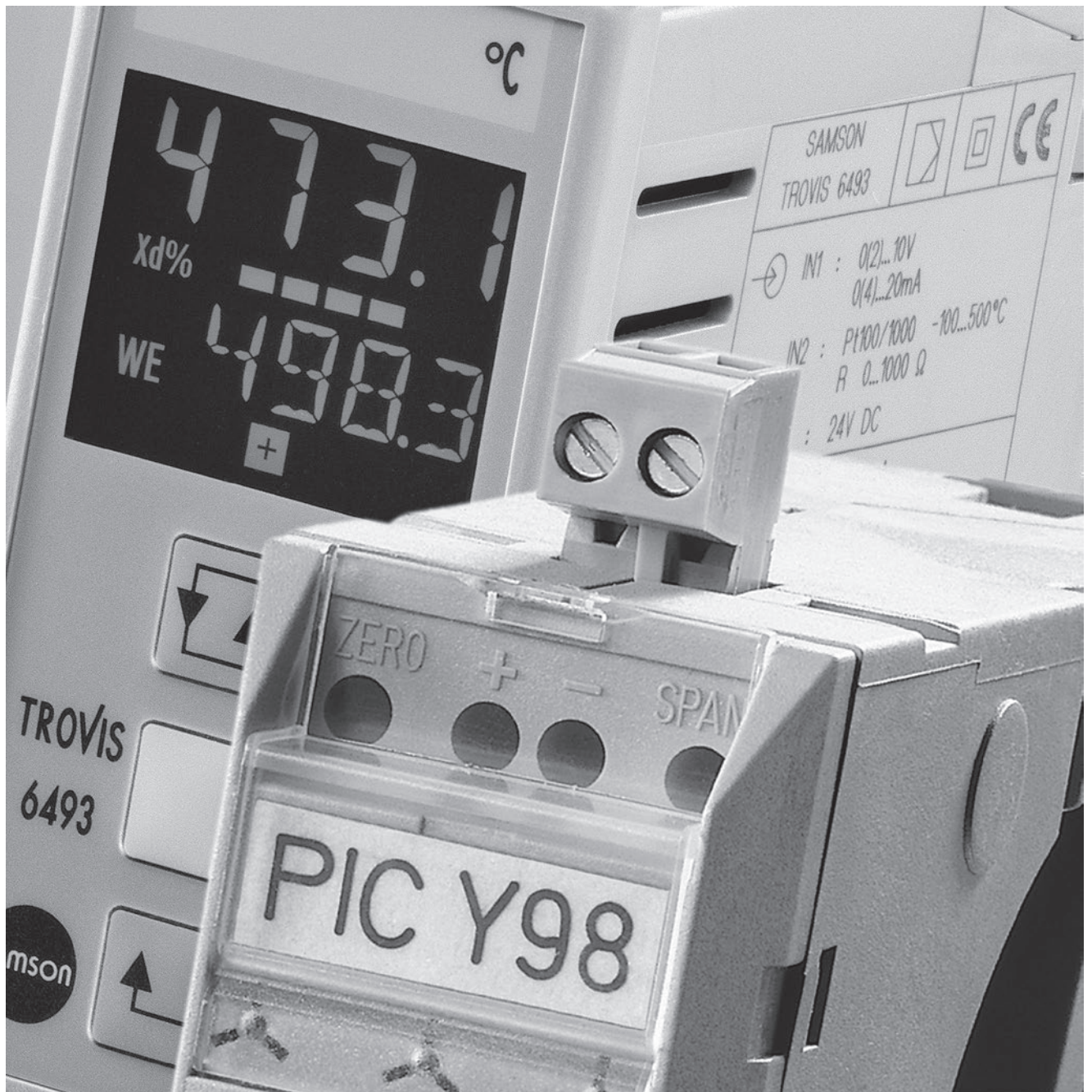






Electropneumatic Converters (Proportional Valves)

Electronic Process Controllers

Signal Converters



Electropneumatic Converters

i/p converters				
Type	6111		6116	6126
Housing style	Rail-mounting unit	Field unit	Field unit ⁵⁾	Field unit
Explosion protection	Ex ia ATEX	Ex ia ATEX	Ex ia, Ex d, ATEX, FM, CSA, Australian standard ¹⁾	–
Degree of protection	IP 20	IP 65	IP 54, IP 65, NEMA 4	IP 54, IP 65
Fieldbus	AS-Interface ⁴⁾			
Input	0 to 20 mA	•	•	•
	4 to 20 mA	•	•	•
	0 to 10 V	• ³⁾	• ³⁾	•
	2 to 10 V	• ³⁾	• ³⁾	•
Output	0.2 to 1 bar	•	•	•
	0.4 to 2 bar	•	•	•
Special ranges	Up to 5 bar			•
	Up to 8 bar	•	•	• ²⁾
Supply air	0.4 bar above the upper signal pressure range, max. 10 bar			Max. 5.4 bar
Electrical connection	Phoenix terminal or angle connector DIN EN 175301-803 A	M20 x 1.5	M 20 x 1.5 ½-14 NPT	Angle connector DIN EN 175301-803 A
Pneumatic connection	Connection for hose with 4 mm inside diameter and 6 mm outside diameter, G ¼, ½ NPT	¼ -18 NPT	¼ NPT, G ¼	¼ NPT, G ¼
See data sheet for further details	▶ T 6111	▶ T 6111	▶ T 6116	▶ T 6126
				

1) Others on request




2) Ex d devices, max. 5.6 bar output (6 bar supply air)

