MATERIAL AND EQUIPMENT STANDARD

FOR

RECEIVING INSTRUMENTS

FIRST EDITION

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1. SCOPE

This Standard covers the general specifications required for the receiving instruments, such as controllers, recorders, indicators, integrators, etc., both pneumatic and electronic. It is intended to be used in oil, gas, and petrochemical industries.

Note: This is a revised version of the standard specification for receiving instruments, which is issued as revision (1). Revision (0) of the said standard specification is withdrawn.

2. REFERENCES

Throughout this Standard the following dated and undated standards/codes are referred to. These referenced documents shall, to the extent specified herein, form a part of this standard. For dated references, the edition cited applies. The applicability of changes in dated references that occur after the cited date shall be mutually agreed upon by the Company and the Vendor. For undated references, the latest edition of the referenced documents (including any supplements and amendments) applies.

ASME (AMERICAN SOCIETY OF MECHANICAL ENGINEERS)

B1.20.1	"Pipe Threads (Except Dry Seal)"
B 40.100	"Gages: Pressure and Indicating Dial Type Elastic Element"

BSI (BRITISH STANDARDS INSTITUTION)

BS EN 837-1	"Bourdon Tube Pressure and Vacuum Gages"
BS 1794	"Chart Ranges for Temperature Recording Instruments"
BS 3693	"Design of Scales and Indices on Analogue Indicating Instruments"

DIN (DEUTSCHES INSTITUTE FÜR NORMUNG)

43 718	"Measurement and Control, and Front Panels of Measurement and Control Equipment Principal Dimensions"

IEC (INTERNATIONAL ELECTROTECHNICAL COMMISSION)

IEC 60297-1	"Dimensions of Mechanical Structures of the 482.6 mm (19 in) Series Part 1, Panel and Racks"
Part 1:	Panels and Racks 3rd Edition-1986
IEC 60529	"Degrees of Protection Provided by Enclosures (IP Code)"-2001

IPS (IRANIAN PETROLEUM STANDARDS)

IPS-I-IN-100	"General Instrument Systems"
IPS-M-IN-120	"Material Standard for Temperature Instruments"

3. UNITS

This Standard is based on International System of Units (SI), except where otherwise specified.

4. CONTROLLERS AND CONTROL MODES

4.1 Receiver/controllers shall have a graduated set point which is accurate within ±0.5% of the scale range.

4.2 The control algorithm e.g. PI, PID, etc. shall be appropriate to the application.

4.3 Controllers shall have an adjustable proportional action which should include the range of 1% and 500% of span.

4.4 When adjustable integral action time is provided, the adjustment shall include times from 0.01 to 50 minutes per repeat.

4.5 Integral action desaturation shall be provided, if required.

4.6 When derivative action is provided, the adjustment shall include, times from 0.01 to 50 minutes.

4.7 All controllers, shall include an automatic-to-manual transfer facility accessible from the front of the instrument. This transfer should not upset the process.

4.8 Controllers shall have provision for the use of manual control facility to enable the controlling instrument to be removed without interrupting control of the process. The system shall be such that an indication of the process variable is available at all times.

4.9 When deviation type controllers are used on cascade service, the set-points of the controllers shall be continuously indicated .

4.10 On level/flow control cascade applications, the level controller shall feature proportional action adjustment in accordance with Clause 4.3, together with integral time adjustable up to 50 minutes and integral desaturation, where the tank level sets the incoming flow line.

4.11 The control action of instruments shall be reversible without use of additional parts or special tools.

4.12 The controller output shall be continuously indicated.

4.13 Electronic controllers shall be of the "plug in" type. Reset and derivative functions shall have an "off" facility.

4.14 Pneumatic controllers shall be of the force balance type. Board controllers shall be of "plug-in" type integrally mounted to board instrumentation through a manifold. Field mounted controllers shall be of the force balance type, have subpanel with transfer switch and be weatherproof. Manifolds shall be provided, if necessary, so the controller can be removed for servicing without additional equipment or shut-off cocks while on manual control from the board. All controllers shall be provided with a 0-2 barg output air gage. In addition, field mounted controllers shall be supplied with a standard air filter-regulator set and 0-2 barg supply air gage.

4.15 Field controllers and their manifolds shall be rigidly mounted at a minimum distance from control valves.

4.16 One or more of the following control functions shall be specified for each controller. Values are approximate.

a) Narrow proportional = Adjustable 1-50%.

b) Normal proportional = Adjustable 1-150%.

c) Wide proportional = Adjustable 10-500%.

d) Fast reset = Adjustable 0.1-100 repeats per minute.

e) Slow reset = Adjustable 0.05-10 repeats per minute.

f) Derivative = Adjustable 0.01-50 repeats per minute.

4.17 Temperature controllers shall be furnished with adjustable Proportional, Reset and Rate action.

4.18 All flow controllers shall be furnished with adjustable proportional and fast reset action.

4.19 Level controllers shall be furnished with adjustable proportional and reset action.

4.20 Pressure controllers shall be furnished with adjustable proportional and reset control action.

4.21 Controllers used for intermittent services such as anti-surge or minimum flow by-passes, shall have adjustable proportional control action only.

