IPAQ®-2 / IPAQ®-2X

Intelligent, Switch and Software Configurable 2-wire DIN Rail Transmitters

IPAQ-2 is a universal and intelligent 2-wire DIN rail transmitter for temperature and other measurement applications.

Calibrated from factory, IPAQ-2 is ready for configuration, either by the IPRO 4 software or by means of external switches.

With the switches, 55 combinations of input type and range can be chosen in seconds.

IPAQ-2X is the Intrinsic Safe version. Without need for I.S. power supply, IPAQ-2X contributes to cost-effective Ex-applications.

The Windows based and user friendly software, IPRO 4, is used for transmitter configuration, documentation, monitoring and calibration purposes.



Rear side of the transmitter with rotary switches for quick range selection.

Performance and design:

Cost saving Intrinsically Safe installations
- *Standard 13-36 VDC supply, e.g. from PLC or DCS. No extra costs for I.S. power supply.*

Excellent stability
- *Long-term stability 0.1 %/year.*

Enhanced total system accuracy
- *Sensor error correction (for known sensor errors).*
- *System error correction (against known temperatures).*

Input-Output isolation 1500 VAC
- *Eliminates measuring errors due to ground loops.*

Designed for harsh conditions
- *Excellent EMC performance (metal shielded).*

Simple mounting
- *Plug-in terminals*
- *Quick mounting on DIN rail.*

5 year limited warranty

Functions:

Total programming flexibility
- *PC programming with IPRO 4, or…*
- *Switch programming with 55 pre-calibrated ranges.*

Input for RTDs, T/Cs, mV, mA and resistance
- *Reduced inventory costs.*
- *Simplified plant engineering.*

True on-line communication
- *Full access to all features while in operation.*

Sensor diagnostics
- *SmartSense detects low sensor isolation (essential for correct measurements).*
- *Selectable sensor break action.*

Simplified loop check-up
- *The transmitter works as an accurate current generator.*

On-screen indications and line recording
- *Valuable tools for temporary measurements.*

Main features of IPAQ-2 and IPAQ-2X

Accuracy and stability

IPAQ-2/IPAQ-2X are designed for applications with standard industrial demands on accuracy. To reach these demands, the following factors are essential:

Linearity and calibration errors -The use of quality components and precision calibration equipment reduce these errors, e.g. ±0.1 % of span for RTD inputs.

High long-term stability -Internal "self calibration", by means of continuos adjustment of important parameters after comparison with accurate built-in references, contributes to a stability of ±0.1 %/year.

Measurements with RTDs and other resistances

IPAQ-2/IPAQ-2X accept inputs from standardized Platinum and Nickel RTDs like Pt10…Pt1000 acc. to IEC 751 (α=0.00385), Pt100 acc. to JIS 1604 (α=0.003916) and Ni100/Ni1000 acc. to DIN 43760, as well as inputs from plain resistance sensors such as potentiometers.
3- or 4-wire connection can be chosen.

Measurements with thermocouples voltage and current

IPAQ-2/IPAQ-2X accept inputs from 11 types of standardized thermocouples as well as plain mV and mA input.

For T/C input, the CJC (cold junction compensation) is fully automatic, by means of an accurate measurement of the terminal temperature. Alternatively, the CJC can be disabled.

Customized linearization and Engineering units

The *Customized linearization* can be used to create a linearization curve for RTD, T/C, resistance, voltage and current inputs. By combining *Customized linearization* with the use of *Engineering units*, the transmitters can be programmed to give a linear output corresponding to a specific measuring range expressed in the primary process value. The sensor characteristics are described by a maximum of 9 data pairs. *Fig. 1a and 1b.*