3) With Type 6151 u/i Module

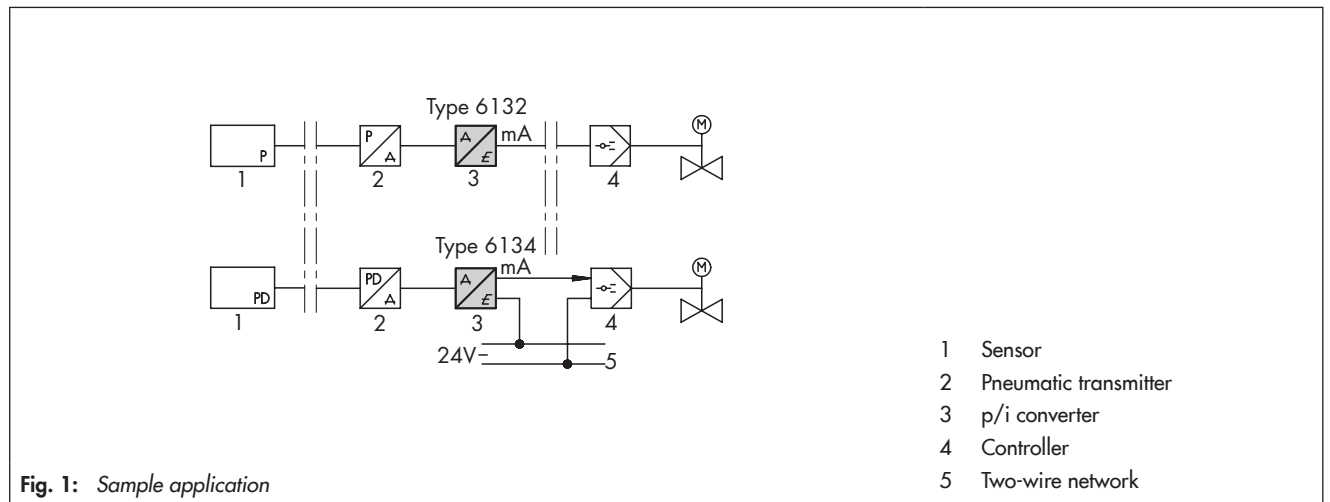
4) With Type 6150 AS-Interface Module

5) Special version for operation using natural gas on request

Electropneumatic Converters

p/i converters				
Type		6132	6134	
Housing style		Rail-mounting unit	Rail-mounting unit	Field unit
Explosion protection		–	–	Ex ia, Ex d
p/i converter unit		1	1 or 2	1
Degree of protection		IP 20	IP 20	IP 54, IP 65
Input	0.2 to 1 bar 3 to 15 psi	•	•	•
	0 to 20 mA 4 to 20 mA	•	•	•
Output	0 to 5 V	•		
	1 to 5 V	•		
	0 to 10 V	•		
	2 to 10 V	•		
Power supply		230 V AC, 115 V AC, 24 V AC, 24 V DC	24 V DC	
Electrical connection		Four-wire	Two-wire	
		Terminals for 0.5 to 2.5 mm ² wires		M20 x 1.5, ½ NPT, terminals for 0.5 to 2.5 mm ² wires
Pneumatic connection		Connection for hose with 4 mm inside diameter and 6 mm outside diameter		¼ NPT, G ¼
See data sheet for further details		▶ T 6132	▶ T 6134	
				

Application



Converter modules

Type		6150	6151
Designation		ASI module	u/i module
Input	AS-Interface	•	
	0 to 10 V		•
	2 to 10 V		•
Output	0 to 20 mA		•
	4 to 20 mA	•	•
Power supply		Over ASi line	16 to 30 V DC
Electrical connection		Angle connector acc. to DIN EN 175301-803 A, M20 x 1.5 (adapter connector)	
Compatibility with SAMSON devices	Positioners	3725, 3730, 3760, 3761, 3767, 4763	
	Series V2001	3321-IP, 3323-IP, 3531-IP, 3535-IP	
	i/p converter	6111, 6116, 6126	
Max. load at the output		300 Ω	$R_B \text{ (k}\Omega\text{)} = \frac{U_s - 10 \text{ V}}{20 \text{ mA}}$ Example: supply voltage $U_s = 24 \text{ V}$, $R_B = 0.7 \text{ k}\Omega$
See data sheet for further details		▶ T 6150	▶ T 6151

