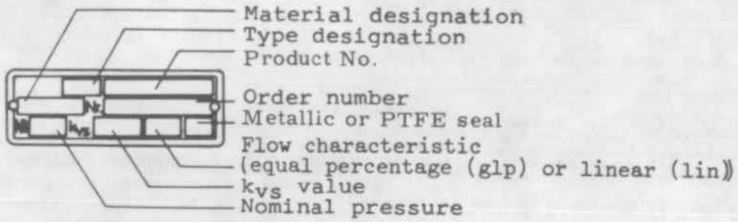


Fig. 16 · Nameplate

9. Lubricants: The following lubricants are available:

9.1 Lubricant Ordering No. 8.150-0112
9.2 Lubricant Ordering No. 8.150-0119

10. Enquiries

When making enquiries please advise the following

1. Order No. (embossed in nameplate)
2. Type, product number, nominal size and valve version
3. Pressure and temperature of the medium
4. Rate of fluw in m^3/h
5. Signal pressure range (e.g. 0,2 to 1 bar) of attached actuator
6. Has a strainer been installed?
7. Installation drawing

Foreign patens for Pneumatic Actuator Type 271:
Great Britain, France, Italy, Netherland, Austria

SAMSON AG
MESS- UND REGELTECHNIK
D 6000 Frankfurt 1 · Telefon (0611) 40090
Weismüllerstraße 3 · Telex 417288 sams d
Postfach 4147

Series 5000

Electropneumatic Converters (i/p Converters)

Type 5288

SAMSON

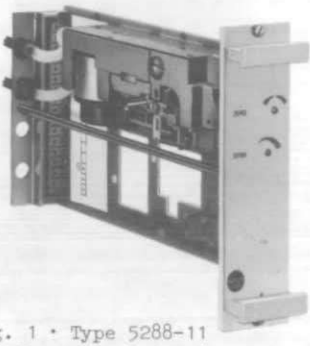


Fig. 1 · Type 5288-11 i/p Converter, plug-in instrument for measuring circuits, without cover plate (20)

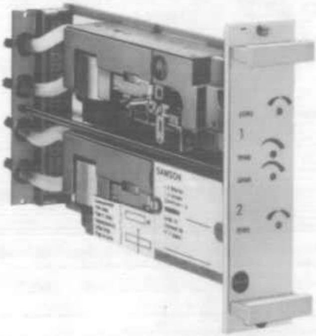


Fig. 2 · Type 5288-12 Double i/p Converter, plug-in instrument, upper conversion unit without cover plate and lower conversion unit with cover plate

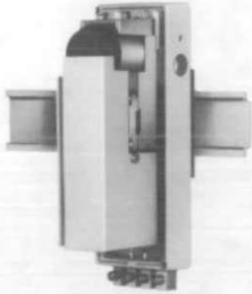


Fig. 3 · Type 5288-54 i/p Converter for valve positioning, switchboard instrument (housing open)

1. Description

1.1 Application

Instruments serve for conversion of a standard dc current signal into a standard pneumatic signal of 0.2...1.0 bar or 3...15 psi, primarily for the change-over from electrical measuring systems to pneumatic controllers, or from electrical controllers to pneumatic control valves.

Edition April 1983

Mounting and operating instruction

EB 5288 E

1.2 Versions

Type 5288-11 (Fig.1) · i/p Converter, plug-in instrument with 1 i/p conversion unit.

Type 5288-12 (Fig.2) · Double i/p Converter, plug-in instrument with 2 i/p conversion units.

Type 5288-14 · i/p Converter, switchboard instrument for mounting on top hat rails.

Type 5288-51 · i/p Converter for valve positioning, plug-in instrument with 1 i/p conversion unit.

Type 5288-52 · Double i/p Converter, plug-in instrument with 2 i/p conversion units.

Type 5288-54 (Fig.3) · i/p Converter for valve positioning, switchboard instrument with 1 i/p conversion unit for mounting on top hat rails.

1.3 Construction and mode of operation

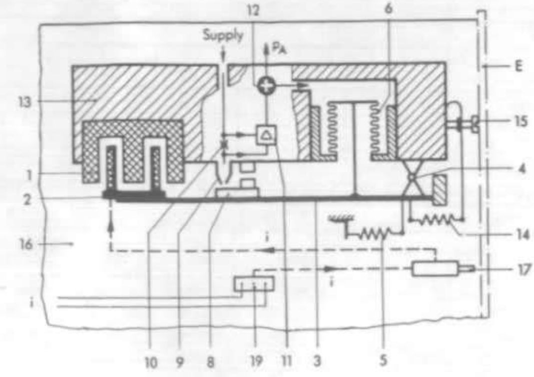
According to the version the instruments are equipped with one or two i/p conversion units, which operates on the force balance principle. These units essentialy consist of a cast block with the electrical measuring system with balance beam, a feetback bellows or compensating diaphragm and a nozzle with pneumatic amplifier.

The d.c. current i fed via the soldered connection (19) flows through the coil (2) which is located in the field of a permanent magnet (1). The force of the coil (2), which is proportional to the current i, and the force generated by the output pressure p_A in the feedback bellows are balanced in the beam (3).

The supply air (p_Z) supplies the amplifier (11) and flows through the restriction (10), the nozzle (9) and hits the flapper (8). If the input current i increases, the force of the coil (2) increases and the flapper (8) moves closer to the nozzle. Due to this the pressure in the nozzle is increased and the output pressure of the amplifier, which has passed to the output of the instrument and to the feedback bellows (6), is also increased. The pressure increases until a new balance state is reached and the output pressure p_A is proportional to the current i.

The adjustment of lower range (adjuster zero 15) and measuring span (adjuster span 17) are independent each of other. In case of plug-in instrument the air delivery is adjustable at the restriction (12) to a minimum value "Q_{min}" or a maximum value "Q_{max}". Switchboard instrument 5288-54 is designed only for "Q_{max}"(see techn. Dat.)

The i/p conversion units for plug-in- and switchboard instruments have the same mode of operation. But the Types 5288-51, 5288-52 and 5288-54 i/p Converters for valve positioning are equipped with a diaphragm in place of the feedback bellows (6), beyond which the fine adjustments for lower range and measuring span drop out.



1 Permanent magnet
2 Coil
3 Beam with balance weight
4 Cross spring pivot
5 Spring
6 Feedback bellows
8 Flapper
9 Nozzle
10 Restriction
11 Amplifier
12 Volume restriction
13 Cast block
14 Zero point spring
15 Zero point adjuster (Zero)
16 Printed circuit board
17 Potentiometer for measuring span adjustment (span)
19 Soldered connection

E Front panel

Fig. 4 · Schematic diagram of the i/p Measuring Converter (Plug-in version)

1.4 Technical Data

		i/p Measuring Converter	i/p Positioning Converter	
Type		5288-11, 5288-12, 5288-14	5288-51, 5288-52	5288-54
Input		4...20 mA	4...20 mA (on request 4...12 or 12...20 mA)	
	Input impedance	approx. 200 Ω, ≈ 4 mH		
Output		0.2...1.0 bar (3...15 psi)	0.2...1.0 bar or 0.4...2.0 bar* max. 0.02...1.3 bar max. 0.04...2.3 bar (3...15 psi or 6...30 psi* max. 0.3...18 psi max. 0.6...34 psi)	
	Air delivery at $Q_{max.}$:	1.7 m_n^3/h	2.5 m_n^3/h min. connected volume: > 0.025 dm³	2.5 m_n^3/h min. connected volume: > 0.025 dm³
	at $Q_{min.}$:	0.5 m_n^3/h – min. connected volume: > 0.006 dm³		
Supply		1.4 ± 0.1 bar (20 ± 1.5 psi)	1.4 ± 0.1 bar or 2.4 ± 0.1 bar (20 ± 1.5 psi or 36 ± 1.5 psi)	
	Power consumption**	0.13 m_n^3/h	< 0.08 m_n^3/h	
Characteristic		Linear characteristic of input and output		
	Hysteresis	< 0.1% of span	< 0.2% of span	
	Terminal based non-conformity	< 0.2% of span	< 1% of span	
Effects in % of span		supply: 0.2%/0.1 bar		
	Ambient temperature	lower range value < 0.02%/°C measuring span < 0.02%/°C	< 0.03%/°C < 0.04%/°C	
	Load characteristic	± 3% with air delivery ± 0.4 m_n^3/h	Reversing errors not detectible	
Environmental conditions, protection type, weights				
Admissible ambient temperature: − 20 to + 80 °C				
Protection type		Plug-in instruments, switchboard intruments with terminals: IP 00 Switchboard instruments with connection cable: IP 50		
Weight approx.		Type 5288-.1: 0.44 kg	Type 5288-.2: 0.75 kg	Type 5288-.4: 0.66 kg

* Special versions with output signals up to maximum 5 bar or 72 psi with maximum permissible supply air pressure of 5.4 bar or 78 psi, e.g. 0.8...2.4.; 0.5...2.5; 0.7...3.5; 1.7...3.2; 1.9...3.3 or 2.0...3.6 bar. Further details on request.

** Power consumption per i/p conversion unit with supply air pressure 1.4 bar.

2. Installation

2.1 Plug-in instrument

The converter is generally supplied in ready wired racks. It is then a component of a prefabricated automation unit. All connections, electrical and pneumatic take place with plug-in connection established automatically when the unit is inserted.
When inserting the unit, ensure, that the printed circuit board is not tilted, i.e. slides freely into the top and bottom guide rails. Front panel must be fixed with two screws. For removing- after loosening the fixing screws- use the grips at front panel, the pneumatic connections shut off automatically.

2.2 Switchboard instrument

Install switchboard instrument vertically on top hat rails 35mm wide to DIN EN 50022.

2.2.1 Electrical connection

For connection see diagram fig. 5

For switchboard instrument the connection is to be carried out at terminals for wires 0.5 to 2.5mm² or connection cable.

2.2.2 Pneumatic connection

The pneumatic connections air supply and output are designed in the form of tapped hole NPT 1/8" (or G 1/8). The normal type of screw connections for metal or plastic pipes can be used. For connections see figures for dimension.

Plug-in instrument

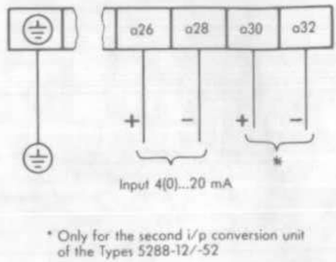
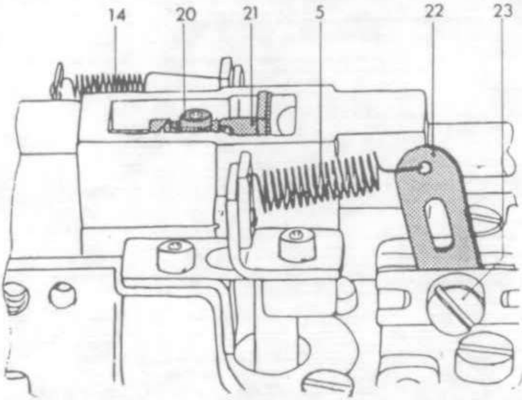


Fig. 5
Connection for switchboard instruments see figures for dimension.

The supply air must be dry and free of oil and dust, the supply air pressure is to be set to 1.4 ± 0.1 bar (20 ± 1.5 psi). Other pressures to max. 5.4 ± 0.1 (78psi) for special versions see techn. Data. The servicing schedules of lined up reducing stations must be respected. The air lines should be carefully blown-out before connection.



5 Zero point spring
14 Zero point fine adjustment spring
20 Screw
21 Plate
22 Lever
23 Screw

Fig. 6 · Section of converter (turned 180°)

3. Operation

3.1 Adjustment of zero point (lower range)

3.1.1 Converter for measuring circuits

Before putting the converter into servis, the zero adjustment should be checked as follows (in case of switchboard instrument the housing must be opened):

Connect the output of the unit with a pressure gauge (range 0...1.6 bar, min. grade 1) and set supply air pressure to 1.4 bar.
Feed the lower-range signal (4 or 0mA) to the input of the converter (see fig. 5) via a convenient d.c. current source. (In case of 0mA the input is open). The output pressure at pressure gauge must indicate the value 0.2 bar. If not, the zero point adjuster "Zero" (15) must be adjustet to the required value.

If adjustibility is not sufficient (e.g. in case of change over from 0 to 4 mA or 4 to 0 mA) the zero point preadjustment, after removing the cover plate, should be changed as follows: Adjust zero point adjuster (Zero) so that zero point spring (14) is tensioned, then adjust zero point by turning the lever (22), loosen screw (23) before and retighten afterwards. Correct small deviations at zero point adjuster (Zero).

3.1.2 Converter for valve positioning

Connect the output of the unit with a pressure gauge. Set supply air pressure to a value 0.4 bar higher than the outputsignal (e.g. output 0.4...2 bar - supply air is to be set to 2.4 bar).
Feed 4mA to the input of the converter via a convenient dc current source, pressure gauge must indicate the lower-range value of the output signal.
In case of bigger diviations adjust lever (22) after loosening screw (23) to attain accurate output signal. Tighten screw (23) again.

3.2 Adjustment of measuring span

3.2.1 Converter for measuring circuits

Feed upper range value 20mA to the input of the converter and adjust measuring span adjuster "Span" (18) that output at pressure gauge indicates 1 bar.

If adjustibility is not sufficient (e.g. in case of change over from 0...20mA to 4...20mA or revers). Readjust potentiometer "Span" to its middle range and shift plate (21) until output indicates 1 bar, loosen screw (20) a little before and retighten afterwards.

Lastly recheck both values, lower and upper range.

3.2.2 Converter for valve positioning

Feed upper range value 20mA to the input of the converter, the output must indicate corresponding value at pressure gauge. In case of bigger deviations loosen screw (20) a little and shift plate (21) until upper range value of measuring range is attained, retighten screw (20).

Lastly recheck both values, lower and upper range.

3.3 Adjustment of volume restriction

The volume restriction (12) of plug-in instrument can be adjusted by turning the restriction 90° to max. or min. air delivery (preset to max. in manufacture, see techn. data)

For plug-in instrument the restriction (12) is situated to the right of printed circuit board. For switchboard instruments the restrictions drops out (air delivery = max.)

4. Maintenance

4.1 Air supply

Efficient function of the converter will only be assured if air supply is well cleaned before beeing supplied to the unit. Filter and condensaition drain of the reducing station must be checked regularly.

4.2 Cleaning of restriction (10)

The restriction is situated laterally in a boring in the housing, in case of plug-in instruments, the cover plate must be removed.
If output pressure is to low or output signal falls out, restriction (10) could be clogged. Therefore remove screw, lift out sieve and clean.

4.3 Adjustment of damping (Fig. 7)

The damping is adjusted by the manufacturer.

Subsequently the adjustment can also be corrected to the conditions of the plant. Therefore connect the output of converter with a convenient hose and (or) container. Set air delivery to the desired value (Q max. or Q min.). Regulate input signal until output indicates approx. 0.6 bar at pressure gauge. Now find, by turning screw (1) and touching balancing beam (3), the point when unit just stops hunting. Then turn out screw (1) one turn (more damping) now the unit will not hunt when the beam (3) is touched.

The adjustment by the manufacturer is carried out as described above to following conditions:
Volume restriction (12) is set to Qmax., at output a hose of 4mm internal diameter and 2m lenght with additional volume 1ccm is connected. Checked with same hose and container 230ccm.

For damping, only oil supplied by the manufacturer (Ordering No. 8.150-0105) should be used. It should be put between the damping surfaces in the form of a Ø 3 droplet.

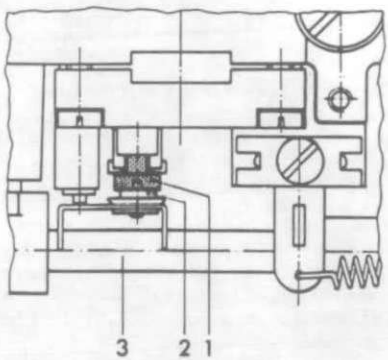
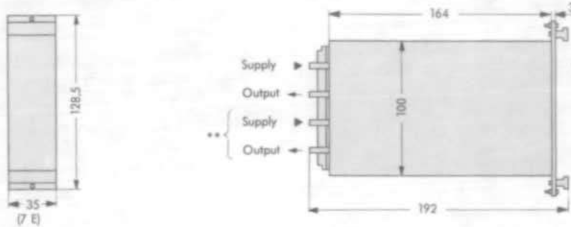


Fig. 7 · Damping

5. Dimensions in mm

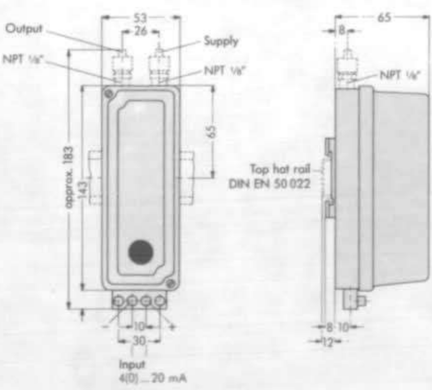
Type 5288-11/-12 and Type 5288-51/-52 Plug-in instruments



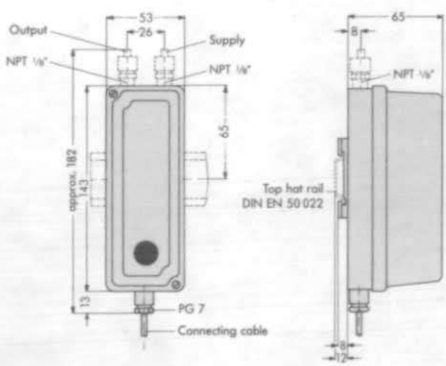
** Only for the second i/p Conversion unit
of the Types 5288-12/-52

Type 5288-14 and Type 5288-54 Switchboard instruments

with connection terminals



with connecting cable



SAMSON AG
MESS- UND REGELTECHNIK
D 6000 Frankfurt 1 · Telefon (0611) 40090
Weismüllerstraße 3 · Telex 417288 sams d
Postfach 4147

18

GRAVITROL®
DENSITY METER
MARK 5
with Pneumatic Transmission

INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

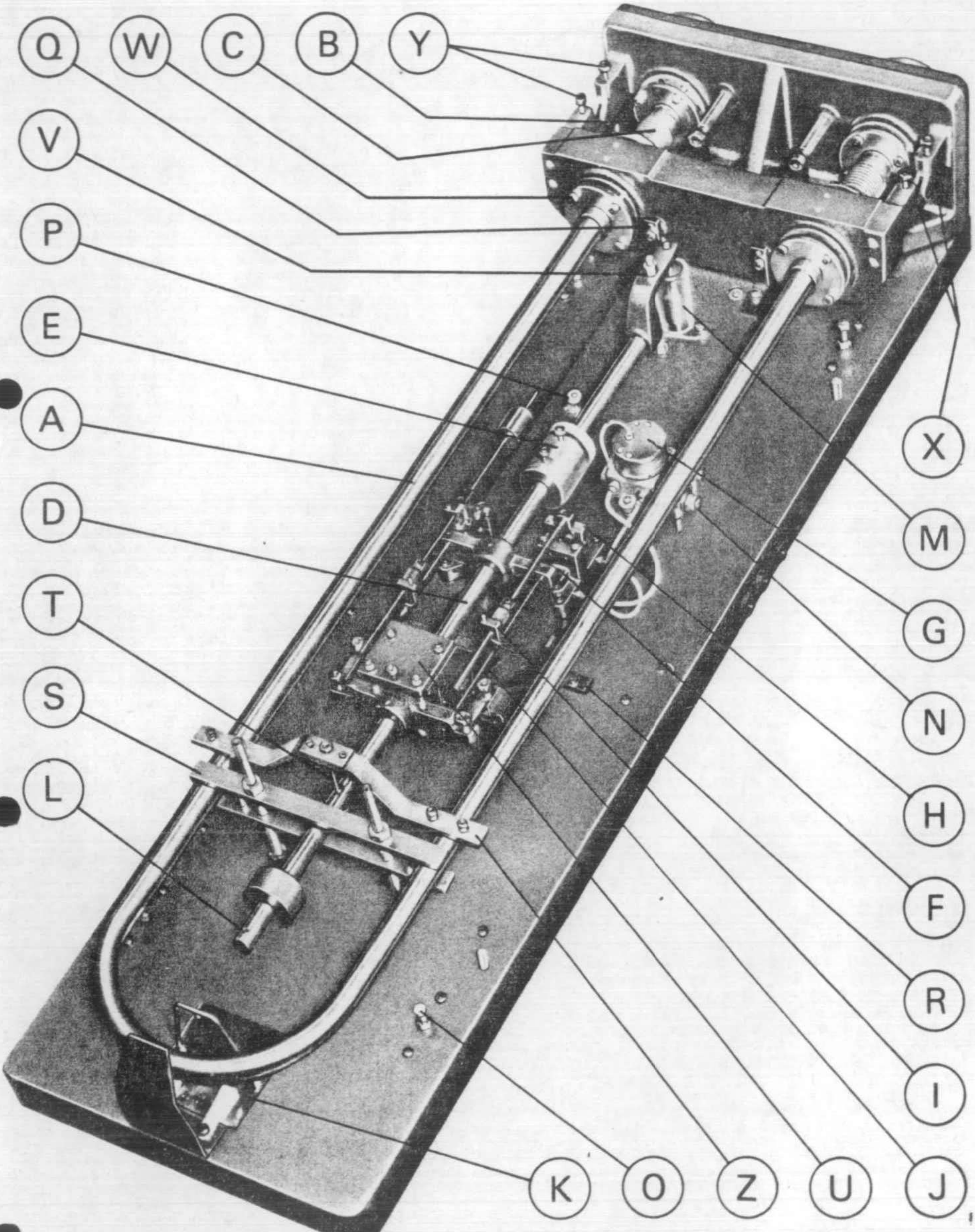


Fig. 1

SHIPPING DIMENSIONS (Approx.)

Plywood Case:-
1500 x 540 x 690 mm.
Net weight 77 kg.
Gross weight 130 kg.

Timber Case:-
1580 x 610 x 710 mm.
Net weight 77 kg.
Gross weight 160 kg.

PRINCIPLE OF OPERATION

1.1 The process liquid flows through the tube loop (A), fig. 1, pivoted on flexures (B) about a horizontal axis which passes through the flexible connectors (C). The weight of the tube loop and contents is transferred to the weigh-beam (D) and counterpoised by the balance weight (E) which is adjustable along the beam.

1.2 A change in density of the fluid produces a directly proportional change of force on the weigh-beam, which is measured by a pneumatic force-balance system, consisting of nozzle and flapper (F), relay (G) and feedback bellows (H). The output signal of 0.2 - 1.0 bar (3 - 15 p.s.i.g.) is directly proportional to the density change.

1.3 The density span corresponding to 0.2 - 1.0 bar is determined by the position of the span-adjustor (I) acting on the force-bar (J) and is adjustable between 0.02 and 0.5 g/cm^3.

1.4 The range for a given span depends upon the weight (E) which can be positioned in accordance with the density to be measured. This adjustment is independent of the span adjustment. The range and span can be verified by using the scale-pan to hang known weights on the pivot (L) to simulate density changes (5.4 - 5.14).

1.5 The dashpot (M) and the adjustable damping restrictor (N) in the relay (G) prevent oscillation of the system.

COMMISSIONING

2.1 The operational environment is of considerable importance in obtaining optimum performance. The application should be considered in detail since careful installation will ensure accurate trouble-free operation. A solid foundation must be provided to isolate the density meter from plant vibration and in particularly adverse conditions, anti-vibration mountings may also be required. To ensure that no stress or vibration is transmitted to the instrument the connecting pipework should be attached with flexible connectors.

