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Issue 2

Pneumatic Recorders and Controllers Series 4000

The series 4000 instruments are available in a wide range of versions with different functions:

- **Recorders for one or two variables**
- **Single or double recorders with one controlled variable**
- **Indicating controller for single variable.**

Indication is done on a segmental graduated scale 120 mm wide, while the recording is performed on a completely visibile circular chart with a diameter of 185 mm and effective recording width of 75 mm.

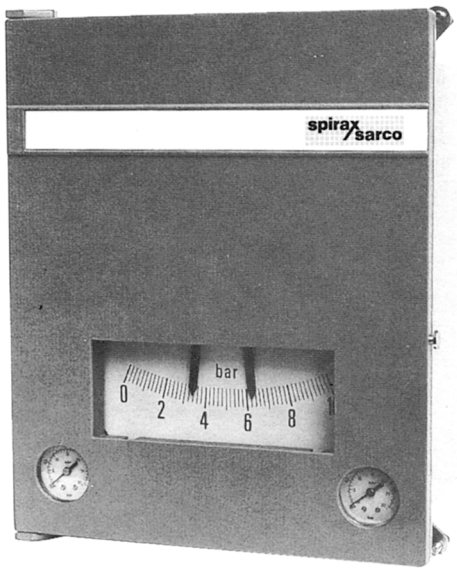
Scale and recording chart are available, with a wide choice of measurement ranges and graduations in both actual and percentage units.
Recording charts are available in a wide choice of scales and the instrument may be provided with a plexiglass transparent vernier, with single or multiple graduation in the actual measuring units, permitting the direct reading of values when the instrument is due to record more than one variable with different ranges or when, for standardisation reasons, charts with percentage scale are used.
The variables can be measured directly (pressures and temperatures), or received in the form of pneumatic or electrical signals.

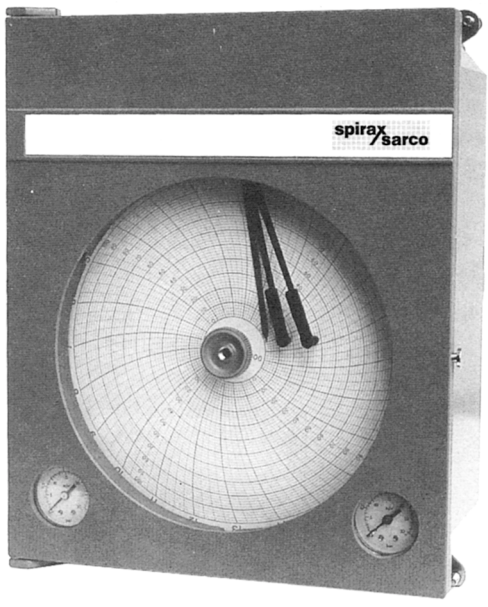
The measuring element are: bulb and capillary thermometric units **gas filled**, also available in sanitary versions, for temperatures measurement, and Bourdon tube or bellows units for pressures and levels detection.
Receivers are provided for measurements of transmitted values in the form of pneumatic signals or electrical current and voltage signals, or from thermoresistances or thermocouples.

The pneumatic control unit is supplied in various versions for the following control modes:

- **on-off**
- **proportional (P) with manual reset**
- **proportional-integral (PI)**
- **proportional-integral-derivative (PID)**
- **proportional-derivative (PD)**

Each of the control modes can be easily adjusted by means of appropriate graduated dials.
The control unit is fitted with a sensitive relay amplifier, ensuring maximum response speed. The unit can also be quickly set up to function with direct or reverse action, simply by rotating the proportional band dial.
The basic control instruments are fitted with a manually adjustable set point which, on request, can be





driven by a pneumatic signal or electric current or voltage signal allowing different control facilities:

- manual remote set point adjustment by means of a manual station
- automatic set point adjustment from a master controller in cascade or ratio control loops
- automatic set point adjustment by a programme transmitter.

Controllers are provided with two pressure gauges for the compressed air supply and output control signal respectively.

Electrical contacts (simple or double) for minimum and/or maximum value of a single variable can be supplied on request; the tripping point can be setted at any point within the scale range.

The chart driving mechanism may be a seven-day spring clock, or a standard 24-Volt - 50Hz electric mechanism; other voltages are available on request.

Each pen traces a curve in a different colour and has a long-lasting ink supply, to ensure long-term efficiency.

The instrument case is in die-cast aluminium, protected with epoxy paint, and is dust and spray-proof; it is fitted with accessories for wall or flush panel mounting and, on request, can be supplied with pipe support mounting. Connection for internal pressurization is available if required.
The instrument air supply must be filtered, oil-free and sufficiently dry; a pressure of 20 psi (1.4 bar) is required.