Application

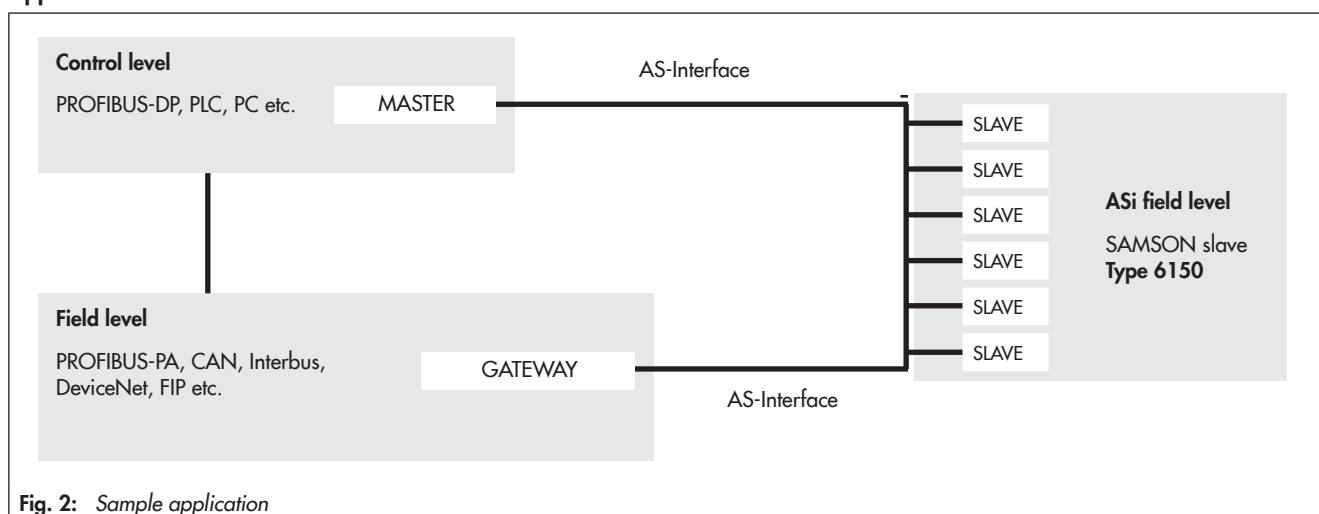




Fig. 2: Sample application

Electronic Process Controllers

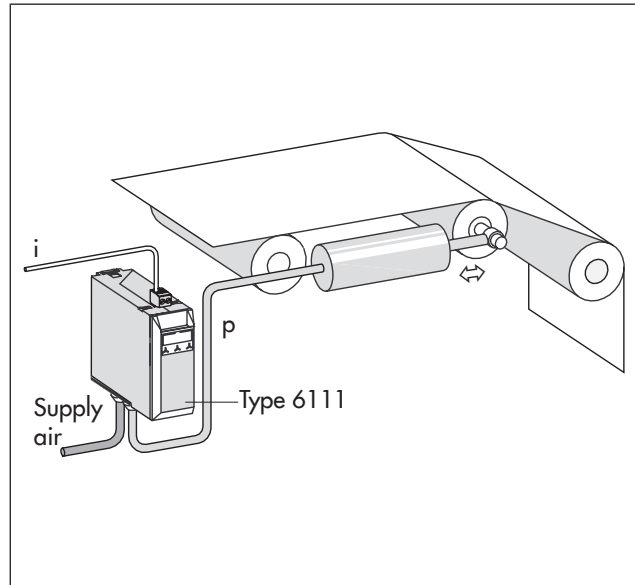
TROVIS		6493	6495-2	
Design	Panel-mounting unit	•	•	
	Front W x H (mm)	48 x 96	96 x 96	
	Degree of protection (front)	IP 65	IP 65	
	Display	LCD	Graphics	
	Keys	6	9	
Functions	Control circuits	1	2	
	P, PI, PD, PID control	•	•	
	Fixed set point and follow-up control	•	•	
	Ratio control		•	
	Cascade control		•	
	Override control		•	
	Linking of input variables	•	•	
Input	Analog inputs	2	4	
	4 to 20 mA, 0 to 20 mA	•	•	
	0 to 10 V, 2 to 10 V	•	•	
	Pt 100 resistance thermometer	•	•	
	Pt 1000 resistance thermometer	•	•	
	Resistance transmitters	•	•	
	Transmitter supply	•	•	
	Binary inputs	1	4	
Output	Analog outputs	1	3	
	4 to 20 mA, 0 to 20 mA	•	•	
	0 to 10 V, 2 to 10 V	•	•	
	Relay	2	4	
	Transistor outputs	1	3	
	On/off, three-step	1	2	
	Limit	2	4	
Communication	Interface	Infrared	•	•
		USB		• ¹⁾
		RS-232		• ¹⁾
		RS-485		• ¹⁾
	Protocol	SSP (TROVIS-VIEW)	• ¹⁾	• ¹⁾
	Modbus RTU		• ¹⁾	
Power supply	85 to 264 V AC, 50/60 Hz		•	
	90 to 250 V AC, 50/60 Hz	•		
	24 V AC/DC, 50/60 Hz	•	•	
See data sheet for further details		▶ T 6493	▶ T 6495-2	
				

¹⁾ Optional

Sample applications

Controlling a positioning cylinder in the paper and printing industry

The electric signal (i) of a controller received from the PLC is converted into a pneumatic signal (p) by the i/p converter. The pressure signal is used to position a cylinder which, in turn, moves a roller that keeps the paper under a certain tension.

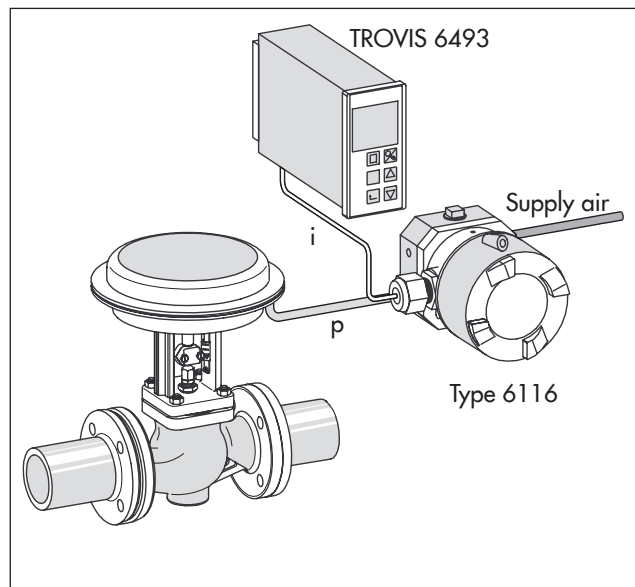


Valve control

Valves with small pneumatic actuators can be controlled directly by an i/p converter. The i/p converter receives the electric signal of a controller received from the PLC.