4.22 Panel mounted controllers shall be standard miniature type (nominal 72 × 144 mm) to DIN 43718. The controller shall have a scaled set point with a clearly identified off-normal display.

4.23 Pneumatic instrument system shall employ 0.2-1 barg transmission and control range.

4.24 Electronic instrument system shall employ 4-20 mA d.c. for transmission and control range. The output load resistance shall be at least 0-600 ohms.

4.25 Cascade controls shall be provided with a control index mechanism capable of setting the control point over the entire scale. Adjustable limit stops shall be provided where desirable. The control point shall also be adjustable over the entire range by means of the manually set control point index. Bias stations shall be used wherever one controller sets more than one secondary control loop.

4.26 It is permissible to record more than one variable on the same chart, but as far as possible the use of linear and square root traces on the same chart shall be avoided. Every effort shall be made to standardize charts for various services wherever practicable.

4.27 Name plates shall be fitted by manufacturer, on front and rear of the instrument.

4.28 Micro processor-based controllers, shall perform traditional PID control, with automatic self-tuning, based on the actual and current process variables, in addition to achieving some calculation and computation functions, such as adding, subtracting, biasing, square, square root, logic gates, etc. They shall accept analog and digital signals. They may be equipped with computer compatible ports.

5. SCALES

5.1 Scales should be in accordance with the readability requirements of BS. 3693, "The Design of Scales and Indexes on Analogue Indicating Instruments".

5.2 With the exception of process levels and flows, scales shall be marked clearly, with the unit of quantity indicated, and graduated in those units.

5.3 Flow rates shall be expressed 0-10 square root or 0-100 linear scale. In all such cases the appropriate multiplying factor shall be displayed.

5.4 When selecting ranges for temperature and pressure instruments, preference should be given to the ranges given in:

BS 1794	"Chart Ranges for Temperature Recording Instruments"
BS EN 837-1-10	"Bourdon Tube Pressure and Vacuum Gages"

6. INSTRUMENT CHARTS

6.1 General Requirements

6.1.1 An initial supply of charts shall be provided for two years of continuous operation.

6.1.2 All charts must revolve in a direction which leaves the trace immediately visible.

6.1.3 Charts shall be calibrated as follows:

Vacuum in mbar

Pressure in bar

Temperature in degree Celsius

Flow in 0-10 square root, or 0-100 linear

Level in Percentage level 0-100

(Double range instruments shall be provided with dual scale range charts.)

6.1.4 Circular charts shall revolve once in each 24 hour period unless specifically stated otherwise. Circular charts will normally be no less than 250 mm in diameter.

6.1.5 300 mm strip charts for temperature recorders shall normally advance 50 mm per hour.

6.1.6 Strip charts for miniature instruments shall advance 20-25 mm per hour. Strip charts for miniature instruments shall be 100 mm scale span.

6.1.7 All charts shall be manufactured from special paper not subject to excessive expansion and contraction due to atmospheric temperature and moisture variations. The instrument manufacturer shall supply a chart meeting these requirements.

6.1.8 No more than 3 traces are permitted on 100 mm span charts. In case of multi trace it is preferable to have the flow trace with red and pressure trace with blue inks.

6.1.9 Recorded accuracy shall be ±0.5% of the scale range or better.

6.1.10 If combination charts are used, scaled in two different units, the different variables shall be shown with graduations on alternate periods.

6.2 Recording Facilities

6.2.1 The number of records shall be kept to a minimum, consistent with effective operation of the plant, and shall be agreed with the user.

6.2.2 Multiple trend recorders should be provided in the ratio of one pen to three variables, and shall always be located on the same horizontal level as their associated instruments. Means of selection should be adjacent to the recorder.

6.2.3 Where continuous record is required, no more than three variables shall be recorded on one chart.

7. INSTRUMENTS IN THE AUXILIARY ROOM

When applicable ancillary instruments in the auxiliary room, such as signal converters, switch/trip amplifiers, high or low signal selectors shall be of modular design and be suitable for mounting in standard 483 mm (19 in.) racks IEC 60297.1.

Where conversion of electric signals (other than 4 to 20 mA) to pneumatic signals is required, these signals shall be first converted to 4 to 20 mA. All converters from 4 to 20 mA to pneumatic signals shall be of the same make and type.

8. TYPICAL SPECIFICATIONS FOR RECEIVING INSTRUMENTS

8.1 Pneumatic Indicators (Receiving Gages)

Standard Features

Standard	Shall be in accordance with BS EN 837-1-10 or ASME. B 40.100
Dial Size	Nominal diameter 100 mm.
Dial Materials	Double anodized aluminum.
Dial Color	White with black graduations.
Scale Range	0-10 sq. root. or 0-100 linear.
Tube Range	0.2-1 barg (marking on dial).
Pressure Element	Bourdon tube.
Element Material	Element and socket 316 stainless steel, unless otherwise specified.
Casing	Alumalife, or cast Iron complete with Neoprene blow out disc, suitable for operation in a humid saliferous, sulphurous atmosphere, weatherproof and dustproof.
Mounting	Panel mounted, or surface.
Bezel Ring	Steel ring held at top by hinge pin, at bottom by clamp screw. or screw on, die cast aluminum with blind holes or face to suit pin spanner to facilitate removal and tightening.
Window	Plate glass (shatterproof) or toughened.
Retaining Ring	Metal.
Pointer	Balanced type, non ferrous material, black finish to have micrometer adjustment form front of the case.
Movement	Material 316 stainless steel (Nylon gears and bushings are not acceptable).
Connection	Back connection screwed ¼ in. Male to be provided with hexagon wrench flats. Height of wrench flats to be not less than ½ in.
Ancillaries	Mounting studs, nuts and washers required.