Fig.1a

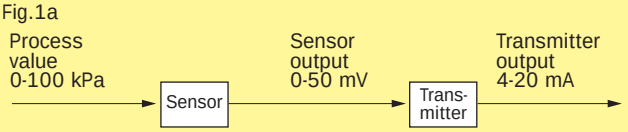
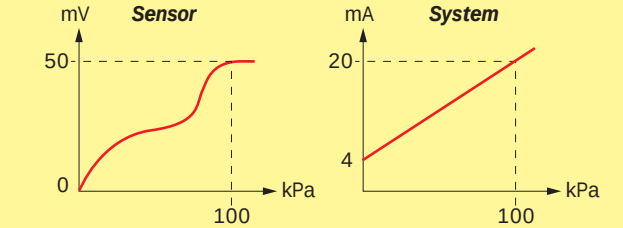


Fig.1b



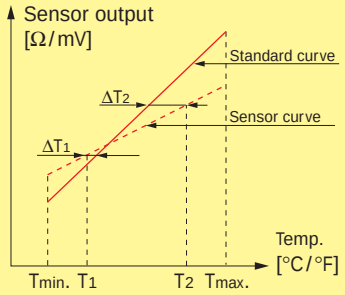
Exemple of a system (sensor + transmitter) with an output linear to the process value, in spite of a non-linear sensor.

Sensor or System error correction

IPAQ-2/IPAQ-2X offer two ways of improving the measurement with temperature sensors:

Sensor error correction - Known sensor errors compared to the standard curve, e.g. for a calibrated sensor, are entered, and the transmitter automatically corrects for the sensor errors. *Fig. 2.*

Fig.2 ***Sensor*** *error correction*



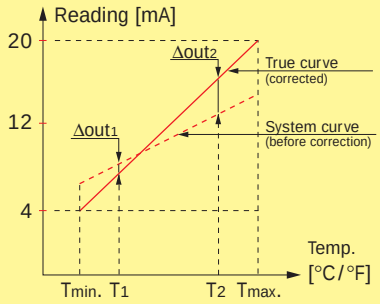
Tmin and Tmax= End values of the measuring range.

ΔT1 and ΔT2=Deviations from Standard curve at T1 and T2.

The transmitter compensates for the deviations and transforms the Sensor curve to a Standard curve

System error correction -This method is used to correct the system error (sensor + transmitter error) by exposing the sensor to one (one-point correction) or two (two-point correction) accurately measured temperatures (true temperatures).The true temperature(s) are entered, and the transmitter automatically corrects for the system errors. *Fig. 3.*

Fig.3 *Two-point* ***System*** *error correction*



Tmin and Tmax= End values of the measuring range.

Δout1 and Δout2= Deviations from True curve at T1 and T2.

The transmitter compensates for the deviations and transforms the System curve to a True curve

SmartSense - Sensor isolation monitoring

SmartSense continuously monitors the isolation resistance of thermocouples and 3-wire connected RTDs as well as the cabling between sensor and transmitter. The transmitter will react by forcing the output to a user defined level if the isolation is too low. SmartSense requires an extra lead inside the thermocouple or RTD. *Fig. 4.*

For detailed information, see section Theory and Facts.

Sensor break monitoring

IPAQ-2/IPAQ-2X monitor sensor break and force the output signal to a user defined level, when *any* sensor lead is broken or disconnected. The sensor break monitoring can be switched off. The monitoring is furnished with a *pulsed excitation current*. This eliminates the voltage drop in the lead wires (giving a measuring error), caused by a standard DC excitation current.

Controlled output for instrument calibration

IPAQ-2/IPAQ-2X can be set to automatically provide a recurring output current regardless of the input signal.
The total time for the controlled output is adjustable up to 30 minutes.

Dampening

The dampening function can be used to dampen undesired instabilities on the input signal.The dampening time is approximately 2 seconds. The dampening time is the time required, in addition to the update time, for the output to reach 90% of its final value after a step change has been applied to the input.

Power supply

IPAQ-2/IPAQ-2X are loop-powered and will work on voltages down to 12 VDC (13 VDC for IPAQ-2X).
Reversed polarity will not damage the transmitter. *Fig. 5*

Mounting

IPAQ-2/IPAQ-2X are designed to fit on a standard 35 mm rail according to DIN EN 50022.