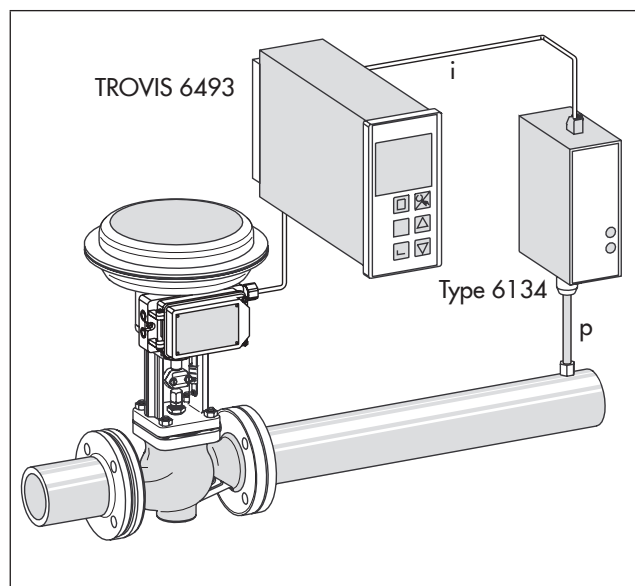
The i/p converter can also control a pneumatic positioner.

Field or industrial units can be mounted directly to a valve (attachment to rod-type yoke or according to NAMUR).



Pressure control

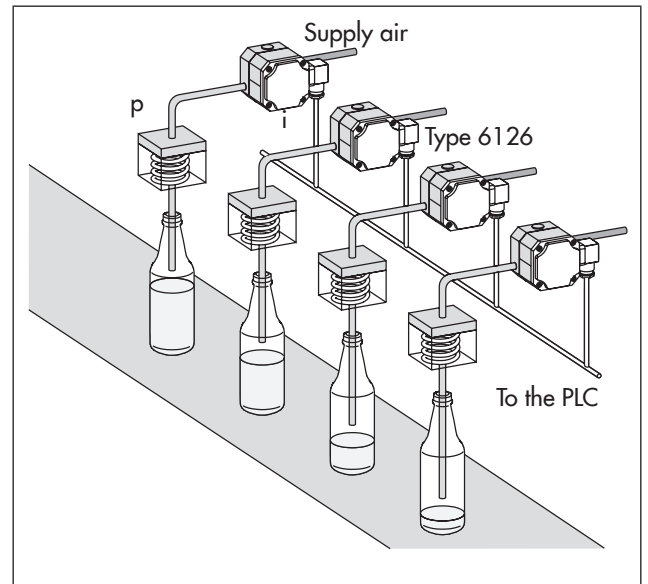
The p/i converter measures the pressure in the pipeline and converts it into an electric signal. The positioner uses the electric signal to calculate the control signal to open or close the pneumatic control valve.



Sample applications

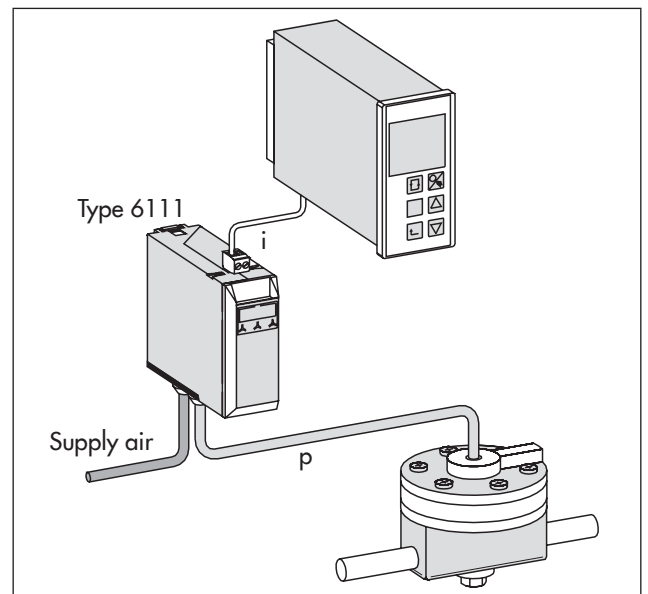
Filling of liquids in the beverage industry and breweries

An electric signal is converted into a pneumatic signal by the i/p converter. The pneumatic signal is used to position the cylinders which insert filling tubes into bottles, depending on the liquid level, to fill them with beverages or detergents.



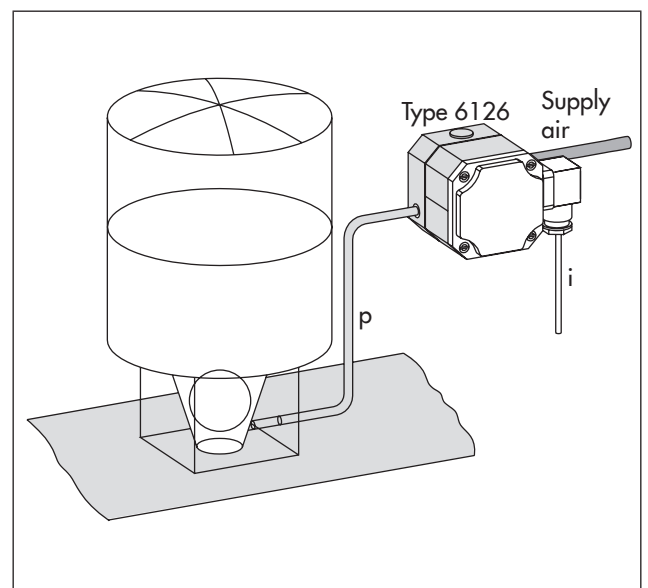
Booster control

Boosters are used to amplify the flow rate of compressed air. In place of a handwheel, they can also be controlled by an i/p converter, which receives an electric signal of a controller from the PLC.



