high accuracy tester-calibrator
PJ 6301

PJ6301 is a high-accuracy instrument: ± 0.005% with 600,000 measuring counts on voltage and current ranges; 0.05°C for thermocouple and 0.005°C for RTD measurement resolution.

- Simultaneous input and output
- RS232 / IEEE488 programmable
- Menu-driven design for easy use

Description

The model PJ 6301 tester-calibrator is a high accuracy instrument for measuring and simulating process signals. Its new design incorporates outstanding performance with either easy manual set up or by computer operation for automatic test application.

Comprehensive, PJ 6301 measures and generates or simulates process signals such as DC voltages and currents, resistance, temperature signals from thermocouple or RTD sensors. Separated circuits allow simultaneous and independent measurement and sourcing.
Its graphical display is divided in two areas for simultaneous indication of measured and emitted values. Numerous other functions such as data processing, customised signal linearisation, recorder analogue output, transmitter function, ramp and step function, relative measurements... open a wide and incomparable application range.

User friendly, PJ 6301 is offered in a compact housing for on site as well as bench-top or panel mounted use. The graphical display concept leads to keyboard simplification. On-line help messages are available at any time when additional information on displayed options is required.

Fully programmable via its RS232 and IEEE488 interfaces, the PJ6301, with the rack mounting accessory, is ideal in test bench and automatic test equipment applications. In addition, the battery and memory storage capacity make the PJ 6301 very portable and most suitable for on-site use.

Applications

Due to its outstanding performance and quality the PJ6301 can achieve many and exacting requirements. Applications can be separated into three groups:
• Accurate measurement for calibration of signal generators such as sensors, voltage and current sources, resistance, and for process control instruments checking;
• Temperature simulation, voltage and current sourcing, resistance simulation for calibration of measuring equipment such as chart recorders, logical controllers, PLC analogue inputs...
• Test of signal conditioners or transmitters, using PJ 6301 simultaneous sensor simulation and output signal measurement capability.

PJ 6301 is naturally in its place in metrological departments, quality-control departments, research and development laboratories; it is also very suitable for maintenance and approval companies. PJ 6301 is a major element at companies which have applied to ISO9000 certification. For this purpose, PJ 6301 is delivered with traceable test certificate.

PJ 6301 fields of application are extremely numerous, from energy (electrical, gas, oil,...), heavy industry (steel work, metallurgy, chemical, glass, cement,...), textile, paper, wood, rubber industries,... food industry, pharmaceutical industry, advanced technology industry (aerospace, military, transportation,...), scientific research...

functions

In measurement mode and for all functions..
Maximum measurement capability: 125% of the range.

In simulation-sourcing mode and for all functions.....
Settling time < 25 ms to obtain specified accuracy.

Maximum admissible floating voltage compared with earth: 250 V AC or 350 V peak.

DC voltage

V-		Input			Output	
Resolution	Range	Accuracy (1)		Input impedance	Range	Accuracy (1)
		90 days	1 year			90 days / 1 year
0.1 µV	± 60 mV	0.005% + 4 µV	0.010% + 6 µV	> 1000 MΩ	-	- / -
1 µV	± 600 mV	0.005% + 4 µV	0.010% + 6 µV	> 1000 MΩ	- 100 to + 600 mV	0.007% + 4 µV / 0.015% + 6 µV
10 µV	± 6 V	0.005% + 20 µV	0.010% + 30 µV	> 1000 MΩ	- 1 to + 6 V	0.007% + 20 µV / 0.015% + 30 µV
100 µV	± 60 V	0.005% + 200 µV	0.010% + 300 µV	> 10 MΩ	- 10 to + 60 V	0.007% + 200 µV / 0.015% + 500 µV

(1) Accuracy is given in ±(% of reading + nV digits) at 23 ± 1°C, temperature coefficient < 10% of accuracy per Celsius degree.