Note: Mounting studs, nuts and washers shall be supplied with each gage.

8.2 Pneumatic Indicating, Miniature

Standard	Shall be in accordance with BS 1780, Part 2
Dimensions	Shall be standard miniature type (nominal 72 × 144 mm) to DIN 43718.
Scale Color	White with black graduations.
Scale Range	0-10 Sq. root, or 0-100 linear.
Measuring Element	Bellows.
Element Range	0.2 -1 barg.
Element Material	316 stainless steel, unless otherwise specified.
Casing	Alumalife, or cast iron.
Mounting	Panel mounted, or surface.
Window	Plate glass (shatterproof) or toughened.
Pointer	Balanced type, nonferrous material, black finish.
Connection	Back connection, screwed ¼ in., to be provided with hexagon wrench flats. Height of wrench flats to be not less than ½ in.

8.3 Pneumatic Recording, Miniature

Standard Features

General	Flush mounted rectangular case with mounting fixtures of manufacturers standard finish. Indicating scales to have black numbers on white background. Individual nameplates to be supplied to read correctly when case door is either open or closed. Adjustable restriction is required in each separate input signal circuit for pulsation dampening.
Actuating Element	Bronze bellows (Phosphor Bronze and Neoprene).
Input Signal	Process variable 0.2 -1 barg.
Connection	Pneumatic, screwed ¼ in. female. electric, screwed M20 × 1.5 conduit entry.
Case	Sheet metal; dust tight housing.
Chart	100 mm strip roll with standard reroll, or scanfold.
Scale Range	0-10 square root, or 0-100 linear.
Chart Speed	20 mm per hour.
Chart Drive	Electrical, 24 Volt A.C. 50 Hz, unless otherwise specified.

Pen Type	Disposable fiber-tip pen.

Optional Features

Extra	Two or three pen recording.

8.4 Pneumatic Controllers Indicating, Miniature Standard Features

General	Rectangular, flush mounted and panel housed. completely self contained with measurement and set point scales, set point adjustment, auto-manual transfer switch, output pressure indicator and manual adjustment located on front of instrument.
Air Supply	1.4 barg.
Element	Bronze bellows (Phosphor Bronze and Neoprene).
Connections	Element ¼ in. ASME B1.20.1 NPT. female. Supply and output ¼ in. ASME B1.20.1 NPT. female. Adaptor to be supplied if ¼ in is not available.
Housing	All steel housing and trim.
Indicating Scale	100 mm vertical scale. Black figures on white background.
Scale Range	0-10 square root, or 0-100 linear.
Control Mode	Proportional + Integral.
Proportional Band Range	1-500%.
Control Signal	0.2-1 barg.
Integral Action	0.01 to 50 minutes/repeat.
Control Action	Increasing process variable increases output, reversible.
Set Point Signal	0.2-1 barg.
Set Point Adjustment	Manually to position set point.

Optional Features

Alarm Switch	Alarm switches (max. of two PV or deviation snap acting SPDT Switches) adjustable over 0.2-1 barg range. Contact rating 7AMP (non-inductive) at 250 Volts a.c., or 30 Volts. d.c.
Signal Lights	Signal lights clear, red or green (two max.) for 24 Volt d.c. operation process nameplate. Two rows of 15 characters max.
Model Variations	Cascade unit with Integral control unit.
	Cascade unit for operating external controller.
	Automatic station for operating external controller.

	Remote controller.
Control Mode	For level instrument-Proportional only. For temperature instrument-Proportional + Integral + Derivative.
Derivative Action	0.01-50 minutes/repeat.

8.5 Pneumatic Controllers, Recording, Miniature

Standard Features

General	Flush mounted rectangular case with mounting fixture of manufacturers' standard finish. Indicating scales to have black numbers on white background. Individual nameplates to be supplied to read correctly when case door is either open or closed. Adjustable restriction is required in each separate input signal circuit for pulsation dampening.
Actuating Element	Bronze bellows.
Connection	Pneumatic screwed ¼ in. ASME B1.20.1 NPT. Electric, screwed M20×1.5 conduit entry.
Case	Sheet metal; dust tight housing.
Chart	100 mm strip roll with standard reroll, or scaffold.
Scale Range	0-10 square root, or 0-100 linear.
Chart Speed	20 mm per hour.
Chart Drive	Electrical, 24 Volts a.c. 50 Hz, unless otherwise specified.
Pen Type	Disposable fiber-tip pen.
Indicating Scale	Dual upper scale, horizontal 100 mm effective length, black figures on white background. Top scale, output signal. Bottom scale primary range.
Control Mode	Proportional + Integral.
Proportional Band Range	1-500%.
Input Signal	Process variable 0.2-1 barg.
Control Signal	0.2-1 barg .
Integral Action	0.01 to 50 minutes/repeat.
Control Action	Increasing process variable increases output, reversible.
Set Point Signal	0.2-1 barg.
Set Point Adjustment	Position pointer, manually to position set point to controller. Integrally mounted.