Applying adhesive or glue

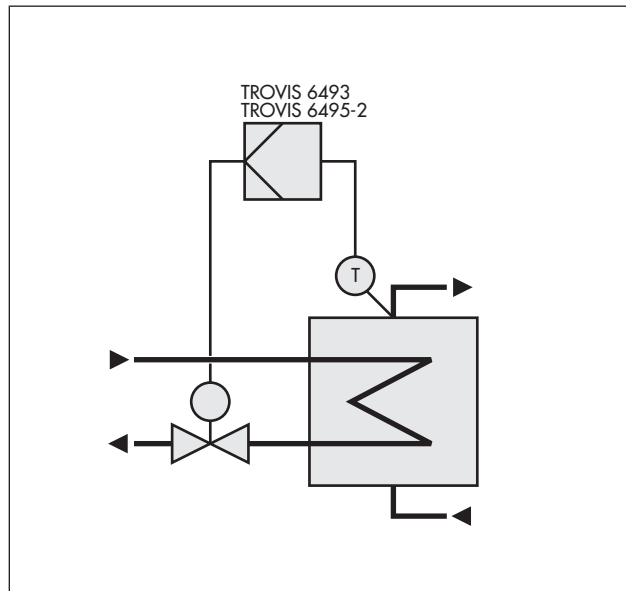
Glue or adhesive is to be applied on different bases. Depending on the speed of the conveyor belt, varying quantities must be applied. The i/p converter receives an electric signal, which changes with the belt speed, and converts it into a pressure signal. The pressure causes the ball of a dispenser to adapt the outlet to the required amount of glue or adhesive. This ensures uniform application.



Sample applications

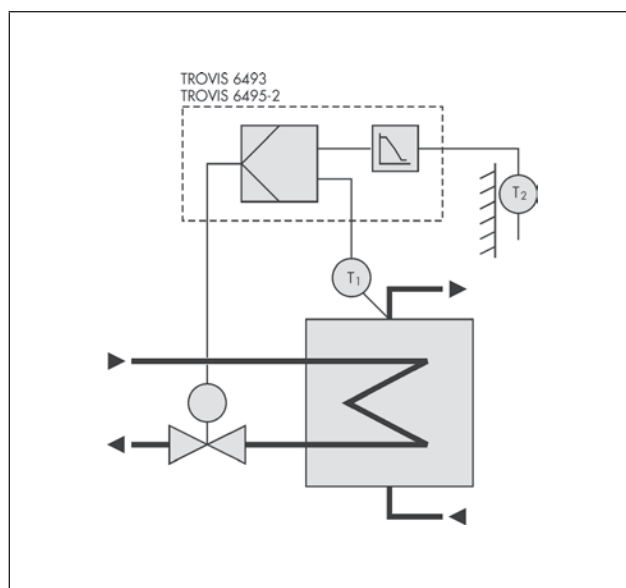
Flow temperature control of a heat exchanger

The TROVIS 6493 or TROVIS 6495-2 Controller logs the flow temperature T in the secondary circuit and positions the valve in the primary circuit to regulate the flow temperature.



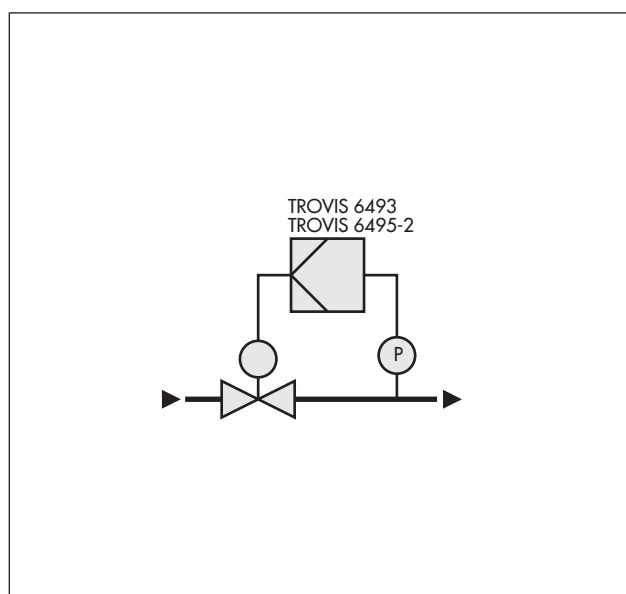
Flow temperature control of a heat exchanger based on the outdoor temperature

The TROVIS 6493 or TROVIS 6495-2 Controller logs the flow temperature T_1 in the secondary circuit and positions the valve in the primary circuit to regulate the flow temperature. The set point for the flow temperature is determined according to a characteristic based on the outdoor temperature T_2 .