2.2 If the atmosphere is particularly corrosive it may be advisable to provide air purging to the instrument case. Special precautions may also be necessary if the temperature of the liquid is lower than ambient. Under such conditions condensation may form on the tube loop causing a zero shift.

2.3 Since the meter measures the density of the tube loop contents, measurement will be unaffected by particle size provided that the particles are small in comparison with the size of the bore. A slurry must be circulated through the tube loop at a sufficient rate to prevent the deposition of solids. The recommended minimum velocity for slurries is 2.2 m/s equivalent to a flow rate of 53 l/min (700 gal/h) in a 23 mm bore tube loop, or 130 l/min (1700 gal/h) for a 36 mm bore.

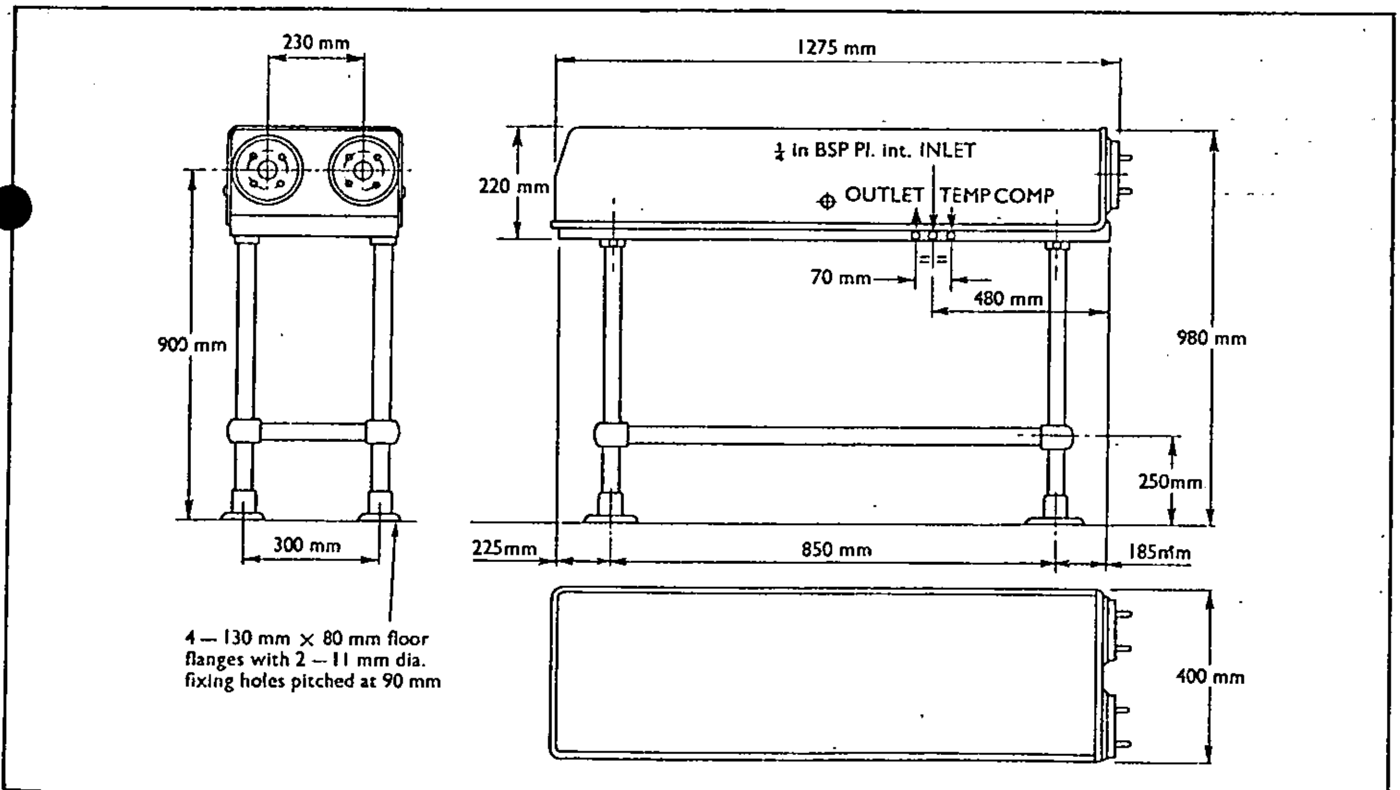


Fig. 2

2.4 For clean liquids a high velocity is only required on start up to clear the air from the tube loop. The recommended minimum velocity is 1 m/s, 25 l/min (330 gal/h) for a 23 mm bore, or 60 l/min (800 gal/h) for a 36 mm bore tube loop. For the 25 mm bore glass tube loop the recommended minimum velocity for clean liquids is 1.1 m/s, 55 l/min (360 gal/h).

2.5 When the air has been cleared from the tube loop the velocity may be decreased, but the mean density of the tube loop contents will then change more slowly.

INSTALLATION

3.1 Mount density meter on legs (fig. 2) or other suitably prepared stand and connect process pipework. Ensure tube loop remains dry. A typical installation is shown in fig. 3.

3.2 Remove cover and release four red transit brackets (Q and R) by removing top screws (store in tapped holes); slacken lower screws, slide bracket clear and re-tighten.

3.3 Level the meter to spirit-level (P) using the four levelling screws (O) and tighten lock-nuts. Secure meter to stand by locking grub screws at top of legs.

3.4 Slacken and re-secure clamp bars (S) to allow free movement of tube loop.

3.5 Lift tube loop and insert link (T) ensuring that pivots and jewels are correctly seated. Do not alter screw adjustments. Allow load on link to be applied gently to prevent damage to jewels.

3.6 Remove outer two screws from weigh-beam locking plate (U) then release central screw (heads painted red).

3.7 Slacken nuts (V) to release weigh-beam. Check piston is in centre of dashpot (M) by passing length of 24 swg wire round piston. Fill dashpot with silicone fluid provided until level is 5 mm above piston.

3.8 Remove transmitter (and temperature compensation unit) force bar transit clips, ensuring the flexures are undamaged.

3.9 All transit locks must be used in reverse order to above if meter is moved subsequently.

AIR SUPPLY

4.1 The instrument should be supplied with compressed air from a regulator capable of delivering 15 l/min (0.5 SCFM) at 1.4 bar (20 p.s.i.g.) fig. 4.

4.2 A drip-well followed by a filter should be installed upstream of each regulator, or alternatively one of the commercially available units can be employed in which regulator, pressure gauge, filter and drip-well are incorporated in the same assembly.

4.3 The air line from the regulator to the density meter supply connection should be as short as possible and must not be smaller than 7 mm bore. Copper, aluminium or nylon tube is recommended. The air pipe to the receiving instrument should not be smaller than 5 mm bore, and again, copper, aluminium or nylon tube should be used. It is essential that this pipe should have no leaks and after start up all joints should be tested with soap solution. The pipe to the receiver can be as long as 125 m, but should be kept at a minimum to avoid transmission lag.

4.4 The usual precautions to ensure a clean dry air supply must be observed. Pipes should be

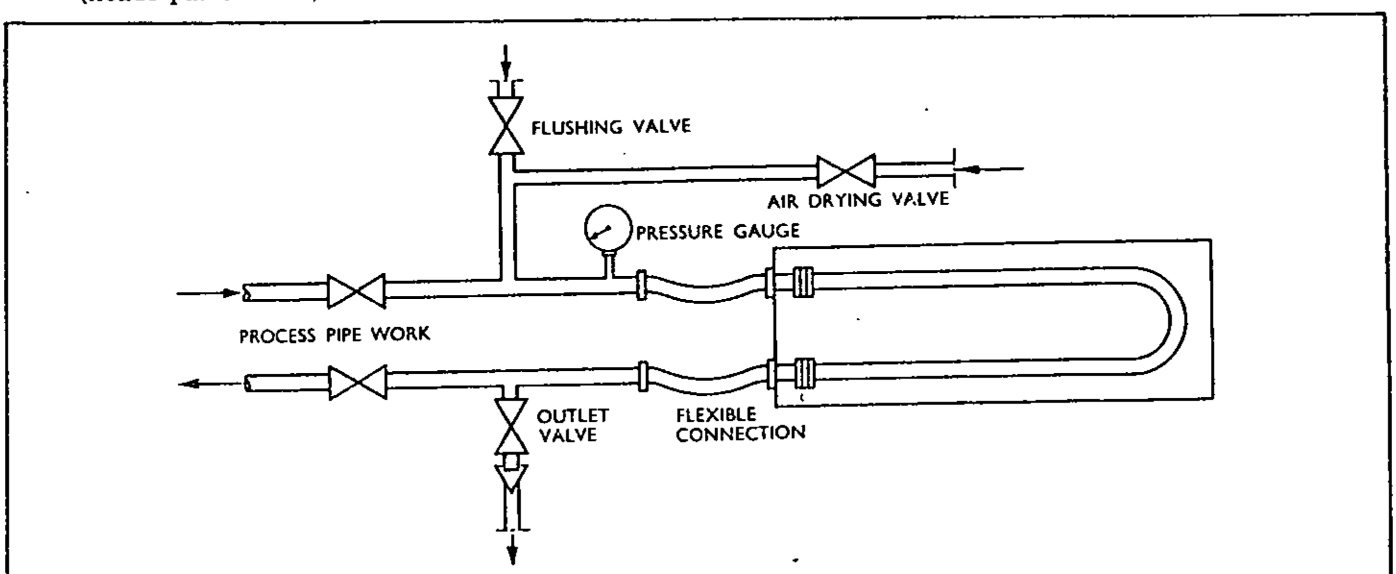


Fig. 3

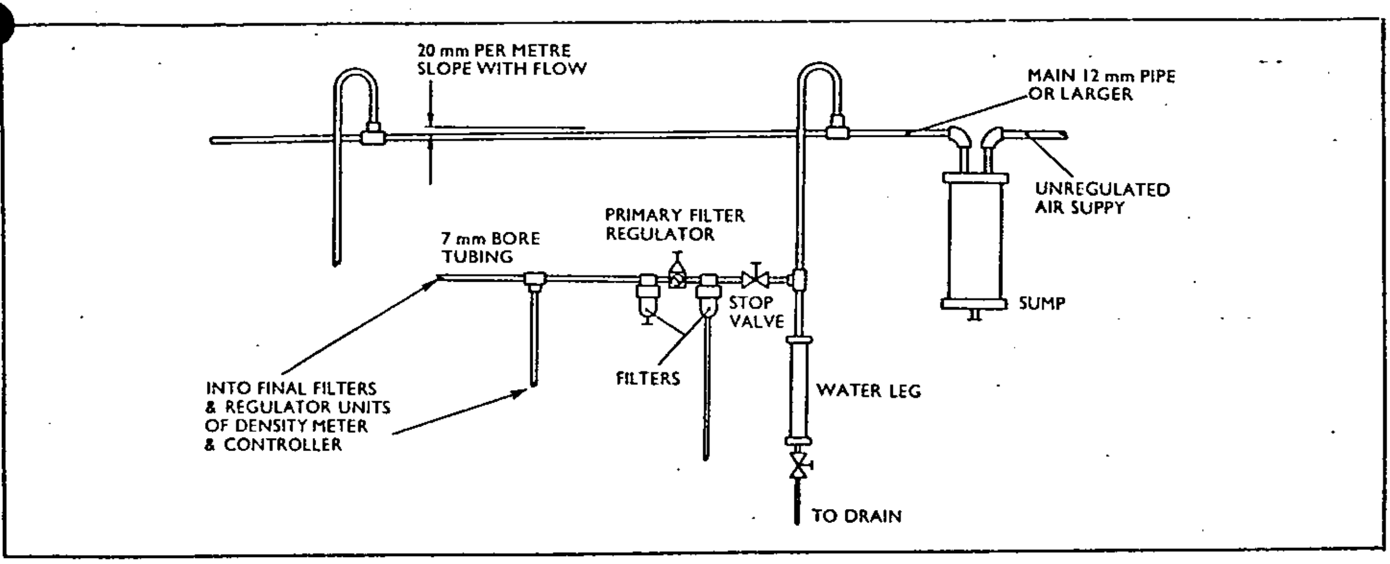


Fig. 4

installed with a falling slope so that moisture can flow to suitably placed drain points. If a supply is taken from an overhead air pipe the connection should be made with the 'T' piece pointing upwards. When installing new pipe-work, jointing compounds should be used sparingly and applied only to male threads.

START UP

5.1 Connect a clean dry regulated air supply of 1.4 bar (20 p.s.i.g.) to the supply connection fig. 5 (4.1 - 4.4).

5.2 Connect the receiver to the output connection and make sure that the damping restrictor (N) is open.

5.3 Set over-range nuts (V) one turn more than is required for an output signal of 0.2 - 1.0 bar (3 - 15 p.s.i.g.).

5.4 Before checking the calibration, verify that the tube loop is clean and dry.

5.5 A scale pan and box of weights are supplied for calibration. The data plate gives the weight values corresponding to minimum and maximum density.

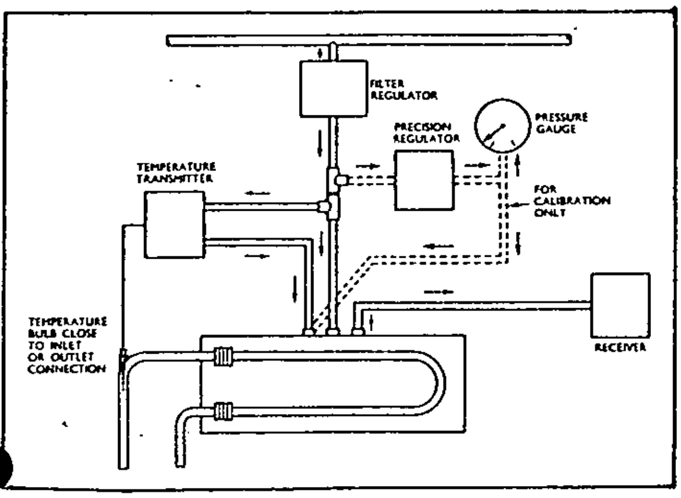


Fig. 5

For example with a 25 mm tube loop:-

Density 1.0 g/cm^3 = 300 g (12.1)
Scale pan weight = 200 g
Range 1.1 - 1.2 g/cm^3 corresponding to a 0.2 - 1.0 bar change in output.

Weight for minimum density = 1.1 x 300 = 330g (0.2 bar)
Weight for maximum density = 1.2 x 300 = 360g (1.0 bar)

Hence the weights to be added, allowing for the 200 g scale pan, are 130 g for minimum density plus a further 30 g for the maximum density output signal. The span, 0.1 g/cm^3 is thus equal to 30 g on the scale pan and equal to a 0.8 bar change in output.

5.6 For an instrument with temperature compensation, see section 6.

5.7 Hang the scale pan from the weigh-beam pivot and add 130 g. Position the weigh-beam balance weight so that the output is 0.2 bar.

5.8 The addition of a further 30 g should give an output of 1.0 bar. If the correct output is not obtained, span-adjuster (I) must be re-positioned; moving the span-adjuster towards the feedback bellows increases the span. While correcting the span, position the balance weight to keep the output signal on the receiver scale.

5.9 After adjustment secure the span-adjuster.

5.10 Set the range with the balance weight for minimum and maximum density when the span has been established.

5.11 With the weight equivalent to midscale, 145 g on the scale pan, the output should be 0.6 bar.

5.12 Adjust the damping restrictor (N) for optimum signal stability and speed response.

5.13 Return the weights to their box. Replace the scale pan under the spring clips on the base plate. Replace the instrument cover and secure the locks.

TEMPERATURE COMPENSATION

6.1 Certain applications such as the measurement of the concentration of a solution require the suppression of density signals caused entirely by process temperature changes. This suppression or compensation is achieved by applying a force change to the measuring system which is equal and opposite to the force change caused by temperature effects.

6.2 The signal from a temperature transmitter is fed into the temperature compensation unit (connection marked 'TEMP'). The force applied to the weigh-beam force-bar is determined by the position of the compensation adjuster (fig. 6).

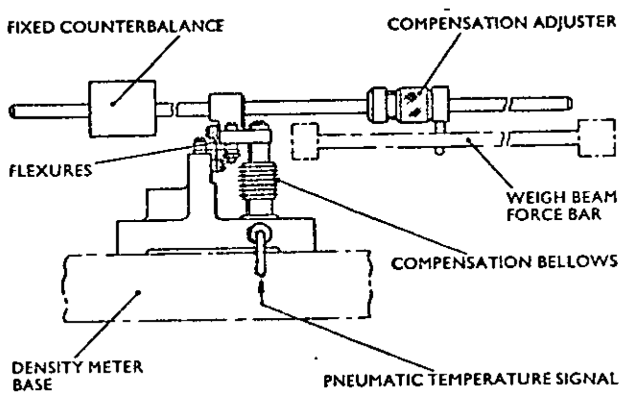


Fig. 6

6.3 As the force applied is proportional to the temperature change the compensation obtained is linear. Where the density-temperature relationship of the process liquid is non-linear, or changes over the density range (e.g. due to changes in the proportion of liquid to solid in a slurry), then the linear coefficient which gives rise to least error is used.

6.4 The maximum compensation available is for a temperature change producing a change in density equal to the span of the instrument.

e.g. Density meter span	=	$0.05\ g/cm^3$
Process liquid co-efficient of thermal expansion	=	$0.5 \times 10^{-3}/°C$
i.e. density-temp. relationship	=	$0.5 \times 10^{-3} g/cm^3/°C$
then, maximum temperature change for which compensation can be applied	=	$\frac{0.05}{0.5 \times 10^{-3}} = 100°C$

6.5 Calibration Example:

Equivalent weight for $1.0 g/cm^3$	=	300g (12.1)
Scale pan weight	=	200g
Reference temperature	=	20°C
Density range at ref. temp.	=	$1.1 - 1.2\ g/cm^3$
Temperature transmitter range	=	30 - 80°C
Temperature transmitter signal	=	0.2 - 1.0 bar
Temperature compensation range	=	40 - 80°C (0.36 - 1.0 bar)
Density temperature relationship of process liquid	=	$0.8 \times 10^{-3} g/cm^3/°C$

6.6 Determine the density range at the maximum compensation temperature, 80°C

i.e. minimum density = $1.1 - (60 \times 0.8 \times 10^{-3})$
= $1.052\ g/cm^3$

Maximum density = $1.152\ g/cm^3$

This is the range to which the transmitter is set, as follows:

Weight for minimum density	=	1,052 x 300
	=	315.6g (0.2 bar)
Weight for maximum density	=	345.6g (1.0 bar)

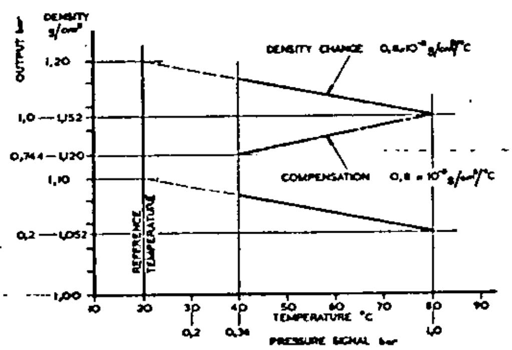


Fig. 7

6.7 Feed a signal corresponding to the maximum compensation temperature into the 'TEMP' connection and continue as 5.7 to 5.12 using a 115.6g at 5.7 and 1,30.6g at 5.11.

6.8 For a change of temperature from 80°C down to 40°C the density of the process liquid increases by:

$0.8 \times 10^{-3} (80 - 40) = 0.032\ g/cm^3$

which is 32% of the density span (6.4). For this density signal to be suppressed the temperature compensation unit must decrease the density meter output by $0.032\ g/cm^3$ (0.256 bar).

6.9 With 145.6g on the scale pan, equivalent of maximum density at 80°C ($1,152\ g/cm^3$), decrease the signal applied to the temperature compensation unit to 0.36 bar corresponding to 40°C. The density meter output should then be:

1.0 - 0.256 = 0.744 bar

6.10 If the required degree of compensation is not obtained, the position of the compensation adjuster must be altered. To increase the amount of compensation the adjuster should be positioned nearer to the compensation flexures.

6.11 If an adjustment is made at 6.10 it will be necessary to re-set the density meter range. Apply a signal corresponding to the maximum compensation temperature at 80°C (1.0 bar) and with 145.6g on scale pan equivalent to maximum density at 80°C (1,052 g/cm^3). Adjust weight E (fig.1) to give a density meter output of 1.0 bar.

6.12 Return weights to box. Replace scale pan under clips and secure cover.

MAINTENANCE

7.1 Under certain working conditions cleaning of tube loop or pneumatic system parts may be necessary.

7.2 Tube Loop
Should a deposit settle inside the tube loop an output error will become apparent because of the increased weight and decreased volume. In most instances the deposit can be removed by flushing with a solvent that does not affect the wetted parts (see fig. 3).

7.3 If more extensive cleaning is necessary the tube loop can be removed, after clamping tube carrier-casting brackets (Q), and a brush or pull-through used. The flexible connectors (C) should not be removed for routine cleaning (10.1).

7.4 It is essential that the range should be verified before returning the instrument to service (5.4 - 5.13).

7.5 Pneumatic System
For relay maintenance see 8.2.

7.6 The nozzle and flapper may require cleaning if sooting occurs.

7.7 Lock over-range nuts (V). Rotate flapper away from the nozzle after moving it against spring to release from locating pin. Remove nozzle, clean with reverse air blast and replace (9.4).

7.8 In the case of damage or replacement of parts, the following procedures are given, but should only be undertaken by an experienced instrument fitter.