Measurement .....
Maximum admissible voltage: 100 V DC or AC peak.
Common mode maximum admissible voltage: 250 V AC or 350 V peak.
Common mode rejection ratio (60 mV range) > 150 dB.

Emission / calibration .....
Positive output maximum current: 60 mA (except 60 V range: 30 mA).
Negative output maximum current: - 5 mA.

Source resistance
< 0.5 mΩ with front panel terminals
< 2 mΩ with rear panel terminals.
Input protected against a temporary misconnection to - 18 V and + 100 V (DC or AC peak).

DC current

I-			Input		Output	
Resolution	Range	Accuracy (1)		Voltage drop	Range	Accuracy (1)
		90 days	1 year			90 days / 1 year
0.1 µA	± 60 mA	0.010% + 0.4 µA	0.020% + 0.6 µA	1.2 V	0 - 60 mA	0.010% + 0.5 µA / 0.020% + 0.8 µA

(1) Accuracy is given in ±(% of reading + nA) at 23 ± 1°C, temperature coefficient < 10% of accuracy per Celsius degree.

Measurement .....
Electronic protection
When measuring current with a two-wire transmitter, the current loop can be supplied from an internal 24 V ± 10% source.

Emission / calibration .....
Maximum output voltage: 30 V.
External power supply:
When calibrating a 2 wire transmitter, the instrument can be powered by an external power supply ≤ 30 V DC.

Source resistance > 100 MΩ.
Outputs protected against a temporary misconnection to - 20 V and + 100 V.

Resistance

Measurement .....
Measurement with two-wire, three-wire or four-wire resistances.
Open circuit maximum voltage: 10 V.

Outputs protected against a temporary misconnection: 100 V DC or AC peak.

Ω			Input		Output	
Range	Resolution	Measurement current	Accuracy (1)		Accuracy (1) (2)	
			90 days	1 year	90 days	1 year
0 - 600 Ω	1 mΩ	1 mA	4 wire 0.005% + 4 mΩ 3 wire 0.005% + 20 mΩ	0.010% + 6 mΩ 0.010% + 20 mΩ	0.005% + 8 mΩ	0.010% + 10 mΩ
0 - 6 000 Ω	10 mΩ	0,1 mA	4 wire 0.005% + 40 mΩ 3 wire 0.005% + 70 mΩ	0.010% + 60 mΩ 0.010% + 80 mΩ	0.005% + 80 mΩ	0.010% + 100 mΩ

(1) In ±(% reading + n Ω) at 23 ± 1°C, temperature coefficient < 10% of accuracy per Celsius degree.
(2) Accuracy is given for measurement current between 0.5 mA and 2.5 mA on 600 Ω range and between 0.05 mA and 0.25 mA on 6000 Ω range.
Admissible measurement current from 0.1 mA to 4 mA on 600 Ω range and from 0.01 mA to 0.4 mA on 6000 Ω range (lower accuracy)