Pressure control

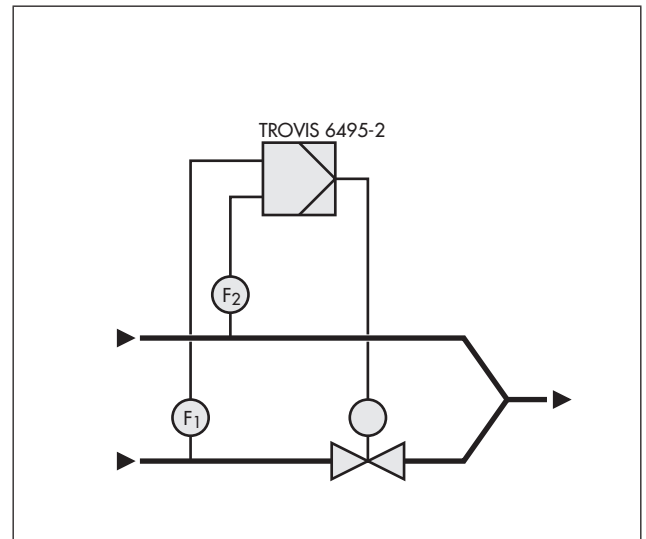
The TROVIS 6493 or TROVIS 6495-2 Controller logs the pressure downstream of the valve received from a pressure transmitter and positions the valve accordingly to regulate the pressure.



Sample applications

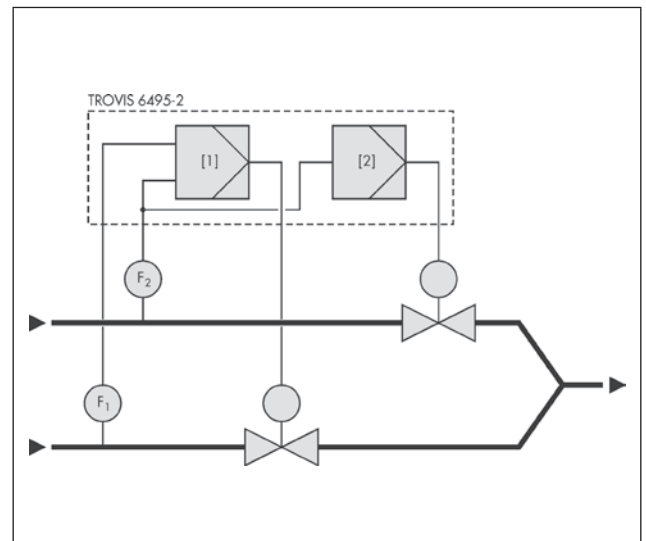
Control of the mixing ratio of two liquids

The TROVIS 6495-2 Industrial Controller logs the flow rates F_1 and F_2 from two flow transmitters. It positions the control valve for the medium to be added to achieve the required mixing ratio F_1/F_2 (ratio control).



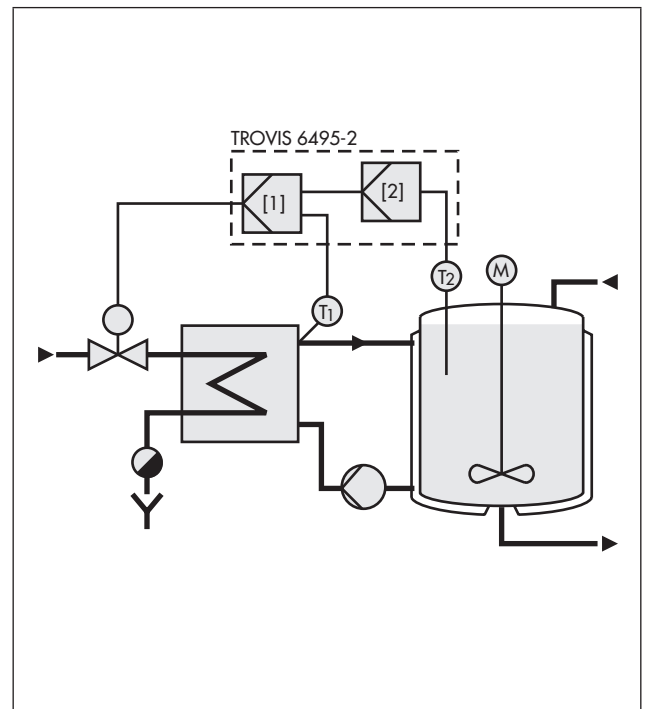
Control of the mixing ratio of two liquids and control of the main flow rate

The TROVIS 6495-2 Industrial Controller logs the flow rates F_1 and F_2 from two flow transmitters. The internal controller [1] positions the control valve for the medium to be added to achieve the required mixing ratio F_1/F_2 (ratio control). The internal controller [2] positions the control valve for the other medium to achieve the flow rate F_2 .