VARIABLE MEASUREMENT

Temperature

Nitrogen-filled thermometer system for temperatures ranging from —100°C to 600°C; cylindrical bulb for liquids which can also be supplied in a sanitary version for food or pharmaceutical processes etc. or spiral bulb for air and gas.
Bulb and capillary are in AISI 316L stainless steel.
The maximum length of the capillary is 10 m for both systems.
No environmental temperature compensation devices are required.

Pressure

Bellows-type pressure element in AISI 316L stainless steel or tombac for vacuum, low pressures, or absolute pressures up to 1 bar.

Bourdon-type pressure element in AISI 316L stainless steel: spiral tube for pressures up to 400 bar and helical tube for pressures up to 1000 bar.

A diaphragm separator with capillary is also available for corrosive or viscous fluids.

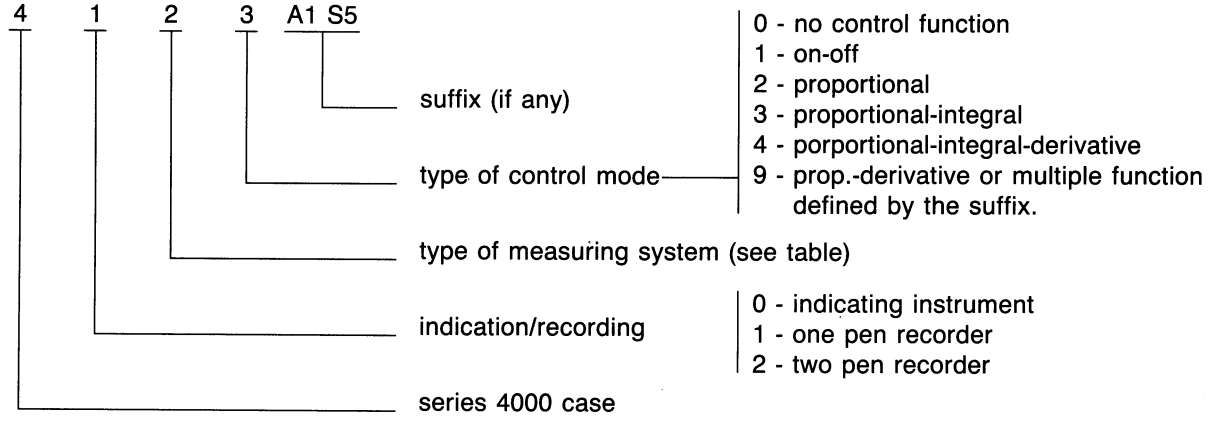
Pneumatic receiving element

Tombac bellows receiver for a standard 3 to 15 psi signal (or 0.2 to1 bar) from pneumatic transmitters.

Electromechanical receiver

Receiver for current or voltage electrical signals (4-20 mA, 0-10 V d.c. etc.) and for signals from resistance thermometers or thermocouples.

According to the variables to be controlled and/or recorded, each instrument is given a four-digit model identification number followed, in some cases, by one or more alphanumeric codes to identifies the general characteristics. The composition of the model number, for example, for a pressure recording controller is as follows:



Ref.	Measuring system
0	Bellows pneumatic receiver for 3-15 psi or 0.2-1 bar signal
1	Bellows element for vacuum, low or absolute pressure or level
2	Stainless steel Bourdon tube for pressure or level
6	Gas-filled thermometer system for temperature
8	Two different variables (temperature, pressure, pneumatic or electromechanical receiver), as specified by the suffix
9	Electromechanical receiver for electric signal or other measuring system, as specified by the suffix

The suffix is used in some cases to complete the description of the instrument characteristics, for example: T5 specifies that the thermometer system is fitted with a cylindrical bulb and is nitrogen-filled; T5-Sy specifies that the bulb is the cylindrical nitrogen-filled but in sanitary version and T6 that thermometer system is nitrogen filled and fitted with a spiral bulb for air and gas; S5 is used to indicate that the instrument is fitted with a pneumatic device for the set-point adjustment, etc.