Controller Location	At instrument and integrally mounted.
Auto-Manual Switch	Internal.

Optional Features

Controller and Recorder Combination	Two records and one control.
Chart Drive	Pneumatic chart drive. Impulse from a master electro-pneumatic pulser.
Controller Location	Field mounted, complete with manifold.
Control Mode	For temperature instrument. Proportional + Integral +Derivative.
Derivative Action	0.01 to 50 minutes/repeat.
Scale Ranges	0-100 linear for level instruments, and for pressure instruments according to pressure transmitters. For temperature instruments scale range is same as temperature transmitters.

8.6 Pneumatic Integrator

Standard Features

General	Force balance type capable of receiving input signal of 0.2-1 barg proportional to square of flow rate. Automatically extracts square root function. Continuously rotating air driven turbine varying its speed in proportion to square root of input air signal. Actuates counter in proportion to flow. Automatically provides running total of flow.
Body	Weatherproof, cast aluminum, gasket cover.
Mounting	Integrator mechanism and six digit counter are integrally mounted. Unit installed on panel.
Air Supply	1.4 barg.
Connections	¼ in. ASME B1.20.1 NPT.
Integral Brake Assembly	Eliminates counters errors due to "coasting" on batching operations and widely fluctuating flows.

8.7 Pneumatic Controllers, Recording, Local Mounting (with Receiver Element)

Standard Features

General	Control unit and recorder shall be mounted in rectangular case, pneumatic receiver type instrument actuated by air signal of 0.2-1 barg from pneumatic transmitter.
Receiver Element	Bronze bellows.
Accuracy	±0.5% of full scale.

Case	Universal rectangular, Die-Cast aluminum. Dust and weatherproof.
Window	Shatterproof Glass.
Mounting	Yoke for 2 in. pipe support.
Chart	300 mm circular.
Chart Range	0-10 square root, or 0-100 linear.
Chart speed	two speed, 24 hours/7 days per revolution.
Chart Drive	Mechanical 7 day wind.
Pen Type	Disposable fiber-tip pen.
Air Supply	1.4 barg.
Connections	Air ¼ in. ASME B1.20.1 NPT. Process ¼ in. ASME B1.20.1 NPT Control algorithm Proportional + Integral Action.
Proportional Band Range	1-500%.
Integral Action	0.01 to 50 minutes/repeat.
Input Signal	0.2-1 barg.
Output Signal	0.2-1 barg.
Set Point Adjustment	Manually to position set point.
Transfer Switch	4 positions (automatic-manual-test-service).
Control Action	As specified. Increase in process variable, increases/decreases output signal.

Optional Features

Transfer Switch	3 position type (automatic-manual-service), 2 positions type (automatic-manual).
Pen	two or three pens.
Cascade Control	Pneumatic set controller. Set point positioned pneumatically. Full span or adjustable span as specified.
Control Algorithm	For temperature instrument, Proportional + Integral + Derivative Derivative Action: 0.01 to 50 minutes/repeat.

Notes:

1) Type of chart markings, 24 hours or 7 days as specified at time of ordering.

2) Limit stops to be provided on pneumatic set scale, with high and low settings, as specified.

8.8 Pneumatic Recording, Local Mounting

Standard Features

General	Recorder for direct connection to process. Element converts pressure changes to mechanical motion thus positioning pen.
Element	Compound range : -1 barg to 0-1 barg. [bellows 316 ss]. Normal ranges : 0-1 barg to 16 barg [spiral 316 ss]. : 0-16 barg to 400 barg [helical 316 ss].
Accuracy	± 0.5% full scale.
Overrange Protection	manufacturer's standard.
Process Connections	¼ in. ASME B1.20.1 NPT., female.
Mounting	Yoke for 2 in pipe support.
Case	Die-cast aluminum, rectangular, dust and weatherproof.
Window	Shatterproof glass.
Chart	Circular, 300 mm nominal size 0-100 linear.
Scale Range	As specified.
Chart Speed	Two speed. 24 hours/7 days per revolution.
Chart Drive	Mechanical 7 days wind.
Pen Type	Disposable fiber-tip pen.

Optional Features

Pen	Two or three pens.

Notes:

1) Type of chart markings, 24 hours or 7 days, to be specified at time of ordering.

2) When process connections required are not of manufacturer's standard then manufacturer should be requested to supply an adapter to meet user requirements.

8.9 Pneumatic Controllers, Indicating, Local Mounting

Standard Features

General	Control unit and indicator shall be mounted in rectangular case. Instrument shall be direct-connected to process with indicator pointer directly positioned by motion from measuring element. Control unit shall transmit corrective pneumatic 0.2-1 barg signal to final control element.