RELAY TYPE R.A.2

8.1 The relay, fig. 8 is of the continuous bleed type and consumes a maximum of 15 l/min (0.5 SCFM). The restrictor feeding the nozzle is situated on the side of the relay mounting block and can be cleared by depressing the external pin. Included in the outlet of the mounting block is an adjustable damping restrictor (N). When setting up the relay ensure that the restrictor is open. Air

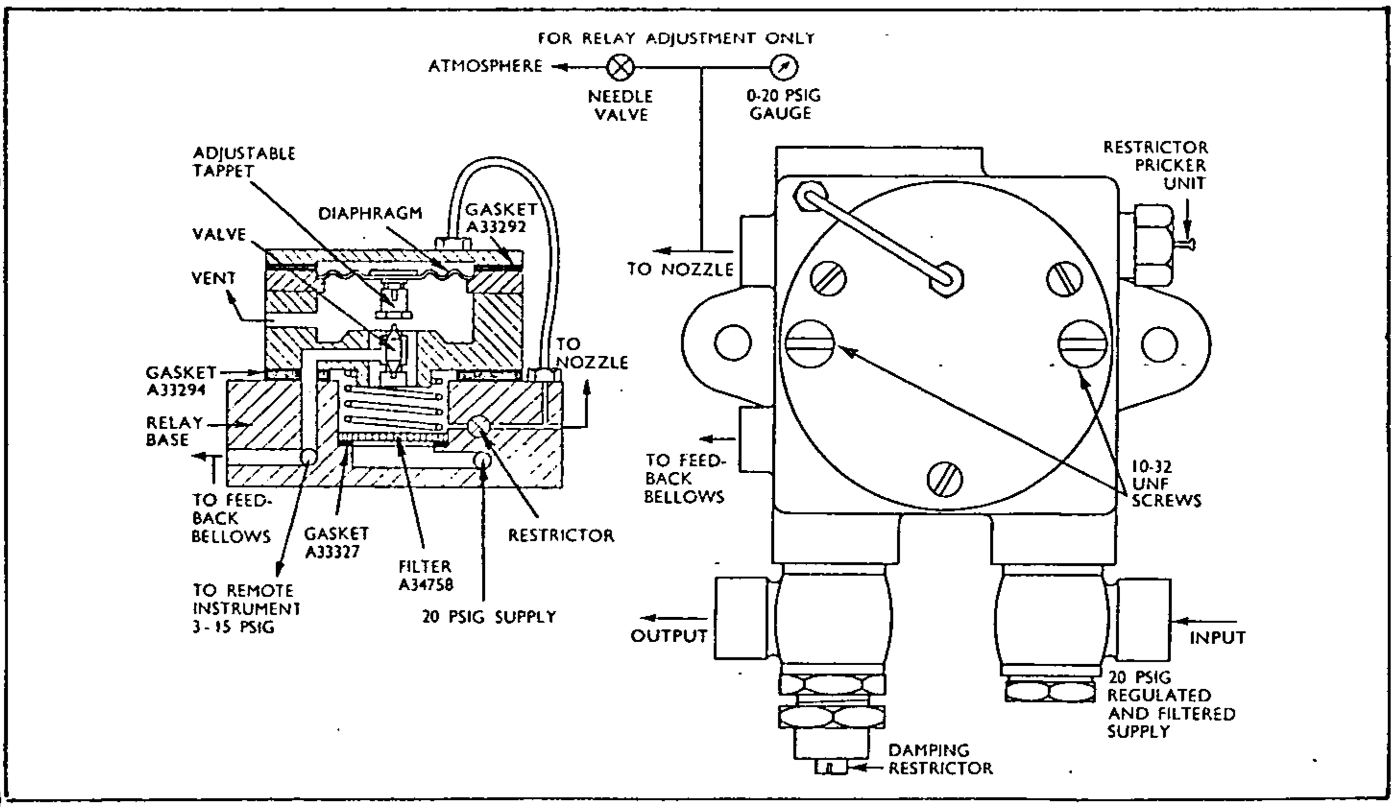


Fig. 8

passes through a filter disc to the restrictor and then to the nozzle. Air also flows to the supply port of the valve. As the nozzle flapper relationship changes, the resulting back pressure on the diaphragm also changes. If the change increases the back pressure, the diaphragm will move down closing the supply port and opening the vent port. This decreases the output pressure fed to the bellows and the receiving instrument.

8.2 The only maintenance required is the occasional cleaning of the filter disc and the restrictor pricker unit with benzine or similar solvent. Access to the filter disc is obtained by removing the two 10 - 32 UNF screws.

8.3 Relay adjustment: The relay is reverse acting in operation. Decreasing the nozzle pressure from 4 - 3 p.s.i.g. increases the output from 3 - 15 p.s.i.g.

8.4 The tappet has been set during calibration, but should it be necessary to check the setting, proceed as follows:-

8.5 Disconnect the nozzle pipe at the relay base.

8.6 Connect a needle valve and pressure gauge to the nozzle connection fig. 8, and a pressure gauge or manometer to the output connection.

8.7 The needle valve should be closed until the pressure indicated on the gauge is 4 p.s.i.g. Carefully adjust the tappet with a $\frac{1}{4}$" A/F spanner until the output is 3 p.s.i.g.

8.8 By opening the needle valve, decrease the pressure to 3 p.s.i.g. The output pressure will be between 13 - 16 p.s.i.g., a gain of 10 - 13.

8.9 Reconnect the nozzle pipe and check for leaks with soap solution.

8.10 Check the range. (5.4 - 5.13).

ALIGNMENT OF MEASURING SYSTEM

9.1 Set weigh-beam parallel with base, previously set true to spirit-level (P), using over-range nuts (V).

9.2 The screw-adjusters at top and bottom of link (T) provide adjustment to ensure tube loop is also parallel with base. The bracket housing the screw-adjuster at top of link provides adjustment to ensure link is vertical.

9.3 If the transmitter bar and force-bar (J) are not parallel the vertical rider-rod in span-adjuster (I) should be re-set.

9.4 Adjust nozzle height to give an output signal of 0.5 - 0.7 bar (8 - 10 p.s.i.g.).

9.5 Release over-range nuts (V) one more turn each than is necessary to obtain full-scale output and check range (5.4 - 5.14).

REPLACEMENT OF FLEXIBLE CONNECTORS OR TUBE LOOP FLEXURES

10.1 The pressure alignment must be checked (11.3 - 11.18) if the flexible connectors are removed for cleaning or replacement, or if the tube loop flexures are replaced.

10.2 Raise bottom clamp-bar (S) to support tube loop, remove link (T) and secure transit brackets (Q).

10.3 Remove damaged flexures and fit replacements.

10.4 Remove flexible connectors for cleaning or replacement.

10.5 When replacing flexible connectors ensure the 'O' ring seals are seated correctly. Replace all flange screws holding flexible connector and screw in until finger tight. Slacken all screws so that flexible connectors can be rotated to take up ideal central position and finally tighten flange screws. The amount of location provided by the flanges should be sufficient to maintain axes of flexible connectors and rest of meter concentric. After final fitting, bellows corrugations must be equi-spaced and free from distortion.

<u>NB</u> Correct alignment of flexible connectors is essential if pressure alignment of the meter is to be achieved over its whole working pressure range (11.1).

10.6 Unclamp tube loop (3.2, 3.4 and 3.5).

10.7 Check the pressure alignment (11.3 - 11.18).

PRESSURE ALIGNMENT

11.1 The pressure alignment is true when the horizontal tube loop flexures are on the same plane as the pressure centres of the flexible connectors. If this condition is not satisfied then a process pressure will produce a moment about the tube loop flexure axis, resulting in an output signal error.

11.2 The meter is pressure aligned by pressurising each flexible connector separately and adjusting the horizontal flexures until minimum output error is observed.

11.3 Raise the bottom tube-clamp bar (S) to support tube loop, remove link (T) and secure transit brackets (Q).

11.4 Slacken eight flange screws (W), insert blanking plates, fig. 9 between tube flange and 'O' ring carrier and tighten flange screws.

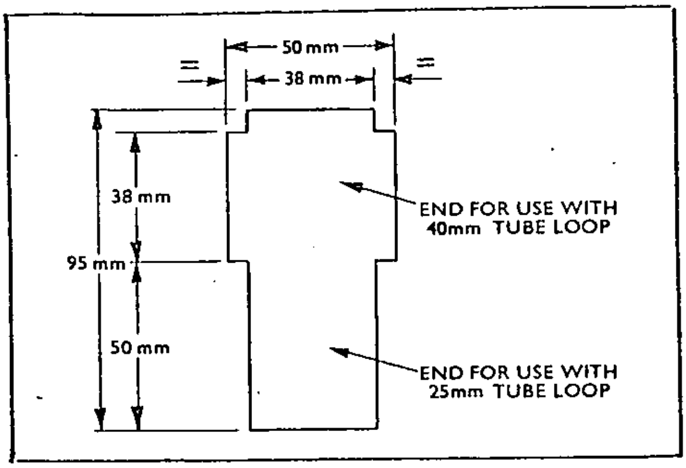


Fig. 9

11.5 Unclamp tube loop (3.2, 3.4 and 3.5).

11.6 Hang scale-pan from weigh-beam pivot and add gram-weights to give an output signal of 0.6 bar (9 p.s.i.g.).

11.7 Unlock the four flexure adjustment clamp screws (X) and lightly re-tighten.

11.8 Connect a clean regulated air, water or process liquid supply to one of the pipe flanges (see 12.3). If liquid is used, ensure that all the air is expelled from the flexible connector before proceeding with the alignment.

11.9 Repeatedly apply the maximum working pressure until a consistent reading is obtained in the unpressurised condition. Take care not to damage the flexible connectors by exceeding the working pressure.

11.10 Pressurise the flexible connector and note the change in output. If the output signal increases, the horizontal flexure, adjacent to the flexible connector being pressurised, must be raised by means of the adjusting screws (Y) on the flexure mounting blocks. Similarly if the output falls the horizontal flexure must be lowered. Care must be taken to ensure that equal height changes are made at each end of the flexure to keep them horizontal.

11.11 Continue adjusting the height of the flexure until there is a minimum change in output over the working pressure range.

11.12 Similarly pressure align the other flexible connector (11.8 - 11.11).

11.13 Repeat the adjustment on each connector alternately until there is a minimum change in output over the working pressure range.

11.14 Pressurise both flexible connectors together and make any adjustment necessary equally on all four adjusters (Y).

11.15 Secure the tube loop (11.3), remove the blanking plates and release tube loop (11.5).

11.16 Fill the tube loop with water or process liquid of constant density, taking care that all the air is expelled. Pressurise and check for minimum output error making adjustments equally to both flexures as necessary.

11.17 Finally tighten clamp screws (X) to lock position of flexures and re-check pressure alignment.

11.18 Empty tube loop and dry. Recouple the process pipework and check the range (5.4 - 5.14).

NOTE With tube loops where blanking plates cannot be inserted (e.g. glass tube loop) both sides of the tube loop have to be pressure aligned simultaneously (11.16) unless an internal method of isolating each flexible connector can be achieved.

Before such a pressure alignment it must be checked that both horizontal flexures are the same height above a suitable datum and truely horizontal.

EQUIVALENT WEIGHT

12.1 The equivalent weight for density 1.000 g/cm^3 is the total weight which must be added to the weigh-beam, at the scale-pan pivot (L), to simulate a fluid of density 1.000 g/cm^3 when the tube loop is dry.

12.2 The equivalent weight for density 1.000 g/cm^3 will require verification if a replacement tube loop is fitted or the tube suspension bridge (Z) moved.

12.3 A clean, air-free water supply capable of delivering the necessary (2.3) flow is required as well as a means of accurately measuring the water temperature close to the inlet or outlet connection.

12.4 Water is advised for this process but any suitable liquid whose density can be ascertained to the required accuracy (12.10) may be used.

12.5 Disconnect the meter from the process pipework. (Note 3.9).

12.6 Connect the meter to the water supply.

12.7 Position span-adjuster (I) 15 - 20 mm from free end of transmitter bar to obtain high sensitivity (fine span).

12.8 Pass water through the tube loop for about three minutes to ensure that all the air has been cleared from the tube loop and that the water temperature has stabilised.

12.9 Position balance weight (E) to give an output signal of 0.6 bar (9 p.s.i.g.).

12.10 Note the water temperature and obtain the density from temperature density tables. The density must be known to better than ½% of the finest span of the meter.

12.11 Disconnect meter from water supply. Completely dry out tube loop.

12.12 Hang scale-pan (K) from pivot (L) and add gram weights to restore the 0.6 bar (9 p.s.i.g.) output signal as at 12.9.

12.13 Divide the total weight added to weigh-beam by the density of water at measured temperature (12.10). The quotient obtained is the weight equivalent to density 1.000 g/cm^3.

12.14 New weight values for minimum and maximum density must be calculated (5.5) if the equivalent weight for density 1.000 g/cm^3 differs from the value given on the data plate.

12.15 Recouple the density meter to the process pipework.

12.16 Re-calibrate the range (5.4 - 5.14).

FAULT FINDING

SYMPTOM	CAUSE	REMEDY
Output will not rise with increasing density	No or inadequate air supply	Check air supply (4.1).
	Damping restrictor (N) fully closed	Open damper restrictor (N).
	Air leaks.	Check with soap solution.
	Incorrectly set over-range nuts (V).	Reset over-range nuts (5.3).
Output will not fall with decreasing density	Blocked restrictor.	Press restrictor pricker on relay (G)
	Blocked nozzle.	Clean nozzle (7.7).
	Incorrectly set over-range nuts (V).	Reset over-range (5.3).
	Dashpot piston touching cylinder.	Centralise piston in cylinder (3.7).
Hysteresis	Over-range nut stud touching weigh-beam.	Set stud to ensure clearance.
	Incorrectly located link (T).	Locate link correctly (3.5).
	Loose or buckled flexures.	Secure or replace flexures (10.1 - 10.3).
	Tube loop touching clamps (S & Q)	Reposition clamps.
	Damaged weigh-beam force bars (J)	Reposition or replace force bar (J)
	Damaged link in adjusters (I).	Renew link.

SPARES

Description	Part No.	Per Set
CONNECTION FLANGES		
Stainless Steel 1" BS 10 'E' (25mm tube loop)	D23284/1	2
Stainless Steel 1½" BS 10 'E' (40mm tube loop)	D23284/2	2
P.T.F.E. Lined 1" BS 10 'E'	C38116/1	2

SPARES (Continued) Description	Part No.	Per Set
FLEXIBLE CONNECTORS (C)		
25 mm Stainless Steel	B38058	2
40 mm Stainless Steel	B38059	2
25 mm P.T.F.E.	A32621	2
TUBE CARRIER INSERTS		
25 mm Stainless Steel	A47406/1	2
40 mm Stainless Steel	A47406/2	2
Insert for glass tube loop	A47466/1	2
Asbestos packing for above insert	A35311	2
TUBE LOOPS		
25 mm Stainless Steel	C38068/1	1
40 mm Stainless Steel	C38068/2	1
25 mm Glass	B32692	1
SEALS		
25 mm tube loop size 'O' Ring	BS1806 No. 216	6
40 mm tube loop size 'O' Ring	BS1806 No. 222	6
'O' Rings are available in Neoprene, Nitrile, P.T.F.E., Silicone and Viton. (Please state material when ordering)		
FLEXURES		
* Stainless Steel 40 mm CRS (weigh-beam)	A29619/1	4
* Stainless Steel 50 mm CRS (tube loop)	A29619/2	4
* Phosphor bronze 15 mm CRS (transmitter & TC Units) ..	A29651	4
TRANSMITTER		
* Tube loop/weigh-beam link (T)	A35304	1
* Pivot screw	A35305	1
* Jewel screw	A35306	1
Dashpot (clear moulding)	A32619	1
Dashpot piston assembly	A47490-1	1
* Silicone dashpot fluid (8 dram vial or $\frac{1}{2}$ 1 bottle)	A35334/-	1
Transmitter unit complete	B38226/1	1
Temperature compensation unit complete	B38227/2	1
Phosphor bronze bellows assembly (H)	A38082	1
Nozzle	A47427	1
Nozzle-flapper	A29649	1
Relay RA2 (G)	B18968	1
Restrictor pricker unit	A35427	1
Force bar (J)	A47696	1
Adjuster link	A47436	1
TOOLS		
Spanner 8 A/F	A35341	2
Spanner 13 A/F - 17 A/F	A35336	1
Allen keys 2, 2.5, 4, 5 A/F and Special 5 A/F	A35335/1-5	5

NOTES

1. The above spares cover standard meters; non-standard spares available on application.
2. Always advise serial number of density meter when ordering spares.
3. Letters in brackets refer to fig. 1.
4. Items marked * are recommended spares - one spare set being despatched with meter.

FISHER Controls

Fisher Controls GmbH Geschäftsbereich Instrumente

Ein Unternehmen der Fisher Controls Corporation of Delaware, U.S.A.

Alb.-Magnus-Str. 11
Postfach 19 05 20
D-5650 Solingen 19

Tel. (02122) 31 40 11
Telex 8 514 832 fcsd

Technische Büros:

Pinneberg
Tel. (04101) 78 51
Telex 2 189 142 fcpd

Solingen
Tel. (02122) 31 40 11
Telex 8 514 832 fcsd

Offenbach/M.
Tel. (0611) 83 10 84
Telex 4 152 629 fcod

München
Tel. (089) 714 10 02
Telex 5 212 743 fcmd

. . . weitere Fisher Controls Verkaufs- und Service-Niederlassungen in mehr als 50 Ländern der Erde

Änderungen vorbehalten

M.I. 126 November, 1975. Printed in England by Roffey & Clark Ltd., Croydon.

19

EG&G BERTHOLD

Sorbus House
Mulberry Business Park
Wokingham
Berkshire
RG41 2GY
Tel: 0118 977 3003
Fax:0118 977 3493
e-mail: John_Sharman@egginc.com

Attn: Paul Shore

Company: Dairy Crest Ingredients SDI

Fax: 01978 782343

From: JOHN SHARMAN

Phone: 01484 866254
Fax: 01484 866255

Date: 16 September, 1999
Pages including this cover page: 2

Paul,

Enclosed is our quotation for the replacement amplifier and spares for the detector

Should you require any further information, please give me a call

Regards

John

£550.00

115/230

4 → 20mA

(1.5mm) 7 core screen cable

EG&G BERTHOLD
Sorbus House
Mulberry Business Park
Wokingham
Berkshire
RG41 2GY
Tel: 0118 977 3003
Fax:0118 977 3493
e-mail: John_Sharman@egginc.com

16 September, 1999

Attn: Paul Shore
Dairy Crest Ingredients SDI
Pickill Lane
Marchwiel
Wrexham
LL13 0UE

Quotation no: 2164 JS

Spares for Berthold LB379 Density Gauge

Comprising:

	Part no:	Description:	
1 off	81474-2	LB386-1C Microprocessor based density gauge amplifier Output 0/4-20mA isolated. Automatic decay compensation. 2 open collector outputs for min/max alarm. 1 open collector for failure alarm 20 character alphanumeric display Data storage in EEPROM for up to 3 data sets for different products Input for temperature compensation 0/4-20mA or PT100 Digital inputs for a) external setting of current output range b) external setting of calibration sets or start stop signal for the measurement Supply 115 v 47-60Hz 19" Rack mounting Weight approx. 8kg.	£3,394
1 off	16651	Complete electronics for Sz6 Detector	£1,405
1 off	16625	PM Tube crystal combination	£1,038

Prices are ex works Germany

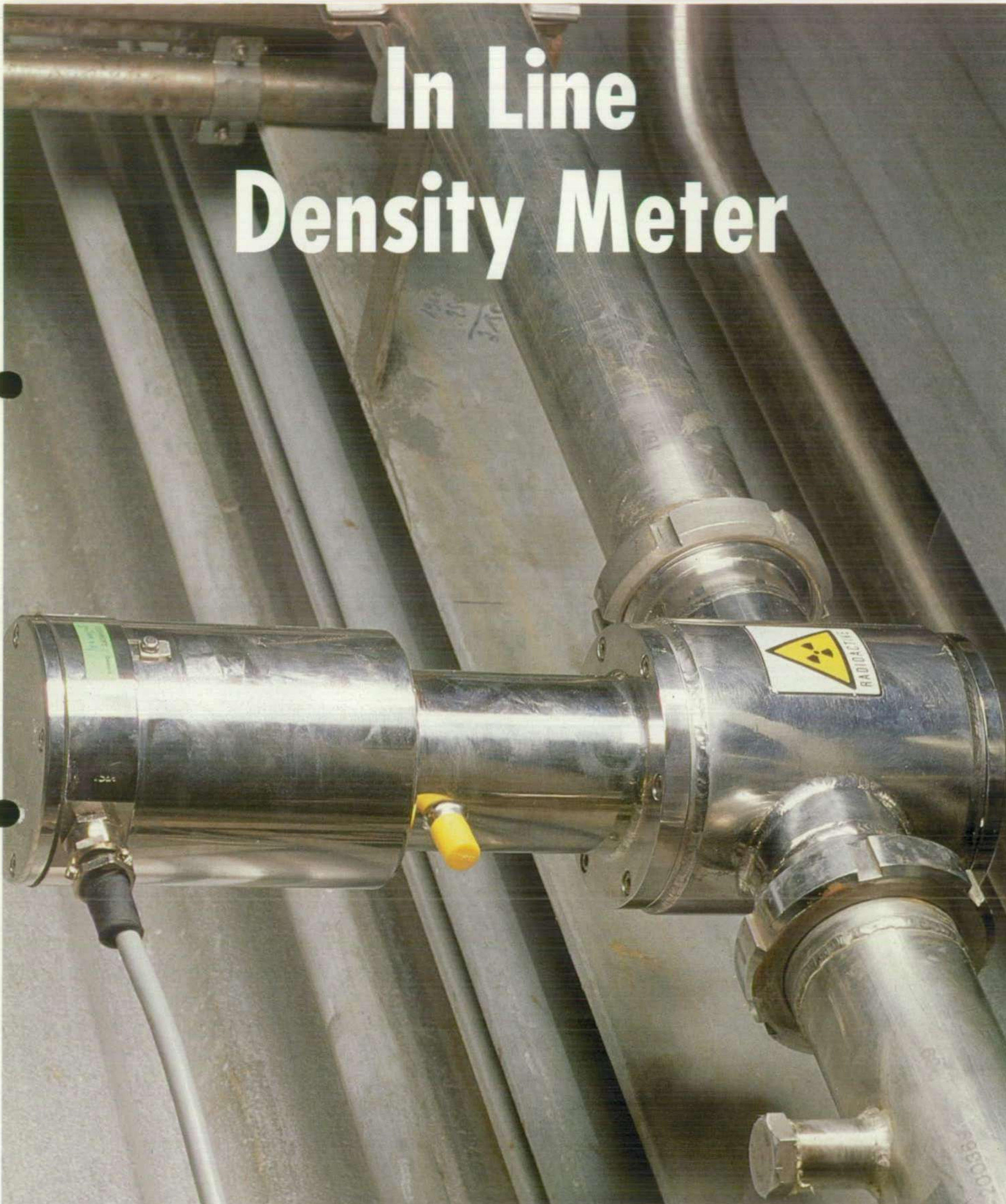
Delivery: 4-6 weeks

Validity: 30 days

Terms of payment: net 30 days

Contactless Measurements

In Line Density Meter



EG&G BERTHOLD

Process Control Division

The In Line Density Meter

The Compelling Advantages

- Noncontact, continuous measurement without contact with medium being measured.
- Minimum radiation exposure (dose rate $\leqq 1 \mu$ Sv/h (0.1 mrem/h) at 10 cm (4") distance from surface).
- ^{241}Am radiation source in ultrasafe capsule with long half-life (433 years).
- Complete stainless steel construction of measuring section.
- Simple installation in existing pipelines.
- High statistical accuracy and longterm stability by use of highly sensitive scintillation counter with patented drift compensation.
- Application in food industry.
- Calibration and measurement output directly in measured variables (g/cm^3, %, °Bx, °Be, g/l).
- Very simple calibration by microprocessor controlled amplifier.

Some Examples for Application

Sugar industry
For measurement of thin and thick juice and milk of lime.

Milk Industry
Concentration measurements on whole milk, skim milk, and whey for control of evaporators.

Beverage Industry
For monitoring mixing of concentrate and water.

Power Plants
Concentration measurements of lime and limestone gas desulfurizing systems (scrubbers) in flue.

Starch Production
Measurement of starch suspensions.

Chemical Industry
Measurement of acids, alkalis, suspensions, concentration of anti-freezing compounds, bulk density determination in washing powder.

Textile Industry
Measurement of foaming of dyeing liquor.

Density measurement in a flue gas desulfurizing facility.

Photo by permission of Neckarwerke and KRC Co.