Temperature with thermocouples

Temperature			Input		Output (2)		
Thermocouple	Range	Resolution	Accuracy (1) (3)		Range	Accuracy (3)	
			90 days	1 year		90 days	1 year
K	- 250 to - 200°C - 200 to - 120°C - 120 to 0°C 0 to + 1 372°C	0.2°C 0.1°C 0.05°C 0.05°C	1°C 0.3°C 0.2°C 0.010% + 0.1°C	1.5°C 0.5°C 0.3°C 0.015% + 0.2°C	- 240 to - 200°C - 200 to 0°C 0 to + 1 372°C	1°C 0.3°C 0.01% + 0.1°C	1.5°C 0.5°C 0.015% + 0.2°C
T	- 250 to - 200°C - 200 to - 0°C 0 to + 400°C	0.2°C 0.05°C 0.05°C	1°C 0.3°C 0.1°C	1.5°C 0.5°C 0.2°C	- 240 to - 200°C - 200 to 0°C 0 to + 400°C	1°C 0.3°C 0.1°C	1.5°C 0.5°C 0.2°C
J	- 210 to - 100°C - 100 to + 1 200°C	0.05°C 0.05°C	0.2°C 0.1°C	0.4°C 0.2°C	- 210 to - 100°C - 100 to + 1 200°C	0.3°C 0.01% + 0.1°C	0.5°C 0.015% + 0.2°C
E	- 250 to - 200°C - 200 to - 100°C - 100 to + 1 000°C	0. 1°C 0.05°C 0.05°C	0.5°C 0.2°C 0.1°C	1°C 0.3°C 0.2°C	- 240 to - 200°C - 200 to - 100°C - 100 to + 1 000°C	0.5°C 0.2°C 0.1°C	1°C 0.3°C 0.2°C
R	- 50 to + 120°C + 120 to + 450°C + 450 to + 1 768°C	0.5°C 0.2°C 0.1°C	1°C 0,5°C 0,5°C	2°C 1°C 1°C	- 50 to + 120°C + 120 to + 1 768°C	1°C 0.5°C	2°C 1°C
S	- 50 to + 120°C + 120 to + 450°C + 450 to + 1 768°C	0.5°C 0.2°C 0.1°C	1°C 0.5°C 0.5°C	1.5°C 1°C 1°C	- 50 to + 120°C + 120 to + 1 768°C	1°C 0.5°C	2°C 1°C
B	+ 400 to + 900°C + 900 to + 1 820°C	0.2°C 0.1°C	1°C 0.5°C	1.5°C 1°C	+ 400 to + 900°C + 900 to + 1 820°C	1°C 0.5°C	1.5°C 1°C
U	- 200 to 0°C 0 to + 600°C	0.05°C 0.05°C	0.3°C 0.2°C	0.5°C 0.3°C	- 200 to 0°C 0 to + 600°C	0.3°C 0.2°C	0.4°C 0.2°C
L	- 200 to - 100°C - 100 to + 900°C	0.05°C 0.05°C	0,2°C 0,1°C	0,3°C 0,2°C	- 200 to - 100°C - 100 to + 900°C	0.2°C 0.1°C	0.3°C 0.2°C
C	- 20 to + 900°C + 900 to + 2 310°C	0.1°C 0.1°C	0.5°C 0.03% + 0.1°C	1°C 0.05% + 0.2°C	- 20 to + 900°C + 900 to + 2 310°C	0.4°C 0.03% + 0.1°C	0.5°C 0.05%+ 0.2°C
N	- 240 to - 190°C - 190 to - 110°C - 110 to + 1 300°C	0.2°C 0.1°C 0.05°C	1°C 0.5°C 0.2°C	1.5°C 1°C 0.3°C	- 240 to - 100°C - 100 to + 1 300°C	1°C 0.2°C	1.5°C 0.4°C
Platinel	- 100 to + 1 400°C	0.05°C	0.2°C	0.4°C	- 100 to + 1 395°C	0.2°C	0.4°C
Mo	0 to + 1 375°C	0.05°C	0.1°C	0.2°C	0 to + 1 375°C	0.2°C	0.3°C

(1) Accuracy given with reference junction at 0°C. With internal reference junction compensation accuracy is decreased an additional 0.2°C .
(2) Calibration resolution (all ranges): 0.01°C.
(3) In ±(% reading + n°C) at 23 ± 1°C, temperature coefficient < 10% of accuracy per Celsius degree.