Element	Compound range: -1 barg to 0-1 barg [bellows 316 SS]. Normal ranges : 0-1 barg to 16 barg [spiral 316 ss]. : 0-16 barg to 400 barg [helical 316 ss].
Accuracy	±0.5% full scale or better.
Overrange Protection	Manufacturer's standard.
Process Connections:	Screwed ¼ in. ASME B1.20.1 NPT. Female for pressures up to 140 barg and ½ in. ASME B1.20.1 NPT. Male for pressures from 140 barg to 400 barg.
Mounting	Yoke for 2 in. pipe support.
Case & Door	Fiberglass reinforced grey polyester molding case. Hinged door in fiberglass reinforced phenyl oxide, with blue polyurethane finish. Enclosure classification NEMA 3 weatherproof.
Window	Clear shatterproof glass. Ultra violet resistant polycarbonate.
Indication	Sector (eccentric) scale. White with black graduations and numerals and red pointer. Effective length 127 mm.
Scale Range	As specified.
Control Algorithm	Proportional + Integral action.
Proportional Band	1-500% of scale range. Adjustable Range.
Set Point Adjustment	Manually to position set-point. Set point is external.
Control Action	Direct: Increase in process variable increases output signal, reversible.
Output Signal	0.2-1 barg.
Air Supply	1.4 barg.
Air Supply Connections:	1.4 in. ASME B1.20.1 NPT. Female.
Transfer Switch	Four position, auto-manual-test-service.
Optional Features	
Control Algorithm	Proportional plus Integral (0.01 to 50 minutes/repeat).
Set Point	Internal.
Set Point Adjustment	Remote pneumatic set point.
Auto/Manual Switching	Internal bump less auto/manual transfer system comprising balanced tube with regulator and 2 position switches.

8.10 Pneumatic Controllers, Recording, Local Mounting (Directly Connected to Process)

Standard Features

General	Control unit and recorder mounted in rectangular case. Instrument direct connected to process with recorder pen directly positioned by motion from measuring elements. Control unit to transmit corrective pneumatic 0.2-1 barg signal to final control element.
Element	Compound range : -1 barg to 0-1 barg. [Bellows 316 ss]. Normal ranges : 0-1 barg to 16 barg [spiral 316 ss]. : 0-16 barg to 400 barg [helical 316 ss].
Accuracy	±0.5% of full scale, or better.
Overrange Protection	Manufacturer's standard or as specified.
Process Connections:	Screwed ¼ in. ASME B1.20.1 NPT. Female for pressures upto 0-140 barg and ½ in. ASME B1.20.1 NPT Male for pressures from 0-140 to 0-400 barg. Mounting Yoke for 2 in. pipe support.
Case	Die-cast aluminum. Dust and weatherproof, unless otherwise specified.
Window	Shatterproof glass.
Chart	Circular, 300 mm nominal size 0-100 linear.
Range	As specified.
Chart Speed	Two speed. 24 hours/ 7 days per revolution.
Chart Drive	Mechanical 7-days wind.
Pen Type	Disposable fiber-tip pen.
Control Algorithm	Proportional + Integral Action.
Proportional Band Range	1 to 500%.
Integral Action	0.01 to 50 minutes/repeat.
Set Point Adjustment	Manually to position set point. Inside of the case.
Control Action	Direct: Increase in process variable increases output signal, reversible.
Output Signal	0.2-1 barg.
Air Supply	1.4 barg.
Air Supply Connections	¼ in. ASME B1.20.1 NPT, female.
Transfer Switch	Four positions, auto-manual-test-service.

Optional Features

Cascade Control	Pneumatic set controller. Set point pneumatically positioned. Specify either full span or adjustable span.
Additional Pens	Two or three pens.

Notes:

1) Type of chart markings, 24 hours or 7 days, as specified at time of ordering.

2) Limit stops to be provided on pneumatic set scale with high and low settings.

8.11 Electronic Indicators, Analogue & Numerical

Standard Features

General	Horizontal or vertical scale servo-operated indicator single pointer (red), or LCD display.
Panel Case	Steel (with aluminum alloy bezel)-Plastic window.
Indicating Scale	Manufacturer standard length. Black markings on white background (for analogue indicators only).
Input	4-20 mA d.c. (1-5V d.c. at instrument).
Scale Range	0-10 square root, or 0-100 linear (for analogue indicators only).
Accuracy	±0.5% of span or better.
Electric Power	Supply 24V dc. ±0.5 V.
Ambient Temperature Limits	0-50°C (for field mounted indicators this range shall be wider to cover at least -15 to 85°C).
Electrical Classification	General purpose, unless otherwise specified.
Electrical Protection	Instrument to be individually fused.
Mounting	Panel, pipe or surface, as specified.
Window	Shatterproof glass.

Optional Features

Extra Pointer	Two pointers (red and green) for analogue indicators only.
Combination	Three pointers (red, green and blue)
Alarms	Lamps only (24 V dc, 40 mA).
	1PV monitor switch plus lamps.
	2PV monitor switch plus lamps.