LB 386-1 C
An Evaluation Unit with Many Advantages

Versatile

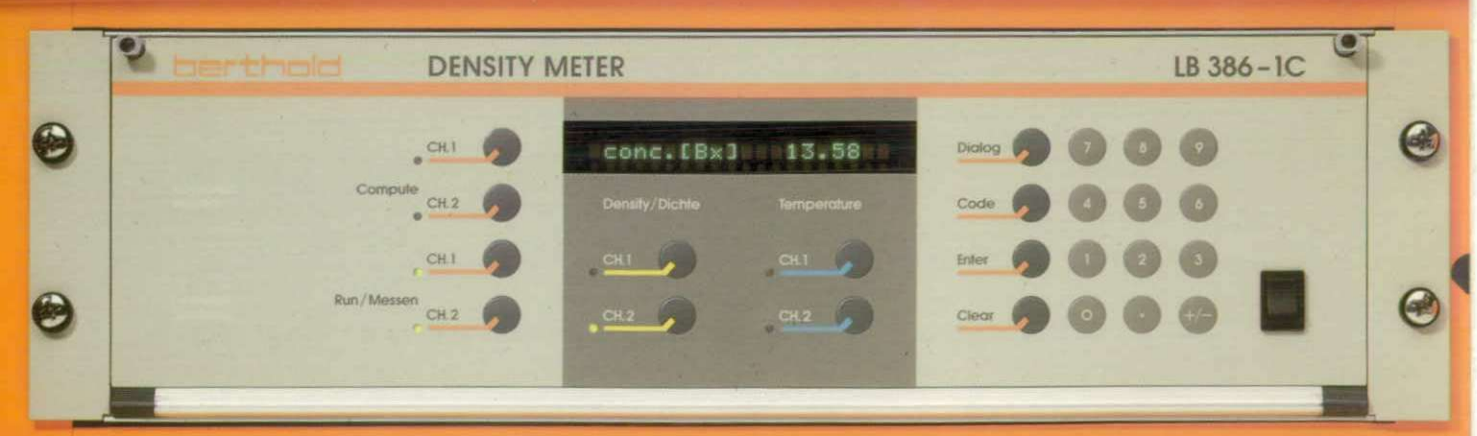
- Storage for 3 different products:
  - calibration data
  - temperature compensation
  - range of current outputs
- Selection of data sets via keyboard or external switch
- Two isolated current outputs per channel 0/4-20 mA
  Output 1 for density or concentration
  Output 2 either for density/concentration or product temperature
  The ranges for both current outputs are freely selectable
- Input for temperature signal: Pt 100 or 0/4 - 20 mA
- Test function for detector signal and current outputs
- Calibration possible with only one measuring point
  For highly accurate measurements one may use up to 10 calibration points. Thus one gets an exact linearization of the output signal even with "difficult" products, such as NaOH or H_2SO_4

Reliable

- Storage of all calibration data in EE-Prom without auxiliary power for at least 25 years
- Detector failure alarm
- Check of the evaluation unit by means of a "watch-dog"
- Alarm via relay output
- Interference due to external sources of radiation can be suppressed, e.g. during non-destructive testing
- The measurement can be stopped via external contact at which point the last measured value will be held, e.g. during empty pipe condition.
- Operating via foil-keypad. To protect the system against unauthorized data manipulation, the keyboard can be locked by entering a password.

Data Outputs

- Printout via printer interface (RS 232 or line current) for
  a) calibration data
  b) product temperature
  c) average value of density or concentration
  The measured value averaged over the interval time (freely selectable between 1-1440 min.) is printed out.
- RS 232 interface for data transfer to a master computer



In Line Density Measurement Facility
Technical Data

LB 379 Measuring System

Approval No.: BW/19/78 (applies to Germany and Austria only)
US licence No: NR-D-101-B

Detector Sz6-G5 44/5:	Scintillation counter with NaI (Tl) crystal 44/5. With drift compensation circuit.
Explosion protection:	EEx de II cT6, PTB No. 81/1049
Temperature range:	– 20 °C to + 50 °C (–4 to +122° F) (253 to 323 K). Standard water cooling for higher temperatures
Source:	Radioactive nuclide: ^{241}Am Activity: 1110 to 3700 MBq (30 to 100 mCi) In ultrasafe (special form) design
Measuring tube:	ND 65, NP 10 (2½" 150 lb./sq. in), stainless steel 1.4571 or 1.4401 (316), material 1.4301 (304) for pipes with linings
Connections:	Flanges according to the following specifications are available: DIN 2576, or ANSI B 16.5, 150 lb./sq. in, or threaded connection pipe SC 65 in accordance with DIN 11851. Measuring path with rubber or PTFE coating available on request (only with flanged design).
Product temperature:	Measuring tube without lining: –190° C to +260° C (–310° to 500° F; 80 to 560 K); measuring tube with rubber coating: –30 to +80° C (–22 to 176° F; 243 to 353 K); measuring tube with PTFE coating: –190° C to +260° C (–310 to 500° F; 80 to 560 K)
Housing:	Stainless steel 1.4301 (304)
Protection class:	IP 65 (NEMA 4)
Weight:	Approx. 18 kg (40 lb.)
Connecting cable:	7-core, shielded, 7 x 1.5 mm², max. cable length between detector and evaluation unit 500 m (1,500')

Evaluation Unit LB 386-1 C

Assembly:	19" Rack, 3 HE, 84 BE, protection type IP 20, weight approx. 6 kg
Power supply:	250/220/125/110/24 V, + 10-15%, 47 - 64 Hz 24 V = (18-36 V)
Power consumption:	at 250/220/125/110/24 V ~: 15 VA at 24 V =: 20 W
Temperature range:	0-50 °C (273 to 323 K) no condensation
Storage of all parameters:	for up to 3 different products
Inputs:	
Analog inputs:	Temperature compensation with Pt 100 in 4-wire network Measuring range: –200 to 400 °C (73 to 673 K), Inputs for temperature signal 0/4-20 mA, Temperature range freely selectable between –99 and +999° C (174 to 1277 K)
Digital inputs:	a) Input for external start/stop of measurement b) Input for external range switching of the current output or c) External selection of the product parameters.
Outputs:	
Analog outputs:	0/4-20 mA isolated max. 500 Ω per channel: a) 1 x density or concentration b) 1 x temperature signal or 2nd range for density or concentration
Threshold outputs:	2 open collector outputs per channel for max. and min. values, 24 V/0.2 A
Collective failure message:	Open collector 24 V/0.2 A
Option:	
Relay outputs for all open collector outputs:	*Switching capacity: 30 V, 80 W with resistive load, 250 V, 2000 VA* *Type: single changer*
Printer Interface:	*RS 232, 75 to 9600 Bd and line current 75 to 9600 Bd*
Computer interface:	*RS 232, 9600 Bd*
Display:	20 charcters, alphanumeric display in g/cm³, g/l, %, °Be, °Bx (selected by DIP-switches) Data input via keyboard with dialog, German, English or French (selectable); data manipulation possible only after password entry
Time constant:	5-9999 s with automatic reduction to 1/10 of this value in case of sudden density changes
Automatic decay compensation:	for ^{137}Cs, ^{60}Co, ^{241}Am and ^{244}Cm, selectable for each channel
Weight	approx. 6 kg

Design modification may occur without notice.

Shieldings see special brochure.

EG&G BERTHOLD
Radiation Measuring Instruments for Industry, Science and Medicine

Laboratorium Prof. Dr. Berthold GmbH & Co. KG · P.O. Box 100163 · D-75312 Bad Wildbad-**Germany** · Phone (+49) 7081/177-0 · Fax (+49) 7081/177-100

Belgium	China	France	Great Britain	USA
(+32) 2-2 51 60 10	(+86) 106 554 4525	(+33) 1 46 49 83 33	(+44) 15 82 71 33 24	(+1) 423 483 2118
Fax (+32) 2-2 51 56 99	Fax (+86) 106 554 5692	Fax (+33) 1 46 49 83 34	Fax (+44) 15 82 76 68 32	Fax (+1) 423 481 2432

LB 835 – 0188 – 0197 – 1000 E – Printed in Germany

With the LB 379 Measuring Section

The Principle of Measurement

The density measurement is based on the absorption method. The radiation emitted by an ^{241}Am radiation source is attenuated by the product being measured. A detector measures residual incoming radiation and delivers an output signal dependent on radiation intensity. The microprocessor unit transforms the detector signal into a current signal. The ^{241}Am radiation offers several advantages when used in chemical production:

- The radiation attenuation depends on the atomic number of the absorber. If the concentration of a material with high atomic number in a liquid, (e.g., HCl, H_2SO_4, CaO, etc. in water) must be determined, very high measurement accuracies can be attained thereby.

  Some examples:

H_2O-HCl	± 0.022 % HCL
H_2O-H_2SO_4	± 0.038 % H_2SO_4
H_2O-$Ca(OH)_2$	± 0.017 % $Ca(OH)_2$
H_2O-TiO_2	± 0.014 % TiO_2
NaH_2O-NaOH	± 0.033 % NaOH
Low-fat milk	± 0.075 % TS
Starch suspension	± 0.085 % TS
Sugar solution	± 0.095 % TS

- Chemical reactions in which materials with high atomic number are deposited can be monitored. This is possible even when no density change, or only a minimal change occurs.

Radiation Protection

The measuring system has been tested by the Physikalisch-Technische Bundesanstalt (PTB), German Federal Standards Laboratory, and by the Austrian Study Commission for Atomic Energy as well as by the US Nuclear Regulatory Commission. The USNRC has registered the gauge for General Licence distribution. A design approval was granted in the above named countries meaning that the operating company does not require the usual handling licence. The radiation level 10 cm (4") from the surface is only 1 μ Sv/h (0.1 mrem/h). Therefore, the in line density meter can be installed in the vicinity of the work place.

The Transducer

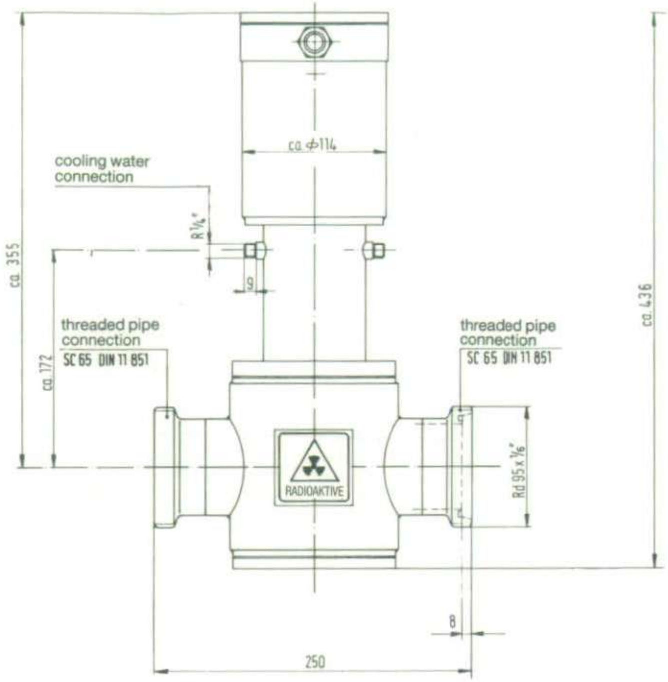
The internal pipe section is completely smooth on the inside and is resistant to corrosion and abrasion from most products. On request, a rubber or teflon lining can be installed. Also, with the contactless measurement, no failures occur from fowling of electrodes, prisms, or other sensors. The measuring unit can therefore be installed for products with high viscosity and high solids content.

For food industry applications the measuring unit can be „integrated" in the normal cleaning cycle without any problem. Due to the stainless steel construction of the measuring section and its compact design, it can easily be integrated into existing facilities.

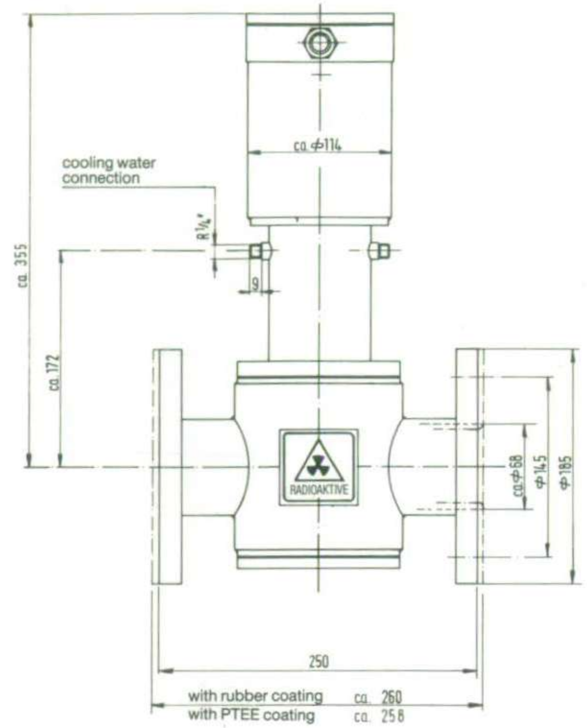
The electronics of the detector are equipped with drift compensation. This provides high long-term stability assuring that the measuring unit will deliver reliable measuring results even under adverse installation conditions.

The measuring signal is transmitted digitally. This transmission method is protected against interference and permits signal transmission over long distances. Thus, the evaluation unit can be installed without any problem in a remote location.

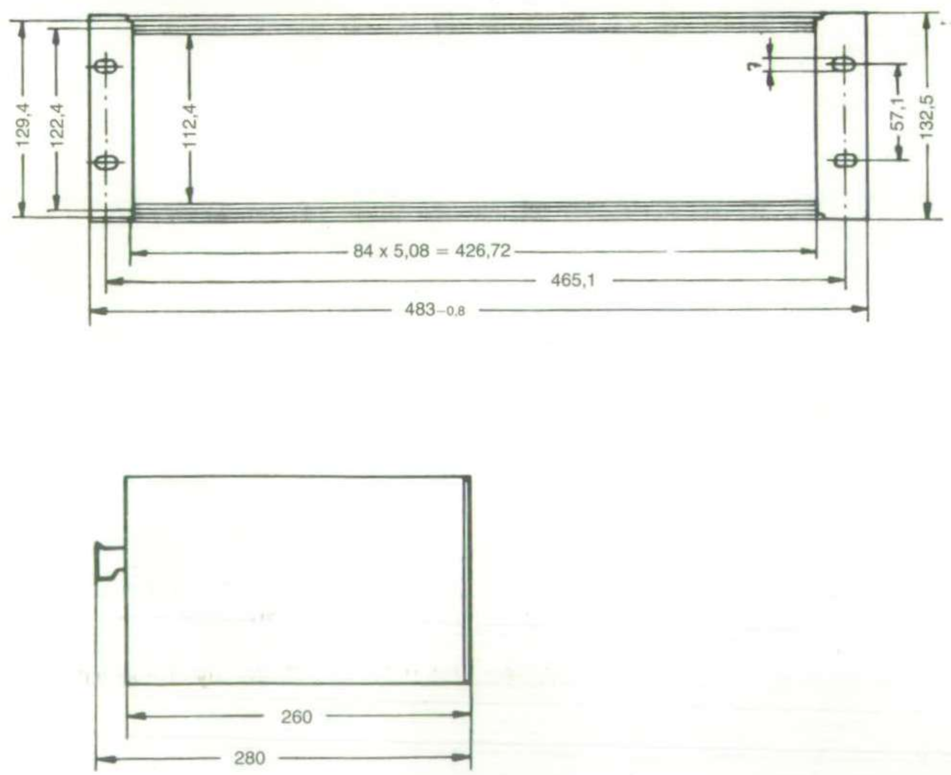
Scale Drawings



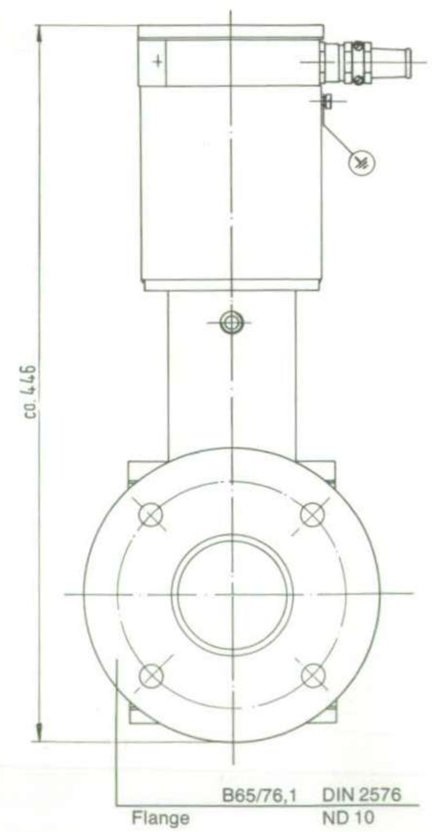
Density measuring system with threaded pipe connection („milk pipe screw connection")



Flanged density measuring system



19" frame



Bedienungsanleitung
Operating Instructions

01908 265744

Bauartgeprüfte Radiometrische
Dichtemeßanlage

LB 379

Radiometric Density Measuring
System

526/G5-44/5 F.R 1334

0118 977 3003

DIRECT 0118 936 7552

GEOFF CLIFF

01484 866 254

WORK

berthold

Inhalt

Anlage

Bauartzulassungsschein BW/29/78
Dichteeichkurven (SK 974)
Maßbild der Meßstrecke (15 113.002)
Bedienungsanleitung für Sondereinschübe (falls vorhanden)
Anschlußplan
Überrahmen-Verdrahtungsplan
Schaltpläne
(Szintillationszähler, Einzeleinschübe)

Content

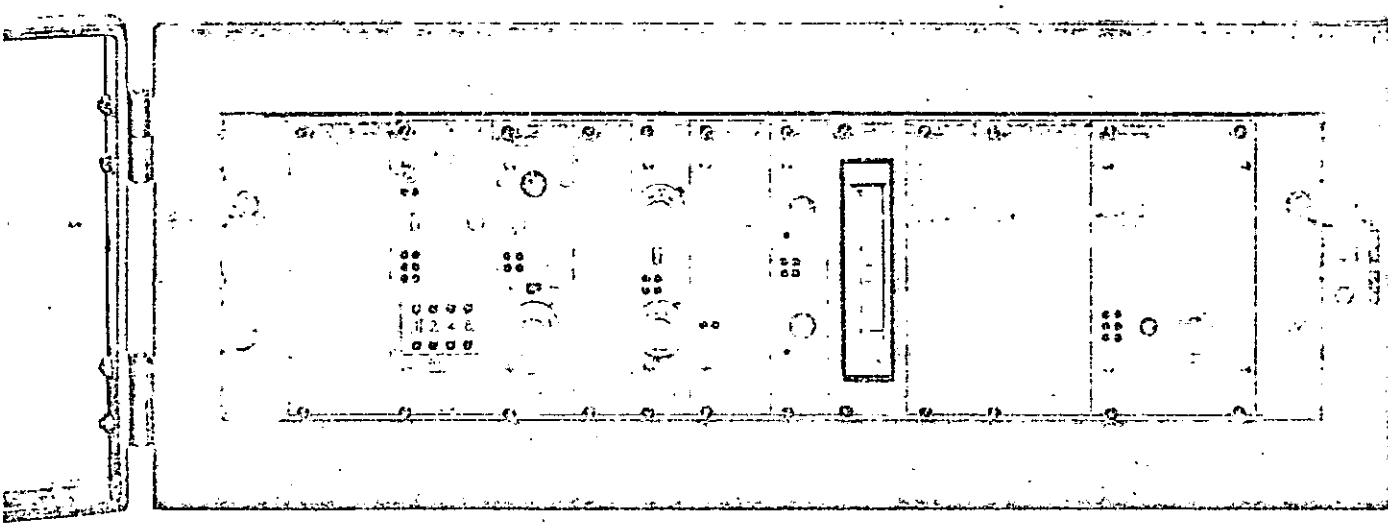
Enclosure

Certification BW/29/78
Calibration Curve SK 974
Dimension Drawing (15 113.002)
Operating Instruction for Special Modules (Option)
Connection Diagram
Circuit Diagrams

CHECKLISTE

1. Kurzanleitung für die Inbetriebnahme der Dichtemeßanlage LB 379

Wir empfehlen dringend, vor der Inbetriebnahme der Meßanlage die Bedienungsanleitung durchzulesen. Insbesondere verweisen wir auf die Auflagen der Genehmigungsbehörde im Bauartzulassungsschein.



1. Füllen der gemäß Bedienungsanleitung montierten und angeschlossenen Meßstrecke mit Medium bekannter Dichte.
2. ADAPTION UNIT LB 3806:
   Schiebeschalter HOCHSPANNUNG auf AUTO.
3. POWER SUPPLY LB 3897:
   Netzschalter auf ON. Kontrollampe leuchtet auf. Abwarten, bis Blinklicht STÖRUNG (ADAPTION UNIT LB 3806) nach max. 20 s erlischt.
4. TEMP. COMP. LB 3822:
   Gegebenenfalls Potentiometer 000−300 °C auf Bezugstemperatur des Mediums, Potentiometer T.K auf gemäß Beispiel 1 (Seite 11) bzw. 12.2 (Seite 14) ermittelten Wert einstellen.
   Schiebeschalter auf ON.
5. RATEMETER LB 3831:
   Schalter TRÄGHEIT auf 1 (5 s), Potentiometer BEREICH auf Einstellwert **u** aus Tabelle Seite 12 (gegebenenfalls siehe 14.).
6. ADAPTION UNIT LB 3806:
   Mit dem 4-stufigen Dekadenschalter EMPFINDLICHKEIT Anzeige auf den der Dichte entsprechenden Anzeigewert einstellen. (Eine Vergrößerung des Zahlenwertes bewegt den Zeiger in Richtung kleinere Dichte.)
7. Gegebenenfalls genaue Kalibrierung gemäß Punkt 14. der Bedienungsanleitung vornehmen.
8. RATEMETER LB 3831:
   Schalter TRÄGHEIT auf maximal zulässige Anzeigeträgheit stellen.
9. THRESHOLD UNIT LB 3862:
   Gegebenenfalls Alarme A (MAX.) und B (MIN.) einstellen.
10. Ca. ein- bis zweimal jährlich EMPFINDLICHKEIT (ADAPTION UNIT LB 3806) nachstellen.
11. Bei Erweiterung um bzw. Herausnahme von Einschüben: Abschnitt 19. (Brücken) und 20. (Blindeinschübe/Blindstecker) beachten!

CHECKLIST

1. Brief Instructions for Startup of Density Measuring System LB 379

It is essential to study the Operating Instructions before starting up the measuring system. Special reference should be made to the conditions for radiation protection imposed by our Approval Authority.

1. Fill measuring path with fluid of a known density after first having installed and connected it as described in the Operating Instructions.
2. ADAPTION UNIT LB 3806:
   Set HV sliding switch to AUTO.
3. POWER SUPPLY LB 3897:
   Main switch to ON. The pilot lamp lights up. Wait until the flashing FAULT light (ADAPTION UNIT LB 3806) goes out after max. 20 s.
4. TEMP. COMP. LB 3822:
   Where applicable adjust 000−300 °C potentiometer to mean temperature of fluid and TC potentiometer to the value indicated in Example 1 (Page 11) or Section 12.2 (Page 14). Set sliding switch to ON.
5. RATEMETER LB 3831:
   Set TIME CONSTANT switch to 1 (5 s) and RANGE potentiometer to the setting **u** indicated in the Table on page 13 (see Section 14 where applicable).
6. ADAPTION UNIT LB 3806:
   Using the 4-decade sensitivity switch, adjust the instrument reading to a value which corresponds to the density (increasing the numerical value shifts the indicator towards lower density).
7. If necessary recalibrate accurately in accordance with Section 7 of Operating Instructions.
8. RATEMETER LB 3831:
   Set TIME CONSTANT switch to maximum permissible indicator time lag.
9. THRESHOLD UNIT LB 3862:
   Adjust Alarm threshold A (HIGH) and B (LOW) as required.
10. Adjust the SENSITIVITY (ADAPTION UNIT LB 3806) approx. every 6 to 12 months.
11. When adding or removing modules:
    Refer to Sections 21 (wire links) and 22 (blank modules/dummy plugs).