Switch selectable ranges

55 different ranges can be selected with the rotary switches on the rear side of the transmitters.
The transmitters are accurately calibrated from factory and no further calibration is needed after selecting a range.
The pre-calibrated ranges include:
15 ranges for Pt100, 3- and 4-wire connection
5 ranges for Pt1000, 3- and 4-wire connection
4 ranges for Pt100, differential temperature
2 ranges for potetiometer
9 ranges for thermocouples

For detailed information about the ranges, please consult Inor or your distributor.

Warranty

IPAQ-2/IPAQ-2X are covered by a 5 year limited warranty.

IPRO 4 - The user friendly software for all transmitters of the IPAQ family

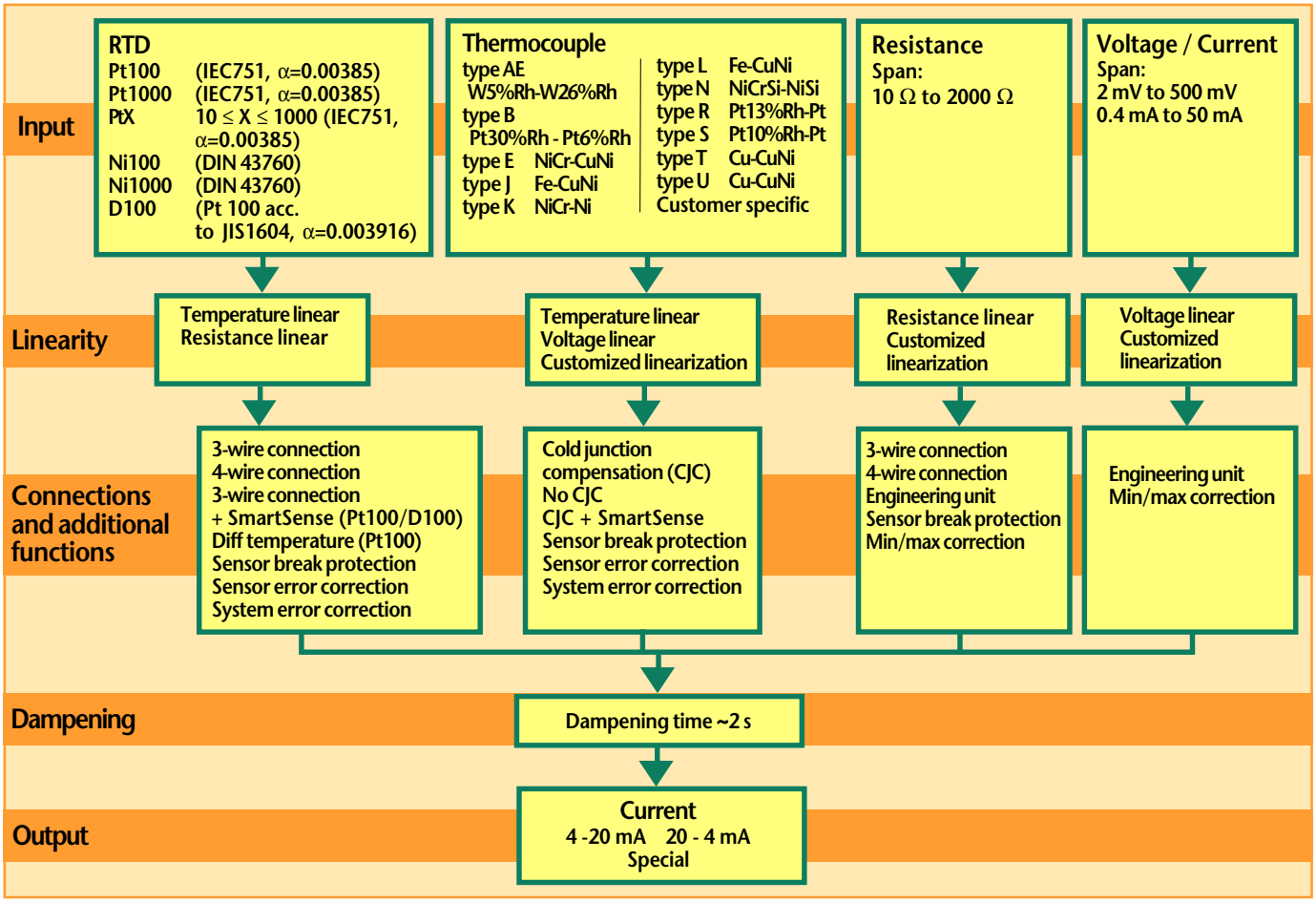
IPRO 4, which is used with all IPAQ-transmitters, is the tool to utilize all the versatile functions of the IPAQ-2/IPAQ-2X such as:

- Measurement configuration: Sensor type, range, sensor or system error correction, linearization, engineering units, output settings, filter activation, etc.
- Monitoring of sensor status: Sensor break and sensor isolation (SmartSense).
- On-screen real time presentation of measured values and output signal in the form of numericals, meters, bar graphs and line recorder.
- Transmitter calibration: Field calibration in one or two points and basic calibration.
- Documentation: Configuration files can be saved for future use and configuration protocols can easily be printed.

The communication with the transmitter can be performed on line, i.e. with transmitter in operation. An isolated and Ex-approved communication cable is included in the software kit, IPRO-X.

IPRO 4 is compatible with Windows 3.1, Windows 3.11, Windows 95 and Windows NT Workstation 4.0. The program is menu-driven and easy to learn. On-line help is an effective tool for the user.

IPAQ-2/IPAQ-2X Configuration scheme



Specifications

Input		
RTD's and Resistance		
Pt100 (IEC751, α=0.00385)	3-, 4-wire connection	-200 to +1000 °C / -328 to +1832 °F
Pt1000 (IEC751, α=0.00385)	3-, 4-wire connection	-200 to +200 °C/ -328 to +392 °F
PtX 10 ≤ X ≤ 1000 (IEC751, α=0.00385)	3-, 4-wire connection	Upper range depending on X-value
Ni100 (DIN 43760)	3-, 4-wire connection	-60 to +250 °C / -76 to +482 °F
Ni1000 (DIN 43760)	3-, 4-wire connection	-60 to +150 °C / -76 to +302 °F
D100 (Pt 100 acc.to JIS1604, α=0.003916)	3-, 4-wire connection	-200 to +1000 °C / -328 to +1832 °F
Potentiometer/resistance	3-, 4-wire connection	0 to 2000 Ω
Sensor current		~ 0.4 mA
Maximum sensor wire resistance		25 Ω/wire
Thermocouples, Voltage and Current		
T/C	Type: AE, B, E, J, K, L, N, R, S, T, U	Ranges according to users manual
Voltage		-10 to +500 mV
Current		-1 to +50 mA
Input impedance	T/C, Voltage	>10 MΩ
	Current	10 Ω[1)]
Maximum sensor wire resistance	T/C, Voltage	500 Ω (total loop)
Monitoring/Alarm		
Sensor break monitoring	User definable output	3.6 to 21.6 mA
	Alarm on LED (front)	Single flash
SmartSense, sensor isolation monitoring	User definable output	3.6 to 21.6 mA
	Alarm on LED (front)	Double flash
Adjustments		
Zero adjustment	All inputs	Any value within range limits
Minimum spans	Pt100, Pt1000, Ni100, Ni1000	10 °C / 18 °F
	Potentiometer	10 Ω
	T/C, Voltage	2 mV
	Current	0.4 mA
Output		
Straight,reversed or any intermediate value		4-20/20-4 mA
Resolution		5 µA
Minimum output signal		~3 mA
Maximum output signal		~22 mA
Permissible load, *see fig.6*	IPAQ-2	545 Ω @ 24 VDC, 22 mA
	IPAQ-2X	500 Ω @ 24 VDC, 22 mA
Temperature		
Ambient, storage		-20 to +70 °C / -4 to +158 °F
Ambient, operation		-20 to +70 °C / -4 to +158 °F
General data		
Selectable dampening time		~ 2 s
Update time		~ 0.5 s
Isolation In - Out	Isolated version	1500 VAC, 1 min
Humidity (non-condensing)		0 to 95% RH
Intrinsic safety	IPAQ-2X, Cenelec	[EEx ia] IIC
	FM	Approval pending
Power supply, polarity protected		
Supply voltage	IPAQ-2	12 to 36 VDC 2-wire
	IPAQ-2X	13 to 36 VDC 2-wire
Permissible ripple		4 V p-p @ 50/60 Hz