Temperature with RTD

Temperature			Input				Output (2)
RTD	Measurement range	Resolution	Accuracy (1) (3) 90 days	Accuracy (1) (3) 1 year	Range	Accuracy (3) 90 days	Accuracy (3) 1 year
Pt 100	- 220 to 0°C 0 to + 630°C + 630 to + 1200°C	0.01°C 0.005°C 0.01°C	0.02°C 0.01% + 0.02°C 0.1°C	0.04°C 0.015% + 0.04°C 0.2°C	- 220 to 0°C 0 to + 1200°C	0.04°C 0.01% + 0.04°C	0.06°C 0.015 % + 0.06°C
Pt 200	- 220 to 0°C 0 to + 630°C + 630 to + 798°C	0.01°C 0.005°C 0.01°C	0.02°C 0.01% + 0.02°C 0.7°C	0.04°C 0.015% + 0.04°C 0.15°C	- 220 to 0°C 0 to + 590°C	0.03°C 0.01% + 0.03°C	0.04°C 0.015% + 0.04°C
Pt 500	- 220 to 0°C 0 to + 1200°C	0.01°C 0.01°C	0.04°C 0.01% + 0.04°C	0.06°C 0.015% + 0.06°C	- 220 to 0°C 0 to + 1200°C	0.05°C 0.01% + 0.05°C	0.1°C 0.015% + 0.1°C
Pt 1000	- 220 to 0°C 0 to + 630°C + 630 to + 1200°C	0.01°C 0.005°C 0.01°C	0.03°C 0.01% + 0.03°C 0.15°C	0.05°C 0.015 % + 0.05°C 0.3°C	- 220 to 0°C 0 to + 1200°C	0.04°C 0.01% + 0.04°C	0.06°C 0.015% + 0.06°C
Ni 100	- 60 to + 180°C	0.05°C	0.1°C	0.15°C	- 60 to + 180°C	0.3°C	0.4°C

(1) Accuracy given with a four-wire sensor.
(2) Resolution (all ranges): 0.01°C
Accuracy is given for external current
- between 0.5 mA and 2.5 mA in Pt 100, Pt 200 and Ni 100 simulation
- of 1 mA in Pt 500 and Pt 1000 simulation
(3) Accuracy is given in ±(% of reading + n °C) at 23 ± 1°C, temperature coefficient < 10% of accuracy per Celsius degree.

additional functions

Choice of temperature unit .....
In measurement or simulation mode temperature can be displayed in °C, °F or K.

Configuration memory.....
PJ6301 is able to store up to 5 user definable configuration programs, easily selectable on request from keyboard.

Input

Alarm thresholds .....
Two set points, or alarm limit S1 and S2, can be programmed with audible beep and relay output.

Peak and valley memory.....
Simultaneous display of current value, minimum and maximum value measured since unit initialisation, or since range switching from initialisation.

Relative measurements («Null» function) .....
Display of difference D (read value) between M (Measured value) and a value R. R is either memorised as a reference during measurement, or edited via keyboard:
D = M - R.

Linearisation by segments L = f(M) .....
Two possibilities are offered:
1- the relation between displayed and measured values is linear; in that case slope (a) and offset (b) are programmed so that displayed value L = aM + b.
2- the relation is not linear, but is known for a certain number of points. In that case up to 9 segments (each defined by a couple of points) can be programmed, to obtain the closest possible response curve. Couples are entered as (X_0, Y_0),...(X_n, Y_n).
Displayed value L = f(M).

Digital filter .....
A programmable digital filter enables the PJ6301 to display a smoothed value taking into account previous measurements.

Trigger function .....
Acquisition on request can be replaced by triggered acquisition, one by one or with an acquisition procedure where number of measurements and time interval between measurements can be programmed.
Measurements of a burst are stored and can be processed off-line in the various ways described in the following paragraph.

Measurement memory .....
Up to 1000 measurements values can be stored in EEPROM in one burst, or up to 128 burst of one measurement. Bursts are tagged with an item number, and can be identified with a label. Data processing program allows to:
- display contents of a burst
- convert stored data into 4/20 mA or 0/10 V signals to be sent to a device fitted with analogue input
- download stored data onto a computer or printer via RS232 interface
Memory can be on request erased partially or totally.