8.12 Electronic Controller/Indicating

Standard Features

General	Rectangular flush mounted and panel housed with measured variable, out put and set point scales. Set point adjustment, auto manual transfer switch manual adjustment, located on front of instrument. Individual nameplates to be supplied.
Panel Case	Steel (with aluminum alloy bezel)-Plastic window.
Instrument Case	Steel.
Indicating Scale	Manufacturer standard length. Black marking on white background.
Scale Range	0-10 square root, or 0-100 linear.
Control Algorithm	Proportional + Integral.
Proportional Band	1-500%.
Integral Action Time	0.01 to 50 minutes/repeat.
Control Action	Increase/decrease in process variable increases output.
Controller output	4-20 mA dc (1-5V dc.).
Set Point Adjustment	Manually to set position.
Electric Power Supply	24 V dc. ±0.5 V.
Mounting	Panel.
Ambient Temperature Limits	0-50°C.
Calibration Facility	Built-in calibration jack.
Electrical Classification	General purpose, unless otherwise specified.
Auto Manual Switch	Integral.

Optional Features

Control Mode	Proportional + Integral + Derivative or Proportional only.
Derivative Action	0 to 10 min. continuously adjustable time+off.
Cascade Control	Local/Remote set point with set point tracking.
	Local/Remote set point without set point tracking.
Override Control	To prevent reset accumulation in override control applications.
Feed Forward Control	Provides second PV function.

Communication	Intercom jack.
Alarms:	Lamps only (24 V dc, 40 mA).
	1PV monitor switch plus lamps.
	2PV monitor switch plus lamps.

8.13 Electronic Controller/Recording

Standard Features

General	Single pen recording controller, rectangular flush mounted and panel housed with measured variable (red pointer), white scale and black graduations and set point pointer (green). Set point adjustment, auto manual transfer switch, and manual adjustment located on front of instrument. Recorder pen (red). Controller integrally mounted. Individual nameplates to be supplied.
Panel Case	Steel (with aluminum alloy or plastic bezel).
Input	4-20 mA dc (1-5 V dc. at instrument).
Chart	100 mm strip roll with standard reroll.
Scale Range	0-10 square root, or 0-100 linear.
Chart Speed	20 mm per hour.
Chart Drive	24 V ac, 50 Hz.
Pen Type	Disposable fiber-tip pen.
Indicating Scale	100 mm long, black figures on white background.
Control Algorithm	Proportional + Integral.
Proportional Band	1-500%.
Integral Action Time	0.01 to 50 minutes/repeat.
Control Action	Increase/decrease in process variable increases output.
Set Point Adjustment	Manually to position set point.
Controller Location	At instrument (integrally mounted).
Controller output	4-20 mA. dc
Control Mode Actuation	Auto/manual switch.
Control signal Indication	Integral output meter.
Ambient Temperature Limits	0-50°C.
Electrical Power Supply	24 V d.c. ±0.5 V.

Mounting	Panel.
Calibration Facility	Built-in calibration Jack.
Electrical Classification	General Purpose.

Optional Features

Controller and Recorder Combination	Two or three records (red, blue & green) and one control.
Control Algorithm	Proportional + Integral + Derivative.
Cascade Control	Local/remote set point (without set point tracking), local/remote set point (with set point tracking).
Alarms:	Lamps only (24V dc, 40 mA).
	1 PV monitors switch plus lamps.
	2 PV monitor switch plus lamps.

8.14 Electronic Recorder (Pen Writing)

Standard Features

General	Rectangular flush mounted and panel housed with white scale and black graduations. Single pen (red). Individual nameplates to be supplied.
Input Signal	4-20 mA dc. (1-5 V dc. at instrument).
Electrical Power Supply	24 V dc.
Mounting	Panel.
Scale Range	0-10 square root. or 0-100 linear.
Accuracy	0.5% of span or better.
Chart	100 mm strip roll with standard reroll, or Scan fold, as specified.
Chart Speed	20 mm per hour.
Chart Drive	24 V ac., 50 Hz.
Pen Type	Disposable fiber-tip pen.
Ambient Temperature Limits	0-50°C.
Calibration Facility	Built-in calibration jack.
Electrical Classification	General Purpose (ordinary) locations.

Optional Features

Extra Recording Combination	Two pens recording (red & blue), Three pens recording (red, blue & green).
Alarms:	Lamps only (24 V dc., 40 mA)- up to 3 sets.
	1 PV monitors switch plus lamps.
	2 PV monitor switch plus lamps.

8.15 Electronic Dot Printing Recorder

Standard Features

General	Rectangular flush mounted and panel housed with white scale and black graduations, 3-points, 6-points, and 12-points dot printing recorders. Individual nameplates to be supplied.
Input Signal	4-20 mA dc, 1-5 V dc, thermocouples, and RTD.
Mounting	Panel.
Scale Range	As specified.
Accuracy	±0.5% of span, or better.
Chart	100 mm strip roll with standard reroll, or Scan fold, as specified.
Chart Speed	20 mm per hour.
Chart Drive	24 V ac., 50 Hz.
Dot Printing Head	Disposable print head with fiber tip marker, and built-in ink cartridge.
Point Printing Interval (Cycle)	Not more than 5 sec.
Ink Colors	Manufacturer standard.
Ambient Temperature Limits	0-50°C.
Electrical Classification	General Purpose (ordinary) locations.