Temperature cascade control

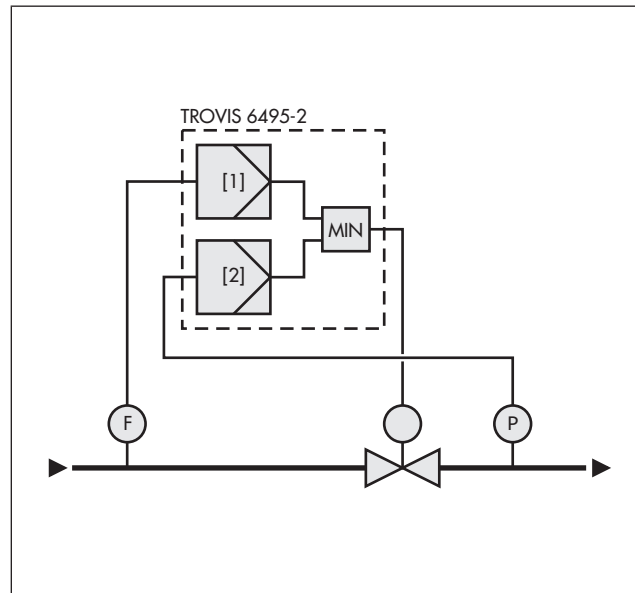
The TROVIS 6495-2 Industrial Controller regulates the product temperature in a vessel and limits the flow temperature of the heat exchanger with the cascade control mode. The temperature in the vessel is generated by steam, which is produced by a heat exchanger and a fluid circulation system. The master controller [2] receives the product temperature T_2 in the vessel and provides its output variable as the set point for the slave controller [1]. The slave controller [1] logs the flow temperature T_1 of the heat exchanger and positions the control valve to regulate the flow temperature and the product temperature. To prevent the product from overheating, the set point for flow temperature is limited to a maximum temperature. Additionally, the pressure and temperature fluctuations in the steam network can be eliminated faster by the slave controller before they cause a noticeable temperature change in the boiler due to the shorter delays in the heat exchanger circuit. This improves the control accuracy. The steam heat exchanger can alternatively be controlled using a steam pressure control in the condensate circuit. In this case, the control valve is installed in the condensate pipe instead of the steam pipe.



Sample applications

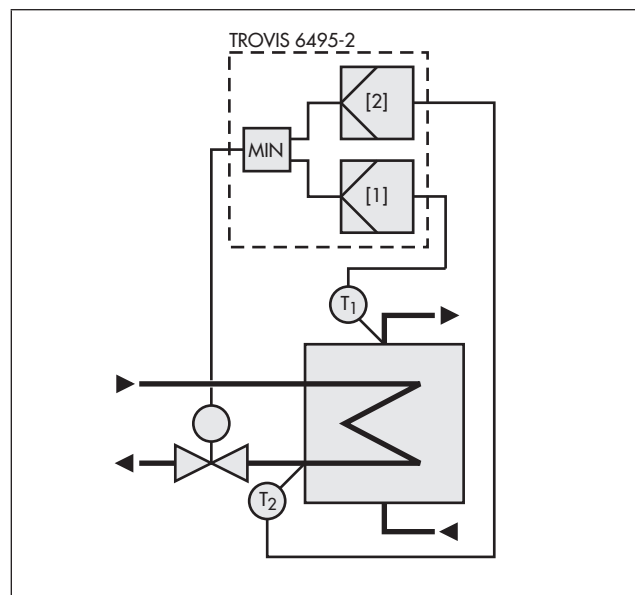
Flow rate control with pressure limitation

The TROVIS 6495-2 Industrial Controller controls the flow rate with the override control mode to ensure that the pressure does not exceed a certain limit. In this case, control signals of two internal controllers influence the control valve by selection of a minimum value. The main controller [1] regulates the flow rate F and the override controller [2] limits the pressure P to a maximum pressure. The controller with the smallest output value is used to position the valve. If the controller [1] is actively positioning the control valve, the control signal of controller [2] is greater than that of controller [1] by the adjustable limiting band at the maximum. This limitation causes controller [2] to take over control more quickly when the pressure exceeds a certain limit.



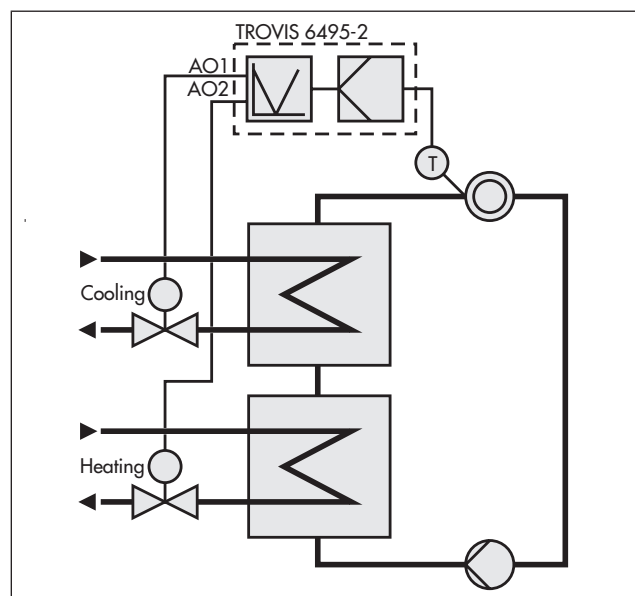
Flow temperature control with return flow temperature limitation

The TROVIS 6495-2 Industrial Controller controls the flow temperature of the heat exchanger in the secondary circuit with the override control mode to ensure that the return flow temperature in the primary circuit does not exceed a certain limit. In this case, control signals of two internal controllers influence the control valve by selection of a minimum value. The main controller [1] regulates the flow temperature T_1 and the override controller [2] limits the return flow temperature T_2 to a maximum temperature. The controller with the smallest output value is used to position the valve. If the controller [1] is actively positioning the control valve, the control signal of controller [2] is greater than that of controller [1] by the adjustable limiting band at the maximum. This limitation causes controller [2] to take over control more quickly when the return flow temperature T_2 exceeds a certain limit.