For instruments fitted with two pens for different variables (third digit = 8), the model number must be followed by two codes that specify the type of measurement system (F = flow rate; L = level; P = pressure, vacuum, absolute pressure; S3 = pneumatic receiver; T = temperature; S4EE = electromechanical receiver) as well as the type of control unit connected to one of the two pens, if present:

C1 - on-off control mode
C2 - proportional (P)
C3 - proportional-integral (PI) control mode
C4 - proportional-integral-derivative (PID) control mode
C6 - proportional-derivative (PD) control mode

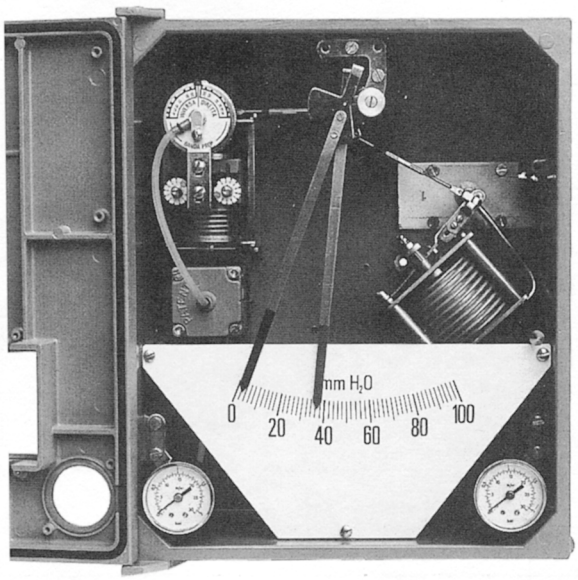
e.g. Mod. 4289 - P2C2 - TS3 - Recording controller with two pens: pressure measured with Bourdon tube (P2) and proportional control mode (C2), and temperature pneumatically received (TS3) and only recorded.

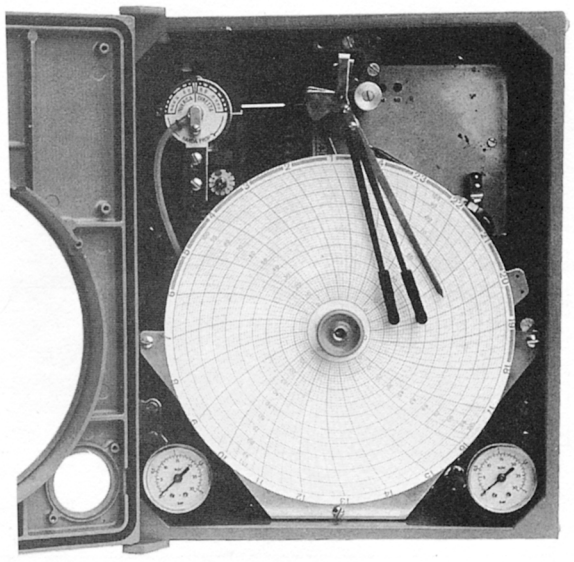
POSSIBLE COMBINATIONS

Recorders
One variable: possibility of electrical contact
Two variables: possibility of electrical contact on the 2nd variable (blue pen)

Recording controller:
One controlled variable: possibility of electrical contact and either pneumatic or electrical remote set-point
Two variables, one of which is controlled: no possibility of optional executions

Indicating controller:
One variable controlled: possibility of contact and pneumatic or electrical remote set-point
Two variables, one of which is controlled: no possibility of optical executions





STANDARD RANGES OF MEASUREMENT

FOR TEMPERATURE

Measuring spans	25°C*	50°C	75°C	100°C	150°C	200°C	300°C	400°C
Ranges in Centigrade degrees	—5 - 20 0 - 25 10 - 35	—25 - 25 —10 - 40 0 - 50 25 - 75 50 - 100	—25 - 50 0 - 75 25 - 100 50 - 125	0 - 100 25 - 125 50 - 150 100 - 200	0 - 150 25 - 175 50 - 200 100 - 250	0 - 200 25 - 225 50 - 250 100 - 300	0 - 300 50 - 350 100 - 400	0 - 400 100 - 500
Admissible over-temperature	25% of the measurement range span							

*** Available with kerosene filled thermometer system only**

FOR PRESSURE AND VACUUM

Pressure in bar, with spiral tube	—1 - 0 —1 - 1 —1 - 4	0 - 1 0 - 2 0 - 3 0 - 4 0 - 5	0 - 7 0 - 10 0 - 15 0 - 20 0 - 25	0 - 30 0 - 50 0 - 75 0 - 100 0 - 200	0 - 300 0 - 400
Pressure in bar, with helical tube	0 - 500	0 - 600	0 - 800	0 - 1000	
Vacuum with bellows element in tombac or stainless steel	0 - 500 mm H_2O 0 - 1000 mm H_2O 0 - 1500 mm H_2O		0 - 100 mmHg 0 - 760 mmHg		
Pressure with bellows element in tombac or stainless steel	0 - 500 mm H_2O 0 - 1000 mm H_2O		0 - 2500 mm H_2O 0 - 5000 mm H_2O		
Admissible over-pressure	25% of the measurement range for Bourdon tubes 1 bar for bellows element				