2. Genehmigung zum Umgang mit radioaktiven Stoffen

Für die Meßanlage LB 379 liegt eine Bauartzulassung Nr. BW/29/78 des Ministeriums für Arbeit, Gesundheit und Sozialordnung Baden-Württemberg vor. Eine Genehmigung zum Umgang mit radioaktiven Stoffen ist zum Betreiben in der Bundesrepublik Deutschland deshalb nicht erforderlich.

Die Verwendung der Anlage ist jedoch der zuständigen Behörde vorher anzuzeigen. In aller Regel wurde dies von uns vor Versand der Anlage für Sie erledigt, wenn nicht speziell etwas anderes vereinbart war.

Wir möchten in diesem Zusammenhang ausdrücklich auf die Beachtung von Punkt 3. der Bedienungsanleitung hinweisen.

3. Auflagen der Genehmigungsbehörde für den Benutzer

Die Meßanlage LB 379 wurde von der Physikalisch-Technischen Bundesanstalt, Braunschweig, bauartgeprüft (Prüfschein 6.32–R33). Aufgrund dieser Prüfung wurde vom Ministerium für Arbeit, Gesundheit und Sozialordnung Baden-Württemberg eine Bauartzulassung gemäß §§ 22 ff der Strahlenschutzverordnung erteilt. Mit dieser Bauartzulassung sind für den Anwender Auflagen verbunden, die *verbindlich* einzuhalten sind.

Wir verweisen auf den der Bedienungsanleitung beiliegenden Zulassungsschein Nr. BW/29/78, speziell auf die Punkte „Auflagen 1 bis 4" (Seite 3 des Zulassungsscheins) und „Hinweise 1 bis 4" (Seiten 4 und 5 des Zulassungsscheins)!

2. Licence for Handling Radioactive Materials

Users of radioactive substances normally require a special licence. The relevant national laws and regulations must be observed.

The technical description which must accompany the application will be supplied on request free of charge.

3. Conditions of Use

The Measuring System LB 379 has been approved by the Physikalisch Technische Bundesanstalt, Braunschweig (German Standards Office — Test Certificate 6.32–R33). Based on this Certificate the system has been approved for general use in the Federal Republic of Germany. This approval is subject to the following (general) conditions which must be observed by the user:

The instrument must be clearly and permanently marked with the radiation warning symbol and the word "RADIOACTIVE". These markings must not be removed or deleted.

If any change or damage to a Density Measuring System is found the manufacturer must be consulted immediately in order to remedy the damage. In case the possibility of damage to the containment of the source cannot be excluded the appropriate supervisory authority must also be notified and a leakage check carried out by the body nominated by the supervisory authority.

Density Measuring Systems which are taken out of service must not be included in ordinary refuse but should be returned either to the manufacturer or to a public radioactive waste disposal centre.

The user of an approved system must ensure that the actual pressure of the liquid being monitored does not exceed 10 bar in the measuring system.

No features of the system which are vital for radiation protection must be modified in any way.

A system which as a result of wear, damage or destruction no longer complies with the requirements of the approving authority must be taken out of Service. The user of the system must immediately take all protective measures required to prevent any radiation damage. The relevant authority must be notified without delay.

4. Aufbau der Anlage und Einsatzbedingungen

Zusammengefaßt als mechanische Einheit sind das Meßrohr mit Normflanschen, der ^{241}Am-Strahler und ein für Gammastrahlung höchstempfindliches Szintillometer als Detektor. Die mit dem Medium in Berührung kommenden Teile (gerades Rohrstück ohne Einbauten, poliert, 250 mm lang, mit Flanschen NW 65 ND 10 DIN 2576) sind aus Werkstoff 1.4541, alle anderen Außenteile aus nichtrostendem Stahl strahlwasserdicht (IP 65) gefertigt.

Achtung!
Die verplombten Schrauben der Meßstrecke dürfen nicht geöffnet werden, da sonst die Bauartzulassung ihre Gültigkeit verliert! Aggressive oder abrasive Medien, für die die Beständigkeit des Werkstoffes 1.4541 nicht garantiert werden kann, dürfen aus strahlenschutztechnischen Gründen nicht in der Meßstrecke gefahren werden.
(Für solche Medien sind werkseitig mit PTFE, Gummi oder ähnlichem ausgekleidete Meßstrecken lieferbar). Vom Kunden muß sichergestellt werden, daß der Druck in der Meßstrecke *10 bar nicht überschreiten* kann (vergleiche BW/29/78 „Auflagen", Punkt 4).
Als „praktisches Optimum" zwischen den Forderungen der Industrie einerseits und der Wahl des günstigsten Meßweges für statistische Genauigkeit und Langzeitstabilität andererseits wurde die Nennweite auf NW 65 festgelegt (effektiver Meßweg = 68 mm).
Die Verarbeitung der Meßsignale erfolgt im Dichtemeßverstärker.

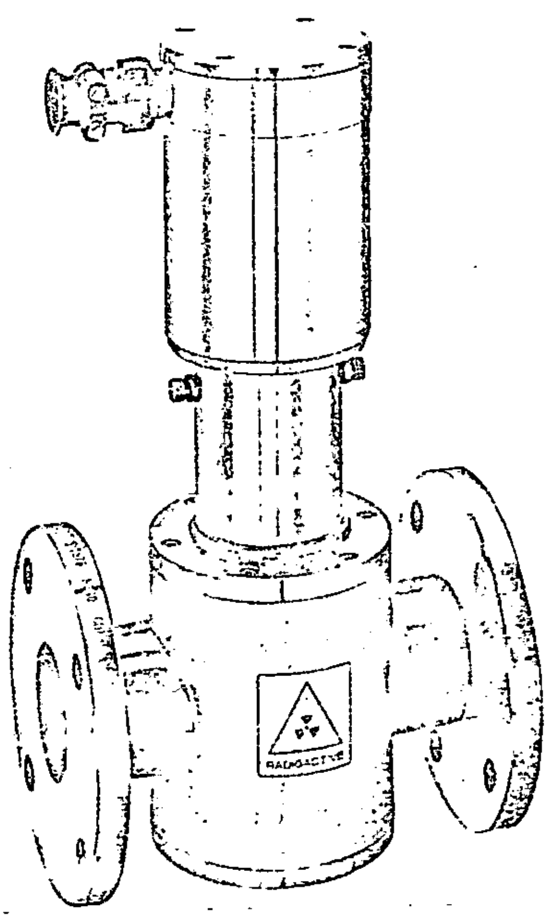
4. System Design and Operating Conditions

The measuring pipe with standard flanges, the ^{241}Am source and a detector, consisting of a scintillometer extremely sensitive to gamma radiation, have been combined to form one mechanical unit. Those parts which come into contact with the liquid (straight pipe section without internal fittings, polished, length 250 mm, with flanges nominal bore 65 mm, nominal pressure 10 bar to DIN 2576) are made of material No. 1.4541, all other external parts of stainless steel conform to the requirements of IP 65 (jet-proof).

Important!
The sealed screws in the measuring path must not be opened for this will invalidate the approval! Corrosive or abrasive fluids for which the resistance of material No. 1.4541 is not guaranteed must not be measured with this system as this might jeopardise radiation protection!
(For fluids of this kind measuring paths lined with PTFE, rubber or equivalent materials can be supplied on request.) The user must ensure that the pressure in the measuring path *cannot exceed 10 bar* (cf. BW/29/78/ "Conditions", Item 4).

As an "optimum compromise" between the needs of industry on one hand and the ideal measuring path for optimum statistical accuracy and long-term stability on the other, a nominal inside diameter of 65 mm was chosen (effective measuring path length = 68 mm).

The detector output signals are processed in the density measuring amplifier.



5. Meßprinzip

Die radiometrische Dichtemessung bietet die Möglichkeit, Messungen kontinuierlich und berührungslos direkt an der Prozeßleitung vorzunehmen und erfüllt dabei gleichzeitig alle an eine derartige Meßeinrichtung zu stellenden Anforderungen, wie große Langzeitstabilität, hohe Nullpunktkonstanz und weitestgehende Wartungsfreiheit.

Das Meßprinzip beruht auf der Absorption von Gammastrahlen beim Durchgang durch das zu untersuchende Material auf einem genau definierten Strahlenweg.

Die Meßanlage nutzt die relativ niederenergetische („weiche") 60 keV-Strahlung von ^{241}Am, die Absorption ist dabei außer von der Dichte zusätzlich abhängig von der Ordnungszahl des absorbierenden Materials. (Hierdurch lassen sich hochspezifische Bestimmungen von höheratomigen Stoffen in niederatomaren Flüssigkeiten realisieren).

Die erforderliche Anzeigeempfindlichkeit für einen vorgegebenen Dichteunterschied ρ_{min} bis ρ_{max} wird durch Nullpunktunterdrückung (Gegenspannung im Gerät) erreicht. Diese Art der Meßproblemlösung bietet bei Dichtemessungen erhebliche Vorteile beim Betreiben der Anlage, auf die hier nicht näher eingegangen werden soll. (Auf Wunsch senden wir Ihnen eine Informationsschrift über dieses Thema mit Erklärung der Arbeitsweise und Darstellung der daraus resultierenden Vorteile gerne zu).

Als UNTERDRÜCKUNG definieren wir den Ausschlag vom tatsächlichen Nullpunkt der Strahlung (für ρ = unendlich) bis zur Skalenmitte für die mittlere betriebsmäßige Dichte (siehe hierzu Zeichnung SK974). Der erforderliche Einstellwert **u** am Poti BEREICH hängt ab vom Medium und von der Größe des gewünschten Meßbereiches (= Anzeigebereich in g/cm³). In Ihrem Anwendungsfall gelten nachstehende Werte.

5. Measuring Principle

Radiometric density measurement offers the possibility of performing continuous measurements direct on the process line whilst avoiding direct contact with the fluid and at the same time meeting all demands normally made on systems of the type, i. e. high longtime stability, low zero drift and minimum maintenance requirements.

The measuring principle is based on the absorption of gamma rays as they penetrate the material being monitored on an accurately defined radiation path. The system utilises the relatively low-energy ("soft") 60 keV radiation of ^{241}Am, the absorption depending not only on the density but also on the atomic number of the absorbing substance (this allows the extremely specific determination of substances with high atomic numbers in liquids with lower atomic numbers).

The necessary detection sensitivity for a given difference in density ρ_{min} to ρ_{max} is achieved by zero suppression (internal bias potential). This approach offers the system user considerable advantages for density measurements which, however, are outside the terms of reference of these Instructions (if requested, we will be pleased to send you a leaflet on this subject which explains the precise operation and illustrates the resulting advantages).

The SUPPRESSION is defined as the indicator deflection from the true zero point of radiation (for ρ = infinity) to the midscale value of the mean operating density (see drawing SK 974). The required setting **u** of the RANGE potentiometer will depend on the liquid and on the required range span (indicator range in g/cm³). In your case the following values will apply:

Meßstelle *Measuring point*	Meßbereich *Measuring range*	Medium *Fluid*	Strahlerstärke *Source intensity*	Einstellwert u *Setting u*		Absorptionskoeffizient *Absorption coefficient*
	(g/cm^3)		(mCi ^{241}Am)	Poti BEREICH *RANGE Pot.*	Poti Spreizung *Spread Pot.*	η
Beispiel (siehe 13) *Example (see 13)*	20° Brix – 0,126 *20° Brix – 0,126*	Zuckerlösung *Sugar Solution*	100	-86,8 V	–	0,162

(Bei der Berechnung des oben angegebenen Wertes für **u** sind die Besonderheiten des Meßproblems berücksichtigt.)
(The specific characteristics of your application have been allowed for in the calculation of the above value for **u***).*

Interessiert primär nicht die Dichte, sondern die Zusammensetzung eines Stoffes und ist mit wesentlichen Dichteänderungen durch Temperaturschwankungen zu rechnen, so kompensiert man den Einfluß der Temperatur (Einbau eines Temperaturfühlers und zusätzlicher Einschub im Dichtemeßverstärker).

If the composition rather than the density of the material is of primary interest, and if major density changes due to temperature fluctuations are expected, then the influence of the temperature is compensated (installation of a temperature sensor and an additional module in the density measuring amplifier.

6. Szintillometer

Im Szintillometer werden Normimpulse erzeugt[1]. Auch die Hochspannungserzeugung und -regelung erfolgt im Szintillationszähler. Zur Kontrolle der Hochspannung wird eine Steuerspannung über das Kabel zum Dichtemeßgerät zurückgeführt. Durch die Potentialtrennung zwischen Szintillometer und Meßverstärker und durch die *symmetrische* Übertragung der Normimpulse ergibt sich eine hohe Störsicherheit der Anlage.

[1] Die Anzahl der Impulse/s ist von der Dichte abhängig.

6. Scintillometer

The scintillometer generates standard pulses, the number of pulses per second depending on the density. The scintillation counter also generates and stabilizes the HV supply which is monitored by a control voltage feedback through the cable to the density measuring unit. Maximum interference protection of the system is ensured by isolating the scintillometer from the measuring amplifier and by *symmetrical* transmission of the standard pulses.

7. Meßverstärker

Die Weiterverarbeitung und Umsetzung der vom Szintillationszähler kommenden Normimpulse in der Dichte proportionale Ausgangssignale (0–10 V und 0/4–20 mA) erfolgt im Verstärker. Er ist in moderner Technik in Einzeleinschüben auf Europakarten aufgebaut. Jeder Einzeleinschub entspricht einer Funktionseinheit und wird in einen fertig verdrahteten 19"-Baugruppenträger mit einer Höhe von 3 U (ca. 135 mm) eingesetzt. Die Zusammenstellung der Einzeleinschübe ist dem Meßproblem angepaßt. Grundsätzlich vorhanden sind folgende Einschübe:

Anpassung (Adaption) LB 3806
(Anpassung der Impulszahl an das Meßproblem und Hochspannungskontrolle, Testeingang)

Ratemeter LB 3831
(mit den Einstellorganen für Meßbereich (= Unterdrückung), Trägheit, Feineinstellung der Impulszahl und der Erzeugung der Ausgangssignale 0–10 V sowie mit Sub-Steckkarte für Ausgangsstrom

LB 3852 für 0/4–20 mA
LB 3853 für 0/4–20 mA (mit Potentialtrennung).

Anzeige (Analog-Display) LB 3886
(mit Präzisionsanzeigeinstrument)

Netzteil (Power Supply) LB 3897
(Erzeugung der Versorgungsspannungen für den Verstärker)

Je nach Dichtemeßproblem kommen zusätzlich bzw. alternativ zum Einsatz:

Linearization LB 3844 / LB 3845 u. LB 3846
(fest vorgegebene/einstellbare Linearisierung des Dichtesignals)

Temperatur Kompensation LB 3822
(für ein auf eine Bezugstemperatur kompensiertes Dichtesignal)

Grenzwert (Threshold) LB 3862
(für zwei innerhalb des Bereiches beliebig einstellbare Grenzwerte)

Die nicht benötigten Plätze im Baugruppenträger sind durch Blindeinschübe (mit entsprechenden Brücken) bzw. durch Blindplatten ausgefüllt.

(Für Sonderanwendungen können auch Einschübe in anderer Zusammenstellung im spezialverdrahteten Baugruppenträger — siehe dann speziellen Verdrahtungsplan — untergebracht sein.

7. Measuring Amplifier

The amplifier processes and converts the standard pulses generated by the scintillation counter into output signals proportional to the density (0–10 V and 0/4–20 mA). The amplifier is of modern modular design based on European standard printed circuit cards. Each individual module covers a separate system function and is plugged into a fully wired 19 inch chassis with a height of 3 U (approx. 135 mm). The configuration of individual modules will depend on the actual application, but the following will always be included:

Adaption Unit LB 3806
(Adapts the number of count pulses to the individual application and provides HV check plus test input)

Ratemeter LB 3831
(with controls for range (= suppression), time constant, fine adjustment of number of count pulses and 0–10 V output signal generation plus sub-card for output current)
LB 3851 for 0/4–20 mA
LB 3853 for 0/4–20 mA (electrically isolated).

Analog Display LB 3886
(with direct-reading precision instrument)

Power Supply LB 3897
(generates amplifier power supplies)

The following additional and/or alternative modules are used depending on the requirements of the application:

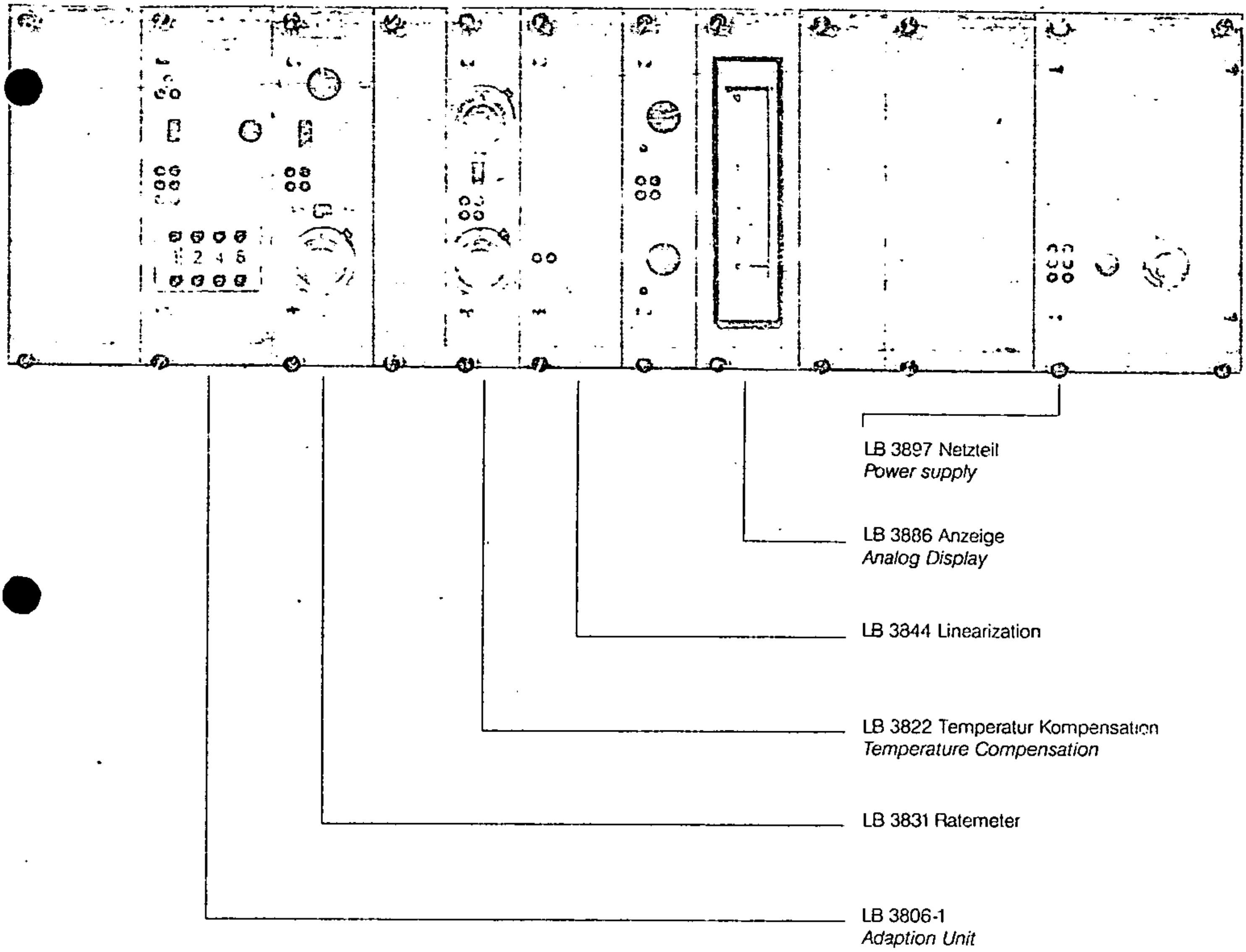
Linearization LB 3844 / LB 3845 or LB 3846
(preset/adjustable linearization of density signal)

Temperature Compensation LB 3822
(for a density signal compensated to a given reference temperature)

Threshold LB 3862
(for two thresholds freely adjustable over the full range)

Unused positions in the chassis are filled with blank modules (with appropriate wire links) or covered with blanking plates.

(For non-standards applications, different module configurations can be housed in a specially wired chassis — in this case refer to the special wiring diagram.)


LB 3897 Netzteil
Power supply
LB 3886 Anzeige
Analog Display
LB 3844 Linearization
LB 3822 Temperatur Kompensation
Temperature Compensation
LB 3831 Ratemeter
LB 3806-1
Adaption Unit

8. Montage

Die Abmessungen der Meßstrecke entsprechen beiliegender Zeichnung 15113.002. Der Einbau in die Produktleitung erfolgt über die Anschlußflansche NW 65 ND 10 DIN 2576.

Durch mechanisch soliden Aufbau der kompletten Meßstrecke sind alle Fehlermöglichkeiten, die sich durch geometrische Änderungen in der Anordnung ergeben können, eliminiert.

Besteht die Gefahr, daß sich im Prozeßrohr Luftblasen oder Ablagerungen und Anbackungen bilden können, so ist dafür Sorge zu tragen, daß sie sich nicht in der Meßstrecke festsetzen. Die Meßanlage mißt die Absorption im Medium (proportional zu Dichte mal Meßweg) und somit bei nicht ganz gefülltem Rohr den „Füllungsgrad". Durch Montage *in einer steigenden oder senkrechten Leitung* können Lufteinschlüsse oder Ablagerungen meist verhindert werden.

Außerdem muß darauf geachtet werden, daß auf die Meßstrecke keine Vibrationen übertragen werden können.

Wandstärkenänderungen (durch aggressive oder abrasive Medien) ergeben ebenfalls eine Änderung der Dichteanzeige. Wir verweisen an dieser Stelle nochmals nachdrücklich auf Punkt 3. und 4. der Bedienungsanleitung.

Die Temperatur des Szintillometers darf 325 K (+50°C) nicht übersteigen. Wenn erforderlich, muß die serienmäßig vorhandene Wasserkühlung angeschlossen werden (Gewinde R 1/4").
(Versuche im Werk ergaben, daß bei Umgebungstemperaturen um 300 K mit einer Produkttemperatur von 355 K die zulässige Temperatur von 325 K am Szintillometer nicht überschritten wird).

Bei Dichtemessung mit Temperaturkompensation wird ein Temperaturfühler (Pt 100) zusätzlich an geeigneter Stelle in das Produktrohr eingebaut.

Das Szintillometer ist in Ex-geschützter Ausführung (Ex d 3n G5) ausgeführt. Der Meßverstärker — je nach Anwendungsfall als 19"-Einschub oder als 19"-Einschub in Feldgehäuse (IP 55) — ist dagegen in einem Bereich aufzustellen, in dem Ex-Schutz nicht erforderlich ist.

8. Installation

The dimensions of the measuring system are indicated on the enclosed drawing No. 15113.002. The connection to the product line is made through the connecting flanges supplied — inside dia. 65, nominal pressure 10 bar to DIN 2576.

The mechanically rigid construction of the complete assembly eliminates all potential error sources which might otherwise result from geometrical changes in the arrangement.