Optional Features

Thermocouple Burnout	
Protection	Open circuitry of input causes indicator to drive upscale or downscale, as specified.
Alarm Micro Switch	One/Two SPDT micro switches for high/low alarms.

8.16 Single Station Microprocessor-Based Controller

General	This type of controllers are microprocessor-based controllers, perform traditional PID control, with automatic self-tuning, based on the actual and current process variables, in addition to having some calculation and computation functions such as adding, subtracting, biasing, square, square root, logic gates, etc. They accept analog and digital signals. They are equipped with computer compatible ports. The front of the controller has a display consisting of graphics and alphanumeric characters.
Input Signal	4-20 mA dc, 1-5 V d., Frequency, T/C, or RTD. One or two contacts or transistor switches.
Output Signal	4-20 mA dc. 1-5 V dc. Two open collector transistor (NPN) switches.
Supply Voltage	24 V dc., +20%, -10% at 1 A maximum unless otherwise specified.
Transmitter Power	Controller should provide power supply for two 4 to 20 mA d.c. transmitters.
Alarms:	-Two absolute alarms for the measurement signal, and one absolute alarm for the output signal. -Deviation alarm for sensing the difference between the setpoint and measurement (error signal). -Alarm status is indicated by a combination of alphanumeric display, the bar graphs, and the contact output. -Alarm dead band is adjustable between 0 and 10% of span.
Front Panel	The controller shall be configured and operated entirely from the front panel with/without external equipment. By using the keypad and the display, complete process information can be read, and all controller settings can be changed.
Environmental Operating	
Limits:	Temperature 5 and 50°C Humidity 5 and 95%
Memory	All configuration and operating parameters are stored in a nonvolatile memory. If a power failure occurs, essential control settings and last operating conditions are saved immediately.

Control Adjustments	P.B.: 1 to 8000%. I: 0.014 to 200 minutes/repeat. D: 0 to 100 minutes.
Other Control Adjustments:	- Automatic self tuning. - Ratio 0 to 5. - Calculations (each input can have a gain and/or bias, and can be combined together in a variety of mathematical equations). - Logic (AND, NAND, OR, XOR, NOR and NOT). - Signal conditioning, square, square root, characterizer, RTD and thermocouple (TC) linearizing.
Accuracy	Shall be as specified by user.
Mounting	Shall be shelf mounting, unless otherwise specified.

8.17 Microprocessor-Based Recorder

Standard Features

General	Flush mounted and panel housed-microprocessor-based instrument; provide up to three pens for recording on a 100 mm (4 in.) strip chart. It also provides both analog and numerical display of the measured input signals.
Input Signals	4-20 mA dc., 1-5 V dc., thermocouples, and RTD.
Mounting	Panel (single or multipack).
Digital Display	Input data is displayed numerically on three channels of five characters, back illuminated LCD's.
Accuracy	0.25% of span, or better.
Chart	100 mm strip chart.
Chart Speed	Adjustable between 1 mm/hr to 1500 mm/hr.
Power Supply	24 V ac., 50 Hz.
Analog Recording	Fiber-tip pen system.
Digital Recording	Fiber-tip pen plotter system.
Fixed Time Recording	Year, month, and day are printed upon turning on the power.
Ink Colors	Red, blue & green.
Ambient Temperature Limits	0-50°C

Electrical Classification General Purpose

Note:

For multipoint digital temperature recorders refer to IPS-M-IN-120 "Material Standard for Temperature Instruments".

8.18 Microprocessor based paperless recorder:

8.18.1 General

It provides flexible electronic data acquisition and recording which displays the measured data on an LCD in real time and in a variety of display formats such as: chart, bargraph, digital indicator and process summary. Historical logs are provided for recording alarms, operator and system events and totalizer values.

8.18.2 Power supply

90-220 VAC 50 Hertz, 24V ac. /dc. or 48V dc. (based on application)

8.18.3 Environmental Requirements for Operation

Ambient temperature: 0 to 50 degree Celsius

Relative Humidity: 10% to 90 %

8.18.4 Input Signal

The input circuitry should be configurable to accommodate various signal types on the same card.

8.18.5 Signal types

- Current types: 0-20 ma+HART, 4-20 ma+HART, Accuracy: ±2% full scale or better
- Voltage types: ±10mV, ±50mV, ±100mV, ±500mV, ±1Volt, ±5Volts, ±10Volts, Accuracy: ±0.1% full scale or better.
- Thermocouples: K, R, S, B, J, T, E, and N types shall be configurable. Characterization shall be in accordance with the international Thermocouple tables. Burnout indication is required. Accuracy: ±0.1% of span or better.
- RTD: PT100, PT200, PT500, PT1000, 100Ω Nickel, 10Ω Copper, 53Ω Copper, Resistance up to 4000Ω.
- Frequency input of 1 Hz to 25,000 Hz
- Digital Input: Dry contact
- Square root extraction shall be available as standard on every input type.
- The attributes of each analog input channel shall be menu selectable. Input type, units and options. A minimum of 10 characters is required for the tag name.