FOR ABSOLUTE PRESSURE

With balance bellows element in stainless steel	0 - 100 Tor 0 - 200 Tor	0 - 500 Tor 0 - 760 Tor
Admissible over-pressure	25% of the measurement range	

FOR LEVEL OF LIQUIDS

For open tanks with tombac or stainless steel bellows element	0 - 500 mm H_2O 0 - 1000 mm H_2O 0 - 2500 mm H_2O 0 - 5000 mm H_2O 0 - 7500 mm H_2O	0 - 1 m H_2O 0 - 2 m H_2O 0 - 3 m H_2O 0 - 4 m H_2O 0 - 5 m H_2O	0 - 7 m H_2O 0 - 10 m H_2O 0 - 100 %
For open tanks with spiral Bourdon tube	0 - 10 m H_2O 0 - 15 m H_2O 0 - 20 m H_2O 0 - 25 m H_2O	0 - 30 m H_2O 0 - 50 m H_2O 0 - 75 m H_2O 0 - 100 m H_2O	0 - 100 %

FOR RECEIVERS

Pneumatic receivers and Electromechanical receivers	Scales available with standard measurement ranges for temperature, pressure and vacuum as described above. 0-100% linear and quadratic percentage scales can also be supplied; special scales can be supplied on request for every variable and in accordance with the type of transmitter connected.

GENERAL CHARACTERISTICS

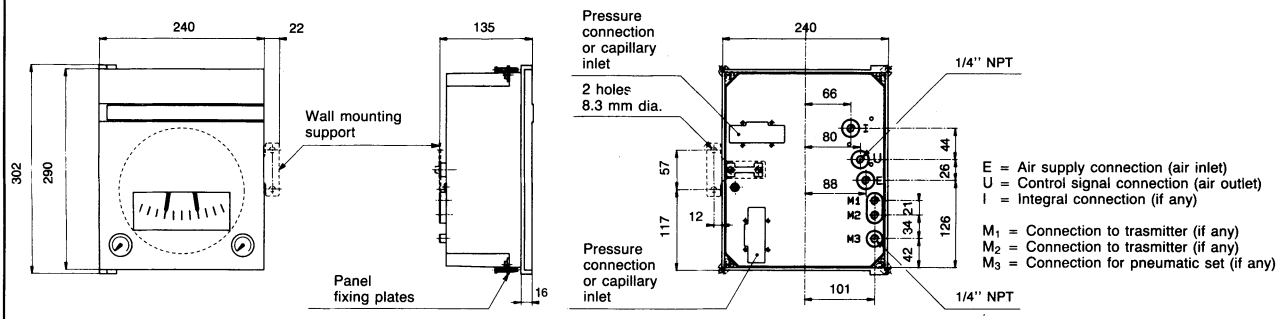
Type of instrument	indicating or recording controller, either simple direct measurement recorder, or pneumatic or electromechanical receiver.
Measuring systems	• AISI 316L stainless steel Bourdon spiral tube for pressures up to 400 bar and helical tube for over 400 bar • AISI 316L or tombac bellows element for pressure • gas-filled thermometer system with capillary and bulb in stainless steel (types, bulb sizes and process connections as per bulletin 7B.380-E) • pneumatic receiver for 3 to 15 psi or 0.2 to 1 bar signal (tombac bellows) • electromechanical receiving transducer for 0 to 20 or 4 to 20 mA signals or for either thermoresistances or thermocouples; input current 24V 50/60Hz (110 and 220V only on request)
Measuring limits	• pressure — 1 to 1000 bar (400 bar max. for spiral tube) • temperature —100 to 600°C
Indicating scale	segmental 120 mm long, for instruments that are indicators only
Recording chart	circular, with a diameter of 185mm and 75 mm actual recording width
Auxiliary indicating scale	in plexiglass for recorders with simple or double graduations (on request)
Chart movement	standard rotation 1 turn per 12/24 hours, or every 7 days; other speeds on request. standard electric mechanism, 24V 50Hz (110V or 220V on request); quartz clock supplied by 1.5V battery; spring- loaded clockwork mechanism wound weekly.
Inking and colours	disposable cartridge pen system with different colours: 1st pen red - 2nd pen blue
Accuracy	1% of the range span
Sensitivity	0.2% of the range span
Repeatability	0.5% of the range span
Linearity	0.5% of the range span
Control action	• direct action, control signal increases on increasing of controlled variable • reverse action, control signal decreases on increasing of controlled variable action can be easily selected on the field
Control modes	• on-off • proportional (P) with manual reset device • proportional-integral (PI) • proportional-integral-derivative (PID) • proportional-derivative (PD)
Differential	1% of the range span; not adjustable (on-off instruments only)
Proportional band	adjustable from 5% up to 200% of the scale span
Integral action	adjustable from 0.1 to 20 repeats per minute
Derivative action	adjustable from 0.02 to 20 minutes
Control signal	3 to15 psi or 0.2 to 1 bar (6 to 30 psi on request) for modulating control mode 0 to 20 psi or 0 to 1.4 bar (0-35 psi on request) for ON-OFF control instruments
Set-point	• manually adjustable on instrument by knob and index (standard) • pneumatically adjustable from remote panel through a 3 to 15 psi or 0.2 to 1 bar signal (on request) • electrically adjustable through a 0 to 20 or 4 to 20 mA signal (on request)
Air supply	compressed air at 20 psi ± 1.5 psi (1.4 bar ± 0.1 bar), 35 psi for higher signals
Electrical supply	24V-50/60Hz (recommended); 110V or 220V-50/60Hz on request
Air consumption	0.25 Nm^3/h (average)
Air connections	1/4' NPT, female for air supply, control signal and input signal (if any)
Process connections	• pressure: 1/4' NPT female • temperature: for bulbs types, dimensions and connections to process see bulletin 7B.390-E
Environment temperature limits	maximum +65° C minimum —15° C
Case	die-cast aluminium, RAL 5010 epoxy coated, dust and spray-proof with standard protection degree IP 54 or IP 55 on request; connection for internal pressurization on request.
Mounting	• wall or flush panel mounting by means of standard fittings • on 2'' pipe support with clamp (optional)
Weight	from 6 to 8 kg depending on the type and function
Dimensions	see drawings on Page 6
Standard accessories	cleaner for the pneumatic unit orifice; adjusting key and, only for recorders, one pack of 50 charts and a cartridge pen for each colour