If there is any risk of air bubbles, sediments or caked deposits forming in the process pipe it must be ensured that they cannot accumulate in the measuring path. The measuring system measures the absorption in the fluid (proportional to the density multiplied by the measuring path length), and when the pipe is not completely filled it therefore measures the "filling ratio". In most cases trapped air or deposits can be prevented by installing the system *in a rising or vertical line.*

It is also important to ensure that no vibrations can be transmitted to the measuring path.

Changes in wall thickness (due to aggressive or abrasive fluids) will also affect the density reading. Attention is once more drawn to Sections 5 and 6 of the Operating Instructions.

The temperature of the scintillometer must not exceed 325 K (+ 50 °C). If necessary, the water cooling system available as standard option must be connected (1/4" BSP thread)!

(Work tests have shown that at ambient temperatures around 300 K and a product temperature of 355 K the permissible temperature limit of 325 K is not exceeded at the scintillometer).

In the case of temperature compensated density measurements an additional temperature sensor (Pt 100) is installed in the product line at a suitable point.

The scintillometer is supplied in a flameproof enclosure (Ex d 3n G5). The measuring amplifier — a 19" rack module or a 19" module in a field chassis (IP 55) depending on the application — on the other hand must be located in an area where no explosion protection is required.

9. Anschlüsse

Szintillationszähler und gegebenenfalls Temperaturfühler werden über handelsübliche Kabel mit dem Dichtemeßgerät verbunden, wobei für den Szintillationszähleranschluß ein 7-adriges, abgeschirmtes Kabel (bis 100 m z. B. LIY—CY 7×1,0/105, bis ca. 500 m z. B. LIY—CY 7 × 1,5/155) und für den Temperaturfühler ein 4-adriges Kabel vorzusehen ist.
Das Anschlußkabel führt nur Niederspannung, die Hochspannungserzeugung und -regelung (DBP) erfolgt in der Sonde.

9.1 Szintillationszähler

Nach Lösen von 4 Zylinderschrauben M 5 × 12 kann der *Deckel* des Szintiliometers abgenommen werden, der Anschlußraum liegt frei. Die Abschirmung des Kabels wird koaxial mit Hilfe der Kabelschelle direkt hinter der Kabeleinführung mit dem Gehäuse verbunden. Die Klemmen 1—7 werden mit den entsprechenden Eingangsklemmen des Meßverstärkers verbunden, wobei im Szintillationszähler die Adern 4 und 7 auf die entsprechend gekennzeichnete Klemme gelegt werden. Im einzelnen gilt der beiliegende Anschlußplan.

9.2 Meßverstärker

Die Anschlüsse am Meßverstärker erfolgen an den Klemmleisten auf der Rückseite des Gerätes gemäß Anschlußplan, wobei das Kabel sowohl angeklemmt als auch — nach Anbringen entsprechender Steckverbinder an den Kabelenden — angesteckt werden kann. Dabei sind die Klemmleisten in mehrere „Blöcke" aufgeteilt, die im einzelnen vorgesehen sind für

Szintillometeranschluß
(7 Klemmen und grün-gelbe Masseschraube für Kabelabschirmung)

Temperaturfühleranschluß
(für Pt 100 in 4-Leiterschaltung)

Ausgänge
(0—10 V und 0/4—20 mA)

Grenzwerte
(2 Umschaltkontakte und 2 open-collector)

Der Netzanschluß erfolgt über 3 Anschlußklemmen (Ph, Mp, Schutzleiter), auf die angegebene Netzspannung ist zu achten!

9. Connections

The scintillation counter and the temperature sensor (if provided) are connected to the density measuring unit through standard cables: a 7-core screened cable, e. g. LIY-CY 7 × 1.5/155 or "Oilflex" SY 7 × 1.5, for the scintillation counter and a 4-core cable for the temperature sensor.

The connecting cable only carries low voltage as the HV supply is generated and stabilized in the probe (German Patent).

9.1 Scintillation Counter

After releasing four M 5 × 12 cap screws the *cover* of the scintillometer can be removed, exposing the terminal compartment. The cable screen is connected to the housing coaxially by means of the cable clamp directly behind the cable entry. Terminals 1 to 7 are connected to the corresponding input terminals of the measuring amplifier, cores 4 and 7 being taken to the appropriately marked terminals in the scintillation counter. For further details see enclosed terminal diagram.

9.2 Measuring Amplifier

The amplifier connections are made to the terminal strips at the rear of the unit as shown on the terminal diagram. The leads can be secured either with terminal screws or by fitting cable lugs to the cable ends. The terminal strips are divided into several terminal blocks, separate blocks being provided for:

Scintillometer connections
(7 terminals and green/yellow earth screw for cable screen)

Temperature Sensor Connections
(for Pt 100 in 4-wire network)

Outputs
(0 — 10 V and 0/4 — 20 mA)

Thresholds
(2 change-over contacts and 2 open-collector outputs)

The main supply is connected to 3 terminals (live, neutral, earth). Check for correct mains voltage.

10. Inbetriebnahme

Vor dem Einschalten des Gerätes wird die Meßstrecke mit dem zu messenden Medium bekannter Dichte innerhalb des gewünschten Meßbereichs gefüllt (zur Bestimmung eines Kontrollwertes bei leerem Rohr vergleiche Abschnitt 15. „Nachkalibrierung und Kontrollwert").

Sinnvoll wird in der beschriebenen Reihenfolge weiter vorgegangen.

10.1 Power Supply LB 3897 (Netzteil)

NETZ-Schalter auf EIN, die eingebaute Kontrollampe signalisiert die vorhandene Netzspannung.
Nach dem Einschalten der Netzspannung benötigt die Hochspannungsautomatik ca. 20 Sekunden um auf einen Wert innerhalb ihres Arbeitsbereiches einzuregeln. Während dieser Zeit blinkt die rote Leuchtdiode STÖRUNG.

10.2 Temperature Compensation LB 3822
(Temperatur-Kompensation)

(nur bei Messungen mit Temperatur-Kompensation).
Potentiometer 0 – 300 °C auf die mittlere Temperatur der Flüssigkeit stellen (der Einstellbereich des 3-Gang-Potentiometers entspricht 0 – 300 °C).
Potentiometer T.K. auf den gemäß Beispiel 1. berechneten Wert stellen.
Schiebeschalter in Stellung EIN bringen.

10.3 Ratemeter LB 3831

Schalter TRÄGHEIT auf 1 (5 s)
Unterdrückung u auf der Skala des Potentiometers BEREICH auf den in der Tabelle unter Abschnitt 5. „Meßprinzip" angegebenen Wert einstellen (max. einstellbar sind 20 Skalen Unterdrückung × 10 V pro Skala = 200 V).
Der Einstellbereich ist durch den Schalter auf 0 – 100 (0 – 10 Skalen) und 100 – 200 V (10 – 20 Skalen) umschaltbar.
Eine Umdrehung des Potentiometers ≙ 10 V (1 Skala).

10.4 Adaption LB 3806
(Sondenanpassung)

Schiebeschalter Hochspannung auf AUTO
Mit dem 4-stufigen Dekadenschalter wird die Anzeige auf den der Dichte entsprechenden Anzeigewert eingestellt (siehe hierzu SK 974). Eine Vergrößerung des Zahlenwertes bewegt dabei den Zeiger nach unten (in Richtung 0 bwz. kleinere Dichte), eine Verkleinerung nach oben in Richtung 10 V (zu großer Dichte).
Mit dem Potentiometer „Empfindlichkeit" am Ratemeter LB 3831 kann noch eine Feineinstellung der Empfindlichkeit vorgenommen werden.

10. Startup

Before switching on the system, the measuring path is filled with the fluid to be monitored, the density of which is known and within the required measuring range (for determining a reference value with the process pipe empty see Section 15 "Recalibration and Reference Value").

It is recommended to proceed as follows:

10.1 Power Supply LB 3897

Set POWER switch to ON. The pilot lamps light up to indicate that power is available.
After the power has been switched on the automatic HV supply will need approx. 20 sec to stabilize at a value within its operating range. The red FAULT light (LED) will flash during this period.

10.2 Temperature Compensation LB 3822
(only for measurements with temperature compensation)

Set 0 – 300 °C potentiometer to the mean temperature of the fluid (the range of adjustment to the 3-turn potentiometer is equivalent to 0 – 300 °C).

Set TV potentiometer to the value calculated in accordance with Example 1 in Section 11.
Set sliding switch to ON.

10.3 Ratemeter LB 3831

Adjust suppression u with the DENSITY RANGE potentiometer to the value indicated in the table in Section 5 "Measuring Principle" (max. adjustment = 20 scales suppression × 10 V per scale = 200 V).
The setting range is switch selectable between 0 – 100 V (0 – 10 scales) and 100 – 200 V (10 – 20 scales).
One full turn of the potentiometer is therefore equivalent to 10 V (1 scale).

10.4 Adaption Unit LB 3806

Set sliding switch HV to AUTO.
Using the 4-decade switch, adjust the reading to the value which corresponds to the density (see SK 974). Increasing the numerical value will shift the indicator towards zero or lower densities, and reducing it will shift the indicator towards 10 V or higher densities.
The "sensitivity" potentiometer on the ratemeter LB 3831 provides an additional fine adjustment.

11. Beispiel 1

(Der Meßweg ist fest vorgegeben durch den Innendurchmesser des Meßrohres zu 6,8 cm*).
Bei ausgekleideter Meßstrecke (PTFE, Gummi) ist der Faktor im Verhältnis der Durchmesser zu korrigieren, z. B. bei 6,2 cm Innendurchmesser zu

$$\frac{9500}{6{,}8} \cdot 6{,}2 = 8660$$

*) Er ist in die Einstellwerte eingerechnet, braucht also nicht mehr berücksichtigt zu werden.

Zu messen sei eine Zuckerlösung im Bereich 60 – 80 ° Brix entsprechend 1,289 – 1,415 g/cm³. Die mittlere Temperatur sei 50 °C, der Temperaturkoeffizient

$$0{,}0006 \frac{g}{cm^3} / °C.$$

Der (im Werk) errechnete Einstellwert **u** – in der Tabelle (Seite 5) als Beispiel eingetragen – ist

u = 86,8 V (8,68 Skalen)

Der einzustellende Wert am Potentiometer T.K. (Einschub-TEMP. COMP.) errechnet sich aus

T.K. = 9500 × Temperaturkoeffizient × Absorptionskoeffizient

und mit dem Absorptionskoeffizient aus Tabelle Seite 9

T.K. = 9500 × 0,0006 × 0,162 = 0,92

Damit ergeben sich für das Beispiel folgende Einstellungen:

Am Ratemeter LB 3831

Poti BEREICH (≙ Unterdrückung)	86,8 V (8,68 Skalen)

An TEMP. COMP. LB 3822

Poti 0 – 300 °C	050
Poti T.K.	092

11. Example 1

(The length of the measuring path is fixed by the inside diameter of the measuring pipe which is 6,8 cm*).
When a lined measuring path is used (PTFE, rubber) the factor must be corrected in proportion to the diameter, e. g. with an inside diameter of 6,2 cm as follows:

$$\frac{9500}{6.8} \times 6{,}2 = 8660$$

*) This is already included in the settings and does not have to be allowed for separately.

Fluid monitored: sugar solution within the range 60 – 80° Brix, which is equivalent to 1.289 – 1.415 g/cm³. The mean temperature is 50 °C, the temperature coefficient

$$0.0006 \frac{g}{cm^3} / °C.$$

The setting **u** (calculated by the manufacturer), which the Table on page 5 quotes as an example, is

u = 86,8 V (8,68 scales)

The setting of the TC potentiometer (TEMP. COMP. module) is calculated from

TC = 9500 × temperature coefficient × absorption coefficient

and with the absorption coefficient from the Table on page 7

TC = 9500 × 0,0006 × 0.162 = 0.92

This produces the following settings for our example:

On Ratemeter LB 3831

RANGE potentiometer (suppression)	86,8 V ≙ 8,68 scales

TEMP. COMP. LB 3822

0 – 300 °C potentiometer	050
TC potentiometer	092

12. Wie ist vorzugehen, wenn keine Angaben in der Tabelle Seite 5 eingetragen sind?

Es besteht die Möglichkeit, daß bei der Projektierung der Dichtemeßanlage im Werk die genauen Daten des Meßproblems nicht bekannt waren, daß die Daten nicht in die Bedienungsanleitung übertragen wurden oder daß die Originalbedienungsanleitung nicht vorliegt. Prinzipiell bestehen dann folgende Möglichkeiten, um eine Inbetriebnahme mit vernünftigem Aufwand (ohne zig-faches Umfüllen zwischen zwei Dichtewerten) vorzunehmen.

Ein Anruf im Werk mit genauer Schilderung des Meßproblems führt zur Berechnung der Einstellwerte. Im Regelfall kann diese Berechnung kurzfristig durchgeführt werden, (Eine Berechnung vor Ort läßt sich wegen der Komplexität bei Americium-Dichte-Messungen nicht durchführen.)

12. How to Proceed when no Information is Given in Table on Page 7

It is possible that the exact data of the application were not known when the Density Measuring System was prepared by the manufacturer, that the data have not been transferred into the operating instructions, or that the original operating instructions are no longer available. In that case there are the following basic possibilities of using the system without an unreasonable amount of preparation (i. e. without countless refilling between two density values).

A telephone call to the manufacturer with an accurate description of the measuring application will allow the settings to be calculated. This calculation can normally be carried out at short notice (a calculation on the spot is impracticable because of the complexity of Americum density measurements).

12.1 Bestimmung der Unterdrückung u (= Einstellwert des Potentiometers BEREICH)

Eine erste *ungefähre* Bestimmung der Unterdrückung kann aus der folgenden Tabelle entnommen werden. Die genaue Bestimmung erfolgt dann, wie unter Abschnitt „Kalibrierung“, Seite 9, beschrieben.

ACHTUNG!
Die Tabellenwerte sind nur ungenau und nur für eine erste Einstellung gedacht, wenn keine genaueren Angaben vorliegen!

Einstellwerte Unterdrückung **u** (v) (Poti BEREICH)
mit/ohne Linearisierung LB 3844

Meßbereich $\Delta\rho$ (g/cm³)	mit Absorptionskoeffizient * für: H_2O	CH_2	CHOH	Al_2O_3	$Ca(OH)_2$	H_2SO_4	HCL
	0,175	0,170	0,165	0,205	0,430	0,235	0,460
0,05	172/116	178/120	183/124	148/100	73/50	130/88	68/47
0,10	89/ 61	91/ 62	94/ 64	77/ 53	39/28	68/47	37/26
0,20	47/ 33	48/ 34	50/ 35	41/ 29	22/16	36/26	21/16
0,30	33/ 24	34/ 24	35/ 25	29/ 21	17/13	26/19	16/12
0,40	26/ 19	27/ 20	27/ 20	23/ 17	14/11	21/16	14/11
0,50	22/ 16	22/ 16	23/ 17	20/ 15	–	18/14	–
0,75	17/ 13	17/ 13	17/ 13	15/ 12	–	14/11	–
1,00	14/ 11	14/ 11	15/ 12	–	–	–	–

*) Die Werte für **u** sind nur angenähert. Für die erste Einstellung können die Werte jedoch für gleichartige Stoffgruppen aus der Tabelle entnommen werden (z. B. für Kohlenwasserstoffe aus der CH_2-Spalte). Im Zweifelsfalle kleinere Werte einstellen, um Übersteuerung des Verstärkers zu vermeiden!

Angenähert kann die erforderliche Unterdrückung **u** auch wie folgt berechnet werden:

ohne Linearisierung

$$u = 10\left(\frac{1}{e^{\Delta\rho \cdot \eta \cdot 6.8^{**}}-1}+1\right) \text{ in V}$$

mit Linearisierung

$$u = \frac{20}{3}\left(\frac{1}{e^{\Delta\rho \cdot \eta \cdot 6,8^{**}}-1}+0,5\right)+5$$

** bei ausgekleideter Meßstrecke tatsächlichen Innenraumdurchmesser in (cm) berücksichtigen!

12.1 Calculating the Suppression u (= setting of DENSITY RANGE potentiometer)

A first approximate determination of the suppression can be made with the Table below. An accurate determination can then follow as described under "Calibration" on page 12.

IMPORTANT!
The figures in the Table for guidance are only intended for an approximate adjustment when no detailed information is available.

Settings for Suppression **u** (DENSITY RANGE potentiometer) with/without Linearization LB 3844 in v							
Meas. range $\Delta\rho$ (g/cm^3)	with absorption coefficient * for:						
	H_2O	CH_2	CHOH	Al_2O_3	$Ca(OH)_2$	H_2SO_4	HCL
	0,175	0,170	0,165	0,205	0,430	0,235	0,460
0,05	172/116	178/120	183/124	148/100	73/50	130/88	68/47
0,10	89/ 61	91/ 62	94/ 64	77/ 53	39/28	68/47	37/26
0,20	47/ 33	48/ 34	50/ 35	41/ 29	22/16	36/26	21/16
0,30	33/ 24	34/ 24	35/ 25	29/ 21	17/13	26/19	16/12
0,40	26/ 19	27/ 20	27/ 20	23/ 17	14/11	21/16	14/11
0,50	22/ 16	22/ 16	23/ 17	20/ 15	—	18/14	—
0,75	17/ 13	17/ 13	17/ 13	15/ 12	—	14/11	—
1,00	14/ 11	14/ 11	15/ 12	—	—	—	—

*) The values for **u** are approximate only. For adjustment, however, the values for similar types of material can be taken from the Table (e.g. for hydrocarbons from the CH_2 column). When in doubt always select a lower value to prevent overloading the amplifier!

An approximate calculation of the required suppession u can also made be as follows:

without Linearization

$$u = 10\left(\frac{1}{e^{\Delta\rho \cdot \eta \cdot 6.8^{**}} - 1} + 1\right) \text{ in V}$$

with Linearization

$$u = \frac{20}{3}\left(\frac{1}{e^{\Delta\rho \cdot \eta \cdot 6{,}8^{**}} - 1} + 0{,}5\right) + 5$$

**) in the case of lined measuring paths use the actual inside diameter in (cm)!

TK 050

0-50% / Dichte 1,208 / 2,31 V Ausschlag 10 V

49 Brix = 1,208

12.2 Bestimmung des Einstellwertes für den Temperaturkoeffizienten (Potentiometer T.K.)

Mit dem Wert **u** (aus vorstehender Tabelle) kann der Einstellwert für das Potentiometer T.K. gemäß Beispiel 1 (Seite 11) ungefähr ermittelt werden.
Ist kein geeigneter **u**-Wert in der Tabelle enthalten bzw. für die genauere Bestimmung, kann experimentell wie folgt vorgegangen werden:
Die Meßstrecke wird mit Produkt gefüllt. (Dabei wird die Ermittlung des Einstellwertes umso genauer, je genauer die betriebsmäßige Dichte und die betriebsmäßige Temperatur mit den Versuchsbedingungen übereinstimmen.) Das Potentiometer 0 — 300 °C wird auf den Wert für die vorhandene Temperatur eingestellt. Das Potentiometer T.K. wird so eingestellt, daß sich bei Erwärmen oder Abkühlen des Meßgutes keine Anzeigeänderung ergibt.
Wandert die Anzeige beim Erwärmen (bzw. beim Abkühlen) zu kleinerer Dichte (bzw. größerer Dichte beim Abkühlen), so ist unterkompensiert und der Einstellwert T.K. entsprechend zu vergrößern (und umgekehrt).

ACHTUNG!
Der Temperaturfühler muß für diesen Versuch die gleiche Temperatur wie das Meßgut annehmen können (Temperatur-Übergangszeiten beachten)!

12.2 Determining the Temperature Coefficient Setting (TC Potentiometer)

Based on the value for u (from Table above) the approximate setting for the TC potentiometer can be determined in accordance with Example 1 (page 11).
If the Table gives no suitable u value, or in case a more accurate determination is necessary, the following experiment will be found useful:
Fill the measuring path with liquid product (the closer the conditions during this experiment reflect the reallife density and temperature, the more accurate the resulting setting will be). The 0 — 300°C potentiometer is set to the value representing the existing temperature. The TC potentiometer is adjusted so that the reading does not change when the temperature of the fluid monitored rises or drops.
If the indicator shifts towards a lower density as the temperature rises (or to a higher density as the temperature drops), then the system is under-compensated and the TC setting must be increased accordingly (and vice-versa).

IMPORTANT!
For this experiment the temperature sensor must be capable of reaching the same temperature as the fluid (note temperature stabilisation times)!

13. Anzeigeträgheit (Ratemeter LB 3831)

Bei betriebsmäßig sehr langsamen Dichteänderungen empfiehlt sich die Einstellung TRÄGHEIT 3 (60 s), da bei großer Trägheit die statistischen Anzeigeschwankungen kleiner sind (die höhere Ablesegenauigkeit nach dem Umschalten auf größere Trägheit kann eine geringe Nachstellung erfordern). Sind schnelle Dichteänderungen zu erwarten, so muß mit TRÄGHEIT 2 (30 s) oder 1 (5 s) gearbeitet werden.
Wird nur die Trägheit umgeschaltet, so bleibt die mittlere Anzeige erhalten. Bei Umschaltungen bzw. Einstellungen am Gerät, die Anzeigeänderungen verursachen (wie z. B. bei der Inbetriebnahme bzw. Kalibrierung der Anlage), empfiehlt sich deshalb zunächst mit TRÄGHEIT 1 zu arbeiten. Ist der Anzeigeendwert ungefähr erreicht, wird wieder auf die größere Trägheit zurückgeschaltet.

13. Indicator Time Constant (Ratemeter LB 3831)

If the rate of density changes is inherently low it is recommended to select TIME CONSTANT 3 (60 s) because the statistical fluctuations of the reading become smaller as the time constant increases (the higher accuracy of reading after switching to a longer time constant may require a slight readjustment). Where fast density changes are expected, the settings TIME CONSTANT 2 (30 s) or 1 (5 s) should be selected.
If only the time constant is changed then the mean reading will remain unchanged. Therefore, when settings are changed or adjustments made which may alter the reading (e. g. initial startup or calibration of the system) it is recommended to select initially TIME CONSTANT 1. Once the final reading is being approached, the system can be switched back to a longer time constant.

14. Kalibrierung der Anlage

Wie bei allen elektronischen Meßgeräten höchster Präzision sollte auch beim Dichtemeßverstärker die endgültige Einstellung auf den gewünschten Dichtemeßbereich erst vorgenommen werden, wenn das Gerät einige Stunden eingeschaltet war.

Das Schwächungsgesetz für γ-Strahler ergibt physikalisch eine exponentielle Abhängigkeit von der Dichte. Bei kleinem Dichtebereich bzw. hoher Unterdrückung ($u > 55$ V (5,5 Skalen) ist die Abhängigkeit auch ohne zusätzliche Linearisierungseinheit fast linear.

Die unter Punkt 10. beschriebene Geräteeinstellung auf einen einzigen Dichtewert in Verbindung mit der im Werk berechneten Unterdrückung genügt beispielsweise zur Regelung auf einen bestimmten Dichtesollwert oder zur Unterscheidung verschiedener Dichtewerte. (Sie ist in jedem Fall genauer als eine „unkontrollierte" Verstellung aller Parameter.)

Wir empfehlen aus diesem Grund, mit dieser Einstellung zu beginnen und die im folgenden beschriebene Kalibrierung nur vorzunehmen, wenn sich unzulässig hohe Abweichungen bei der Kontrolle zeigen sollten.