[1)] With power supply connected. Without power supply there is a voltage drop of 5 VDC over the input.

Accuracy		
Linearity	RTD Potentiometer, mV, mA	±0.1 % [1]
	T/C	±0.2 % [1]
Calibration	RTD	Max. of ±0.1 °C / ±0.2 °F or ±0.05 % [1]
	Potentiometer	Max. of ±0.05 Ω or ±0.05 % [1]
	mV, T/C	Max. of ±20 µV or ±0.05 % [1]
	mA	Max. of ±4 µA or ±0.05 % [1]
Cold Junction Compensation (CJC)	T/C	±0.5 °C / ±0.9 °F
Temperature influence [4]	All inputs	Max. of ±0.125 °C/25 °C or ±0.125%/25 °C [1] [3]
		Max. of ±0.25 °F/50 °F or ±0.14 %/50 °F [1] [3]
Temperature influence CJC [4]	T/C	±0.5 °C/25 °C / ±1.0 °F/50 °F
Instrument calibration output	4-20 mA	±8 µA
Sensor wire resistance influence	RTD, Potentiometer, 3-wire	Negligible [2]
	RTD, Potentiometer, 4-wire	Negligible
	mV, T/C, mA	Negligible
Load influence		Negligible
Power supply influence		Negligible
RFI influence, 0.15-1000 MHz, 10 V or V/m		±0.1% [1] (typical)
Long-term stability		±0.1 % [1] /year
Housing		
Material / Flammability (UL)		ABS/HB
Mounting		Rail acc. to DIN EN 50022, 35 mm
Connection	Single/stranded wires	≤2.5 mm², AWG 14, Plug-in terminals
Weight		125 g
Protection, housing / terminals		IP 20 / IP 00

[1] Of input span

[2] With equal wire resistance

[3] If zero-deflection > 100% of input span: add 0.125% of input span/25 °C or 0.14% of input span/50 °F per 100% zero-deflection

[4] Reference temperature 23 °C/73°F

The User Instructions must be read prior to adjustment and/or installation.

Intrinsic Safety specifications

Specifications	IPAQ-2X	IPAQ-2X
Approval	Demko / Cenelec	Factory Mutual (FM)
Classification	[EEx ia] IIC [5] Intrinsic Safety on	IS Connections to Class I-III,
	input circuit only	Div. 1, Group A-G
Certificate No.	96D.118141X	Approval pending
Output/Supply		
Max voltage to transmitter	Ui = 36 VDC	
Max voltage in power circuit	Um = 250 VAC/300 VDC [6]	
Input (Sensor)		
Max voltage from transmitter	Uo = 14.6 VDC	
Max current from transmitter	Io = 20 mA	
Max power from transmitter	Not specified	
Max inductance (input loop)	Lo = 80 mH	
Max capacitance (input loop)	Co = 600 nF	

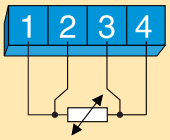
[5] The equipment must be placed outside the hazardous area.