DATA REQUIRED FOR OFFERS AND ORDERS

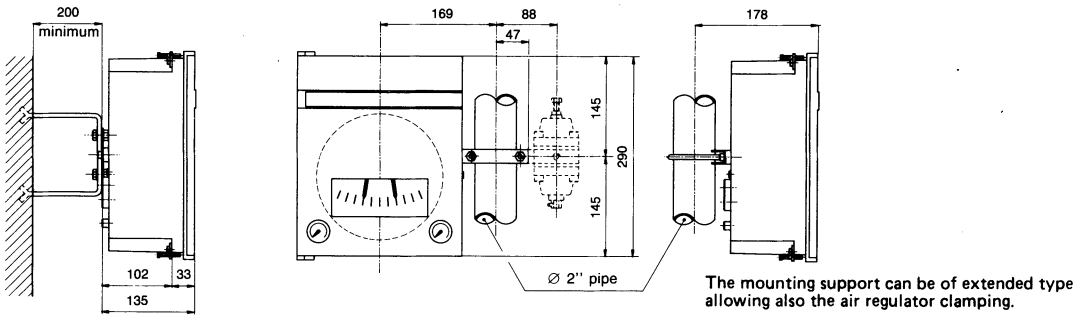
	Example 1	Example 2
Type of instrument and application	temperature recording controller for fuel oil	pressure recording controller and temperature receiver recording
Numbers of pens	1	2
Type of measuring system	nitrogen filled thermometer with cylindrical bulb	bourdon type for 1st pen, pneumatic receiver for 2nd pen
Measurement range	0 to 100°C	pressure 0 to 10 bar temperature 25 to 125°C
Maximum temperature of fluid (even accidental peak)	110°C	150°C
Maximum pressure of fluid (even accidental peak)	25 bar	10 bar
Control mode	proportional-integral	proportional
Chart revolution	1 revolution in 24 hours with electrical drive for 24V-50Hz	1 revolution in 24 hours with spring clockwork
Auxiliary indicating scale	no	yes
Mounting style	on 2" pipe support	on panel
Ambient temperature variations	From —5 to 40°C	From 10 to 35°C
Capillary length and bulb (only for temperature)	5m capillary tube, standard cylindrical bulb	—
Bulb well (only for temperature)	AISI 316 termowell	—
Model	4163- T1	4289-P2C2-TS3

DIMENSIONS (mm)

Overall dimensions



Wall or pipe support mounting



Flush panel mounting