Temperature control with two control valves for heating and cooling (split-range control)

The TROVIS 6495-2 Industrial Controller logs the coolant temperature T of a machine and positions one control valve for heating and one control valve for cooling over two analog outputs to regulate the coolant temperature. In split-range operation, the working range is assigned to two analog outputs to allow the cooling valve to close first and then the heating valve to open as the control signal rises.



Explosion protection

Some of the SAMSON electropneumatic converters are suitable for use in hazardous areas as they are frequently used in the chemical and petrochemical industry.

Important factors of the explosion protection relevant for such applications are listed in the following. For details, please refer to the standards mentioned.

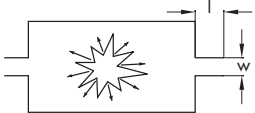
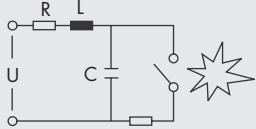
Zone classification

Hazardous areas are grouped into zones to indicate the risk of explosion. Each zone prescribes particular measures which ensure explosion protection.

Zone	Identifier	Example
0	Dangerous, potentially explosive atmospheres occur permanently or for a long time .	Inside of reaction tanks containing flammable gases
1	Dangerous, potentially explosive atmospheres occur occasionally .	In the proximity of Zone 0, immediate area around packing that are not sufficiently sealed.
2	Dangerous, potentially explosive atmospheres occur rarely or for a short time (less than two hours).	Areas surrounding the Zones 0 and 1

Type of protection

The type of protection describes the measures to be taken to prevent electrical appliances from igniting explosive atmospheres.

Type of protection	Basic principle	Standard or regulation
d Flameproof enclosure 	Parts which can ignite an explosive atmosphere are placed in an enclosure which can withstand the pressure caused by an explosion inside the enclosure and prevents the transmission of the explosion to the surrounding explosive atmosphere. Flameproof enclosures are suitable for Zones 0, 1 and 2.	IEC 60079-1
i Intrinsic safety 	An electrical device is intrinsically safe when all circuits are intrinsically safe. A circuit is intrinsically safe when it does not produce sparks or thermal effects whose energy suffices to ignite an explosive atmosphere.	IEC 60079-11 VDE 0170/0171, Part 7
Category ia	Devices of this category are suitable for Zones 0, 1 and 2. Zone 0 must be certified separately.	
Category ib	Devices of this category are suitable for Zones 1 and 2.	

Temperature classes

The temperature classes group electrical appliances according to their max. permissible surface temperature. It must be smaller than the ignition temperature of the explosive material.

Temperature class	Maximum permissible surface temperature of the appliance	Ignition temperature of the flammable material
T1	450 °C	> 450 °C
T2	300 °C	> 300 °C ≤ 450 °C
T3	200 °C	> 200 °C ≤ 300 °C
T4	135 °C	> 135 °C ≤ 200 °C
T5	100 °C	> 100 °C ≤ 135 °C
T6	85 °C	> 85 °C ≤ 100 °C

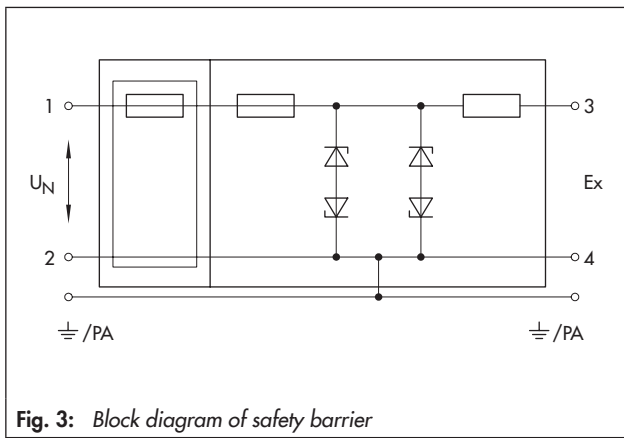


Fig. 3: Block diagram of safety barrier

Safety barriers according to IEC 60079-0

Safety barriers are passive networks which separate intrinsically safe and non-intrinsically safe circuits without isolating them electrically. The output circuits of the safety barriers meet the requirements of the intrinsic safety "ia" and "ib".

Safety barriers are always installed outside the hazardous area.

Degrees of protection (IP rating)

The IP code characterizes an electrical appliance's protection against accidental contact and foreign particles as well as its protection against water. The code consists of two code numbers whose meanings are listed in the table below.

IP code	IP	6	5
First code number (0 to 6) Protection against contact and foreign particles			
Second code number (0 to 8) Protection against water			

Code number	First code number		Second code number
	Protection against contact	Protection against foreign particles	Protection against water
0	No protection	No protection	No protection
1	Protection against contact with the back of the hand	Protection against penetration of foreign particles larger than 50 mm	Protection against water drops
2	Protection against contact with fingers	Protection against penetration of foreign particles larger than 12.5 mm	Protection against water drops when the device is tilted by up to 15° from the vertical position
3	Protection against contact with tools	Protection against penetration of foreign particles larger than 2.5 mm	Protection against spray water hitting the device, at an angle of 60° from the vertical position
4	Protection against contact with a wire	Protection against penetration of foreign particles larger than 1.0 mm	Protection against spray water from all directions
5	Protection against contact with a wire	Protection against dust deposits which could impair the functioning of the device	Protection against a water jet from all directions
6	Protection against contact with a wire	Dust-tight	Protection against a strong water jet from all directions
7	–	–	Protection against water when immersed under standardized time and pressure conditions
8	–	–	Protection against water when permanently immersed under conditions which are agreed upon by the manufacturer and customer.

Specifications subject to change without notice



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