8.18.6 Alarm Outputs

"C Form" relays, NO/NC, 3 ampere 240V ac. rating minimum.

Analog outputs capable of retransmitting selected signals shall be 4-20 mA/0-20mA. At least 4

analog outputs shall be available.

8.18.7 Auxiliary Power Supply

An isolated 24 V dc. power supply shall be supplied for each channel for field transmitter power (1.0 amps max.)

8.18.8 Display

- Digital color LCD (TFT), industrial grade with bright adjustment and wide viewing angle, resolution: 800×600 pixels or better.

- Each display requires a mix of various display formats or objects that can be combined to meet the operator's needs. Color coding of bar indicators, trend lines, numeric displays, and other graphic elements shall be fully configurable.

- The display shall be updated by a minimum frequency of once per second.

- Chart displays shall have adjustable chart speeds without access to configuration tools or interruption of data collection.

- Visibility: Line thickness and character size should be configurable to meet operator requirement.

- A complete set of mathematical operations shall be configurable to each pen or data pointer. Math functions to be included are addition, multiplication, subtraction, division, sine, cosine, tangent, arcsine, arccosine, arctangent, square root, natural logarithm, exponential function, absolute value, parenthetical and rolling average.

8.18.9 Alarms

All alarms shall be logged. The log include alarm occurrence and alarm clearing. Alarm limits shall be configurable.

8.18.10 Data Security

Any changes to the Set-up files shall be protected by password.

8.18.11 Communications

Ports shall be accessible from the rear of the recorder. EIA RS 485 (2 wire, with Modbus protocol support) and Ethernet 10/100BASE T shall be included as standard on the recorder. The Ethernet port shall comply with the IEEE 802.3 standard.

8.18.12 Option

Parallel printer port

8.19 Recorder Data Storage

8.19.1 Internal Memory

The recorder shall have a minimum buffer memory of 70 megabytes. This will be capable of being partitioned between display buffered data and data for archiving to the media.

8.19.2 Long term Archive Storage

Mass storage media shall be capable of accepting Compact Flash card up to 2.0 Gigabytes

commercially available and not unique to the recorder manufacturer.

8.19.3 Software Qualification

All application software shall be supplied directly from the recorder manufacturer. Software used for the creation of screens, database building, hardware configuration, logic and math and history analysis shall be classified as application software.

9. DOCUMENTATION/LITERATURE

1) AT Quotation Stage

Suppliers are to provide the following in the numbers requested at the time of quotation:

a) Comprehensive descriptive literature.

b) List of recommended commissioning and two years spares with prices.

c) Details of any special tools required with prices.

2) At Ordering Stage

Suppliers are to provide the following in quantities and at times as detailed on the order:

a) List of recommended spares for two years continuous operation.

b) Illustrated comprehensive spare parts manual with part numbers suitable for warehouse stocking.

c) Illustrated installation and operating instructions.

d) Maintenance manuals.

e) List of interchangeability and sub-suppliers parts shall be provided (in SPIR form).

Note: The above shall include identification of all proprietary items.

All drawings and literature shall be in English language and show all dimensions, capacities, etc., in metric units.

The order number must be prominently shown on all documents. Drawings are to be properly protected and packed. Electronic file of all documents shall also be provided.

10. INSPECTION AND TEST

- Inspection by appointed representative will consist of but not necessarily be confined to:

1) Visual and dimensional checks.

2) Hydraulic and functional tests where applicable.

- Certified test reports shall be provided for each instrument.

- The user reserves the right to reject any instrument for bad workmanship or defects.

- Detailed inspection requirements are specified in IPS-I-IN-100(1) "Factory Inspection for Instruments and Instruments Systems".

11. PACKING AND SHIPPING

Equipment must be carefully protected and packed to provide adequate protection during transit to destination and shall be in accordance with any special provision contained in the specification or order.

Special attention must be given to protection against corrosion during transit.

All bright and machined parts must be painted with rust preventive.

Ancillary items forming an integral part of the equipment should be packed preferably in a separate container if the equipment is normally cased or crated. Alternatively the ancillary items should be fixed securely to the equipment and adequate precaution taken to ensure that the items do not come loose in transit or be otherwise damaged.

Instruments having delicate movements and assembled into panels for inspection and test must be placed in marked special shock absorbing packages for transit, all connections being marked for remounting in Iran. Such instruments to be packed in same case as associated panel, but protected by a bulkhead or equivalent packing arrangement.

12. GUARANTEE

Vendor shall guarantee the following when the instrument is operated in accordance with the written operating instructions.

12.1 Designed performance and quality under conditions per specifications.

12.2 Instrument is free from fault in design, workmanship and material to fulfill satisfactorily the operating conditions specified.

12.3 Spare parts guarantee for minimum 10 years and performance guarantee for one year after installation or 18 months after shipment whichever is closer.