Eine genaue Absolutmessung im ganzen Bereich erfordert mindestens zwei Füllungen der Meßstrecke bei möglichst verschiedenen Dichten innerhalb des Meßbereiches. Bei bekannter Unterdrückung erhält man für den Verstärker ohne Linearisierung die Form der Eichkurve aus der beiliegenden Zeichnung SK974.

14. Calibrating the System

As with all high-precision electronic measuring systems, the density measuring amplifier should only be finally adjusted to the required density range after the unit had been switched on for several hours.

The physical law of γ ray absorption implies that its variation with the density follows an exponential function. At small density ranges or with high suppression ($u > 5{,}5$ scales) this dependence is virtually linear even without additional linearization unit.

Setting the system to a given density value in conjunction with the suppression calculated by the manufacturer (description see Section 10) will, for example, be sufficient for controlling a certain nominal density value or for differentiating between different densities (this method will always be more accurate than an "uncontrolled" adjustment of all parameters).

We therefore recommend to start with the above settings and to carry out the calibration described below only when a check shows unacceptably high deviations from the standard values.

An accurate absolute measurement over the full range, however, requires at least two fillings of the measuring path with fluids of widely diverging densities which are still within the overall measuring range. At a given known suppression, the shape of the calibration curve for the amplifier without linearization unit is shown on the enclosed drawing SK 974.

14.1 Kalibrierung ohne Linearisierung (mit Beispiel 2)

(Nur durchlesen, wenn in den Verstärker weder Einschub LB 3844 noch LB 3845 oder LB 3846 eingebaut ist).
Die relative Dichteskala auf der beiliegenden Zeichnung SK 974 wird ersetzt durch die gewünschte absolute Dichteskala. Der Kurvenschar wird die der Unterdrückung **u** zugehörige Eichkurve entnommen (im gezeichneten Beispiel 2: **u** = 20 V [2 Skalen]).
Man füllt die Meßstrecke mit Flüssigkeit kleiner Dichte ρ_1 und stellt durch Änderung am 4-stufigen Dekadenschalter die Anzeige auf den Sollwert A_1 (im Beispiel 2,0 V), wobei eine Vergrößerung des Zahlenwertes den Zeiger in Richtung 0 V bewegt.

Beispiel 2

Dichte ρ = 1,0 ..... 2,0 g/cm³
alter Einstellwert BEREICH u = 20 V (2 Skalen)

Wird nun umgefüllt auf große Dichte ρ_2, so wird im allgemeinen ein vom Sollwert A_2 (im Beispiel 8,9 V) abweichender Istwert A_2' (im Beispiel 8,3 V) abgelesen. Die Unterdrückung ist jetzt zu ändern auf den neuen Wert **v**.

$$v = (u - 5)\frac{A_2 - A_1}{A_2' - A_1} + 5$$

Der neue Wert **v** wird am Poti BEREICH eingestellt und anschließend mit dem 4-stufigen Dekadenschalter auf den Sollwert A_2 (im Beisiel 8,9 V) eingestellt.

$$v = (20 - 5)\frac{8{,}9 - 2{,}0}{8{,}3 - 2{,}0} + 5 = 21{,}4 \text{ V (2.14 Skalen)}$$

neuer Einstellwert BEREICH v = 21,4 (2,14 Skalen)

14.1 Calibration without Linearization (with Example 2)

(Only applicable to amplifiers not including modules LB 3844 or LB 3845 or LB 3846).
The relative density scale on the enclosed drawing SK 974 is replaced by the required absolute density scale, and the calibration curve corresponding to the calculated suppression u is selected from the family of curves (in Example 2 below: u = 2 scales ≙ 20 V).
The measuring path is filled with liquid of low density ρ_1 and the reading is adjusted with the 4-decade switch to the nominal value A_1 (in our example 2.0 V), any increase in the numerical value shifting the indicator towards 0 V.

Example 2

Density ρ = 1,0 ..... 2,0 g/cm³
old DENSITY RANGE setting u = 20 V (2 scales)

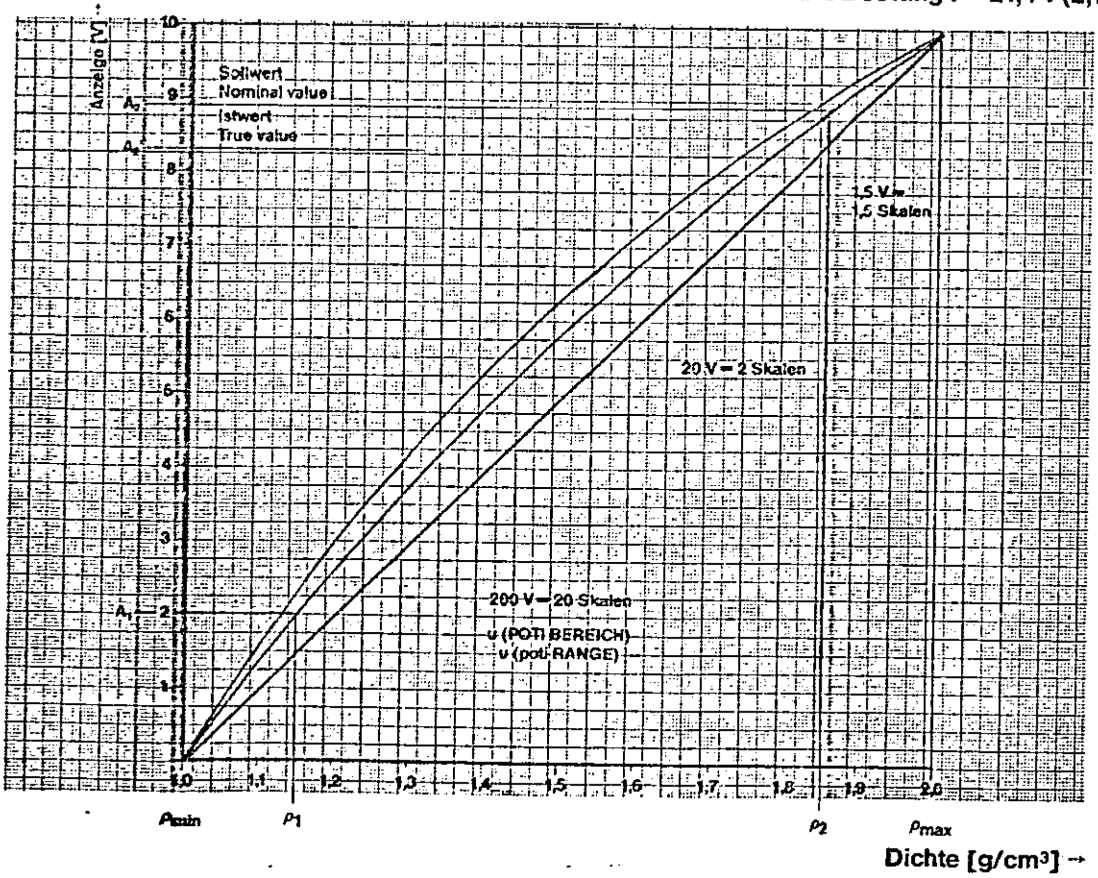
When the measuring path is refilled with the higher density liquid ρ_2 then the reading A_2' obtained (in our example 8.3 V) will generally deviate slightly from the expected nominal value A_2 (in our example 8.9 V). In that case the suppression must be changed to the new value v.

$$v = (u - 5)\frac{A_2 - A_1}{A_2' - A_1} + 5$$

The RANGE potentiometer is set to the new value v, and finally the 4-decade switch is adjusted to the nominal value for A_2 (in our example 8.9 V).

$$v = (20 - 5)\frac{8.9 - 2.0}{8.3 - 2.0} + 5 = 21{,}4 \text{ (2,14 scales)}$$

new DENSITY RANGE setting v = 21,4 V (2,14 scales)



14.2 Kalibrierung mit Linearisierung

(Nur durchlesen, wenn die Einschübe LB 3844 / LB 3845 oder LB 3846 in den Verstärker eingebaut sind).

Für einen linearen Zusammenhang zwischen Anzeige (Ausgangssignalen) und Dichte werden spezielle Linearisierungseinheiten verwendet. Linearisierung ist z. B. erforderlich, wenn die Dichtemessung für die Bilanzierung (eventuell in Verbindung mit einer Durchflußmeßeinrichtung) verwendet wird. Wünschenswert ist Linearisierung oft bei Einstellwerten **u** < 55 V (5,5 Skalen).

Bitte Fußnote bei 16. (Seite 20) beachten!

14.2.1 Standard-Linearisierung LB 3844 (mit Beispiel 3)

Man füllt die Meßstrecke mit Flüssigkeit kleiner Dichte ρ_1 (im Bespiel 1,05 g/cm³) und regelt mit dem 4-stufigen Dekadenschalter genau auf den Sollwert für ρ_1 ein (im Beispiel 1,0 V).

Nach Einfüllen großer Dichte ρ_2 (im Beispiel 1,45 g/cm³) wird sich im allgemeinen nicht der Sollwert für ρ_2 (im Beispiel 9,0 V), sondern ein mehr oder weniger davon abweichender Istwert (im Beispiel 8,0 V) ergeben. Man liest die dem Istwert zugehörige Dichte ρ_2' ab (im Beispiel 1,40 g/cm³) und errechnet daraus den Wert **v** (siehe Beispiel 3).

$$v = (u - 5) \frac{1}{1 + \frac{\rho_2' - \rho_2}{\rho_2 - \rho_1} \cdot e^{-3,4 \cdot \eta \cdot (\rho_2 - \rho_1)}} + 5$$

η aus Tabelle Seite 5

Der neue Wert **v** wird am Poti BEREICH eingestellt und anschließend mit dem 4-stufigen Dekadenschalter auf den Sollwert ρ_2 (im Beispiel 9,0 V) eingestellt.

Beispiel 3

Dichte: 1,0 ..... 1,5 g/cm³

alter Einstellwert u: 13 V (1,3 Skalen)

neuer Einstellwert v: 13,9 V (1,39 Skalen)

14.2 Calibration with Linearization

(Only applicable to amplifiers incorporating modules LB 3844, LB 3845 or LB 3846).

Special linearization units are used to obtain a linear correspondence between the instrument reading (output signals) and the density.

Linearization is necessary, for example, when the density measurements are used for preparing a material balance (possibly in conjunction with a flow meter). Linearization is often desirable for suppression settings of u < 55 V (5,5 scales).

See footnote at 16. (page 20), please!

14.2.1 Standard Linearization LB 3844 (with Example 3)

The measuring path is filled with liquid of low density ρ_1 (in our example 1.05 g/cm³) and the instrument reading is accurately adjusted with the 4-decade switch to the nominal value for ρ_1 (in our example 1.0 V).

After refilling with liquid of high density ρ_2 (in our example 1.45 g/cm³) it will generally be found that the actual reading obtained the nominal value for ρ_2 (in our example 9.0 V). Next, the density ρ_2' associated with the actual value is read off (in our example 1.40 g/cm³), and from this the value v is calculated (see Example 3).

$$v = (u - 5) \frac{1}{1 + \frac{\rho_2' - \rho_2}{\rho_2 - \rho_1} \cdot e^{-3,4 \cdot \eta \cdot (\rho_2 - \rho_1)}} + 5$$

η from Table on page 5

The DENSITY RANGE potentiometer is set to the new value v, and finally the 4-decade switch is adjusted to the nominal value for ρ_2 (in our example 9.0 V).

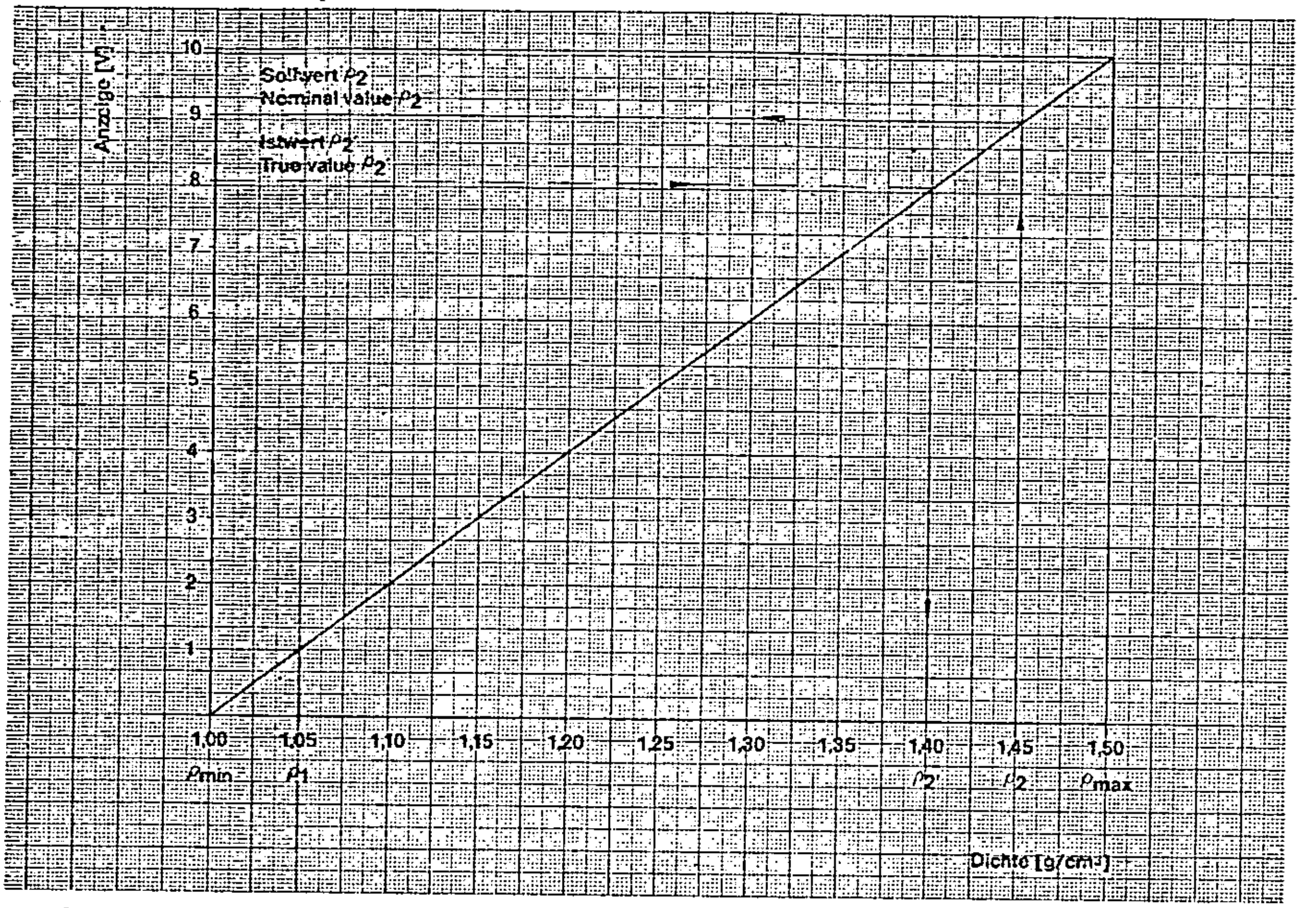
Example 3

Density: 1.0 ..... 1.5 g/cm³

old setting u: 13 V (1,3 scales)

new setting v: 14 V (1,39 scales)

$$v = \left(13 - 5\right) \times \frac{1}{1 + \frac{1,4 - 1,45}{1,45 - 1,05} \times e^{-3,4 \times 0,162\,(1.45 - 1.05)}} + 5 = 13,9\,\text{V (1,39 Skalen)}$$



14.2.2 Einstellbare Linearisierung LB 3845 oder LB 3846

Bei Verwendung der Linearisierungseinheit LB 3845 muß ein fester Wert am Poti BEREICH eingestellt sein. Der genaue Wert ist am Poti angegeben, er darf nicht verändert werden.
(Wurde versehentlich die Einstellung verändert, so können folgende Werte eingestellt werden.

bei LB 3845-1/1	30 V
bei LB 3845-2/1	19 V
bei LB 3845-3	0 V
bei LB 3846-1+2	0 V

An der Linearisierungseinheit wird am Poti SPREIZUNG der im Werk errechnete Wert

Spreizung S = (siehe Tabelle Seite 5)

eingestellt. Die Meßstrecke wird mit Flüssigkeit kleiner Dichte ρ_1 gefüllt, mit dem 4-stufigen Dekadenschalter wird der Sollwert für ρ_1 genau eingeregelt. Nach Umfüllen auf ρ_2 wird die Anzeige kontrolliert.
Ergibt sich eine Abweichung, so wird analog der Abbildung bei Beispiel 3 (Seite 11) die neue Spreizung errechnet zu:

$$S_1 = (S+RV)\frac{A_2 - A_1}{A_2' - A_1} - RV$$

RV bei

LB 3845-1/1	= 2,49
LB 3845-2/1	= 2,49
LB 3845-3	= 4,32
LB 3846-1+2	= 16,9

und dieser neue Wert am Potentiometer eingestellt. Anschließend wird mit dem Dekadenschalter auf den Sollwert A_2 für ρ_2 nachgestellt.

14.2.2 Adjustable Linearization LB 3845 Or LB 3846

When using the Linearization Unit LB 3845, the RANGE potentiometer must be set to a fixed value. The precise setting is marked on the potentiometer and must not be altered.
(If the setting has inadvertently been altered the following values can be adjusted.

for LB 3845-1/1	30 V
for LB 3845-2/1	19 V
for LB 3845-3	0 V
for LB 3846-1+2	0 V

The SPREAD potentiometer on the Linearization Unit is adjusted to the

SPREAD S = (see table page 5)

value calculated by the manufacturer. The measuring path is filled with liquid of a known low density ρ_1' and the 4-decade switch is set to the exact nominal value for ρ_1. After refilling with ρ_2 the display is checked. If a deviation is found, then the new SPREAD value is calculated as illustrated in Example 3 (page 13) as follows:

$$S_1 = (S+Rv)\frac{A_2 - A_1}{A_2' - A_1} - Rv$$

Rv for

LB 3845-1/1	= 2,49
LB 3845-2/1	= 2,49
LB 3845-3	= 4,32
LB 3846-1+2	= 16,9

and the SPREAD potentiometer is adjusted to this new value. Finally, the decade switch is adjusted to the nominal value A_2 for ρ_2.

15. Nachkalibrierung und Kontrollwert

Durch die große Halbwertszeit von ^{241}Am (433 Jahre) beträgt der jährliche Intensitätsverlust der Strahlung nur 0,16%. Dies bedeutet, daß für nahezu alle Meßprobleme eine jährliche Nachstellung der Empfindlichkeit ausreichend ist. Lediglich Messungen mit extremer Anforderung an die Genauigkeit erfordern eine halbjährliche Nachstellung.
Hierzu wird bei bekannter Dichte (z.B. über Probennahme) bzw. bei leerer Meßstrecke mit dem 4-stufigen Dekadenschalter auf den Sollwert für die Dichte bzw. den Kontrollwert (bei leerer Meßstrecke) nachgestellt.
Zur Schaffung eines Kontrollwertes (zur gelegentlichen Nullpunktkontrolle des Verstärkers) kann es vorteilhaft sein, bei völlig entleertem Meßrohr mit dem 4-stufigen Dekadenschalter eine Anzeige in der Nähe der Skalenmitte einzustellen, und diesen Wert und den zugehörigen Einstellwert zu notieren. Der Kontrollwert sollte erst nach endgültiger Kalibrierung bestimmt werden, wenn die Unterdrückung (Poti BEREICH) nicht mehr verändert wird.

Spannung = [ ] Volt
an den Testbuchsen 0 – 10 V
des Ratemeters LB 3831

Kontrollwert = [| | |]
am Dekadenschalter

Durch diesen Test wird gleichzeitig die eingestellte Unterdrückung und damit die Stabilität der Versorgungsspannung überprüft.

ACHTUNG!
Wegen der hohen Nachweisempfindlichkeit der Meßanlage für Dichteunterschiede muß das Rohr völlig entleert sein, da schon geringste Mengen Material eine andere Anzeige ergeben.

Nach der jährlichen Empfindlichkeitsnachstellung sollte auch der Kontrollwert neu bestimmt werden (der natürliche Strahlerzerfall bewirkt bei voll aufgedrehter Unterdrückung [20 Skalen] am Potentiometer BEREICH eine jährliche Änderung von ca. 0,3 V).

15. Recalibration and Reference Value

Due to the long half-life of ^{241}Am (433 years) the annual intensity decay of the radiation is only 0.16%. This means that one annual recalibration of the sensitivity will be sufficient for practically all applications. Recalibration in six month intervals will only be necessary where extreme accuracy is demanded.

To adjust the sensitivity, set the 4-decade switch to the nominal value for a given known density, or alternatively to the reference value while the measuring path is left empty.

In order to obtain a reference value (for occasional checks of the amplifier zero setting) it is advisable to proceed as follows: Drain the measuring pipe completely set the 4-decade switch to obtain a reading near midscale and note down both this reading and the corrosponding switch setting. The reference value should only be determined after final calibration when the suppression (RANGE potentiometer) will not be altered any more.

Potential = [ ] Volts
at test sockets 0 – 10 V
of ratemeter LB 3831

Reference value = [| | |]
on decade switch

This test at the same time checks the preset suppression and consequently of the supply voltage.

IMPORTANT!
Because of the high detection sensitivity of the Density Measuring System the pipe must be completely drained as even minute traces of liquid will alter the reading.

Following the manual sensitivity adjustment the reference value should also be determined again (with maximum suppression [20 scales] the natural radiation decay will change the potential across the RANGE potentiometer by approx. 0.3 V per annum).

16. Umkalibrierung auf anderen Dichtemeßbereich

Soll die Dichtemeßanlage an ein geändertes Meßproblem angepaßt werden, so wird dazu wie folgt vorgegangen:

16.1 Vergrößerung oder Verkleinerung des Meßbereichs bei gleichem Meßmedium

Der Einsteilwert für die Unterdrückung $\mathbf{u_1}$ (Potentiometer BEREICH) wird auf den neuen Wert $\mathbf{u_2}$ wie folgt geändert:

$$u_2 = (u_1 - 5) \cdot \frac{\Delta\rho_1}{\Delta\rho_2} + 5$$

Beispiel:

$\Delta\rho_1 = 0{,}126$ g/cm³

u_1 = 86,8 V (8,68 Skalen)

$\Delta\rho_2 = 0{,}150$ g/cm³

$u_2 = (86.8 - 5) \cdot \frac{0{,}126}{0{,}150} + 5 =$ **73,8 V (7,38 Skalen)**

Bei größeren Änderungen empfiehlt sich anschließend eine Überprüfung und gegebenenfalls genaue Einstellung gemäß Punkt 14. der Bedienungsanleitung.

16.2 Einsatz der Meßanlage für ein anderes Meßproblem (und ein anderes Meßmedium)

Die ersten Einstellwerte für das Meßproblem sind gemäß Punkt 12. der Bedienungsanleitung zu bestimmen. Die genaue Einstellung erfolgt gemäß Punkt 14. der Bedienungsanleitung.

ACHTUNG!
Bei Meßverstärkern mit Linearisierung LB 3844-1 sollte bei Änderung des Einstellwertes für u um größer ca. 2 V ≙ 0,2 Skalen ein neuer Subeinschub in die Linearisierung eingesetzt werden!
Fragen Sie im Zweifelsfalle in einem unserer Büros oder im Werk nach.