Programmable recorder analogue output .....
An analogue output proportioned to any of the input ranges being measured is available on the rear terminals.
The output is 0-2.5 Vdc and is suitable for monitoring displayed values on a chart recorder.

Printer output .....
This digital output is available on RS232 interface to send displayed values onto a peripheral printer.

Output

Emission values memory .....
Up to 100 different emission-simulation values can be stored in memory, even on different ranges. These values can be entered by keyboard or via the RS232 link by a computer.
Each value can be sent one by one by keyboard, or using internal «synthesiser» function which allows automatic output according to operator's requirements.

Step function .....
Emitted value can vary by steps, whose amplitude, direction, and number of iterations are user programmable.

Ramp function .....
This function allows the emitted signal to vary between various programmable values, at programmable time intervals.
Ramps can be:
- simple (increasing or decreasing)
- cyclic.

Synthesiser function.....
This function allows to recall manually or automatically all or a part of memorised emission values. The generated signal varies according to memorised data, time interval between two consecutive values being programmable.

Scaling.....
This function allows to display a value A, and to obtain on terminals an output value S different from A but linked with relation S = f(A).
Two possibilities:
- A and S are related by a linear relation, with programmable slope (a) and offset (b). In that case the relation between displayed and emitted values is
S = aA + b.
- The relation between A and S is not linear. In that case the relation can be approached by segments. In the same way as for measurements, 9 sets of values can be programmed to linearise output signal from displayed value.

Transmitter function.....
The PJ6301's ability to measure and generate simultaneously is extremely useful in transmitter loop applications.
The measured signal can be linearised and converted to a 4-20 mA or 0-10 V signal available on the output terminals. The PJ6301 then reacts exactly as a programmable transmitter and interfaces sensor to process control or monitoring system.

Digital communications.....
RS 232 and IEEE 488-2 interfaces are designed for total control of instrument by external computer.

general specifications

Display.....
Graphical back-lit LCD display, with on-line menu and two separated areas for generation and measurement operation. 600000 counts + clear units + icons + messages.

Common mode voltage.....
Max. 250 V between earth and terminals.

Operating conditions.....
Reference temperature: 23 ± 1°C. Reference relative humidity (RH) 45 to 75%. Nominal operating temperature and humidity: 0 to + 50°C, 20 to 75% RH. Maximum operating temperature and humidity: - 10 to + 55°C, 10 to 80% RH.

Power supply.....
Mains 110 to 240 VAC, 50 to 400 Hz. Optional battery with internal charger.

Presentation.....
Bench-top ABS plastic case with rack and panel mount adapters.
Dimensions: 225 x 88 x 310 mm
Weight: 2 to 3 kg according to hardware configuration.

Standards.....
For thermocouples type K, T, J, E, R, S, B: DIN-CEI 584-1 (NFC 42-321)
For thermocouple type L: DIN 43710
For RTD type Pt100: DIN-CEI 751 (NFC 42-330)
For RTD type Ni100: DIN 43760.

Traceability.....
AOIP owning in EVRY (France) a metrological laboratory accredited by French national bureau of Metrology (COFRAC) under number 2-1524 in Electricity and Magnetism and number 2-1525 in Temperature, PJ6301 is traceable to national and international standards. It is delivered with checking report available for ISO 9000. On request, it can be delivered with full calibration certificate.

sensors

Various sensors are available from our catalogue and can be delivered as options including traceable temperature probes and process sensors.

ordering instructions

Tester-calibrator	PJ 6301-3
Tester-calibrator + battery	PJ 6301-4

Accessories .....

Soft carrying case	AN 6901
RS 232 lead 9/25 female	AN 5874
RS 232 lead 9/9 male	AN 5875
RS 232 lead 9/25 male	AN 5876
IEEE 488 lead	AN 5836
Panel mounting kit	AN 5883
Rack mounting kit	AN 5884
Calibration certificate	On request
Processing software	On request
Sensors	On request

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