[6] The supply voltage for other kinds of equipment, which are connected to the same circuit, must not exceed Um=250 VAC/300 VDC

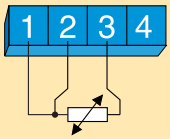
INPUTS

RTD

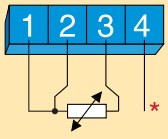
Pt100, Pt1000, Ni100, Ni1000, PtX, D100
4-wire connection



Pt100, Pt1000, Ni100, Ni1000, PtX, D100
3-wire connection

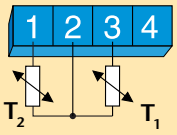


Pt100, D100
3-wire connection



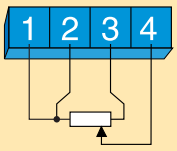
*SmartSense lead

Pt100
Diff temperature $T_1 > T_2$

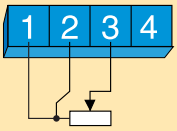


Potentiometer

4-wire connection

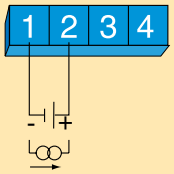


3-wire connection



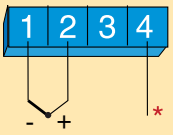
Voltage/Current

mV / mA



Thermocouple

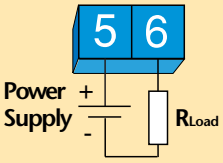
AE,B,E,J,K,L,N,R,S,T,U
or customer specific



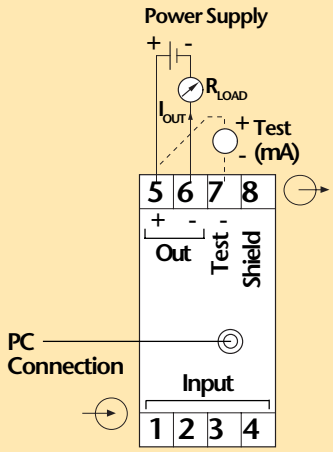
*SmartSense lead

OUTPUT

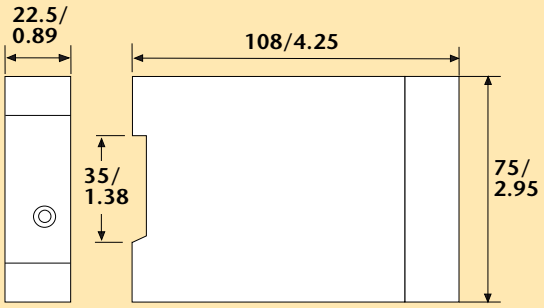
4-20 mA Output



Connections



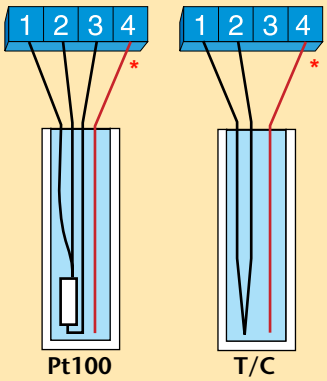
Dimensions



mm/inches

SmartSense

Fig.4

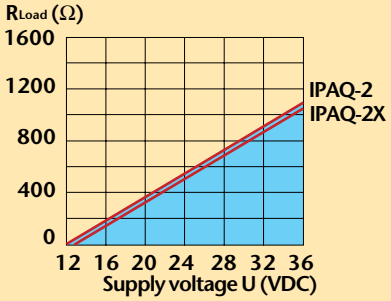


* SmartSense lead

Output load diagram

Fig.5

Permissible R_{Load} at 22 mA output



$R_{Load}=(U-12)/0.022$ (IPAQ-2)
$R_{Load}=(U-13)/0.022$ (IPAQ-2X)

Ordering table

Item	Part No.
Transmitter	
IPAQ-2	70IPQ00001
IPAQ-2X (Cenelec)	70IPQX0001
IPAQ-2X (FM)	70IPQX1001
Options	
Configuration	70CAL00001
Configuration with 5-point calibration certificate	70CAL00051
Software and cable	
IPRO-X (IPRO with cable)	70IPRX0001
Software IPRO upgrade	70IPRS0001

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