16. Recalibration to Different Density Ranges

To adapt the density measuring system to a different application, proceed as follows:

16.1 Increasing or Decreasing the Range for the Same Liquid

The suppression setting $\mathbf{u_1}$ (DENSITY RANGE potentiometer) is adjusted to the new value $\mathbf{u_2}$ as follows:

$$u_2 = (u_1 - 5) \times \frac{\Delta\rho_1}{\Delta\rho_2} + 5$$

Example:

$\Delta\rho_1 = 0.126$ g/cm³

$u_1 = 86{,}8$ V (8,68 scales)

$\Delta\rho_2 = 0.150$ g/cm³

$u_2 = (86{,}8 - 5) \times \frac{0.126}{0.150} + 5 = 73{,}8$ V (7,38scales)

In case of major changes we recommend a subsequent check and, if necessary, accurate readjustment as described in Section 14 of the Operating Instructions.

16.2 Using the System for a Different Application (and a different Liquid)

The initial settings for the application concerned are determined in accordance with Section 12 of the Operating Instructions. Final adjustment is made as described in Section 14 of the Operating Instructions.

IMPORTANT!
When using amplifiers with linearization LB 3844-1, another submodule should be inserted into the linearization unit for alteration of the setting of u for more than approx. 2 V ≙ 0,2 scales.
In case of doubt, ask one of our agents or the factory.

17. Szintillometerspannung

(Hochspannungseinheit im Szintillometer, Kontrolle und Einstellung in ADAPTION LB 3806).
Um Alterungs- und Temperatureinflüsse unwirksam zu machen, wird die Hochspannung automatisch so geregelt (DBP), daß die Impulsgröße nach Verstärkung konstant ist (Driftstabilisierung). Eine Einstellung der Szintillometerspannung für den Betrieb erübrigt sich somit (Schalterstellung AUTO). Die Schalterstellung MAN (manuell) dagegen erlaubt eine Funktionskontrolle des Szintillationszählers, speziell des Fotovervielfachers. Mit dem sich über dem Schiebeschalter befindenden mehrgängigen Potentiometer kann die Hochspannung in dieser Stellung im Bereich zwischen ca. 500 – 1500 V verändert werden. Stellt man *die* Hochspannung ein, auf die der Verstärker in Stellung AUTO einregelt (die Hochspannung kann über eine Referenzspannung an den Ausgangsbuchsen genau gemessen werden, wobei 1 V Spannung an den Buchsen 300 V Hochspannung entspricht), so darf eine Änderung der Referenzspannung um ca. ± 0,3 V (entspricht ca. ± 90 V Hochspannung) nur eine geringe Anzeigeänderung bewirken (Arbeitspunkt im Spannungsplateau). Bei größeren Änderungen der Anzeige liegt ein Defekt im Szintillometer vor.

Kann die Hochspannungsautomatik in Stellung AUTO keinen Arbeitspunkt innerhalb ihres Regelbereiches einstellen, so liegt ein Defekt im Szintillometer (oder eine Leitungsunterbrechung) vor. Diese Störung wird durch Blinken der Leuchtdiode STÖRUNG signalisiert.

17. Scintillometer Voltage

(HV supply in scintillometer-check and adjustment with ADAPTION UNIT LB 3806).
In order to counteract ageing and temperature effects, the HV supply is automatically regulated (German patent) so that the pulse amplitude always remains constant after amplification (drift stabilisation). This obviates the need to adjust the scintillometer voltage during normal operation (switch position AUTO.). The MAN. (manual) switch position, however, permits performance checks of the scintillation counter, and especially of the photomultiplier. In this switch position the HV supply can be adjusted between 500 and 1500 V by means of the multiturn helipot above the sliding switch. If the HV supply is adjusted to that voltage at which the amplifier operates (reference voltage across the output sockets, 1 V across the sockets being equivalent to 300 V HV) then a change in reference voltage by approx. ± 0.3 V (equivalent to approx. ± 90 V HV) must only cause a slight change in indicator reading (operating point along the voltage plateau) – major changes indicate a fault in the scintillometer.

If, in the AUTO mode, the automatic HV supply is unable to establish an operating point within its range of control then this is caused by a scintillometer fault (or a continuity fault). The faults are indicated by a flashing "FAULT" light (LED).

18. Einstellung der Alarme (Einschub LB 3861)

Die beiden Relais der Doppel-Grenzwert-Einheit sind vom Werk als MAX.- (A) und MIN.-Relais in Ruhestromschaltung ausgelegt, d. h., beide Relais sind im „normalen" Dichtebereich angezogen und fallen beim Eintreten des zu alarmierenden Betriebszustandes (oder bei Netzausfall) ab. Sie bieten mit dieser Schaltungsart höchste Alarmsicherheit. Bei vorhandener Netzspannung wird das abgefallene Relais (Alarmsituation) durch das Aufleuchten der zugehörigen Leuchtdiode angezeigt.
Sie Skalenteilung auf den Potentiometern A (MAX.) und B (MIN.) ist linear und entspricht der Skala des Anzeigeinstrumentes (0—10 V) im Einschub LB 3886. Die Schaltpunkte können beliebig innerhalb des Meßbereiches eingestellt werden. Es ergeben sich Kontaktzustände wie in der Tabelle dargestellt.
Durch Umlöten einer Brücke kann der MIN.- in einen MAX.-Alarm umgeändert werden (sinngemäßes gilt für den MAX.-Alarm). Dadurch können z. B. Vor- und Hauptalarm für MAX. signalisiert werden. Außerdem besteht für spezielle Anwendungen die Möglichkeit, die Relais an getrennten Eingängen zu betreiben.

Nähere Informationen hierzu siehe Datenblatt des Einschubs.

18. Alarm Threshold Setting (Module LB 3861)

The two relays of the dual threshold unit are preset by the manufacturer as normally closed HIGH (A) and LOW (B) relay. contacts, i.e. the relays are energised within the normal density range and drop out when the threshold value is exceeded or the mains supply should fail. This circuit configuration offers maximum alarm reliability. A dropped-out relay (alarm condition) is indicated by the associated LED as long as mains power is available.

The scale divisions on the HIGH (A) and LOW (B) potentiometers are linear and correspond to the scale of the indicating instrument (0—10 V) in module LB 3886. The alarm thresholds can be adjusted over the full measuring range. The possible contact conditions are indicated in the Table below.
By resoldering a wire link, the LOW threshold can be converted into a HIGH threshold(conversely, the same applies to the HIGH threshold). This makes it possible, for example, to provide HIGH and HIGH HIGH alarms. For special applications there is in addition the possibility of operating the relays with separate inputs. Further details see Data Sheet for this Module.

Dichte	Relais A (MAX.)	LED	Relais B (MIN.)	LED	Kontakte geschlossen A (MAX.)	Kontakte geschlossen B (MIN.)	Open Collector (npn) A (MAX.)	Open Collector (npn) B (MIN.)
NORMAL	angezogen	aus	angezogen	aus	31 – 30	35 -- 34	leitend	leitend
größer MAX.	abgefallen	an	angezogen	aus	31 – 32	35 – 34	sperrt	leitend
kleiner MIN.	angezogen	aus	abgefallen	an	31 – 30	35 – 36	leitend	sperrt
Stromausfall	abgefallen	an	abgefallen	aus	31 – 32	35 – 36	–	–

Außer den Kontakten der Relais sind für MAX. und MIN. je ein Open-Collector-Ausgang herausgeführt (max. + 30 V; 0,1 A).

Density	Relay A (HIGH)	LED	Relay B (LOW)	LED	Contacts closed A (HIGH)	Contacts closed B (LOW)	Open Collector (npn) A (MAX.)	Open Collector (npn) B (MIN.)
Normal	picked-up	OFF	picked-up	OFF	31 -- 30	35 – 34	turned-on	turned-on
> HIGH	dropped-out	ON	picked-up	OFF	31 – 32	35 – 34	turned-off	turned-on
<LOW.	picked-up	OFF	dropped-out	ON	31 – 30	35 – 36	turned-on	turned-off
Power failure	dropped-out	ON	dropped-out	OFF	31 – 32	35 – 36		–

In Addition to the relay contacts, one open-collector output each is provided for HIGH and LOW (max. + 30 V; 0.1 A).

19. Brücken

Das Dichtemeßgerät wurde bei der Prüfung in unserem Werk auf die vorgesehene Meßaufgabe eingestellt. Bei nachträglicher Erweiterung des Meßverstärkers um zusätzliche Einschübe (z. B. Temperaturkompensation) oder bei Austausch eines Einschubs sind anhand des jeweiligen Schaltplanes die Brücken in den Platinen zu überprüfen bzw. den Bedingungen entsprechend zu ändern.

20. Blindeinschübe / Blindstecker

Die für die Einschübe DECAY-COMP., TEMP. COMP. und LINEARIZATION im Baugruppenträger reservierten Plätze (siehe beiliegenden Überrahmenplan) müssen bei Fehlen dieser Einschübe durch Blindeinschübe / Blindstecker gebrückt werden. Bei der Prüfung der Anlage wurde die dem Auftragsumfang entsprechende Auslegung vorgenommen, bei nachträglicher Erweiterung oder Entfernen eines Einschubs ist entsprechend zu verfahren (Blindeinschübe sind lieferbar unter der Typen-Nr. LB 3825).

ACHTUNG!
Zum Herausziehen und Einsetzen von Einschüben müssen die Schraubenzieherschlitze der Schnellverschlüsse horizontal stehen!

19. Wire Links

This Density Measuring System has been preset at our works for its specific application. If the amplifier is subsequently extended by additional modules (e. g. temperature compensation), or if a module is replaced, the wire links in the printed circuit boards must be checked against the appropriate circuit diagrams and modified as required.

20. Blank Modules / Dummy Connectors

The positions reserved in the chassis for the DECAY-COMP., TEMP. COMP. and LINEARIZATION modules (see enclosed chassis plan) must be blanked off by blank modules/dummy connectors if they are not included. When checking out the module the system configuration was arranged according to the specific requirements, and the same procedure must be adapted when subsequently adding or removing a module (blank modules are available under reference LB 3825).

IMPORTANT!
For removing and replacing modules the screwdriver slots in the quick-release mechanism must be horizontal!

21. Strahlenschutz

Eingebaut in die Meßstrecke ist ein ^{241}Am-Strahler von maximal 100 mCi (3,7 × 10^9 × 1/s). Die Abschirmung der Strahlung wurde so effektiv ausgelegt, daß die für die Erteilung der Bauartzulassung erlaubten Dosisleistungen (in 10 cm Abstand = 1 mrem/h = 2,78 × 10^{-9} W/kg) mindestens *um den Faktor 10 unterschritten werden.* Der Strahlenschutz wird hierdurch besonders vereinfacht, es entstehen *keine Kontrollbereiche.* Abschrankungen bzw. zeitliche Begrenzungen des Aufenthaltes am Meßort können ebenso entfallen wie ärztliche oder meßtechnische Überwachung des Bedienungspersonals.

Wiederholungsprüfungen des eingebauten Strahlers auf Dichtigkeit der Umhüllung sind nicht erforderlich (vergleiche Bauartzulassungsschein BW/29/78, Seite 2). Wir verweisen in diesem Zusammenhang jedoch auf Punkt 3. der Bedienungsanleitung.

Die versiegelten Schrauben der Meßeinrichtung dürfen nicht geöffnet werden!

Nach schweren Betriebsstörungen, wie z. B. Brand oder Explosion, bei der die Wahrscheinlichkeit besteht, daß Strahler oder Abschirmung in Mitleidenschaft gezogen worden sind, ist unverzüglich der im Werk zuständige Strahlenschutzbeauftragte zu verständigen. Er setzt sich dann gegebenenfalls mit unserer Firma in Verbindung, wenn tatsächlich Fehler, die die Sicherheit oder Funktion der Anlage beeinträchtigen, festgestellt werden.

Nicht mehr benötigte oder abgeklungene radioaktive Strahler müssen an die staatliche Sammelstelle für radioaktive Abfälle, an den Lieferanten oder an den Hersteller abgegeben werden.

Es empfiehlt sich, diese Punkte in einer internen oder auf den Betrieb der Anlage zugeschnittenen Dienstanweisung festzulegen.

21. Radiation Protection

The measuring system incorporates a ^{241}Am source with a max. dose rate of 100 mCi (3,7 × 10^9 × 1/s). The shielding of the source has been designed so efficiently that the dose rate is smaller *by a factor of at least 10* than the dose rate limit required for type approval in the Federal Republic of Germany (at 10 cm distance = 1 mrem/h = 2.78 × 10^{-9} W/kg). This greatly simplifies radiation protection, and *no controlled zones* are created. This obviates the need to provide physical access barriers or to limit the duration of stay in the direct vicinity of the source, as well as medical and radiometric checks of the staff unnecessary.

Repeat checks of the built-in source for containment leaks are no longer required in the Federal Republic of Germany. However, reference is made in this context to Section 3 of the Operating Instructions.

The sealed screws in the measuring system must not be tampered with!

After serious disturbances, e. g. fire or explosion, where there is a likelihood that the source or the shielding has been damaged, the person responsible for radiation protection within the company must be notified immediately. He should contact our firm if he has found any defects which may adversely affect the safety or performance of the system.

Radioactive sources which are no longer needed or have reached the end of their useful life must be returned to the national radioactive waste disposal centre or to the manufacturer.

It is recommended to formalise these points in internal procedural instructions which take account of the specific conditions in the user's establishment.

Anschriften

Adresses

Stammwerk

Factory

LABORATORIUM PROF. DR. BERTHOLD
D 7547 Wildbad 1 · Postfach 160
Phone 0 70 81/39 81 · Telex 07 24 019

Vertrieb in der BRD

German Sales Office

LABORATORIUM PROF. DR. BERTHOLD
Abteilung Industrie
D 7547 Wildbad 1 · Postfach 160
Phone 0 70 81/39 81 · Telex 07 24 019

Verkaufsbüros und Servicestellen in der BRD mit allen Verkaufs- und Servicemöglichkeiten

Büro Berlin

1000 Berlin 46 · Siemensstraße 13
Telefon 0 30/771 20 11

Büro Hannover

3004 Isernhagen 1 · Siemensstraße 4
Telefon 05 11/6 17 51 · Telex 09 21 273

Branch offices in Germany with full sales and service facilities

Büro Köln

5060 Bergisch-Gladbach 1 · Eichenhainallee 63
Telefon 0 22 04 / 6 70 01 · Telex 08 878 538

Büro München

8000 München 40 · Karl-Theodor-Straße 29
Telefon 0 89/33 40 01

Export

Export Office

LABORATORIUM PROF. DR. BERTHOLD
- EXPORTABTEILUNG -
D 7547 Wildbad 1 · Postfach 160
Phone 0 70 81/39 81 · Telex 07 24 019

Ausländische Niederlassungen mit allen Verkaufs- und Servicemöglichkeiten

Austria

BERTHOLD-ANALYTISCHE INSTRUMENTE
VERTRIEBSGESELLSCHAFT MBH
Witzelsbergergasse 10/28
A-1150 Wien

Belgium

BENELUX ANALYTICAL INSTRUMENTS SA
Vaartijk 22
B-1800 Vilvoorde

France

BERTHOLD FRANCE SA
68bis, Rue Sartoris
F-92250 La Garenne-Colombes

Subsidiary and affiliated companies with full sales and service facilities

Great Britain

LABORATORY IMPEX LIMITED
Lion Road
Twickenham Middlesex
England

Spain

ICAINSA
Plaza de Almuncear, 7
Madrid 8
Spain

Switzerland

MASSINI AG
Hönggerstraße 122
CH-8105 Regensdorf

**Vertretungen in zahlreichen Ländern
Namen und Adressen auf Anfrage**

**Representation in all other countries,
Names and Addresses on request**

1000 – 05/81

Berthold [illegible]

JS Engineering
102 Commercial Rd
Skelmanthorpe
Huddersfield
HD8 9DS

Tel:+44 1484 866254
Fax:+44 1484 866255
e-mail:Jsengineeringuk@aol.com

Attn: Chris Dale

Company: Dairy Crest

Fax: 01978 782343

From: JCHN SHARMAN

Phone: 01484 866254
Fax: 01484 866255

Date: 3 May, 2002
Pages including this cover page: 1

Chris,

Price for updating the Berthold Density gauge is:
Quotation No: 2356

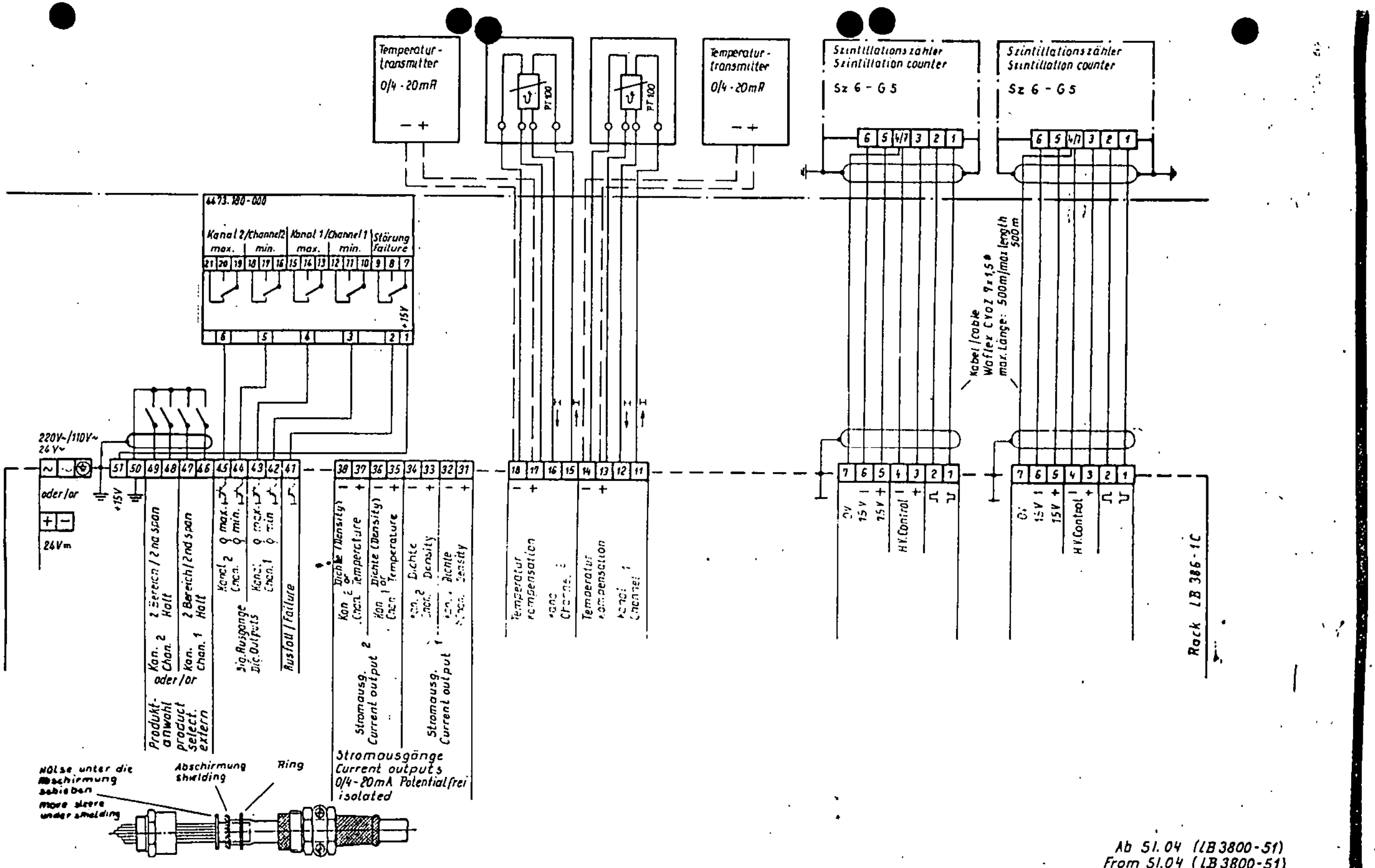
Qty	Part no	Description	Price
1	81474-2	**LB 386-1C Density Evaluation Unit (1 channel)** outputs a) 0/4-20 mA isolated for density b) 0/4-20 mA isolated for density or product temperature (reversible) digital 2 open collectors for max and min output: 1 open collector for malfunction indicator input: temperature compensation Pt 100 or 0/4-20 mA (reversible) memory for 3 calibration sets for different products data storage in EEPROM digital a) external setting of current range display: 20 characters, alphanumeric automatic decay compensation Supply Voltage 115 V +10/-15%, 47 - 65 Hz	£3,650

Prices are Ex works

Delivery: 4-6 weeks

Terms of payment: net 30 days

Regards
John



Kabeldurchführung am Szintillationszähler

CABLE PASSAGE AT THE SCINTILLATION COUNTER

Ab 51.04 (LB 3800-51)
From 51.04 (LB 3800-51)

01: Klemmennum. 31 bis 51				
01	9003066	13.3.90	gez. 22.9.89 Kappler	berthold
			gepr. 22.9.89	15183.101-991/1
Anschlußplan	LB 386-1C mit/with			
Connection diagram	Sz 6 - G 5 ...			

01753 834384.

MEASUREMENT PATH 6-8cm

WATER TRO

1,100
CALIB. → RUN

CONC 10 - 12 K
RUN

1,110 DENSITY 'O'

1,101 PRODUCT → RUN → RUN
60% → COMPLETE.

Countrates g/cm³/g/l/%/°Be		Date	Lab values		Temperature	
1100	.... cps	....	1110	....	1120	....
1101	.... cps	....	1111	....	1121	....
1102	.... cps	....	1112	....	1122	....
1103	.... cps	....	1113	....	1123	....
1104	.... cps	....	1114	....	1124	....
1105	.... cps	....	1115	....	1125	....
1106	.... cps	....	1116	....	1126	....
1107	.... cps	....	1117	....	1127	....
1108	.... cps	....	1118	....	1128	....
1109	.... cps	....	1119	....	1129	....

1130	Calibration mode	1	
1131	Zero countrate	....	cps
1132	Measuring path	6.8	cm
1133	Absorption coefficient a_1	....	
1134	Absorption coefficient a_2	....	
1135	Absorption coefficient a_2	....	
1136	Factor (·)	1	
1137	Offset (±)	0	
1138	Quad. error	....	
1140	Current output 1: 0/4 mA	....	
1141	Current output 1: 20 mA	....	
1142	2. range: 0/4 mA	....	
1143	2. range: 20 mA	....	
1144	Threshold min	....	
1145	Threshold max	....	
1146	Hysteresis	....	
1147	Linear temp.coefficient TC_1	....	
1148	Quadrat. temp.coefficient TC_2	....	
1149	Reference temperature	....	°C

01753 834 384.

MEASUREMENT PATH 6-8cm

WATER TAO

1,100
CALIB. → RUN

COUNT 10 - 12 K
RUN

1,110 DENSITY 'O'

1,1,1,01 PRODUCT → RUN → RUN
60% → COMPLETE.

SET-UP PROTOCOL LB 386-1C V.2.0

Channel 1

Measuring Point ....
Radioactive Source: No .... Activity: .... Isotope: ....
Pipeline: .... mm Material: ....
Irradiation angle: 90°/45°/30°/others ....

Code No.	Function	Value
2	Password	....
3	Instrument ID	....
4	Print interval	.... min
6	Program version	....
1010	Time constant	.... s
1011	Automatic switchover	....
1012	Countrate threshold min	.... cps
1013	Countrate threshold max	.... cps
1020	Temperature compensation	
	0 = off; 1 = on	....
	Current input for temperature:	
1021	0/4 mA	.... °C
1022	20 mA	.... °C
	Current output for temperature:	
1023	0/4 mA	.... °C
1024	20 mA	.... °C